# Minutes

# 47th Meeting of the Academic Council

## held on 7 October 2024

**Directorate of Academics**
**Bahria University Islamabad**

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## ACRONYMS AND ABBREVIATIONS USED IN THIS DOCUMENT

| | |
|---|---|
| BBS | Bahria Business School |
| BH3S | Bahria Humanities and Social Sciences School |
| BSEAS | Bahria School of Engineering and Applied Sciences |
| BUAR | Bahria University Academic Rules |
| BUCAH | Bahria University College of Allied Health Sciences |
| BUCM | Bahria University College of Medicine |
| BUCPT | Bahria University College of Physical Therapy |
| BUDC | Bahria University Dental College |
| BUHSCI | Bahria University Health Sciences Campus Islamabad |
| BUHSCK | Bahria University Health Sciences Campus Karachi |
| BU-HSHM | Bahria University & Hashoo School of Hospitality Management |
| BUHS-PGI | Bahria University Health Sciences Post Graduate Institute |
| BUIC | Bahria University Islamabad Campus |
| BUKC | Bahria University Karachi Campus |
| BULC | Bahria University Lahore Campus |
| BULS | Bahria University Law School |
| BUMC | Bahria University Medical College |
| CCH | Course Codes Handbook |
| CE | Computer Engineering |
| CH | Credit Hour(s) |
| CS | Computer Sciences |
| DA | Director Admissions |
| DAcad | Director Academics |
| DLC | Director Lahore Campus |
| DM | Director Marketing |
| EDC | Estimated Date of Completion |
| ERD | Exams Record Database |
| EE | Electrical Engineering |
| E&ES | Earth & Environmental Sciences |

| | |
|---|---|
| EP | Examination Policy |
| FHB | Faculty Handbook |
| FYP | Final Year Project |
| ES | Engineering Sciences |
| GEP | Graduate Education Policy |
| HS | Health Sciences |
| H&SS/ HSS | Humanities & Social Sciences |
| IATD | Institute of Art and Textile Design |
| IHO | International Hydrography Organisation |
| IPP | Institute of Professional Psychology |
| IR | International Relations |
| MS | Management Sciences |
| NBEAC | National Business Education Accreditation Council |
| NCEAC | National Computing Education Accreditation Council |
| NSH | National School of Hydrography |
| ODL | Online & Distance Learning Policy |
| PFM | Permanent Faculty Member |
| PH | Public Health |
| PM&DC | Pakistan Medical & Dental Council |
| PN&MC | Pakistan Nursing & Midwifery Council |
| PNNC | Pakistan Navy Nursing College |
| PP | Professional Psychology |
| SCM | Supply Chain Management |
| SE | Software Engineering |
| SHB | Students Handbook |
| UEP | Undergraduate Education Policy |
| UG | Undergraduate |
| URD | User Requirements Document |
| VFM | Visiting Faculty Member |

# Attendance

## BUHO

**Present**

| | | | |
|---|---|---|---|
| 1. | Vice Admiral Asif Khaliq HI(M) (Retd) | Rector | in Chair |
| 2. | Rear Admiral Ahmed Fauzan HI(M) (Retd) | Pro-Rector (RIC) | Member |
| 3. | Rear Admiral Muhammad Arshid Javed SI(M) (Retd) | Pro-Rector (Acad) | Member |
| 4. | Surg Rear Admiral Ijaz Ahmad | Pro-Rector (HS)/ DGMS(N) | Member |
| 5. | Cdre Muhammad Jalaluddin Qureshi SI (M), (Retd) | Registrar | Member |
| 6. | Dr Faisal Bashir | Dean ES/ Principal BSEAS-IC | Member |
| 7. | Dr Adam Saud | Dean H&SS/ Principal BH3S-IC | Member |
| 8. | Dr Muhammad Fayyaz | Dean Law/ Principal BULS | Member |
| 9. | Cdre Asim Raza SI(M) (Retd) | DAcad | Member & Secy |
| 10. | Cdre Zahid Iqbal SI(M) (Retd) | CE | Member |
| 11. | Cdre Shakeel Ahmed khan SI(M), S.Bt | DA | Member |
| 12. | Brig Asif Ali Asif (Retd) | DHS | Member |
| 13. | Dr Asad Waqar | DPGP | Member |
| 14. | Mr Fazal Wahab | DQA | Member |
| 15. | Dr Saleem Aslam | DORIC | Member |
| 16. | Dr M. Awais Mehmood | DIO/ DSMP | Member |

**In Attendance**

| | | |
|---|---|---|
| 17. | Ms Sundal Mufti | DSA |
| 18. | Mr. Zulfiqar Ahmed Janjua | DLPDC |
| 19. | Hidayat Ullah Khan | Director Academics, HEC |
| 20. | Capt Khalid Hameed PN (Retd) | Dy Registrar (Academics) |
| 21. | Cdr Zulfiqar Haider Malik PN (Retd) | Dy Registrar (Regulations & Statutes) |
| 22. | Ms. Saima Akber | Dy Director (Academics), BUHO |

## BUIC

| | | | |
|---|---|---|---|
| 23. | **Present** | | |
| 24. | Rear Admiral Zaka Ur Rehman HI(M) (Retd) | DG BUIC | Member |
| 25. | Dr Khalid Mumtaz | Principal BBS-IC | Member |
| 26. | Dr Saima Kalsoom | HOD BSPP | Member |
| 27. | Dr Junaid Imtiaz | HOD (EES), BSEAS-IC | Member |
| 28. | Dr Shehzad Khalid | HOD (CE), H-11 | Member |
| 29. | Dr Adeel M. Syed | HOD (SE), H-11 | Member |
| 30. | Dr Syed M. Shahid Tirmazi | HOD (IS) BH3S-IC | Member |
| 31. | Dr Irfan Qaisrani | HOD (HSS) BH3S-IC | Member |
| 32. | Dr Farrukh Shahzad | HOD (Med St) BH3S-IC | Member |
| 33. | Dr Shahzia Yusuf | HOD (PP) BSPP (H-11) | Member |

**In Attendance**

| | | |
|---|---|---|
| 34. | Cdre Shoukat Ali (Retd) | DAdmin, BUIC (E-8) |
| 35. | Capt M. Sarfraz Khan PN (Retd) | DAcad, BUIC (E-8) |
| 36. | Cdr M Ajmal Hashmi (Retd) | DD Admission, BUIC (E-8) |
| 37. | Lt Cdr M Yaseen | DD Acad, BUIC (H-11) |

## BUKC

**Present**

| | | | |
|---|---|---|---|
| 38. | Vice Adm K. G. Hussain HI(M) (Retd) | DG BUKC | Member |
| 39. | Dr Muhammad Zahid | Dean BBS-KC | Member |
| 40. | Dr Haroon Rashid Ahmed | Principal BSEAS-KC | Member |
| 41. | Dr Mahe Darkhashan | Principal BH3S-KC | Member |
| 42. | Cdr Syed Amar Jamshed | OI/C NSH | Member |
| 43. | Lt Cdr Fatima Sadiq Ali PN | Principal IATD | Member |
| 44. | Dr Shaista Iftikhar | HOD (E&ES) BSEAS-KC | Member |
| 45. | Dr Talha Ahmed Khan | HOD (CS) BSEAS-KC | Member |
| 46. | Dr Liaqat Ali | HOD (MS) BBS-KC | Member |
| 47. | Dr Asif Inam | HOD (Mar Sc) BSMAS | Member |
| 48. | Dr Saher Afshan | HOD (HSS) BH3S-KC | Member |
| 49. | Dr Aurangzeb | HOD (IS) BH3S-KC | Member |
| 50. | Dr Hina Shakir | HOD (SE) BSEAS-KC | Member |
| 51. | Dr Abdul Attayab | HOD (EE) BSEAS-KC | Member |
| 52. | Dr Muhammad Ashfaq | HOD (Media Studies) | Member |
| 53. | Dr Mubashir Ali Shah | HOD (BS) BBS-KC | Member |

**In Attendance**

| | | | |
|---|---|---|---|
| 54. | Cdre Rashid Mahmood Sheikh SI(M) | Commandant PNS Bahadur | |
| 55. | Cdre Faiq Hussain SI(M) | DAdmin BUKC | |
| 56. | Capt Majid Mahmood PN (Retd) | DAcad BUKC | |
| 57. | Dr Waqar ud Din | DD ORIC | |
| 58. | Engr Erum Shafiq | AD QA | |

## BUHSC

**Present**

| | | | |
|---|---|---|---|
| 59. | Capt Noaman Imam (Retd) | Ag DG BUHSCK/ DC | Member |
| 60. | Maj Gen Prof Shehla M. Baqai HI(M) (Retd) | Dean HS/ Principal BUMC | Member |
| 61. | Capt Noaman Imam (Retd) | Director Campus BUHSCK | Member |
| 62. | Dr Kashif Naqvi | Principal BUDC | Member |
| 63. | Prof. Ijaz H.Z | Principal BUHS-PGI | Member |
| 64. | Dr Khalid Aziz | Principal BUCPT | Member |
| 65. | Dr Mahreen Lateef | Principal BUCAHS | Member |
| 66. | Lt Cdr Samreen Alam PN | Principal PNNC | Member |
| 67. | Dr Amir | Principal (UMS) | Member |

**In Attendance**

| | | | |
|---|---|---|---|
| 68. | Dr Khalid Mustafa | Vice Principal BUMC | Member |
| 69. | Dr Shama Asghar | Vice Principal (BUDC) | Member |
| 70. | Dr Abida Razzaq | Vice Principal PNNC | Member |
| 71. | Dr Innayat Hussain Thawar | HOD (CHS), BUMC | Member |

## BULC

**Present**

| | | | |
|---|---|---|---|
| 72. | Cdre Jawad Ahmed Qureshi SI(M) | Director BULC | Member |
| 73. | Dr Muhammad Sajid | HOD (MS) | Member |
| 74. | Dr Khawaja Qasim Maqbool | HOD (CS & IT) | Member |

| | | | |
|---|---|---|---|
| 75. | Dr. Khawar Bilal Baig | HOD (PP) | Member |

**In Attendance**

| | | |
|---|---|---|
| 76. | Muhammad Umair Saeed | Manager QA |

**IPP**

**Present**

| | | | |
|---|---|---|---|
| 77. | Dr Zainab Hussain Bhutto | Dean PP/Director IPP | Member |
| 78. | Dr Kiran Bashir Ahmad | Principal IPP | Member |

**PNSL**

**Present**

| | | | |
|---|---|---|---|
| 79. | Mr Muhammad Asmat Ullah | HOD, PNSL | Member |

**In Attendance**

| | | |
|---|---|---|
| 80. | Cdr Dr Zubair bin Junaid PN | Chief instructor |

# PRELIMINARIES

**Opening Remarks by the Chair**

1. The Chair extended a warm welcome to all members and participants of the BU ACM, underscoring the forum's critical role in shaping decisions and setting ambitious goals for the next six months and beyond. He urged everyone to communicate with clarity and purpose, remain focused, and ensure the meeting concluded efficiently and on time.

**Confirmation of the Minutes Opening Remarks by the Chair**

2. The Secy apprised that the last/ 46th Meeting of the Council was held on 16-17 April 2024. Draft Minutes of the Meeting were communicated to all Members/ non-member participants on 2 May 2024. Comments thus received were incorporated accordingly, followed by processing (on file) for approval of the Rector. Approved Minutes were disseminated to all concerned on 14 May 2024. He then requested the Chair to confirm the Minutes of 46th ACM as disseminated, which was approved by the Chair.

## REVIEW ITEMS

| Item 3652: Approval of Case Writing Centers in Bahria Business School Islamabad and Karachi<br>Responsibility: Dean MS |
|---|

**Action from the Last ACM**

3. The following was approved by the Council:

   a. Replacement/ upgradation of CWC to RBSC is approved for BUIC and BUKC, with the relevant organizational framework and financial details as given at **Appendage 46(3652)**, including DataStream at BUKC and licensed SmartPLS software at BUKC, BUIC and BULC.

   b. Tasks assigned to existing research groups are to be reviewed as a separate activity and the groups with roles similar to the RBSC are to be merged into the latter.

   c. Progress is to be reported.

**Progress**

4. Financial requirements for RBSC are being pursued from BUHO for inclusion in the budget for FY 2024-25. Meanwhile, tasks assigned to existing Research Groups have been reviewed by the Faculty of MS and verified that no such Group has the role or structure similar to RBSC.

**Discussion**

5. Dean MS reported that Rs 0.61 million had been received for RBSC at BUKC while further funds were awaited through allocation in the budget for FY 2024-25. Principal BBS-IC indicated that similar funds allocation would be required for other CUs too. Pro-Rector (Acad) indicated that budgetary allocations did not fall into the purview of the Academic Council and proposed the CUs to pursue it separately through Treasurer. He suggested that Dean MS should submit the progress related to the RBSC at each CU in terms of the assigned functions for review by the Council, which was consented by the Chair.

**Decision 47(3652)**

6. Funds allocations for RBSC are to be pursued by the CUs from the Treasurer as per standard procedure. Dean MS is to present the progress of each RBSC in terms of the assigned functions in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of Decision | Principal BBS-KC, Principal BBS-IC | Dean MS |

**Item 3910: Launch of New Programme *Bachelor of Science in Coastal & Marine Sciences* at the Department of Maritime Sciences, BUKC**

Responsibility: DG-BUKC

**Action from the Last ACM**

7. The following was approved by the Council:

a. The programme *BS in Coastal & Marine Sciences* is to be frozen till the review of its objectives and financial effects, which are to be processed through case file.

b. The proposal for an alternate degree/ diploma/ certificate programme is also to be processed separately through case file.

c. The proposal for shifting the responsibility for non-MS related programmes to Dean ES is to be processed through case file.

d. Progress is to be reviewed.

**Progress**

8. The subject programme has been frozen and was not offered in Fall 2024 semester. Alternatively, the proposal for launching a certificate course of 3 x CH with the title *Coastal Zone Management and Contemporary Issues* was processed for approval through a case file and subsequently advertised during the 1st week of July 2024. While 27 x students registered in it as a regular course of *MS in Maritime Ports and Shipping Management*, no applicant registered for the certificate course.

9. The proposal to shift the BSMAS under the Faculty of ES was presented to the Rector, where it was decided to explore the option of raising a separate *Faculty for the Maritime and Environmental Sciences*. After due deliberation, a committee has been formulated under Dean ES with members from BUKC, BUIC, MSTP and Acad Dte (BUHO) to undertake a feasibility study of raising the proposed separate Faculty with close linkages with the MSTP, along with the available and required resources. The committee has also been tasked to review the following:

a. Evaluate the utilization of the BU FMs availing the maritime domain PhD programmes at Dalian Maritime University, to form a part of the new Faculty.

b. Review the Phase-wise roadmap formulated as part of the study report undertaken by another committee in 2022 for its viability.

c. Propose a revised plan with recommendations for way ahead to attain the objectives for which the BSMAS was launched.

10. The committee will submit its report in the last week of October 2024.

**Discussion**

11. The Secy proposed to review the progress in light of the committee report mentioned in the above-stated progress, which was approved by the Chair.

**Decision 47(3910)**

12. Progress of the outcome of the committee report for the feasibility of raising a separate *Faculty of Maritime and Environmental Sciences* is to be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of Decision | Dean ES, Principal BSMAS | Dean ES |

**Item 4017: Launch of New Programme *Bachelor of Science in Mathematics* at BH3S-KC**
Responsibility: Dean H&SS

**Action from the Last ACM**

13. Progress of the programme is to be reviewed in the next ACM to evaluate the outcome of revised fee structure in Fall 2024 semester. Progress is to be reported.

**Progress**

14. As decided in the 45th ACM, the programme was to be monitored for 2 more semesters (Fall 2024 inclusive) for a decision on its continuation. Meanwhile, the revised fee structure for this programme was promulgated after the completion of Phase-I of Fall 2024 admission. Consequently, this opportunity was advertised in the marketing campaign of Phase-II. Only 4 x applicants submitted the fee against the target intake of 10. The programme was, hence, launched in Fall 2024 semester with low intake after special approval by the BUHO.

**Discussion**

15. The status of the programme was deliberated and noted that concerted efforts by the CU were required for improvements in the intake. Pro-Rector (RIC) enquired about the suitability of keeping the related PFMs engaged despite of less no. of students and was informed that the FMs were well occupied in teaching the Maths related courses for other degree programmes.

**Decision 47(4017)**

16. Concerted efforts are to be made by the CU for desired intake. The programme is to be monitored for 2 more semesters. In case of continued low intake, it may be frozen in Fall 2025 semester. Progress is to be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Principal BH3S-KC | DG BUKC |

**Item 4109: Launch of New Programme *Bachelor of Science in Remote Sensing & GIS* at BSEAS-KC**
Responsibility: Dean ES

**Action from the Last ACM**

17. Progress is to be reviewed in the next ACM, to evaluate the feasibility of the programme continuation with respect to the admissions status in Fall 2024 semester.

**Progress**

18. After completion of the admissions process for Fall 2024 semester, only 6 students deposited the fee against the reduced intake target of 10 students. The programme was launched in the Fall 2024 semester with low intake after special approval by the BUHO.

**Discussion**

19. The point was deliberated in the meeting and agreed that more effort was required for desired intake.

**Decision 47(4109)**

20. More efforts are to be made by the CU for desired intake. The programme is to be monitored for 2 more semesters. In case of continued low intake, it may be frozen in Fall 2025 semester. The progress is to be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Principal BSMAS | DG BUKC |

**Item 4201: Approval of BS (4-Yrs) Degree Programme in *Islamic Studies***

Responsibility: Dean H&SS

**Action from the Last ACM**

21. Fee structure of the programme is to be reviewed as a separate activity, while pursuing the launch in fall 2024 semester. Progress is to be reviewed in the next ACM.

**Progress**

22. *BS in Islamic Studies* was offered at BUIC and BUKC, but the response of the students was not encouraging. At BUIC, 6 students applied for the programme, 5 appeared in the CBT but None deposited the Admission Fee. At BUKC, 3 students applied for the programme, 2 appeared and qualified the CBT. Due low intake, BUKC proposed to freeze the programme which was approved by BUHO.

**Discussion**

23. After detailed discussion, it was agreed to keep the programme frozen at BUIC and BUKC and resumed when considered suitable by the respective CUs. through fresh ACM approval. The current point may be dropped from the ACM.

**Decision 47(4201)**

24. The programme is to be kept frozen at BUIC and BUKC till considered suitable for resumption by the respective CUs. The point is dropped from the ACM agenda.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | DA, Principals BH3S-IC & BH3S-KC | DG BUIC, DG BUKC |

**Item 4314: Launch of New Programme *Master of Science in Business Analytics***

Responsibility: Dean MS

**Action from the Last ACM**

25. Progress of the programme is to be reviewed for one more semester (Fall 2024) in the next ACM.

**Progress**

26. 35 x students have registered for the programme in the Fall 2024 semester and the classes have commenced on 7 Sep 24.

**Discussion**

27. The Secy proposed to review the progress of the programme for one more semester, i.e. Spring 2025 semester which was approved by the Council.

**Decision 47 (4314)**

28. The progress of the programme is to be reviewed for one more semester (Spring 2025) after which it may be dropped.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Principal BBS-IC | DG BUIC |

**Item 4325: Launch Proposal of *MS in Medical Lab Sciences (MS-MLS)* at BUCAHS, BUHSCK**

Responsibility: Dean HS

**Action from the Last ACM**

29. Induction of second FM for the intended programme is to be expedited, while the issuance of NOC by the HEC is to be pursued by DQA. Progress is to be reviewed.

**Progress**

30. One PhD FM is still deficient to pursue the NOC at the HEC level. A new FM was facilitated with an improved salary contract, but he refused to join. Headhunting is underway to identify another FM.

**Discussion**

31. The point was deliberated in the meeting. DQA explained that RAC approval of the held FMs will be pursued as per the HEC guidelines.

**Decision 47(4325)**

32. Progress related to the assessment of the held FMs by the RAC and pursuing the NOC for the programme from the HEC is to be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Principal BUCAHS, DHS, DQA | Dean HS |

**Item 4334: Launch of *MS in Applied Linguistics* at BUKC**

Responsibility: Dean H&SS

**Action from the Last ACM**

33. Degree title of the proposed programme is to be amended as *Master of Studies in Linguistics (English)* and so mentioned in the MOM. Issuance of the NOC by the HEC for the amended title is to be pursued by DQA. Progress is to be reviewed in the next ACM.

**Progress**

34. Two relevant PhD FMs were head hunted but they did not appear in the selection board. The Dept has restarted its efforts to hire two relevant FMs to launch the MS programme.

**Discussion**

35. DG BUKC explained that the FMs had left due to higher pay offers from other institutions. He shared hope with the committee constituted at BUHO to review the salary/ benefit packages of PFMs.

**Decision 47 (4334)**

36. Progress of the availability of required FMs is to be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Principal BH3S-KC, DQA | DG BUKC |

**Item 4339: Improvement of Evening Programmes Quality at BULC**

Responsibility: DQA

**Action from the Last ACM**

37. Corrective Action Plan for BULC is to be complied along with more frequent audits of the CU. Improvements in the quality of evening programmes at BULC are to be reviewed in the next ACM.

**Progress**

38. Academic Mock Audit of BULC programmes has been included in the QA Activities Calendar, scheduled in November 2024 for the Fall 2024 semester. Improvements in the quality of Evening programmes will be ascertained in that audit.

**Discussion**

39. It has been highlighted that Academic Mock Audit of BULC programmes has been included in the QA Activities Calendar; in November 2024 for the Fall 2024 semester.

**Decision 47 (4339)**

40. Improvements in the quality of evening programmes at BULC are to be reviewed in the next ACM. The point may then be dropped.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Dir BULC, DQA | DQA |

**Item 4405: Commencement of Weekly Online Classes**

Responsibility: DQA

**Action from the Last ACM**

41. Online classes on the first Wednesday of each month are to be continued for 3 more months, after which their efficacy is to be reviewed in an exclusive meeting. Progress is to be reviewed in the next ACM.

**Progress**

42. An IHD was held at BUHO on 22 July 2024 chaired by Pro-Rector (Acad) and attended by all the CUs (through VLC) as well as the Deans, Registrar, Treasurer and relevant BUHO Dirs, to review the efficacy of online classes by the CUs. After detailed discussion, the following action items were directed by the Chair, with compliance as mentioned against each:

a. *Shortcomings in the conduct of online classes presented by the CUs should be reviewed to include only those constraints that cannot be resolved at the CU level and need support from the BUHO. Further, the highlighted limitations should be specific/ substantiated by the relevant statistical details, and not generalized comments.* **The same is being complied accordingly.**

b. *FDT conducted by LPDC should include the online pedagogies for the new FMs.* **The same will be complied in all future trainings.**

c. *DQA should review the online teaching quality aspects during periodic audits of the CUs for local/ departmental level mitigation.* **The same has been included in the QA Activities Calendar for the Fall 2024 semester approved by the Rector and will be pursued through Academic Mock Audits of all the CUs.**

d. *Monthly coordination meetings should be held between the CUs from July to September 2024 - coordinated and chaired by the DQA - to share the experiences of online teaching for resolving the constraints at the local level, as far as practicable. Thereafter, the frequency of these meetings may be kept as quarterly*. **DQA has been closely coordinating online classes conducted by the CUs through DD QA/ Managers of CUs. Experiences of online teaching have been regularly shared and improvements brought in the following:**

  i. Lab-oriented courses scheduled on other working days instead of Wednesday to meet the accreditation bodies' requirements.
  ii. LMS improved by the IT Dte to provide more facilities to the FMs to share their core and supplementary teaching materials.
  iii. Internet connectivity issues resolved by CUs for smooth conduct of online classes.
  iv. FMs including VFMs trained on online teaching tools (including MS Teams, Zoom).
  v. Zoom license renewed through IT Dte to provide alternate online teaching tool.

e. *Consequent upon the completion of the 3 months approved in the last ACM, the Registrar's office should process the review of the continuation of online classes on 1st Wednesday of each month, keeping in view the outcome of this IHD.* **Based on the feedback from all the CUs, the Registrar office has maintained the status quo.**

**Discussion**

43. The Chair inquired about the effectiveness of online teaching vs regular classes and the impact on the quality of education standard; highlighting that Air University had discontinued this practice. Pro-Rector (Acad) explained that monthly online classes were being conducted at BUIC and BULC very smoothly; BUKC raised some points which could be resolved at the CU level. He highlighted that holding of coordination meetings by DQA was in that backdrop. He further indicated that online classes were facilitating capacity building of the University for the intended launch of online programmes. The Chair acknowledged that the practice of online classes was adopted to retain the expertise acquired during the Covid-19 episode and to move towards the launch of online programmes with the assistance of VU. He asked for the opinion of the CUs for continuation of the practice. Dean H&SS indicated that online classes were facilitating orientation of the students for online courses i.e. MOOCs which were being include in the UG roadmaps as per HEC UEP 2023. Regarding any compromise of the quality of education, he emphasized that the extent was not much and that the intended benefits outweighed them. DG BUKC confirmed substantial savings in utilities due to online classes. He highlighted that Impact on teaching quality was not very significant and could be mitigated through closer monitoring. He proposed to review the practice after another 3 months, while recommending its continuation in view of the financial and online pedagogies training aspects. BULC explained the benefits of improvements in related infrastructure, training of FMs for online teaching, capacity building to launch online

programmes, and developing ability in the graduates to manage online working in their professional careers.

44. Pro-Rector (Acad) further highlighted that online courses were being included in the UG programmes as per HEC guidelines. Proposals to this effect will be presented in the next ACM, for required amendments in related roadmaps. He further indicated that approval had been attained to appoint a Dean ODL as per the HEC ODL Policy and interviews of the candidates shortlisted from the volunteering PFMs across all the CUs were being scheduled in next few weeks. The Chair directed to continue the practice for another 3 months, while reviewing the roadmap for the online programmes including the activities undertaken so far, actions in hand and the plans ahead.

**Decision 47 (4405)**

45. The following was decided for compliance by all concerned:

a. Online classes on 1st Wednesday of each month are to be continued for another 3 months (including December 2024).

b. Roadmap for the launch of online programmes is to be presented after 2 months (in November 2024).

c. The progress is to be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision 45. a. & c. | All HCUs | Registrar |
| Implementation of the Decision 45. b. & c. | DAcad | DAcad |

**Item 4407: Launch Proposal for Associate Degree in Business Administration**

Responsibility: Dean MS

**Action from the Last ACM**

46. Continuation of the programme is to be reviewed by the Faculty of MS, along with the need to review its composition, after assessing the admissions response in Fall 2024 semester. Progress is to be reported.

**Progress**

47. After completion of the admissions process for Fall 2024 semester, only 9 students deposited the fee against the intake target of 20 students. BUKC has proposed to allow the low intake for Fall 2024 semester, which has been approved by the BUHO.

**Discussion**

48. Dean MS indicated that 13 students had registered for the programme at BUKC in the ongoing semester. DQA proposed to give this programme more time, as its continuation will also enable lateral entry into the related BBA programme. The Council agreed with the same.

**Decision 47(4407)**

49. The programme is to be monitored for 2 more semesters with extended efforts at BUIC and BULC. In case of continued low intake, it may be frozen in Fall 2025 semester. The progress is to be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | DG BUKC, Principal BBS-KC | Dean MS |

**Item 4523: Review of Faculty Course Load Reduction Policy**

Responsibility: DAcad

**Action of the Last ACM**

50. Review of ASAs appointment mechanism is approved as presented for adoption from the next (Fall 2024) semester through Registrar Notification. The following is also to be ensured:

a. Confirmation of updated profiles of FMs is to be included in the duties of Dept Coordinators, while making the respective Principals responsible for authenticity/ correctness of the FMs profiles on BU website.

b. DQA is to devise a suitable mechanism for record keeping of the advisory/ counselling provided to the students by the PFMs in general and the Class Advisers in particular.

c. LPDC is to formulate suitable courses for the Dept Coordinator and Class Adviser duties, including suitable assessment to qualify for related appointment, and conduct the same regularly through respective CUs as part of Faculty Development Training.

d. IT Dte is to include the updating of FMs profile and the provision of course outline for each programme in the presentation being given to the Rector on BU website.

51. All related BU statutory documents are to be amended accordingly. Progress is to be reviewed in the next ACM.

**Progress**

52. Related amendments in BUAR have been included in the revised draft BUAR 2024, while intimating DHR of the related amendments in BU HR Policy Manual. LPDC has conducted the training sessions of newly inducted *Dept Coordinators* and *Class Advisers* for BUKC, BULC and BUIC (H-11) during the month of September 2024. The training for BUIC (E-8) is scheduled during the 2nd week of October 2024, while for BUHSC it has been planned in October-November 2024.

**Discussion**

53. DAcad elaborate the details as given in the progress. After brief discussion, the Council consented to drop the point from the ACM agenda.

**Decision 47(4523)**

54. The point is dropped from the ACM agenda.

**Item 4602: Alignment of Faculty of Management Sciences PG Programmes with GEP 2023**

Responsibility: Dean MS

**Action of the Last ACM**

55. Revised roadmaps of 13 x PG programmes of the Faculty of MS and amended course outlines for level 700 courses are approved for adoption as given at Appendage 4602 from Spring 2024 semester and Fall 2024 semester. ERD, related CU prospectus and website are to be updated accordingly. Progress is to be reported.

**Progress**

The roadmaps were approved and implemented in Fall 2024 semester, followed by updating on BU website. ERD and CCHB have been updated accordingly and revision of BU Prospectus finalised.

**Discussion**

56. The Secy indicated that all actions required in the last ACM had been complied and that the point could be dropped from the ACM, which was concurred by the Council.

**Decision 47(4602)**

57. The point is dropped from the ACM agenda.

**Item 4601: Ratification of Launch of *Bachelor of Science in Business and Information Technology* at BULC**

Responsibility: Dean MS

**Action of the Last ACM**

58. Launch proposal for *Bachelor of Science in Business and Information Technology* at BULC is approved for admissions from Fall 2024 semester, with additional Electives (including FinTech) as mentioned in Appendage 4601. Exams Dte ERD, CU prospectus and BU website are to be updated accordingly. Progress is to be reviewed.

**Progress**

59. The programme has been launched successfully in Fall 2024 semester. Classes have been commenced on 9 Sep 24 with 51 x students**.**

**Discussion**

60. The Secy proposed to review the progress of the new launch for 2 more semesters, which was agreed by the Council.

**Decision 47(4601)**

61. Progress of the programme is to be reviewed for 2 more semesters, including Fall 2025.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | DC BULC | HCU BULC |

**Item 4606: BU Recognition of Postgraduate Diploma (Category B) in Hydrographic Survey at the National School of Hydrography**

Responsibility: Dean ES

**Action of the Last ACM**

62. The following was decided by the Council:

a. Award of BU Postgraduate Diploma (Category B) in Hydrographic Survey at the National School of Hydrography is approved by the Council as per the study scheme at Appendage 4606A.

b. Format of the certificate and the transcript to be awarded is also approved by the Council as given at Appendage 4606B.

c. Award of CU status to the NSH is to be processed for the BOG approval thorough EC.

d. Progress is to be reported in the next ACM.

**Progress**

63. Declaring NSH as a CU of BU for conduct of courses allowed by BU Academic Council was approved by the BOG in its 51st meeting held on 16 May 24**.** Henceforth, the OI/C NSH will attend

the ACMs as a member of the BU Academic Council. Meanwhile, the SOP for the functioning of the NSH as a CU of BU has been forwarded by the Registrar office to the NHQ, for approval by the Chairman BOG.

**Discussion**

64. The Secy indicated the compliance of all the actions of the last ACM decisions and proposed to drop the item from the ACM agenda, which was concurred by the Council.

**Decision 47(4606)**

65. The point is dropped from the ACM agenda.

| **Item 4607: Launch of New Programme *Master of Science in Artificial Intelligence* at BUIC (H-11)** |
|---|
| Responsibility: Dean ES |

**Action of the Last ACM**

66. The following was approved by the Council:

a. Launch proposal for *Master of Science in Artificial Intelligence* is approved subject to the issuance of NOC issued by the HEC for BUIC (H-11), BUKC and BULC as given at Appendage 4607.

b. RAC assessment for at least two relevant Ph.D. Faculty Members at respective CUs is to be undertaken accordingly.

c. Progress is to be reported.

**Progress**

67. NOCs have been received from the HEC for BUIC (H-11) and BUKC. Admissions for the Fall 2024 semester were open for 2 weeks but the programme could not be started due low number of applicants. At BUIC (H-11), 17 x candidates applied, and 3 appeared for the CBT. The programme was not started due to low intake. At BUKC, 5 x candidates applied and 4 x passed the CBT. The programme was not started due to low intake. NOC for BULC could not be attained because the relevant FM resigned in mid of Spring 2024 semester. His replacement has been inducted and RAC conducted successfully. The NOC case for HEC is being prepared accordingly.

**Discussion**

68. Dean ES shared expectations for better response in the next semester as inadequate time was available after obtaining the HEC NOC. He proposed the vetting of RAC recommendation for BULC FM by the Academic Council. DPGP emphasized that the HEC GEP 2023 necessitated presenting of the RAC report to the statutory body. DQA explained that the HEC requirement was for reporting but not its endorsement by the Academic Council. DAcad supported the stance by indicating that RAC assessment of FMs was reported to the Academic Council as part of the progress for the NOC. He requested Dir Academics HEC attending the ACM to provide further clarity in this regard, who acknowledged to convey the same after consulting the QEC Div, HEC.

69. Pro-Rector (Acad) emphasized on the need of the CUs to timely complete the processing of new launch proposals for subsequent submission to the HEC for the NOC (in case of PG programmes), so that the related admissions campaign can be launched in sync with the overall timelines. The Chair concurred with the observation.

**Decision 47(4607)**

70. The following was decided by the Council:

a. All new launch proposals are to be timely completed by the sponsoring CUs for timely processing of HEC approvals (for PG programmes) and conduct of the related admissions campaign in sync with the overall timelines for respective semesters.

b. Clarification from the HEC is to be sought on the need of presenting the RAC report to the ACM or including its assessment approvals in the overall status of related programme proposal.

c. The progress is to be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of Decision 71. a. & c. | All HCUs | All Deans |
| Implementation of Decision 71. b. & c. | DQA | DQA |

**Item 4608: Launch of New Programme *Bachelor of Studies in English* at BULC**

Responsibility: Dean H&SS

**Action of the Last ACM**

71. Launch of new programme *Bachelor of Studies in English* at BULC is approved for Fall 2024 semester as given at Appendage 4608. Necessary activities are to be undertaken by all concerned for the admissions and commencement of classes. Progress is to be reported.

**Progress**

72. The programme was launched in the Fall 2024 semester. Vigorous efforts were made for its promotion through social media, print media, seminar on *Literature and Linguistics*, speech competition on *Linguistics & AI* and webinars. However, due to Nil fee submission the programme could not be commenced.

**Discussion**

73. DAcad outlined the progress on the related point, while BULC assured of better outcome in the next/ Spring 2025 semester. Dean H&SS recommended a comprehensive review of the programme continuation in after Fall 2025 semester admissions which was concurred by the Chair.

**Decision 47(4608)**

74. The programme is to be monitored for 2 more semesters (fall 2025 inclusive) with more concerted efforts at BULC. The progress is to be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | DC BULC | Dean H&SS |

**Item 4609: Launch of New Programme *PhD in Islamic Studies* at BH3S-IC and BH3S-KC**

Responsibility: Dean H&SS

**Action of the Last ACM**

76. The following was approved by the Council:

a. Launch of *PhD in Islamic Studies* at BUIC (E-8) and BUKC is approved by the Council subject to issuance of the NOC by the HEC, as per the proposal at Appendage 4609.

b. Proposed fee structure is to be reviewed for compatibility with other HEIs.

c. Progress is to be reported.

**Progress**

77. NOCs for the programme launch at BUIC and BUKC have been received from the HEC. During the admission process, 6 candidates qualified for BUIC (E-8) and 5 for BUKC. One applicant has been admitted in BUIC (E-8) and the classes commenced on 23 Sep 24. At BUKC, 4 candidates were accepted, and the classes commenced on 2 Oct 24.

**Discussion**

78. The Secy proposed to review the progress in the next ACM, after which the point may be dropped. The Council agreed with the same.

**Decision 47(4609)**

79. The programme progress is to be reviewed in the next ACM, after which the item may be dropped from the ACM agenda.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Principals BH3S-IC & BH3S-KC | Dean H&SS |

**Item 4610: Launch of New Programme *Master of Studies in Linguistics (English)* at BH3S-IC**
Responsibility: Dean H&SS

**Action of the Last ACM**

80. Launch of the new programme *Master of Studies in Linguistics (English)* at BUIC (E-8) is approved by the Council subject to the issuance of NOC by the HEC, as per the proposal at Appendage 4610. Deficiency courses are to be reviewed for level 600. Progress is to be reported, with the Responsibility assigned to Principal BH3S-IC.

**Progress**

81. The programme has been successfully launched after approval from the HEC. Classes have commenced on 18 Sep 24 with 14 x students.

**Discussion**

82. The Secy proposed to monitor the progress of the new launch for one more semester, which was agreed by the Council.

**Decision 47(4610)**

83. The programme progress is to be reviewed in the next ACM, after which the item may be dropped from the ACM agenda.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Principal BH3S-IC | Dean H&SS |

**Item 4611: Launch of Independent Programme *Bachelor of Science in International Relations* at BH3S-IC**
Responsibility: Dean H&SS

**Action of the Last ACM**

84. Launch of the new programme *Bachelor of Science in International Relations* at BUIC from Fall 2024 semester is approved as given at Appendage 4611 to replace the *Bachelor of Social*

*Sciences* with the IR stream. CU prospectus, website and ERD are to be updated accordingly. Progress is to be reported.

**Progress**

85. The programme has been successfully launched after approval from the HEC. Classes have commenced on 18 Sep 24 with 14 x students.

**Discussion**

86. The Secy proposed to monitor the progress of the new launch for one more semester, which was agreed by the Council.

**Decision 47(4611)**

87. The programme progress is to be reviewed in the next ACM, after which the item may be dropped from the ACM agenda.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Principal BH3S-IC | Dean H&SS |

**Item 4612: Launch of Independent Programme *Bachelor of Science in Development Studies* at BH3S-IC**

Responsibility: Dean H&SS

**Action of the Last ACM**

88. Launch of the new programme *Bachelor of Science in Development Studies* at BUIC from Fall 2024 semester is approved as given at Appendage 4612 to replace the *Bachelor of Social Sciences* with DS stream. CU prospectus, website and ERD are to be updated accordingly. Progress is to be reported.

**Progress**

89. The programme has been offered in Fall 2024 Semester. Classes commenced on 9 Sep 24 with 83 x students against the target intake of 40. ERD and CCHB have been updated accordingly and the roadmaps are updated on the BU website.

**Discussion**

90. The Secy proposed to monitor the progress of the new launch for one more semester, which was agreed by the Council.

**Decision 47(4612)**

91. The programme progress is to be reviewed in the next ACM, after which the item may be dropped from the ACM agenda.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Principal BH3S-IC | Dean H&SS |
| | | |

**Item 4613: Review of PG Programme *MS in Media Studies* for Inclusion of Professional Track**

Responsibility: Dean H&SS

**Action of the Last ACM**

92. PG programme *Master of Science in Media Studies* reviewed for inclusion of professional track courses as given at **Appendage 4613** is approved for adoption at BH3S-IC and BH3S-KC from Fall 2024 semester. Progress is to be reported.

**Discussion**

93. Compliance has been done, including related updating of BU prospectus and website. The Secy proposed to drop the item from the agenda which was approved by the Council.

**Decision 47(4613)**

94. The item is dropped from the ACM agenda.

**Item 4614: Approval of Degree Programmes at IATD/ BSAAD, Karachi**

Responsibility: Dean H&SS

**Action of the Last ACM**

95. The following was decided by the Council:

a. Degree programme proposed by IATD is in-principle approved for *Visual Communication Design*. Degree title and academic roadmap of the programme are to be finalized as per the HEC UEP 2023 with required General Education, Interdisciplinary and Major courses. *Quran and Seerah* courses are also to be included along with Internship and CSP.

b. The finalized roadmap is to be processed through FBOS for approval through case file, followed by ratification in the next ACM.

c. Award of CU status to IATD may be pursued from the BOG through ECM.

d. Progress is to be reported.

**Progress**

96. Declaring PN IATD as a CU of BU for the conduct of programmes allowed by the ACM was approved by the BOG in its 51st Meeting held on 16 May 24. Accordingly, the Principal IATD will henceforth attend the ACMs as a member of the BU Academic Council. The SOP for the functioning of the IATD as a CU of BU has been finalized by the Registrar office and forwarded to the NHQ for approval by the Chairman BOG. Outline of the courses and academic roadmap for the degree programme *BS in Visual Communication Design* (VCD) have been processed through a case file for scrutiny by the Exams and QA Dtes. Dean H&SS will present the same for approval by the Academic Council. Launch of the approved programme *BS in VCD* will be subject to the readiness of the IATD in terms of the required faculty, fee structure and admissions process.

**Discussion 47(4614)**

97. The launch proposal for *BS in Visual Communication Design* (VCD) was presented by the Principal IATD. Pro-Rector (Acad) noted that the presentation slides indicated the institution name as BSAAD (Bahria School of Art, Architecture and Design) whereas the BOG had approved its CU status as IATD (Institute of Art and Technical Design). He advised the Principal IATD to use the BOG-approved title till the time BSAAD was approved by the NHQ.

98. The Secy and Dean H&SS noted that presentation being given to the Academic Council was not the complete launch proposal as per the format given in BU Academic Rules. DAcad explained that the launch proposals comprised of two parts: Academic Details and Financial Details, with fee structure etc. covered in the latter. He confirmed that the IATD had prepared the Academic Details, approval of which will facilitate the Institute to pursue the availability/ hiring of required faculty. He explained that the Financial Details would be processed through the DBOS of BH3S-KC as per the procedure contained in the SOP for the CU, followed by FBOS-H&SS for the ACM approval.

99. Principal IATD then presented the Academic Details of *BS in VCD* as placed at **Appendage 47(4614)**. Dean ES noted that the proposal comprised of total 156 CH which were much more than the HEC limit of 144 CH given in UEP 2023. DQA explained that the proposed roadmap was aligned with the other HEIs. Dir Academics HEC indicated that the HEC has set a limit of 144 x CH for UG programmes which is being followed by the other HEIs for the proposed degree programme, including the National College of Arts, the University of Lahore, and the Beaconhouse National University; offering the *BS in VCD* with 144 CH, 132 CH and 131 CH respectively as displayed on their websites. After further discussion, DAcad and DQA proposed the ACM approval of the roadmap for *BS in VCD* as presented by the IATD for subsequently arranging the required faculty, while the complete launch proposal including the Financial Details may be processed through case file for ratification in the next ACM. After further deliberation, the Chair consented the same.

**<u>Decision</u>**

100. Academic Details of the launch proposal for *BS in Visual Communication Design* (VCD) are approved by the Council as given at **Appendage 47(4614)** for pursuing the required faculty at IATD. The Institute is to process the complete launch proposal including the Financial Details as per standard format given in BU Academic Rules, with revised roadmap comprising 144 x CH or less in compliance of the HEC UEP 2023, through DBOS of BH3S-KC and FBOS-H&SS. The progress is to be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Principal IATD, Principal BH3S-KC | Dean H&SS |

**Item 4615: Adoption of Result Submission Form for Quran and Seerah Courses**

Responsibility: Dean H&SS

**<u>Action of the Last ACM</u>**

101. Result submission form for Quran and Seerah courses is approved as given at Appendage 4615 with amended title, *Quran and Seerah Courses Completion Status*. Adoption of the form at all CUs is to be promulgated through Registrar Notification and its compliance included in BU Examinations Policy. Progress is to be reported.

**<u>Progress</u>**

102. Compliance has been done. The format of Result Submission Form and its adoption is also being included in the BU Examinations Policy.

**<u>Discussion</u>**

103. Considering the compliance, the Secy proposed to drop the item from the ACM agenda which was approved by the Chair.

**Decision 47(4615)**

104. The item is dropped from the ACM agenda.

| **Item 4616: Approval of the Psychological Services Centre Policy** |
|---|
| Responsibility: Dean PP |

**Action of the Last ACM**

105. The Psychological Services Centre policy is to be presented in a separate meeting, and only the academic aspects of the approved policy are to be brought to the ACM. Progress is to be reported.

**Progress**

106. The subject Policy has been reviewed by Dean PP based on the feedback from all the CUs, scrutinised by the QA & Acad Dtes and proofreading by the relevant faculty at BH3S-IC. The updated document is retitled as the *BU Policy for Psychological Services Centres*.

107. The Policy will replace the current Chapter 11 (*Psychological Services*) in BU HR Policy Manual 2023 and corresponding amendment in BU Statutes 2022 Annex A for inclusion in the *List of BU Statutory Documents*.

**Discussion**

108. Dean PP presented the *BU Policy for Psychological Services Centres* as placed at **Appendage 47(4616)**. After detailed deliberations on the changes from the previous policy, the Council approved the Policy as presented for adoption at all BU CUs.

**Decision 47(4616)**

109. The following was approved by the Academic Council:

a. Adoption of the *BU Policy for Psychological Services Centres* as given at **Appendage 47(4616)** by all the BU CUs from Fall 2024 semester onwards through Registrar Notification.

b. Amendment in BU Statutes 2022 Annex A for inclusion of the approved Policy in the *List of BU Statutory Documents*.

c. Removal of Chapter 11 (*Psychological Services*) in BU HR Policy Manual 2023.

d. The progress is to be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of Decision at 109. a. b. & d. | All HCUs, Registrar | Dean PP |
| Implementation of Decision at 109. c. & d. | DHR | |

| **Item 4617: Launch Proposal for *Master of Science in Clinical Psychology* at BSPP (H-11)** |
|---|
| Responsibility: Principal BSPP (BUIC) |

**Action of the Last ACM**

110. The following was approved by the Council:

a. Launch proposal for *Master of Science in Clinical Psychology* at the Dept of Professional Psychology, BUIC (H-11) is approved subject to the issuance of NOC by the HEC.

b. Deficiencies in the required facilities/ resources are to be resolved on priority, including the relevant PhD qualified PFMs, psychology lab, psychological test kits, library books and Psychological Services Centre.

c. Progress is to be reported.

**Progress**

111. Required FMs have been inducted, their relevancy for the subject programme verified by the RAC, and NOC obtained from the HEC. The programme has been launched at BUIC (H-11) in Fall 2024 semester and classes commenced on 30 Sep 24 with 16 x students. The status of required resources noted in the last ACM is as follows:

a. Psychological Lab has been successfully established.

b. 69 x library books for the programme have been added; more will follow.

c. A suitable place has been allocated for the Psychological Services Centre.

d. Psychological test kits have been arranged as follows:

i. **For Fall 2024 Semester**

1) 3 tests are available (BGT, QNST, DAP-IQ).

2) 1 test is being shared with E-8 Campus (WISC-5).

3) 1 test is under purchase process (WAIS).

ii. **For Spring 2025 Semester**

1) 2 tests are available (HFD, HTP).

2) 8 tests will be shared with E-8 Campus (Back Inventories, TAT, CAT, Dyslexia test, PAI-A/ MMPIA-2, RISB, ROR);

3) 4 tests are under purchase process (SDS, CONNERS, CARS, Baron EQ).

**Discussion**

112. After brief deliberation, the Chair directed to pursue the progress in the next ACM.

**Decision 47 (4617)**

113. Timely procurement of **Not Held** tests is to be ensured by the CU. The progress is to be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Principal BSPP | DG BUIC |

**Item 4618: Launch Proposal for *Master of Philosophy in Professional Psychology* at BSPP (E-8)**

Responsibility: Principal BSPP (BUIC)

**Action of the Last ACM**

114. The following was approved by the Council:

a. Launch proposal for *Master of Philosophy in Professional Psychology* at BSPP, BUIC (E-8) is approved subject to the issuance of NOC by the HEC.

b. Deficiencies in the required facilities/ resources are to be resolved on priority, including the relevant PhD qualified PFMs for Clinical/ Organisational/ Educational domains, related test kits, required faculty-to-students ratio and managing the supervisory workload with new programme.

c. Progress is to be reported.

**Progress**

115. NOC was obtained from the HEC and the programmes launched in Fall 2024 semester on 16 Sep 24 with 19 x students. The status of required resources noted in the last ACM is as follows:

a. Available Faculty to Students Ratio – 5:1

b. Management of Supervisory Workload – 3 relevant FMs held, 2 more required.

c. Psychological test kits have been arranged as follows:

i. **For Fall 2024 Semester**

1) 11 tests are available (BGT, QNST, VABS, TONI, PAI-II, CRI, DAP, DAT, Stress Inventory, Emotional Regulation Scale, Emotional Quotient Inventories).

2) 1 test is under purchase process (16 PF).

3) 1 test is replaced (MBTI with MMPI-II).

ii. **For Spring 2025**

1) 10 tests are available (MMPI, TAT, CAT, RISB, HFD, HTP, ROR, MBDI, SDSS, IPAT Depression Scales).

2) ]1 test is under purchase process (Raven Progressive Matrices APM, CPM, SPM).

**Discussion**

116. The Secy proposed to review the course outline of *Measurement and Assessment* (PPY 703) for replacing MBTI with MMPI-II and its adoption from the ongoing/ Fall 2024 semester. DQA sought clarification for the need of the proposed review. The Secy indicated that the CU has already reported through the agenda progress that it was teaching the test MMPI-II instead of the test MBTI mentioned in the course outline, and that the proposed review was to address this anomaly. DQA suggested to keep such changes at the FBOS level. The Secy agreed and highlighted that the suggested review would be taken at the FBOS level without a need for the ACM approval; however, it had to be recorded because the deviation from the course outline had been noted at the ACM level. Principal BSPP intimated that MMPI-II was the latest version of the previous test. Principal IPP indicated that MMPI was used for clinical assessment/ psychodiagnosis and could not be compared with MBTI which measures personality traits. After further deliberation, the Chair asked Dean PP to resolve the observation.

**Decision 47(4618)**

117. The following was decided by the Council:

a. Deviation from the course outline of *Measurement and Assessment* (PPY 703) is to be resolved by the CU for the teaching of MBTI test or its suitable replacement with necessary updating at DBOS/ FBOS level.

b. Timely procurement of **Not Held** tests is to be ensured by the CU.

c. The progress is to be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision 117. a. & c. | Principal BSPP | Dean PP |
| Implementation of the Decision 117. b. & c. | Principal BSPP | DG BUIC |

**Item 4619: Launch of MBBS Programme at Bahria University College of Medicine, BUHSCI**

Responsibility: Dean HS

**Action of the Last ACM**

118. The following was decided by the Council:

a. Launch of MBBS programme at Bahria University College of Medicine (BUCM), BUHSCI is approved from 2024-25 intake.

b. Vision and Mission approved for BUMC, BUHSCK is to be adopted for BUCM, BUHSCI as well.

c. Review of MBBS curriculum for alignment with the latest PM&DC requirements is to be completed in May 2024, for special ACM in June 2024 to approve the updated curriculum for subsequent PM&DC inspection/ visit in July 2024.

d. Plan for the launch the BSN, DPT and BS (MLT) programmes at BUHSCI from the next year (2025) is to be formulated and presented separately.

e. Progress is to be reported.

**Progress**

119. The following Mission has been approved for BUCM on case file, which will be presented for ratification in the ACM:

> *"Our mission is to develop competent medical professionals through the promotion of excellence in medical education and research, nurturing individuals who embody compassion, responsibility, professionalism, ethical conduct, lifelong learning, and leadership qualities, with the expectation that our graduates will contribute to the improvement of healthcare in society and drive national development through national and international linkages".*

120. BUCM is currently establishing its departments and faculty i.a.w PM&DC standards for upcoming inspection and accreditation, which is expected to be completed by end Dec 24. A detailed plan for the launch of BSN, DPT and/or BS (MLT) programmes at BUHSCI will be formulated and presented separately once the above stated establishment and accreditation processes are finalized.

**Discussion**

121. The Mission statement was presented by the Principal BUCM, BUHSCI and approved by the Council with a few amendments as given below:

> *"To develop competent medical professionals through the promotion of excellence in medical education and research, nurturing individuals who embody compassion, responsibility, professionalism, ethical conduct, lifelong learning, and leadership qualities, with the expectation that the graduates will contribute to the improvement of healthcare in society and drive national development through national and international linkages".*

**Decision 47(4619)**

122. The Mission statement for BUCM, BUHSCI is approved as mentioned in para 121 above. The item is dropped from the ACM agenda, while the plan for the launching the BSN, DPT and BS (MLT) programmes are to be pursued as a separate/ new agenda item from the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Principal BUCM | DHS |

**Item 4620: Review of MCQs-SAQs Distribution in MBBS and BDS Examinations**

Responsibility: Dean HS

**Action of the Last ACM**

123. The following was approved by the Council:

a. Format of the question papers for the MBBS and BDS annual professional examinations is amended to 70:30 ratio of MCQs and SAQs with immediate effect. Outcome of the same is to be reviewed in the next ACM and any further amendment is to be considered later.

b. Questions databank maintained by the Exams Dte (BUHO) is to be reviewed by the Faculty of HS for improvement of the quality of questions, commensurate with the increased ration of MCQs.

c. Progress is to be reviewed.

**Progress**

124. New TOS comprising 70% BCQs and 30% MCQs is now implemented. Review of on-site questions of Databank has also been completed. Related changes have been implemented in CMS and ERD.

**Discussion**

125. Acting DG BUHSCK proposed to keep the agenda item under discussion till the time results of 3rd module are entered into CMS, by end October 2024. The Secy explained that closing and agenda item did not imply that the related actions are not to be reported. He proposed to drop this item from the ACM agenda while the compliance sought by BUHSCI may be included in the 1st progress report of the action items of this ACM. The proposal was concurred by the CU.

**Decision 47(4620)**

126. The item is dropped from the ACM agenda while the IT Dte is to comply the adoption of the revised MCQs/ SAQs distribution in the results of 3rd module by end October 2024.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Principal BUMC, Principal BUDC, DIT | Dean HS |

**Item 4621: Revised Eligibility Criteria for *PhD in Health Sciences* Programme**

Responsibility: Dean HS

**Action of the Last ACM**

127. Proposed eligibility criteria for *PhD in Health Sciences* is approved as presented. Related statutory documents, CU prospectus and website are to be updated accordingly. Progress is to be reported, along with HEC acceptability/ stance on revised eligibility criteria.

**Progress**

128. Revised approved admission eligibility criteria for *PhD in Health Sciences* is fully aligned with HEC GE Policy 2023. As per guidelines of QA Division of HEC, there is no need to get acceptability from the HEC. CU prospectus and BU website have been updated.

**Discussion**

129. The Secy proposed to drop the item from the ACM agenda which was approved by the Chair.

**Decision 47(4621)**

130. The item is dropped from the ACM agenda.

**Item 4622: Teaching and Supervision of MPhil Students by Non-PhD Regular Faculty Members**

Responsibility: Dean HS

**Action of the Last ACM**

131. The Council approved teaching/ supervision by non-PhD FM, Prof Dr Summayya Shawana in Fall 2023 semester as a special case. Shortage of related PhD FMs is to be resolved on priority by BUHSC-PGI, Progress is to be reported.

**Progress**

132. Hiring of 4 x MBBS-based PhD FMs faculty FMs (Anatomy, Histopathology, Physiology, Public Health) has been approved by the Rector. The vacancies have been posted on website and need to be placed in the newspapers.

**Discussion**

133. The Secy proposed to expedite the hiring process of the required FMs while reviewing the progress in the next ACM, which was approved by the Chair.

**Decision 47(4622)**

134. The hiring process of required FMs is to be expedited. The progress is to be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Principal BUHS-PGI, DHR | DHS |

**Item 4626: Approval of 5% Quota for Children of Overseas Pakistanis in BU Semester-Based Programmes**

Responsibility: DA

**Action of the Last ACM**

135. 5% quota for children of overseas Pakistanis in BU UG semester-based programmes (excluding MBBS/ BDS) is approved by the Council, for adoption from Fall 2024 admissions. HEC is to be approached by the DQA for consent on restricting the quota to UG programmes only. Progress is to be reported.

**Progress**

136. Action complied. As confirmed by DQA, HEC has no objection to restricting the 5% quota for children of overseas Pakistanis for the UG programmes only. As per HEC guidelines, all instructions/ policies/ guidelines issued by it should be deliberated in the respective Statutory Body of the University (i.e. BU Academic Council) for approval and the decision communicated to the respective stakeholders for compliance and implementation.

**Discussion**

137. The Secy proposed to drop the item from the ACM agenda which was approved by the Chair.

**Decision 47(4626)**

138. The item is dropped from the ACM agenda.

**Item 4627: Approval of Courses at Bahria University & Hashoo School of Hospitality Management (BU- HSHM)**

Responsibility: DLPDC

**Action of the Last ACM**

139. The following was approved by the Academic Council:

a. Approval of the launching of BU-HSHM at BFS Islamabad and Karachi.

b. Conduct of CTH Level 4 and 5 Diploma courses in Hospitality and Tourism Management at BU-HSHM, including the eligibility criteria, assessment methodology and Retake policy as of the CTH.

c. Amendments in BU statutory documents for changing the title of Pakistan Navy Finishing School to Bahria Finishing School at Islamabad and Karachi, followed by ratification by the BOG through EC.

d. Finalization of the modalities for the conduct of CTH courses at BFS, Karachi through a separate meeting/ presentation.

e. Progress is to be reported.

**Progress**

140. Admissions for Fall 2024 are in process for Subject Diploma Courses at BU-HSHM. The BOG has approved amendments in BU Statutes 2022 for the change of PN Finishing School nomenclature to Bahria Finishing School. The Proposal for the launch of Associate Degree (AD) in *Tourism & Hospitality Management* at BU-HSHM is under process of approval.

**Discussion**

141. Pro-Rector (RIC) asked about the process being adopted for the launch proposal of *AD in Tourism & Hospitality Management*. The Secy apprised that as a standard procedure the launch proposals for new programmes are processed through respective case file for scrutiny by the QA and Exams Dtes, after finalisation by the concerned DBOS and recommendation by the respective FBOS, so that any shortcomings are duly addressed before the ACM.

142. Dean MS indicated the requirement of the inclusion of the course *Pakistan Studies* in the proposed roadmap for the AD programme, as per the latest HEC instructions. The Secy updated that in subject case the launch proposal has to be finalised by the Faculty of MS. Accordingly, the Dean may review the roadmap at the FBOS level to fulfil any HEC or BU requirements prior recommending to the Academic Council.

**Decision 47(4627)**

143. The launch proposal for *AD in Tourism & Hospitality Management* at BU-HSHM is to be processed by the Faculty of MS in compliance of the HEC requirements and as per the standard format given in BUAR. The progress is to be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | DLPDC, Dean MS | Dean MS |

**Item 4632: Approval of BU Academic Rules 2024**

Responsibility: DAcad

**Action of the Last ACM**

144. Revised versions of statutory documents, including BU Academic Rules 2024, are to be presented in an exclusive meeting prior consideration by the Academic Council. However, amendments in BUAR 2016 clause 5.4.1 & 5.4.2 (Late Fee) placed at Appendage 4632, approved through a case file and promulgated vide Registrar letter BU-HO letter BU-HO/Reg/2024/N/013 dated 22 Feb 2024 are approved for ratification by the EC. Progress is to be reported.

**Progress**

145. Draft BUAR 2024 have been finalised through a process comprising of:

a. An exclusive meeting chaired by the Rector and attended by all the CUs on 20 May 24.

b. A review of the updated contents by all the CUs in May-June 2024.

c. Further review of the updated document in an IHD chaired by the Pro-Rector (Acad) and attended by all the Deans & relevant BUHO Dirs on 10 June 2024.

d. Scrutiny of the revised draft by the DQA and the Legal Adviser, followed by its proofreading by the relevant faculty at BUIC.

146. The BUAR 2024 thus finalised were presented to the Rector in an exclusive meeting on 19 September 2024. After detailed discussion on the clauses being reviewed, the draft was finalized for approval in the forthcoming ACM, with a few changes. The finalized draft will be presented by DAcad for approval by the Council.

**Discussion**

147. DAcad presented the finalized BU Academic Rules 2024 to the Academic Council. After a detailed review of all the major changes highlighted in the presentation, as placed at **Appendage 47(4632)**, the Council recommended the approval of the revised Rules by the Executive Committee (EC).

**Decision 47 (4632)**

148. BU Academic Rules 2024 are recommended by the Academic Council for approval by the EC as presented, with major changes as mentioned in **Appendage 47(4632)**. The progress is to be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | DAcad, Registrar | DAcad |

## NEW ITEMS

| **Item 4701: Revision of BEE Programme Curriculum** | |
|---|---|
| Sponsor: Dean ES | Referral Authority: FBOS-ES |

**Summary of the Case**

149. The curriculum of BEE programme has been revised by the Pakistan Engineering Council (PEC) vide **Appendage 4701-A**. In this regard, roadmaps of BEE programmes of the EE Dept at BUIC and BUKC have been aligned according to the PEC's Dec 2023 revised BEE programme roadmap. Major changes in the proposed BEE Roadmap are:

a. Breadth of core courses for the Telecommunication, Electronics & Power specialization streams are changed. Power Distribution and Utilization is added as a Major-Based Core (MBC) course in the $6^{th}$ semester.

b. As recommended by the PEC, Final Year Design Project is offered as Project-I (2+0) and Project-II (4+0) in $7^{th}$ and $8^{th}$ semester respectively.

c. Two new specialization streams of *Electrical Vehicles* and *Computer Systems* have been added to the new BEE curriculum.

150. The new streams are made part of the revised curriculum of BEE programme of BU but can be offered after approval of PEC through the change of scope/ Zero Visit. The first 2 years (4 x semesters) of the new roadmap of BEE programme are aligned with the previously approved roadmap of BEE at BU vide $45^{th}$ ACM 45 Appendage 45(4130) B2. Dean ES will present the revised roadmaps approved through case file for ratification by the Academic Council.

**Discussion**

151. Dean ES presented the roadmaps of BEE programme as given at Appendage 4701-B. Pro-Rector (RIC) enquired about the need to adopt the *Computer Systems* stream in EE while already offering *Computer Engineering*. Dean ES and DQA explained that both the degree programmes covered different domains. Pro-Rector (RIC) also asked about the need to set up the mechanical lab to venture into the *Electrical Vehicles* stream. Dean ES explained that the EE domain pertained to the electrical part of these vehicles only. DQA supported the proposals due being the emerging areas which required ACM approval for further pursuance. Principal BSEAS-IC highlighted that *Computer Systems* stream in EE was generally offered where the *Computer Engineering* programme is not offered separately. In case of BUIC (H-11) the latter was already being offered. However, *Electrical Vehicles* stream would be a good addition. DQA elaborated that *Computer Engineering* programme will not have any impact with the launch of *Computer Systems* stream in EE because of the base degree being the BEE. He explained that such streams were being introduced to overcome the ongoing decline in the EE programmes. DPGP further explained that the EE programmes were being realigned world over towards the AI technologies for alignment with the latest trends, while *Computer Engineering* remained a different domain. The Chair consented that the proposed new streams were being launched by the PEC to retain the interest in EE programmes.

152. The Chair also sought the views of BUKC. The Principal BSEAS-KC supported the introduction of *Electrical Vehicles* stream as the emerging trend and apprised that the CU had already done some work in this regard. He reiterated that mechanical lab was not required for this stream and assured that significant progress could be attained in this domain within bearable cost.

153. After further discussion and review of the proposed changes in the EE programmes, the Council ratified the amendments proposed in the roadmaps for alignment with the PEC designed *Computer Systems* and *Electrical Vehicles* streams.

**Decision 4701**

154. Revised roadmaps of BEE programmes aligned with the PEC curriculum are ratified by the Academic Council as given at **Appendage 4701-B**, for adoption from the intake of Fall 2023 semester. CU prospectus, BU website and ERD are to be updated accordingly. The progress will be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Dean ES, CE, DA, DIT | Dean ES |

**Item 4702: Curriculum Revision of PG Programmes of Engineering Sciences**

Sponsor: Dean ES Referral Authority: FBOS-ES

**Summary of the Case**

155. Curriculum revision is a continuous process, through which new courses are added in the Postgraduate (PG) degree programmes. In addition, course contents and course codes of some courses are revised and the curriculum aligned with HEC GEP 2023. Deans ES will present the amended roadmaps of the following PG programmes for ratification by the Academic Council, as placed at **Appendage 4702**:

a. MS in Electrical Engineering
b. MS in Software Engineering
c. MS in Computer Engineering
d. MS in Computer Science
e. MS in Data Sciences
f. MS in Information Security
g. MS in Mathematics
h. MS in Engineering Management
i. MS in Environmental Science
j. MS in Geology
k. MS in Geophysics

**Discussion**

156. Dean ES presented the amended roadmaps of the above listed PG programmes as given at **Appendage 4702**. He also explanation of the mechanism adopted for the proposed curriculum review. After brief discussion, the Council ratified the amended roadmaps as presented.

**Decision 4702**

157. Revised roadmap of the faculty of ES PG programmes aligned with the updated PEC curriculum were ratified by the Academic Council as given at **Appendage 4702** for implementation from Fall 2024 semester. CU prospectus, BU website and ERD are to be updated accordingly. The progress will be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Dean ES, CE, DA, DIT | Dean ES |

**Item 4703: Correction of Pre-requisite for the Course *Programming for AI* in BS (AI) Roadmap**
Sponsor: Dean ES Referral Authority: FBOS-ES

**Summary of the Case**

158. The revised roadmap of *BS in Artificial Intelligence* programme was approved in the 45th ACM. Prerequisite courses for *Programming for Artificial Intelligence* and its Lab mentioned in the approved roadmap need to be corrected as follows:

| Replace | | | | With | | | |
|---|---|---|---|---|---|---|---|
| Pre-requisite | Course Code | Course | Credits | Pre-requisite | Course Code | Course | Credits |
| CSC 113 | AIC 202 | Programming for Artificial Intelligence | 02 | AIC 201 | AIC 202 | Programming for Artificial Intelligence | 02 |
| CSC 113 | AIL 202 | Programming for Artificial Intelligence Lab | 01 | AIC 201 | AIL 202 | Programming for Artificial Intelligence Lab | 01 |

**Discussion**

159. The Secy explained the amendments being incorporated through the proposal. Dean ES confirmed that the only changes being pursued were the correct pre-requisite courses for 2 courses. The Council consented to comply the same.

**Decision 4703**

160. The pre-requisite amendments for the course *Programming for Artificial Intelligence* and its *Lab* are approved by the Academic Council as tabulated in para 158. above. Related roadmaps are to be amended in BU prospectus, on BU website and in CMS as well as the ERD. The item is dropped from the ACM agenda.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Dean ES, CE, DA, DIT | Dean ES |

**Item 4704: Review of Admission Policy for Lateral Entry of *AD (CS)* Graduates into UG Computing Programmes**
Sponsor: Dean ES Referral Authority: FBOS-ES

**Summary of the Case**

161. *Associate Degree in Computer Science*, AD (CS) was launched in Fall 2023 semester at the CS Dept of BULC and in Spring 2024 semester at the CS Dept of BUIC (H-11). Currently, 52 x students are enrolled at BULC and 64 at BUIC (H-11). The AD (CS) programme is a 2-year degree spanning 4 x semesters. The senior-most batches at BULC and BUIC H-11 are currently in their 3rd

and 2nd semesters respectively. The curriculum and roadmap of the AD (CS) programme are aligned with the BS (CS) programme.

162. The AD (CS) students have expressed interest in continuing their education to complete a 4-year bachelor's degree, preferably in Computer Science. Providing them lateral internal into the ongoing BS programmes benefits the BU too, as it would enable the filling of seats vacated by the students who have been dropped or left the programme.

163. Above in view, the following admission policy is recommended for lateral entry of AD (CS) students/ graduates into the UG Computing programmes BS (CS), BS (IT) and BS (AI):

a. **<u>BU Graduates</u>.** BU's AD (CS) graduates would be eligible for admission into the BS (CS), BS (IT) and BS (AI) programmes with exemption from the admission test. Admissions will be based on the availability of seats in these programmes to support lateral entry in 5th semester of UG Computing programmes. Merit will be determined based on the CGPA from the AD (CS) programme. All credits of AD (CS) programme will be transferred to the respective BS programme (as per applicable roadmap).

b. **<u>Non-BU Graduates</u>.** AD (CS) from other (non-BU) HEC-recognized HEIs would be eligible for admission into the BS (CS), BS (IT) and BS (AI) programmes. These applicants will be required to secure admission into the desired UG programme after qualifying the BU admission test (CBT). Transfer of credits from AD (CS) to respective degree programme will be facilitated in accordance with the prevailing BU Transfer of Credits Policy.

**<u>Discussion</u>**

164. Pro-Rector (RIC) suggested to raise the minimum CGPA requirement for lateral entry from the proposed 2.0 keeping in view the high merit of the BS (CS) programme that the AD (CS) applicants would be joining. DQA indicated that the provision for lateral entry was as per HEC UEP 2023 while CGPA 2.0 would be minimum and lateral entry would be only for the seats available in the 5th semester of BS programme as per merit. Dean ES opined that raising the minimum CGPA requirement for AD (CS) graduates would induce discouragement for the aspiring candidates for lateral entry. HOD CS BULC highlighted that the AD (CS) have the roadmap of 4 semesters quite similar to the BS (CS) students and should not be considered to have an inferior learning prior lateral entry. As such, minimum CGPA may be kept at 2. DG BUKC agreed with the Pro-Rector (RIC) suggestion and proposed to keep CGPA 3.0 as the minimum to qualify for the lateral entry. Dir Academics HEC also suggested to keep a minimum CGPA for the proposed admission in the 5th semester. He further indicated that for different disciplines, i.e. IT, AI the AD (CS) graduates will have to take the deficiency courses. DQA explained that the first semesters of BS programmes in CS, IT and AI have the similar roadmaps. Dean ES indicated that the proposed admissions procedure catered the transfer of similar courses, which implied that deficiency courses will have to be taken by the AD (CS) in the BS programmes. However, he agreed to explicitly include this aspect in the pre-requisites for proposed lateral entry. DORIC proposed to adopt 2.5 as the minimum CGPA in AD (CS) to qualify for the proposed lateral entry, while CE, DA and Dean H&SS proposed to keep it at 2. Dir Academics HEC reiterated that CGPA 2.0 was set as the minimum to qualify for the AD degree while the universities were under no bar to raise the entry level for higher programmes. and requirement. After further discussion, the consensus was developed among the participants to adopt the minimum CGPA 2.5 in AD (CS) programme to qualify for applying into the lateral entry into the proposed BS programmes.

165. Pro-Rector (RIC) also dissented with the admission test waiver for the BU graduates. He proposed to keep all the lateral entries through an admission test for all BU and non-BU graduates, so that the CU could get the best applying entrants. He further indicated that the admission test waiver for BU graduates, if adopted, should have some time limit; otherwise, an applicant may seek the admission into the BS programme after a considerable break into the studies post the AD degree. DA agreed with the requirement of admission test for all the applicants. Pro-Rector (RIC) highlighted that the related HEC UEP 2023 considered the proposed lateral entry as admission into the 5th semester of BS programme; accordingly, the admission test should be taken by all the applicants, including BU graduates. The Chair sought further clarification in this regard from the Dir Academics HEC, who explained that the related HEC Policy did not mention the phrase ***lateral*** entry, thereby meaning that there was no provision for direct induction of AD students into a BS programme. However, admission in the 5th semester of a BS programme may be referred as the lateral entry. He further emphasises that the entry test for admission in the 5th semester was the prerogative of the HEIs as HEC UEP 2023 defined only a minimum CGPA or percentage for such admissions. Pro-Rector (RIC) further indicated that the students taking the option of AD programme followed by the BS would have 2 x degrees after the 4-year period (AD and BS) for which they should be taking 2 separate admission tests and not just 1 as proposed. DC BULC informed that Superior University at Lahore was offering lateral entry of its AD graduates into the BS programme without an admission test. The Chair asked for further clarity from the HEC rep. Dir Academics HEC checked it from the concerned HEC Division through telecon and informed that admissions into the 5th semester of BS programme would be taken as fresh admissions, which would necessitate an admission test for all the applicants. The Chair accordingly directed to keep the admission test requirement for the BU graduates as well.

**Decision 4704**

166. The proposed admission policy for the lateral entry of AD (CS) graduates into UG Computing programmes is approved by the Academic Council for adoption from the Spring 2025 semester, with a minimum CGPA 2.5 in AD (CS) and admission test (separately designed) for lateral entry into the UG Computing programmes in all the Campuses for BU and non-BU AD (CS) graduates. After qualifying the admission criteria and the entry test, admission will be given to the candidates subject to the availability of seats in the 5th semester on a merit basis. After admission, individual cases should be evaluated for transfer of credits as per the existing policy of BU. BU prospectus and website are to be amended accordingly. The progress will be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Dean ES, DA, DIT | Dean ES |

**Item 4705: Approval of MBBS Curriculum as per PM&DC Standards 2024**

Sponsor: Dean HS Referral Authority: FBOS-HS

**Summary of the Case**

167. PM&DC has launched the new Curricular Standards 2024 for MBBS programme on 24 June 2024. Overall, there are no gross effects on the already approved curriculum. However, minor readjustments in subjects and their hours distribution were required, which have been recommended by the FBOS-HS for approval by the Academic Council, in its meeting held on 19 September 2024. Principal BUCM, BUHSCI will present the updated curriculum for adoption at BUCM.

**Discussion**

168. Principal BUCM presented the MBBS curriculum as per PM&DC Standard 2024 placed at **Appendage 4705**, indicating the changes from the previous/ 2019 curriculum in terms of teaching hours for some subjects, 3 x sub-specialities instead of 2 in Medicine & Allied, horizontally & vertically integrated curriculum, etc. Dean HS indicated that the proposed curriculum will also be adopted at BUHSCK at a later stage. After brief discussion, the Council approved the adoption of MBBS curriculum at BUCM as presented.

**Decision 4705**

169. The updated MBBS curriculum placed at **Appendage 4705** is approved by the Academic Council for adoption at BUCM, BUHSCI from the fresh intake. BU prospectus and website are to be updated accordingly. The item may then be dropped from the ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Principal BUCM, DA, DIT | DHS |

**Item 4706: Approval of Revised BSN Roadmap for implementation from Spring 2025**

Sponsor: Dean HS Referral Authority: FBOS-HS

**Summary of the Case**

170. Academic roadmap of BSN programme has been revised by the HEC as intimated in March 2024. The same will be adopted at PNNC from Spring 2025 semester subject to approval by the Academic Council. Vice Principal PNNC will present the revised roadmap of BSN programme for approval by the Council.

**Discussion**

171. The amended roadmap was presented by the Vice Principal PNNC. She intimated that the course contents were still under review by the consortium constituted by the Pakistan Nursing Council (PNC) for this purpose, which would be processed through case file – after finalisation – for adoption in Spring 2025 semester. She also indicated the changes incorporated in the revised roadmap, including *Tajweed* & *Seerah* courses and Capstone Project as per the HEC requirements.

172. Regarding ongoing curriculum review, the Secy explained that the ACM approval was not required for any changes incorporated in the existing courses that are overall up to 20% of the total contents. He proposed that the Council may accord approval for the revised roadmap as being presented, while the approval of any new course or review of more than 20% of existing course outline may be pursued from the Academic Council as a separate/ new agenda item as and when required. DQA supported the proposal and explained that the BSN curriculum was generally formulated by the HEC through an exclusively formed consortium, while the HEIs followed the same.

173. Dean H&SS indicated that the roadmap presented did not have course codes allocated for the courses. The Secy explained that the roadmap had been scrutinised by the QA Dte and the Course Codes duly allocated by the Exams Dte. However, the same had been missed in the presentation. Dir Academics HEC noted that the course *Pakistan Studies* had not been indicated in the roadmap. The Secy acknowledged that coverage of the same through the course *Ideology and Constitution of Pakistan* had been assumed at the BU level; however, as per the latest HEC instructions in this regard, the course *Pakistan Studies* will be included in the approved roadmap along with the course *Ideology and Constitution of Pakistan*.

**Decision 4706**

174. The revised roadmap of BSN is approved by the Academic Council as placed at **Appendage 4706** with course codes mentioned for all the courses and inclusion of the course *Pakistan Studies*, for adoption from the Spring 2025 semester intake. BU prospectus, website, CMS and ERD are to be updated accordingly. Progress will be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Principal PNNC, DA, CE, DIT, DHS | DG BUHSCK |

**Item 4707: Approval of 2 New Elective Courses in *PhD in Health Sciences* Programme**

Sponsor: Dean HS Referral Authority: FBOS-HS

**Summary of the Case**

175. The Dept of Community Health Sciences/ Public Health at BUHSCK has developed the following 2 x new Elective courses for the discipline of Public Health in the *PhD in Health Sciences* programme:

a. Advanced Techniques of Research Data Analysis (Course Code PBH 809)

b. Applied Demography and Family Planning (Course Code PBH 810)

176. The addition of these courses to the list of Electives will provide more choices for the PhD scholars to choose/ select the elective courses. HOD CHS/ PH BUHSCK will present the proposal for approval by the Academic Council, as recommended by the FBOS of the Faculty of HS.

**Discussion**

177. PGP Coordinator, BUHS-PGI presented the new Electives with course outline of each, as given at **Appendage 4707**. He intimated that the courses had been reviewed by DQA, CE and DPGP, and cleared for the ACM approval.

**Decision 4707**

178. Two new elective courses presented by BUHSCK are approved by the Academic Council for inclusion in the list of Electives for *PhD in Health Sciences* programme at given **Appendage 4707**. BU prospectus, website, CMS and ERD are to be updated accordingly. The point may then be dropped from the ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Principal BUHS-PGI, DA, CE, DIT | Dean HS |

**Item 4708: Launch of Certificate in Health Professional Education (CHPE) Course at BUHSCI**

Sponsor: Dean HS Referral Authority: FBOS-HS

**Summary of the Case**

179. *Certificate in Health Professional Education* (CHPE) is a mandatory requirement for the Faculty of Health Sciences. BUCM has Medical Education degrees/ diploma holders (MHPE/ MCPS-HPE) qualified faculty members who have graduated from the Aga Khan University, Riphah University, and CPSP. Therefore, a standard CHPE course can be launched at BUCM, BUHSCI. The proposal has been recommended by the FBOS-HS for approval by the Academic Council, in its

meeting held on 19 September 2024. Principal BUCM, BUHSCI will present the proposal for approval by the Council.

**Discussion**

180. Principal BUCM explained that the CHPE was a mandatory requirement for all prospective teachers of the Faculty of HS and that the BUCM has planned to conduct this course because it has the requisite faculty qualified in Health Professional Education. He proposed to launch it in January 2025 after the BUCM has been recognised by the PM&DC. The Chair accorded the in-principle approval for further processing of the proposal as per standard procedure.

**Decision 4708**

181. Launching of the *Certificate in Health Professional Education* (CHPE) at BUCM on the recommendations of FBOS-HS is approved by the Council as given at **Appendage 4708**. The item is then to be dropped from the ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Principal BUCM, DHS | DHS |

**Item 4709: Launch of Research Mentorship Programme (RMP) for all UG Students at BUHSCK**

Sponsor: Dean HS  Referral Authority: FBOS-HS

**Summary of the Case**

182. The Research Cell at Bahria University Health Sciences Campus Karachi (BUHSCK) serves as the central hub for research activities and is dedicated to promoting high-quality research aligned with the institution's vision of excellence in education and societal betterment. This Research Cell has proposed a comprehensive 3-year strategic plan to enhance its research capabilities, community engagement, fund diversification, and achieve national and international recognition. The proposal has been recommended by the FBOS-HS for approval by the Academic Council, in its meeting held on 19 September 2024. Dean HS will present the proposal for approval by the Council.

**Discussion**

183. Dean HS presented the proposal for the Research Mentorship Programme for BUHSCK undergraduate students as placed at Appendage 4709, based on 1 Research Mentor for every 5 students; a total of 50 students selected in the first year. Financial effects would be negligible. Workshops will be held for the capacity building of Mentors. In the first 3 years, 10 x senior Mentors will be involved in the programme. Criteria for mentees will be formulated so that dedicated Mentors are shortlisted. It will be expected that at least 4-5 research works are published during the 3-years process. With desired progress, the new batch may be subsequently inducted. Dean HS highlighted that the UG students are usually under-represented in the research domain. As the BU Vision and Mission are research oriented, the Faculty of HS wants to inculcate research habit in its UG students at an early stage so that they have a research publication by the time they graduate, are well conversant with the research traits and know how to conduct research. She added that the proposal had been supported by the FBOS of HS. The Chair endorsed the proposal for approval by the Council.

**Decision 4709**

184. Research Mentorship Programme for UG students of BUHSCK is approved by the Academic Council for adoption as given at **Appendage 4709**. The item is then dropped from the ACM agenda.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Dean HS | Dean HS |

**Item 4710: Supervision of MPhil Candidates by Regular PhD faculty**

Sponsor: Dean HS Referral Authority: FBOS-HS

**Summary of the Case**

185. Regular PhD faculty members (FMs) shall teach and supervise MPhil and PhD students aligned with the HEC GEP 2023. The rule for supervision of MPhil students by PhD FMs is applicable from Fall 2023 semester. In case of non-availability of required PhD faculty, permission for MPhil supervision by the MPhil FMs is to be taken from the ACM forum. A PhD FM in the discipline of Anatomy has resigned, due to which a Supervisor is required for an MPhil student of Batch-7 (2023-2025) inducted in Fall 2023 semester (Dr Areeba Younus). Prof Dr Yasmeen Mahar, HOD Anatomy (MPhil) may be granted permission for the supervision of Dr Areeba Younus. She has recently supervised MPhil candidates. Meanwhile, the headhunting for PhD Anatomy FM will continue.

**Discussion**

186. Dean HS apprised that the requested approval was aligned with the related HEC policy, which has been relaxed for the HS disciplines for the next 5 years. DQA confirmed that besides the recent HEC policy relaxation, supervision by MS qualified FMs in case of non-availability of PhD FMs was permissible subject to the Academic Council approval. DPGP intimated that the previous HEC policy required at least 5 years supervision experience for the MS qualified FMs to supervise the PhD scholar; however, the new policy did not necessitate that. Pro - Rector RIC conveyed the HEC requirement of 5-year experience to supervise under this policy. Dean HS indicates that Dr Yasmeen Mahar has 7 years of supervision experience; thus qualified as per the previous HEC policy. The Chair conceded to approve the subject supervision.

**Decision 4710**

187. Prof Dr Yasmeen Mahar is granted permission by the Academic Council to supervise Dr Areeba Younus for the MPhil programme. The item is then dropped from the ACM.

**Item 4711: Amendments in BU Affiliation Policy 2024**

Sponsor: CE Referral Authority: Case File

**Summary of the Case**

188. The current BU Affiliation Policy has been formulated in sync with the HEC Institutional Affiliation Policy promulgated in January 2024 and was approved in the last/ 46th ACM, followed by ratification in the last/ 20th ECM. The HEC has further incorporated 2 x amendments in the said Policy which requires corresponding amendments in BU Affiliation Policy. The CE will present the proposed amendments in BU Affiliation Policy for approval by the Academic Council.

**Discussion**

189. CE presented the amendments to the BU Affiliation Policy as given at **Appendage 4711**. It was indicated that the amendments comprised of inclusion of the Affiliated College/ Institute on the degree, and approaching the HEC in case any difficulty arose in interpretation of any provision of the HEC Affiliation Policy. The Council approved the amendments as presented.

**Decision 4711**

190. Amendments in *BU Affiliation Policy* as presented by the CE are approved by the Academic Council as given at **Appendage 4711** for incorporation through Registrar office (Regulations Cell). The item is then dropped from the ACM agenda.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | CE, Registrar | CE |

**Item 4712: Amendments in BU HR Policy Manual due to Revised CLR Policy for PFMs**

Sponsor: DHR Referral Authority: Registrar Notification

**Summary of the Case**

191. Course Load Reduction (CLR) Policy for BU PFMs has been reviewed through a committee, the recommendations of which were presented in the 45th ACM (Item 4523) followed by approval of the revised CLR through a case file on 29 Jan 24, which were subsequently promulgated through Registrar Notification 02/2024 dated 31 January 2024. As part of the approved recommendations, related amendments in BU HR Policy Manual are to be approved by the Academic Council i.a.w BU Statutes 2022 clause 2.12.3 for subsequent incorporation. DHR will present the proposed amendments in BU HR Policy Manual 2023 for approval by the Academic Council.

**Discussion**

192. DHR presented the amendments to the BU HR Policy Manual 2023 as placed at **Appendage 4712**, comprising of inclusion of the regular workload of PFMs in HR Policy Manual Chapter 3 (Workload Policy) and revised CLR. The amendments were fully endorsed by the Academic Council.

**Decision 4712**

193. Amendments in BU HR Policy Manual 2023 are approved by the Academic Council as placed at **Appendage 4712** for incorporation through Registrar office (Regulations Cell). The point is then dropped from the ACM agenda.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | DHR, Registrar | DHR |

**Item 4713: Amendments in BU Statutes Service Structure**

Sponsor: DHR Referral Authority: Case File

**Summary of the Case**

194. The initial appointment period of retired Naval personnel has been increased from one year to two years with the approval of the Chairman BOG, which needs to be amended in the related clause of BU Statutes (8.3.6).

195. Further, fuel ceiling to the Registrar, Directors and Heads of the CUs authorized vide BU Statutes clause 8.28.1 has been revised from 250 ltr per month to 275 ltr per month. The same needs to be amended in the Statutes accordingly.

**Discussion**

196. The Chair enquired about the procedure adopted for revising the fuel authorisation. DHR apprised that the same was processed on file. The Chair desired to review this aspect separately. However, the amendment related to the increase of the initial appointment period of retired Naval personnel was concurred by the Council.

**Decision 4713**

197. The following was decided:

a. Amendment in BU Statutes 2022 clause 8.3.6 for increased initial appointment period of retired Naval personnel from one year to two years, already approved by the Chairman BOG, is recommended by the Academic Council for approval by the Executive Committee followed by ratification by the BOG.

b. Amendment in BU Statutes pertaining to the revision of fuel authorisation is to be processed separately by the HR Directorate.

c. The progress will be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | DHR, Registrar | DHR |

**Item 4714: Amendments in BU Statutes due to Re-organization of BBS-IC**

Sponsor: Principal BBS-IC — Referral Authority: Case File

**Summary of the Case**

198. Academic infrastructure of Bahria Business School, Islamabad (BBS-IC) has been re-organised by replacing the Cluster Heads with Programme Managers for academic control of related degree programmes and restricting the domain of HODs for the academic administration only. This requires amendments in BU Statutes for revised duties of HODs, inclusion of duties/ responsibilities of Programme Managers, and amendment of the organogram of BBS-IC. Principal BBS-IC will present the proposed amendments in BU Statutes for pursuing the BOG approval through the Executive Committee.

**Discussion**

199. Principal BBS-IC presented the updated organogram and associated duties of the HODs and Programme Managers as placed at **Appendage 4714-A** respectively for ratification by the Academic Council, so as to incorporate related amendments in BU Statutes 2022. The Secy indicated that the revised organogram of BBS-IC had been approved by the Chair in an exclusive meeting and could be ratified by the Academic Council accordingly. However, duties of HODs and Programme Managers proposed by BBS-IC were yet to be reviewed by the BUHO. He suggested to process them separately and ratify the finalised contents in the next ACM after approval on case file. The Chair consented the same.

**Decision 4714**

200. The revised organogram of BBS-IC as placed at **Appendage 4714-A** is ratified by the Academic Council for amendment in BU Statutes 2022 Annex E, subject to approval by the

Executive Committee. However, the duties of HODs and Programme Managers as proposed in **Appendage 4714-B** are to be processed separately for approval by BUHO. The progress is to be reported in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Principal BBS-IC, Registrar | DG BUIC |

**Item 4715: Amendments in BU Statutes 2022 due to Review of Students' Advisory and Counselling Infrastructure**

Sponsor: DAcad Referral Authority: Case File

**Summary of the Case**

201. As per Decision 46(4523) of the 46th ACM, mechanism of students' advisory and counselling has been changed by replacing the Advisor Students Affairs with Class Advisers from the faculty with revised academics-related work scope and appointing dedicated Departmental Coordinators for the routine departmental working. Accordingly, clause 7.5 of BU Statutes 2022 for *Advisor Students Affairs* needs to be replaced with the new clauses**.** DAcad will present the proposed amendments in BU Statutes for pursuing the BOG approval through the EC.

**Discussion**

202. DAcad proposed amendments to the BU Statutes 2022 for the Academic Council recommendations as given at as given at **Appendage 4715**, which comprise of replacing *Advisor Students Affairs* in clause 7.5 with *Departmental Coordinators* and adding clause 7.6 for *Class Advisers*. He indicated that the proposed duties had been approved as part of the committee recommendations for review of students' advisory and counselling infrastructure and that the proposed amendments in BU Statutes 2022 were to comply the same in related statutory documents. After a brief review of the proposed clauses, the Council concurred with the related amendments in BU Statutes 2022.

**Decision 4715**

203. Amendment in BU Statutes 2022 clause 7.5 and addition of clause 7.6 as mentioned in **Appendage 4715** is recommended by the Academic Council for approval by the EC followed by ratification by the BOG. The progress will be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | DAcad, Registrar | DAcad |

**Item 4716: Approval of SOP for Students Exchange with Istanbul Kultur University, Türkiye**

Sponsor: DIO Referral Authority: Case File

**Summary of the Case**

204. In line with the Strategic Plan of Bahria University, BU has initiated an Exchange of Students MOU with Istanbul Kultur University, Turkiye from Fall 2024 semester. Keeping in view the practice followed for other universities, an SOP has been prepared by the IO Dte to define the students' selection, credit transfer and grade mapping mechanism under the exchange programme. The SOP was processed and approved by the Rector. The DIO will present the key points of the SOP, particularly the comparison of the grading system of both the universities.

**Discussion**

205. DIO presented the SOP for the exchange of students with Istanbul Kultur University, Turkiye as given at **Appendage 4716**. After brief discussion, the Academic Council ratified the SOP for adoption from Fall 2024 semester.

**Decision 4716**

206. The SOP presented by DIO for the exchange of students with Istanbul Kultur University, Turkiye as given at **Appendage 4716** is ratified by the Academic Council for adoption from the Fall 2024 semester. The item is then be dropped from the ACM agenda.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | DIO | DIO |

| **Item 4717: Approval of SOP for Students Exchange with University of Malaga, Spain** | |
|---|---|
| Sponsor: DIO | Referral Authority: Case File |

**Summary of the Case**

207. In line with the Strategic Plan of Bahria University, BU has initiated Exchange of Students with University of Malaga, Spain from Fall 2024. Keeping in view the practice followed for other universities, an SOP has been prepared by the IO Dte to define the students' selection, credit transfer and grade mapping mechanism under the exchange programme. The SOP was processed and approved by the Rector. The DIO will present the key points of the SOP, particularly the comparison of the grading system of both the universities.

**Discussion**

208. DIO presented the SOP for the exchange of students with University of Malaga, Spain as given at **Appendage 4717**. After brief discussion, the Academic Council ratified the SOP for adoption from Fall 2024 semester.

**Decision 4717**

209. The SOP presented by DIO for the exchange of students with University of Malaga, Spain as given at **Appendage 4717** is ratified by the Academic Council for adoption from the Fall 2024 semester. The item is then be dropped from the ACM agenda.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | DIO | DIO |

| **Item 4718: Approval of SOP for Students Exchange with Istanbul Aydin University (Türkiye)** | |
|---|---|
| Sponsor: DIO | Referral Authority: Case File |

**Summary of the Case**

210. In line with the Strategic Plan of Bahria University, BU has initiated an Exchange of Students MOU with Istanbul Aydin University, Turkiye from Spring 2025 semester. Keeping in view the practice followed for other universities, an SOP has been prepared by the IO Dte to define the students' selection, credit transfer and grade mapping mechanism under the exchange programme. The SOP was processed and approved by the Rector. The DIO will present the key points of the SOP, particularly the comparison of the grading system of both the universities.

**Discussion**

211. DIO presented the SOP for the exchange of students with Istanbul Aydin University, Turkiye as given at **Appendage 4718**. After brief discussion, the Academic Council ratified the SOP for adoption from Spring 2025 semester.

**Decision 4718**

212. The SOP presented by DIO for the exchange of students with Istanbul Aydin University, Turkiye as given at **Appendage 4718** is ratified by the Academic Council for adoption from the Spring 2025 semester. The item is then be dropped from the ACM agenda.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | DIO | DIO |

**Item 4719: Standardizing Teaching Activities Policy for BU Officers**

Sponsor: DIO Referral Authority: Case File

**Summary of the Case**

213. Recently, several BUOs have been actively involved in various teaching activities at Bahria University. These cases have been handled individually or under relevant existing policies. To ensure a more consistent approach, a committee was formed at BUHO to develop a comprehensive policy that streamlines the teaching activities of BUOs. This policy has been approved by the Rector and is now being presented to the ACM for ratification by the DIO in capacity of the head of the said committee.

**Discussion**

214. DIO presented the committee report and recommendations as placed at Appendage 4719. The Chair asked about the applicability of the proposed Policy. While the DIO attributed it to the BUOs as well as the FMs appointed on admin duties at BUHO or in CUs, the Secy indicated that provisions were given in BU Statutes/ HR Policy Manual for the PFMs appointed on admin duties at BUHO/ CUs. The Chair asked about the no. of BUOs undertaking teaching duties and suggested to continue processing them on case-to-case basis. DIO explained that the proposed Policy was formulated to streamline this procedure. DG BUKC shared concerns on allowing the BUOs to undertake teaching during the regular working hours as that would compromise their availability for the main work for which they are employed. DIO explained such activities would be subjected to spared by the concerned Dept. DG BUKC reiterated that such approvals should be limited to non-working hours only. Pro-Rector (RIC) opined that such circumstances are already covered in existing policies and that a new policy would not be required. DG BUKC suggested that existing policies do not cover employability of BUOs for teaching duties even in non-working hours, which required the adoption of a related policy. Pro-Rector (RIC) proposed to cater this aspect through suitable amendment of existing policies. After further detailed discussion, the Chair advised to review the proposed Policy in more detail, considering the aspects highlighted in the ACM, through a separate session and then put up for the ACM consideration.

**Decision 4719**

215. The proposed Policy to standardise teaching activities by BUOs is to be reviewed as per the observations raised during the ACM and processed through a separate/ exclusive session for re-consideration by the Academic Council. The progress will be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | DIO | DIO |

**Item 4720: Ratification of 1% Additional Quota for Balochistan at BU CUs**

Sponsor: DA — Referral Authority: Case File

**Summary of the Case**

216. HEC has forwarded a letter from the Ministry of Education & Professional Training to double the existing quota of students from Baluchistan to provide greater opportunities for the youth of Baluchistan and contribute to the overall development and prosperity of the province. In this regard, a case was processed through file and the Rector approved to implement the subject quota w.e.f Fall 2024 semester.

**Discussion**

217. The approval was ratified by the Council as presented.

**Decision 4720**

218. One percent (1%) additional quota approved for the BU students with domicile of Balochistan, approved on a case file, is ratified by the Academic Council through amendment in clause 2.21 of BU Admissions Policy. The point is then be dropped from the ACM agenda.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | DA | DA |

**Item 4721: Approval for Conduct of *MS in Media Studies* Classes on Weekends**

Sponsor: BUKC — Referral Authority: Case File

**Summary of the Case**

219. BUKC has proposed through a letter to allow the holding of classes for *MS in Media Studies* from the regular Evening schedule to Weekends on account of the preference of the students. The proposal has been supported by the concerned Dean (H&SS), DQA, DPGP and the Registrar, with the suggestions to get the written consent of the students for the change of class schedule and approval of the Rector through case file followed by ratification in the next ACM. The Pro-Rector (Acad) has proposed to allow the flexible schedule for the subject programme at both the CUs (BUKC & BUIC) to schedule the classes on evenings or weekends as per the preference of the students which has been approved by the Rector on file, subject to ratification by the Academic Council.

**Discussion**

220. DQA raised a potential issue regarding the possibility of splitting students into both Evening and Weekend programmes, emphasizing the importance of maintaining the class cohesion. The Chair agreed to shift classes between Evening and Weekend timings for the whole class, without any split. Dean H&SS submitted that the option of shifting the classes schedule may be given in BUKC only as BUIC had not suggested this proposal and preferred the retain the conduct of *MS in Media Studies* classes in Evening schedule. CE further highlighted the implications of changing the classes schedule of a particular batch in different semesters on the ERD as the students of Evening programme were assigned the Enrolment No. with ‘02’ designation following the CU numeral,

while Weekend programme students were given the designation '03'. DG BUKC assured that such implications will be resolved at the CU level. CE suggested to keep the BUHO Exams Dte informed of such changes for related updating of ERD. After further discussion, the Council ratified the approval to change the Evening programme classes to Weekend schedule or vice versa subject to the conditionalities for the CU's administrative suitability and applicability of the amended timings on the whole class.

**Decision 4721**

221. Shifting of classes of any Evening programme to Weekend schedule or vice versa is approved by the Academic Council subject to administrative suitability of the concerned CU, applicability of the new schedule to the whole class and explicit approval in this regard by the respective HCU. All such changes are to be intimated to the CE and DQA. The item is then dropped from the ACM agenda.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | CE, All HCUs | DQA |

**Item 4722: Amendments in MBA Thesis Rules**

Sponsor: Dean MS Referral Authority: Case File

**Summary of the Case**

222. BU MBA Thesis/ Project Rules 2016 require certain changes as tabulated at **Appendage 4722**, specifically clause 3.1 as follows:

| Replace | With |
|---|---|
| Students shall be registering for 2 credit hours out of 6 credit hours in the second last semester of their MBA program. During this semester, students shall be undergoing 30 contact-hour tutorials with the thesis/project tutor on thesis writing skills. The tutorial will culminate at the preparation of a tentative thesis proposal. The research proposal shall be 6-10 pages printed on A-4 size page with double line spacing and using font size 12. | Student will register D1 with Zero Contact Hours & 3 Cr. hours in second last semester, 3 Credit Hours in last semester under the supervision of Supervisor. |

223. Dean MS will present the proposed amendments for approval by the Academic Council.

**Discussion**

224. Dean MS presented the proposed amendments as given at **Appendage 4722**. DQA amplified that the proposed changes were necessitated during the audit of MS programmes and were in conformance with related NBEAC requirements. DGPG highlighted that the MS/ MPhil Rules for splitting the Thesis related courses approved in the last ACM would be applicable for the MBA Thesis as well, which was concurred by Dean MS and DQA. After further discussion, the Council approved the changes in BU MBA Thesis/ Project Rules 2016 as presented.

225. The Secy indicated that the document presented was titled as MBA Thesis/ Project Rules 2024. He suggested to accord the ACM approval for the said title, replacing the previous 2016 version. He also proposed to replace the renumeration amounts mentioned in the current Rules with 'as per approved rate' as incorporated in other similar rules/ policies. The Chair consented the proposals.

**Decision 4722**

226. Proposed amendments in BU MBA Thesis/ Project Rules 2016 are recommended by the Academic Council for approval by the Executive Committee as revised MBA Thesis/ Project Rules 2024, with the addition of rules pertaining to splitting of Thesis related courses approved in the last ACM and replacement of remuneration amounts with 'as per approved rate', for adoption from Fall 2024 semester. The updated version is to be promulgated through the Registrar office and placed on BU website after approval by the Executive Committee. The progress will be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Dean MS, Registrar, DIT | Dean MS |

**Item 4723: Amendment of Academic Roadmaps of BBA and AD(BA) Programmes for Inclusion of *Pakistan Studies* Course**

Sponsor: Dean MS Referral Authority: FBOS-MS

**Summary of the Case**

227. The HEC through a recent letter has reiterated to offer the course *Pakistan Studies* of 2-3 credit hours in all the UG programmes. The Faculty of MS has reported that the same is not being complied in the BBA and AD(BA) programmes, which have the course *Pakistan and Geo-politics Studies* (HSS-403) instead. As such, roadmaps of these programmes need to be amended. The requirement has been deliberated by the FBOS-MS which has recommended amending the roadmaps of BBA and AD(BA) programmes by replacing the course *Pakistan and Geo-politics Studies* (HSS-403) with *Pakistan Studies* (PAK 101) from Fall 2024 semester.

**Discussion**

228. DQA indicated that the course *Pakistan Studies* Course is to be taught in addition to the course *Ideology & Constitution of Pakistan*. Dir Academics HEC supported the same. Dean MS acknowledged that the course *Ideology & Constitution of Pakistan* was currently not included in its roadmaps. Dean H&SS further explained that the HEC UEP 2023 necessitated the inclusion of a new course *Ideology & Constitution of Pakistan* while not emphasising to retain the already taught course *Pakistan Studies*. Accordingly, some HEIs had replaced the course *Pakistan Studies* (2 CH) with the course *Ideology & Constitution of Pakistan* (2 CH). However, the HEC has now advised to include both the courses in all the UG programmes. Within BU, some faculties had included the course *Ideology & Constitution of Pakistan* in their roadmaps while some faculties including H&SS had reviewed the course outline of *Pakistan Studies* to include the contents of *Ideology & Constitution of Pakistan* with enhanced 3 CH. As such, all the faculties will have to review the roadmaps of their UG programmes for compliance of the above stated latest HEC instructions. Dean MS flashed the related HEC letter (placed at **Appendage 4723**) for consent by all the participants. The Secy proposed to approve the replacement of the course in BBA and AD (BA) programmes as proposed by Dean MS while all the UG programmes may be reviewed by each faculty to comply with the HEC instructions vide its letter at **Appendage 4723**. The proposal was conceded by the Chair.

**Decision 4723**

229. Approval is accorded by the Academic Council to amend the roadmaps of BBA and AD(BA) programmes by replacing the course *Pakistan and Geo-politics Studies* (HSS-403) with *Pakistan Studies* (PK 101) from Fall 2023 semester. BU prospectus, website and ERD may be updated

accordingly. As a separate activity, all UG programmes are to be reviewed for compliance of the HEC instructions vide its letter at **Appendage 4723** for inclusion of *Pakistan Studies* and *Ideology & Constitution of Pakistan* courses in the academic roadmaps. The progress will be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | All Deans, CE, DA, DIT | Dean MS |

**Item 4724: Launch of New Programme MS (Supply Chain Management) at PNSL**

Sponsor: Dean MS Referral Authority: FBOS-MS

**Summary of the Case**

230. The PNSL intends to launch a new degree programme *MS in Supply Chain Management* at its premises. The proposal has been reviewed by the FBOS-MS and recommended for consideration by the Academic Council. HOD/ CI PNSL will present the launch proposal for approval by the Academic Council.

**Discussion**

231. The Chief Instructor (CI) PNSL presented the Academic Details of the MS (SCM) programme for launching at PNSL, as given at **Appendage 4724**., to be offered to Lt Cdr/ Lt rank officer of the Supply branch of Pakistan Navy (PN) holding the BS (SCM) degree. He highlighted that the proposed programme was fully aligned with 1.5 yrs MS (SCM) programme already offered by BU and would replace the SMEAC course currently essential for the Supply branch officers of PN. In the roadmap presented to the Council, he indicated the option of Electives or Thesis in the 3rd/ last semester. He also apprised that PNSL had 1 x PhD FM already in place while another is likely to join by the end of November 2024.

232. In the presented roadmap, DORIC suggested to align the courses with relevant UN SDGs. The CI conceded to comply the same. The Secy informed that the launch proposal will be scrutinised by the QA and Exams Dtes prior applying for the HEC NOC. DQA also confirmed that availability of minimum 2 x PhD FMs and their assessment by the RAC will be complied prior applying for the HEC NOC as a standard procedure, after the ACM approval for the programme launch. After brief deliberation, the Council approved the launch of proposed programme at PNSL subject to availability of required PhD faculty and issuance of NOC by the HEC.

**Decision 4724**

233. The academic details of the launch proposal of *MS in Supply Chain Management* programme at PNSL are approved by the Academic Council subject to the NOC from the HEC. The complete launch proposal including the Financial Details is to be processed on the case file for scrutiny by the QA and Exams Dtes. The progress will be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | PNSL, DQA | Dean MS |

| **Item 4725: Revised Table of Specifications for MBBS and BDS Programmes** | |
|---|---|
| Sponsor: Dean HS | Referral Authority: Case File |

**Summary of the Case**

234. MBBS and BDS final examination question papers are formulated as per the format/ Table of Specifications (TOS) of each subject. Keeping in view the revised distribution of MCQs and SAQs (70%-30%) in these papers approved in the last/ 46th ACM (Decision 4620), the Faculty of HS has accordingly reviewed the TOS for MBBS and BDS programmes and processed these for approval on the case file. Dean HS will present the revised TOS thus approved for ratification by the Academic Council.

**Discussion**

235. Dean HS presented revised Table of Specifications (ToS) of all subjects and programme for MBBS and BDS programmes, as placed at **Appendage 4725**. After brief review of their contents, the ToS for MBBS and BDS programme were approved by the Council for adoption from the modules and annual examination of 2024.

**Decision 4725**

236. The revised Table of Specifications (ToS) for MBBS and BDS programmes are ratified by the Academic Council as placed at **Appendage 4725**, for adoption from the modules and annual examinations of 2024. The item is then to be dropped from the ACM agenda.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | Dean HS | DHS |

| **Item 4726: Amendment in BUAR to Allow Conduct of *Ethics* Course for Non-Muslims Regardless of Class Size** | |
|---|---|
| Sponsor: Dean H&SS | Referral Authority: Case File |

**Summary of the Case**

237. As per HEC requirement, all UG students have to take the course *Islamic Studies* during their degree programme. Non-Muslim students have to take the course *Ethics* in lieu. As per BUAR 2024 clause 3.24.1, the class size for UG programmes should comprise of 20-45 student; any shortfall referred to the Rector for approval. In each semester, requests are received from the CUs to conduct the *Ethics* classes for a few non-Muslim students, due to their overall lesser no. While the *Ethics* course is a mandatory requirement for degree completion of non-Muslim students, Rector approval is processed for less class size.

238. Dean H&SS has proposed to review the related BUAR to allow the conduct of *Ethics* course for non-Muslim students at any CU during any semester/ Summer session, regardless of the class size. The proposal is supported for consideration by the Academic Council.

**Discussion**

239. After brief discussion, the proposal was approved by the Council.

**Decision 4726**

240. BU Academic Rules are reviewed to allow the conduct of ***Ethics*** course for non-Muslim students at any CU during any semester/ Summer session, regardless of the class size, through following additions in clause 3.24.1 (highlighted in yellow) in the 2024 version to be approved by the Executive Committee:

3.24.1 The class size/ strength for UG & PG is as under:

a. Undergraduates – 20 to 50 students

b. Postgraduate – 10 to 35 students

c. PhD – as per availability of supervisory slots

d. The class size/ strength mentioned above is not applicable to elective courses defined in the road maps of respective programmes, or to the compulsory course *Ethics* to be taken as an alternative to the course *Islamic Studies* by non-Muslim students.

e. Any shortfall to the above-stated shall be referred to the Rector, with full justification, for approval. There shall be no additional fee for any shortfall; the practice is to be followed unless approved otherwise.

241. The progress will be reviewed in the next ACM.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | DAcad, Registrar | Dean H&SS |

**ANY OTHER POINT**

242. With the consent of the Chair, the house was opened for any other point. The following points were raised therein.

**Item 4727: Fixing of Duration of BUHO Director Duties by FMs**

Sponsor: DG BUKC

243. DG BUKC proposed that the duration of BUHO Director duties by the FMs should be fixed like the duration for the Deans and Principals. The Secy opined that 3-year period was specified in related rules. DHR apprised that a timeline was not being complied in any case. Pro-Rector (Acad) suggested that even the 3-year period for a PhD FM on admin duties was not appropriate; they should be employed on their core research or academic activities, and any exposure to administrative work should not be more than 1 to 1-1/2 years. The Chair opined that such taskings were to be done on a case-to-case basis, considering the suitability of the individuals for a particular domain. He asked the DHR to undertake a necessary review of related policy/ rules in this regard.

**Decision 4727**

244. HR Dte is to undertake a necessary review of the policy/ rules related to the duration of BUHO Director duties by the FMs as a separate activity, while not being an ACM action item.

| Action Required | Action by | Responsibility |
|---|---|---|
| Implementation of the Decision | DHR | DHR |

MoM 47th ACM

**Schedule and Follow-Up/ Timelines For 48th ACM**

245. The Secy then presented the schedule for the follow-up of action items for the 47th ACM and the timelines for the next/ 48th ACM as mentioned below:

a. 1st Progress Report (Action Items of 47th ACM) – 13 December 2024

b. 2nd Progress Report (Action Items of 47th ACM) – 14 February 2025

c. FBOS by each faculty for ACM New Items (as per the timelines given in ACMROB 2023) – by 28 February 2025

d. Agenda Items for 48th ACM (including points from respective FBOS) – 14 March 2025

e. Scheduled dates of 48th ACM – 2nd week of April 2025

**Closing Remarks by the Chair**

246. In his closing remarks, the Chair thanked all the participants for a great participation and a very patient hearing in many cases. He noted that few points not concluded during the ACM would be taken up separately, as absolute clarity of mind was essential to arrive at a decision.

247. There being no further point, the meeting was adjourned.

**ASIM RAZA SI(M)**
Commodore (Retd)
Director Academics
Secy Academic Council

Dated: 30 October 2024

**Appendage 4614**

**APPROVAL OF DEGREE PROGRAMMES AT IATD/ BSAAD**

| A. ACADEMIC DETAILS | |
|---|---|
| 1 | **Faculty/Department: Department of Design- BSAAD** |
| 2 | **Name of the Programme: Bachelors of Studies in Visual Communication Design** |
| 3 | **Mission of the Programme:**<br>The mission of a Bachelors of Studies in Visual Communication Design specifically aims to prepare students for careers in the dynamic and evolving field of visual communication, which encompasses graphic design, branding, advertising, digital media, and other visual forms of communication. |
| 4 | **Objectives of the Programme:**<br>1. Demonstrate an understanding of the design process, critical thinking skills, research methodologies and creative ideation as a means of problem-solving and enhancing visual communication.<br>2. To develop a thorough understanding of the form and function of typography and methodologies for successfully communicating ideas, narratives, concepts, and/or identities through various media.<br>3. Demonstrate an understanding of the history, theory and criticism of design and the impact that historical analysis plays in contemporary practice.<br>4. Skillfully employ the tools and technology that will prepare them for design practice and management in collaborative environments.<br>5. Interpret the social, moral and ethical consequences of their design decisions and work to become socially and culturally responsible decision makers within the larger global community. |

| | |
|---|---|
| 5 | **Outcomes of the Programme:**<br>PLO 1: Demonstrate with proficiency the creation of compositions that successfully use the elements of art and principles of design.<br>PLO 2: Demonstrate with proficiency the ability to execute a professional-level body of work (in at least one form of media) in a way that reflects a professional level of aptitude and knowledge of technical and artistic skill sets.<br>PLO 3: Demonstrate with proficiency, the ability to include individual expression/voice in a given body of work or to communicate and express unique ideas.<br>PLO 4: Employ efficient and accurate drawing and painting abilities that convey an understanding of perspective, light, material, and color.<br>PLO 5: Apply the use of anatomy, gesture, form, and staging in figure drawing and character design.<br>PLO 6: Apply principles of composition, color theory, and form to concept designs and illustrations as a way to emphasize and dramatize story.<br>PLO 7: Combine traditional and digital tools to create a variety of concept art including creatures, characters, environments, vehicles, costumes, and props in both 2D and 3D. PLO 8: Develop proficient problem-solving skills through the use of research and development in ideation for storyboarding and sequential art.<br>PLO 9: Develop skills in modeling, texturing, lighting, and rendering for 3D and 2D animation. |
| 6 | **Rationale for the Programme:**<br>The rationale behind a Bachelors of Studies in Visual Communication Design lies in addressing the growing demand for skilled professionals who can effectively communicate ideas, messages, and information visually across various media platforms. |
| 7 | **Brief Description of the Programme:** The program spans 4 years, which includes a Foundation year. Its aim is to ensure students grasp design-thinking thoroughly and can tackle the changing market confidently. The programme is a mix of different subjects including theatrical and studio practice-based subjects to cover a wide range of skills and knowledge. |
| | Alongside Studio work, we also focus on contemporary and traditional Art, ensuring students understand not just how to design, but also why it's important, and how it affects people's lives. |
| 8 | **Duration: 4 years / 08 Semesters** |
| 9 | **Venue(s): On Site/Off Site/Both On & Off Site** *(Tick one; if Off Site, give details)*<br>On Site |
| 10 | **Programme Scheduling Format: Morning/Evening/Weekend** *(tick one)*Morning<br>**Bi-Semester/Trimester/Semester+Summer Session/Annual/Bi-Annual** *(tick one)*<br>Annual Admissions; Semester system |
| 11 | **Proposed Date of Commencement: Spring 2025** |
| 12 | **Mode of Study/Examination:**<br>**On Site, As per BU examination system** |
| 13 | **Additional Faculty Member(s) Required:** *(Indicate if there is a requirement for additional faculty members, fulltime/visiting, along with qualifications.)*<br>**01x Hod, 01x PM faculty member added each semester to bring total to 7** |
| 14 | **Additional Skilled-Worker(s) Required:** *(Indicate if there is a requirement for additional Skilled Staff, fulltime/part-time, along with their qualifications/skill sets.)*<br>**Workshop assistants/instructors( Welding/ Metallurgy, Woodwork, Clay-***Pottery maker, Painter) Lab assistants for graphic and computer labs* |

| | |
|---|---|
| 15 | **Additional Infrastructure/Classroom(s) required:** *(The requirement is to include the number of classrooms and their capacities.)*<br>**02x lecture halls** |
| 16 | **Additional Requirement for Laboratories:** *(The requirement is to include the number of laboratories, their equipment and their capacities.)*<br>**TRG Aid, equipment and paraphernalia** |
| 17 | **Additional Requirement for Books, Subscriptions, Memberships to Online Research Sites/ Repositories:**<br>Additional requirement for books (other than purchased from within the country) will be generated by SMEs and provided by the institute. Monetary fund will be arranged by HQs. Membership requirements for foreign journals and online repositories (art and design related) will be fulfilled upon hiring and nomination of HoD. Furthermore, art and design related articles are available on open access and in case of membership fee requirements the same will be made online. Art galleries and museums with notable portfolios will be approached for learning<br>and research membership via HoD |
| 18 | **Minimum Entry Level: Intermediate with 45%** |
| 19 | **Admission Criteria:**<br>As per BU Admission policy in addition with high grades in drawing. |
| 20 | **Additional/Different Examination Requirement**<br>*(Indicate if there will be any examination requirement, additional to or different from the BU Academic Rules or Examination Policy in vogue).*<br>As per BU policy |
| 21 | **Number of Admissions Expected for First Intake: 25-40** |
| 22 | **Number of Admissions Planned/Expected for Subsequent Intakes:45 max each year** |
| 23 | **Maturity Period of the Program 4 years** |
| 24 | **Marketing campaign requirements: Advertisement, print and social media. To be undertaken by PNS BAHDUR i.c.w NHQ/ DNE** |
| 25 | **Referred by: (delete which is inapplicable)**<br>**FBOS: 44th FBoS, agenda item No. 4401 at BUKC.** |
| 26 | **Complete Plan of Studies, inclusive of complete Roadmap: (Attach as Annex 'A')** |
| 27 | **Course Outlines, Descriptions, Pre-Requisites & Readings (Compulsory & Recommended) (Attach as Annex 'B')** |
| **B** | **FINANCIAL DETAILS** |
| 1 | **Source of Funding: BS ADA: Fully** |
| 2 | **Degree Duration: 4 years** |
| 3 | **Annual or Semester System: Annual** |
| 4 | **Expected fee to be charged based on Cost & Benefits Analysis:** |

5

| **Students** | | | | **Fee per semester** | | **Total Fee** | | |
|---|---|---|---|---|---|---|---|---|
| **Semester** | **Fresh** | **Existing Total** | **Total** | ****Fresh** | **Existing** | **Fresh** | **Existing** | **Total** |
| **Fall 2024** | 25 | 0 | 25 | 293,120 | **0** | 7,328,000 | 0 | 7,328,000 |
| **Fall 2025** | 30 | 25 | 55 | 293,120 | 208,120 | 8,793,600 | 5,203,000 | 13,996,600.00 |
| **Fall 2026** | 35 | 55 | 90 | 293,120 | 208,120 | 10,259,200 | 11,446,600 | 21,705,800.00 |
| **Fall 2027** | 40 | 90 | 130 | 293,120 | 208,120 | 11,724,800 | 18,730,800 | 30,455,600.00 |

**6000 Rs per credit hour and 18-21 credit hours per semester (Total 140 credit hours)

**For first semester: 25K admission fee, and 20K refundable security fee shall be applicable.

6 **Expected Number of students for 1st & 2nd Intakes:** 25/30 students ; 40 Students

7 **Expected Earning from first two Intakes (B5): Rs. 33,251,400.00**

8

| **Students** | | | | **Fee per semester** | | **Total Fee** | | |
|---|---|---|---|---|---|---|---|---|
| **Semester** | **Fresh** | **Existing Total** | **Total** | ****Fresh** | **Existing** | **Fresh** | **Existing** | **Total** |
| **Fall 2024** | 25 | | 0 | 25 | | | 293,120 | 0 |
| **Fall 2025** | 0 | | 55 | 25 | | | | 208,120 |

9 **Expected Earnings for the Next Three Years (B6):**

| **Students** | | | | **Fee per semester** | | **Total Fee** | | |
|---|---|---|---|---|---|---|---|---|
| **Semester** | **Fresh** | **Existing Total** | **Total** | ****Fresh** | **Existing** | **Fresh** | **Existing** | **Total** |
| **Fall 2024** | 25 | 0 | 25 | 293,120 | **0** | 7,328,000 | 0 | 7,328,000 |
| **Spring 2025** | 0 | 25 | 25 | 208,120 | 208,120 | 0 | 5,203,000 | 5,203,000 |
| **Fall 2025** | 30 | 25 | 55 | 293,120 | 208,120 | 8,793,600 | 5,203,000 | 13,996,600.00 |
| **Spring 2026** | 0 | 55 | 55 | 208,120 | 208,120 | 0 | 11,446,600 | 11,446,600. |
| **Fall 2026** | 35 | 55 | 90 | 293,120 | 208,120 | 10,259,200 | 11,446,600 | 21,705,800.00 |
| **Spring 2027** | 0 | 90 | 90 | 208,120 | 208,120 | 0 | 18,730,800 | 18,730,800 |

10 **Total 3 years' earnings: Rs. 78,410,800.00/-**

11 **Total earnings per annum: Rs. 12,531,000.00/- , 25,443,200.00/- , 40,436,600.00/-**

12 **Cost of Additional Laboratory Equipment/Tools (B8):**
The art department must have wood, clay & metal labs and it may be shared. Moreover, it may be expanded/upgraded during the 3rd year of the program. The approximate cost of construction is 2 million.

13 **Cost of Additional Classrooms (B9): to be done via MES**

14 **Cost of Additional Books, Subscription & Memberships to on-line Sites/Repositories (B10):**
Year 2: Rs. 500,000.00

15 **Off-Site rental Expenses and Cost of other Fixtures (B11):** N/A

16 **Miscellaneous Expenses required for Starting the Program (B12):**

Advertisement: Rs. 100,000. Printing &
Stationary: Rs. 50,000. Admin Cost:
Zero Visit: Total: Rs. 150,000

17 **Annual Recurring Expenditures in Subsequent Years (B13):**

Salaries: Rs. 5,500,000 (per annum)

Rentals: Nil Subscriptions/Memberships:
50,000 Advertisements: Rs.
100,000.
Printing & Stationary: Rs. 50,000. Admin
Cost:

| | |
|---|---|
| | Accreditation Fee:<br>Total: Rs. 5,650,000. |
| 18 | **Total Cost of the Program (B14):** [Add B(7) to B(12)] Rs. 6,900,000.00 (Per Year) |
| 19 | **Net Cost of the Program (B15):** [Subtract B(1) from B(14)] Rs. 6,900,000.0 (Per year) |
| 20 | **Net Earnings in First Year (B16):** [Subtract B(15) from B(5)] Rs. 255,000.00 |

## Bahria School of Art, Architecture and Design

Program/Degree Title: **Bachelor of Studies in Visual Communication Design**

Duration: 4 years (8 semester)

Total Credit Hours: 156 credit hours

**Endorsement References:**

A: Recommendations of DBOS/Curriculum Committee 24th April 2024 (Minutes of DBOS meeting)
B: Recommendations of FBOS dated 25 April 2024 (Minutes of FBOS meeting)

**Program Objectives (POs)**:

1. Demonstrate an understanding of the design process, critical thinking skills, research methodologies and creative ideation as a means of problem-solving and enhancing visual communication.
2. To develop a thorough understanding of the form and function of typography and methodologies forsuccessfully communicating ideas, narratives, concepts, and/or identities through various media.
3. Demonstrate an understanding of the history, theory and criticism of design and the impact thathistorical analysis plays in contemporary practice.
4. Skillfully employ the tools and technology that will prepare them for design practice and management incollaborative environments.
5. Interpret the social, moral and ethical consequences of their design decisions and work to become socially and culturally responsible decision makers within the larger global community.

**Program Learning Outcomes (PLOs)**:

1. PLO 1: Demonstrate with proficiency the creation of compositions that successfully use the elements of art and principles of design.
2. PLO 2: Demonstrate with proficiency the ability to execute a professional-level body of work (in at least one form of media) in a way that reflects a professional level of aptitude and knowledge of technical and artistic skill sets.
3. PLO 3: Demonstrate with proficiency, the ability to include individual expression/voice in a given body of work or to communicate and express unique ideas.
4. PLO 4: Employ efficient and accurate drawing and painting abilities that convey anunderstanding of perspective, light, material, and color.
5. PLO 5: Apply the use of anatomy, gesture, form, and staging in figure drawing and characterdesign.
6. PLO 6: Apply principles of composition, color theory, and form to concept designs andillustrations as a way to emphasize and dramatize story.
7. PLO 7: Combine traditional and digital tools to create a variety of concept art including creatures, characters, environments, vehicles, costumes, and props in both 2D and 3D.
8. PLO 8: Develop proficient problem-solving skills through the use of research and development in ideation forstoryboarding and sequential art.
9. PLO 9: Develop skills in modeling, texturing, lighting, and rendering for 3D and 2D animation.

**Summary of Credit Hours**

**Semester-wise Road map**

| Sr. No. | Category as per HEC new UG Policy | Credit Hours |
|---|---|---|
| 1. | General Education (Mandatory) | 32 |
| 2. | Major/Disciplinary (Mandatory) | 97 |
| 3. | Interdisciplinary (Mandatory) | 07 |
| 4. | Electives toward specialization (Specialization Illustration) | 08 |
| 5. | Quran and Seerah Courses (Compulsory) | Non-Credit |
| 6 | Internship (Mandatory) | 3 |
| 7. | Capstone Project (Mandatory) | 09 |
| 8 | Double Major (Optional) | No |
| 9. | Minor (Optional) | No |
| Total | | 156 |

**Semester-1**

| Sr. No. | | Proposed Academic Road-map | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Pre-requisite Course Code | Course Code | Course Title | Category | Credit Hours | Theory | Studio/ Lab | SDGs |
| 1 | - | VCD 101 | Drawing-I | Disciplinary | 0+3 | 0 | 3 | |
| 2 | - | VCD 102 | Drafting-I | Disciplinary | 0+3 | 0 | 3 | 8 |
| 3 | - | VCD 103 | Sculpture-I | Disciplinary | 0+3 | 0 | 3 | |
| 4 | - | VCD 104 | Design Studio-I | Disciplinary | 0+3 | 0 | 3 | |
| 5 | - | ISL 102 | IslamicStudies | GE | 3+0 | 3 | 0 | 4, 16 |
| 6 | | ENG 101 | Functional English | GE | 3+0 | 3 | 0 | 4 |
| 7 | | AAD 101 | History of Art | GE | 3+0 | 3 | 0 | |
| 8 | | ISL 107 | Tajweed | Non-Credit | | | | 4 |
| **Total Credit Hours** | | | | | 21 | 9 | 12 | |

**Semester 2**

| Sr. No. | | Proposed Academic Road-map | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Category | Credit Hours | Theory | Studio/ Lab | SDGs |
| 1 | VCD 101 | VCD 111 | Drawing-II | Disciplinary | 0+3 | 0 | 3 | |
| 2 | VCD 102 | VCD 112 | Drafting-II | Disciplinaryy | 0+3 | 0 | 3 | 8 |
| 3 | VCD 103 | VCD 113 | Sculpture-II | Disciplinaryy | 0+3 | 0 | 3 | |
| 4 | VCD 104 | VCD 114 | Design Studio-II | Disciplinary | 0+3 | 0 | 3 | |
| 5 | - | PAK 104 | Pakistan Studies | GE | 3+0 | 3 | 0 | 4, 16 |
| 6 | | ENG 207 | Advanced Academic Writing | GE | 3+0 | 3 | 0 | 4 |
| 7 | | AAD 103 | History of Design | GE | 3+0 | 3 | 0 | |
| 8 | | ISL 108 | Understand ing Quran-I | Non-Credit | | | | 4 |
| **Total Credit Hours** | | | | | 21 | 9 | 12 | |

## Semester 3

| Sr. No. | | Proposed Academic Road-map | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Pre-requisite Course Code | CourseCode | Course Title | Category | Credit Hours | Theory | Studio/Lab | SDGs |
| 1 | VCD 114 | VCD 201 | Visual Comm.Design-I | Disciplinary | 0+3 | 0 | 3 | |
| 2 | - | VCD 202 | Typography &Calligraphy-I | Disciplinary | 0+3 | 0 | 3 | 8 |
| 3 | - | VCD 203 | Illustration-I | Disciplinary | 0+3 | 0 | 3 | 8 |
| 4 | - | VCD 204 | Drawing forDesign-I | Disciplinary | 0+3 | 0 | 3 | 8 |
| 6 | | AAD 110 | Photography-I | GE | 0+3 | 0 | 3 | 8 |
| 5 | - | VCD 201 | Marketing &Outreach | Interdisciplinary | 3+0 | 3 | 0 | |
| 7 | | AAD 114 | Analytical Reasoning Techniques-I | GE | 3+0 | 3 | 0 | 4 |
| 8 | ISL 108 | ISL 109 | Understanding Quran-II | Non-Credit | | | | 4 |
| **Total Credit Hours** | | | | | 21 | 6 | 15 | |

## Semester 4

| Sr. No. | | Proposed Academic Road-map | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Pre- requisite CourseCode | Course Code | Course Title | Category | Credit Hours | Theory | Studio/Lab | SDGs |
| 1 | VCD 201 | VCD211 | Visual Comm.Design-II | Disciplinary | 0+3 | 0 | 3 | |
| 2 | VCD 202 | VCD212 | Typography & Calligraphy-II | Disciplinary | 0+3 | 0 | 3 | 8 |
| 3 | VCD 203 | VCD 213 | Illustration-II | Disciplinary | 0+3 | 0 | 3 | |
| 4 | VCD 204 | VCD 214 | Drawing forDesing-II | Disciplinary | 0+3 | 0 | 3 | 8 |
| 5 | AAD 114 | AAD 224 | Analytical Reasoning Techniques-II | GE | 3+0 | 3 | 0 | 4 |
| 6 | | HSS 219 | Civic & Community Engagement | GE | 2+0 | 2 | 0 | 17 |
| 7 | | ENV105 | Introduction to EnvironmentalSciences | GE | 3 | 2 | 1 | 13 |
| 8 | ISL 109 | ISL 110 | Understanding Quran-III | Non-Credit | | | | 4 |
| **Total Credit Hours** | | | | | 20 | 7 | 13 | |

***Internship of 6-9 weeks after 4th semester is mandatory**

| Sr. No. | Code | Title | Credit Hours |
|---|---|---|---|
| 1 | SDW 498 | Internship | 03 |

## Semester 5

| Sr. No. | | Proposed Academic Road-map | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Pre- requisite CourseCode | CourseCode | Course Title | Category | Credit Hours | Theory | Studio/Lab | SDGs |
| **1** | VCD 211 | VCD 221 | Visual Comm.Design-III | Disciplinary | 0+3 | 0 | 3 | |
| **2** | VCD 212 | VCD 222 | Typography & Calligraphy-III | Disciplinary | 0+3 | 0 | 3 | 8 |
| **3** | VCD 213 | VCD 223 | Illustration-III | Disciplinary | 0+3 | 0 | 3 | 8 |
| **4** | VCD 214 | VCD 224 | Drawing forDesign-III | Disciplinary | 0+3 | 0 | 3 | 8 |
| **5** | AAD 110 | AAD 210 | Photography-II | Disciplinary | 3+0 | 3 | 0 | 8 |
| **6** | | AAD 111 | Design Shaping | Disciplinary | 2+0 | 2 | 0 | |
| **7** | | AAD 112 | Current Trendin VCD | Disciplinary | 2+0 | 2 | 0 | 5 |
| **8** | ISL 110 | ISL 111 | UnderstandingQuran-IV | Non-Credit | 4 | **8** | ISL 110 | ISL 111 |
| **Total Credit Hours** | | | | | 19 | 7 | 12 | |

## Semester 6

| Sr. No. | Pre- requisite Course Code | Course Code | Course Title | Category | Credit Hours | Theory | Studio/ Lab | SDGs |
|---|---|---|---|---|---|---|---|---|
| | | Proposed Academic Road-map | | | | | | |
| 1 | VCD221 | VCD231 | Visual Comm. Design-IV | Disciplinary | 0+3 | 0 | 3 | |
| 2 | - | ANI 101 | Animation | Disciplinary | 0+3 | 0 | 3 | |
| 3 | VCD223 | VCD 323 | Digital Drawings (vector) | Disciplinary | 0+3 | 0 | 3 | |
| 4 | - | VCD411 | UI/UX Explorations | Disciplinary | 0+3 | 0 | 3 | |
| 5 | AAD 210 | AAD 310 | Photography-III | Disciplinary | 3+0 | 3 | 0 | 8 |
| 6 | | AAD 113 | AI in the Realm of Art & Design | Inter- disciplinary | 2+0 | 2 | 0 | |
| 7 | | | Elective-I | Specialization | 0+2 | 0 | 2 | |
| 8 | ISL 111 | ISL 112 | Understanding Quran-V | Non-Credit | | | | 4 |
| Total Credit Hours | | | | | 19 | 5 | 14 | |

## Semester 7

| Sr. No. | Pre- requisite Course Code | Course Code | Course Title | Category | Credit Hours | Theory | Studio/Lab | SDGs |
|---|---|---|---|---|---|---|---|---|
| | | Proposed Academic Road-map | | | | | | |
| 1 | AAD 310 | AAD410 | Photography-IV | Disciplinary | 0+2 | 0 | 2 | |
| 2 | VCD231 | VCD331 | Visual Comm. Design-V | Disciplinary | 0+3 | 0 | 3 | |
| 3 | - | VCD500 | Design Research | Disciplinary | 0+3 | 0 | 3 | 12 |
| 4 | VCD 323 | VCD 423 | Digital Drawings (Raster) | Disciplinary | 0+3 | 0 | 3 | |
| 5 | - | | Elective-II | Specialization | 0+2 | 0 | 2 | |
| 6 | | | Elective-III | Specialization | 2+0 | 2 | 0 | |
| 7 | | CSC 444 | Computer Graphics | Inter- disciplinary | 0+2 | 0 | 2 | |
| 9 | | ISL 113 | Seerah-I | Non-Credit | | | | 4 |
| Total Credit Hours | | | | | 17 | 2 | 15 | |

## Semester 8

| Sr. No. | Proposed Academic Road-map | | | | | Theory | Studio/Lab | SDGs |
|---|---|---|---|---|---|---|---|---|
| | Pre- requisite Course Code | Course Code | Course Title | Category | Credit Hours | Theory | Studio/Lab | SDGs |
| **1** | AAD410 | AAD 510 | Photography-V | Disciplinary | 0+2 | 0 | 2 | |
| **2** | - | AAD 504 | Visual Communication Design-VI | Disciplinary | 0+2 | 0 | 2 | |
| **3** | - | | Elective-IV | Specialization | 0+2 | 0 | 2 | |
| **4** | | CAP 490 | Capstone Project | Disciplinary | 0+9 | 0 | 9 | 12 |
| **5** | | | Seerah-II | Non-Credit | | | | 4 |
| **Total Credit Hours** | | | | | 15 | 0 | 15 | |

***40 Hrs CSP activity is mandatory List of**

## Electives

| Sr No | Course Code | Course Title | Credit Hours |
|---|---|---|---|
| 1 | AAD 600 | Poetry and Illustration | 02 |
| 2 | AAD 601 | Exploring Virtual Realities | 02 |
| 3 | AAD 602 | Crafting Narratives for Animation | 02 |
| 4 | AAD 603 | Archiving Using Art & Design | 02 |
| 5 | AAD 604 | Thinking through Material | 02 |
| 6 | AAD 605 | Reality Reshaped: VisualNarratives | 02 |

## List of General Education

| Sr No | Course Code | Course Title | Credit Hours |
|---|---|---|---|
| 1 | ISL 102 | Islamic Studies | 03 |
| 2 | ENG 101 | Functional English | 03 |
| 3 | AAD 101 | History of Art | 03 |
| 4 | PAK 104 | Pakistan Studies | 03 |
| 5 | ENG 207 | Advanced Academic Writing | 03 |
| 6 | AAD 103 | History of Design | 03 |
| 7 | AAD 110 | Photography-I | 03 |
| 8 | AAD 114 | Analytical ReasoningTechniques-I | 03 |
| 9 | HSS 219 | Civic & Community Engagement | 02 |
| 10 | ENV 105 | Introduction to EnvironmentalSciences | 03 |
| 11 | AAD 224 | Analytical ReasoningTechniques-II | 03 |

## List of Major/Disciplinary Courses

| Sr No | Course Code | Course Title | Credit Hours |
|---|---|---|---|
| 1 | VCD 101 | Drawing-I | 03 |
| 2 | VCD 102 | Drafting-I | 03 |
| 3 | VCD 103 | Sculpture-I | 03 |
| 4 | VCD 104 | Design Studio-I | 03 |
| 5 | VCD 111 | Drawing-II | 03 |
| 6 | VCD 112 | Drafting-II | 03 |
| 7 | VCD 113 | Sculpture-II | 03 |
| 8 | VCD 114 | Design Studio-II | 03 |
| 9 | VCD 201 | Visual Communication Design-I | 03 |
| 10 | VCD 202 | Typography & Calligraphy-I | 03 |
| 11 | VCD 203 | Illustration-I | 03 |
| 12 | VCD 204 | Drawing for Design-I | 03 |
| 13 | VCD 211 | Visual Comm. Design-II | 03 |
| 14 | VCD 212 | Typography & Calligraphy-II | 03 |
| 15 | VCD 213 | Illustration-II | 03 |
| 16 | VCD 214 | Drawing for Design-II | 03 |
| 17 | VCD 221 | Visual Comm. Design-III | 03 |
| 18 | VCD 222 | Typography & Calligraphy-III | 03 |
| 19 | VCD 223 | Illustration-III | 03 |
| 20 | VCD 224 | Drawing for Desing-III | 03 |

| | | | |
|---|---|---|---|
| 21 | AAD 210 | Photography-II | 03 |
| 22 | AAD 111 | Design Shaping | 02 |
| 23 | AAD 112 | Current Trend in VCD | 02 |
| 24 | VCD 231 | Visual Comm. Design-IV | 03 |
| 25 | ANI 101 | Animation | 03 |
| 26 | VCD 323 | Digital Drawings (vector) | 03 |
| 27 | VCD 411 | UI/UX Explorations | 03 |
| 28 | AAD 310 | Photography-III | 03 |
| 29 | AAD 410 | Photography-IV | 02 |
| 30 | VCD 331 | Visual Comm. Design-V | 03 |
| 31 | VCD 500 | Design Research | 03 |
| 32 | VCD 423 | Digital Drawings (Raster) | 03 |
| 33 | AAD 510 | Photography-V | 02 |
| 34 | AAD 504 | Visual Communication Design-VI | 02 |

**List of Interdisciplinary Courses**

| Sr No | Course Code | Course Title | Credit Hours |
|---|---|---|---|
| 1 | VCD 201 | Marketing & Outreach | 03 |
| 2 | AAD 113 | AI in the Realm of Art & Design | 02 |
| 3 | CSC 444 | Computer Graphics | 02 |

## Course outlines

Course Title: **Design Studio I**
Course Code: VCD 104
Pre-Requisite:
Semester: I

Course Type: Disciplinary
Credit Hours: 03
Program: BS
Instructor:

**Course Descriptions:**

The Design Studio course offered as part of the BS in Visual Communication program is a dynamic exploration of design principles and methodologies essential to effective visual communication. Through a series of hands-on projects and collaborative exercises, students will delve into the intricacies of design thinking and problem-solving within diverse creative contexts. Emphasizing both traditional and digital mediums, this course equips students with the skills and techniques necessary to conceptualize and execute innovative visual solutions. By engaging in critiques and peer feedback sessions, students will refine their design sensibilities and develop a critical eye for evaluating visual communication strategies. Ultimately, this course aims to cultivate versatile designers who are capable of navigating the complexities of the contemporary visual landscape with confidence and creativity.

**Course Objectives:**

In the Design Studio course for the BS in Visual Communication, our primary objective is to immerse students in a thorough exploration of design principles and methodologies pertinent to visual communication. Through a series of hands-on projects, we aim to nurture creative problem-solving skills while encouraging experimentation with various mediums and approaches. Students will develop proficiency in utilizing industry-standard software and tools, empowering them to conceptualize and execute compelling visual solutions. Furthermore, the course fosters critical thinking abilities, enabling students to analyze, critique, and refine their own work and that of their peers within a collaborative studio environment.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1. To understand elements and Principles of Design through practical assignments | PLO 2 |
| 2. To study 2D space and its organization possibilities | PLO 6 |
| 3 .To introduce technical terms related to design | PLO 8 |
| 4.To evaluate design solutions, will be able to thoughtfully assess their own work and that of their peers within a collaborative studio environment. | PLO 8 |

**Text Books:**

1. "Graphic Design: The New Basics" by Ellen Lupton and Jennifer Cole Phillips (Second Edition, 2015)
2. "Designing Brand Identity: An Essential Guide for the Whole Branding Team" by Alina Wheeler (Fifth Edition, 2017)
3. "Layout Essentials: 100 Design Principles for Using Grids" by Beth Tondreau (Revised Edition, 2011)
4. "Interaction of Color: 50th Anniversary Edition" by Josef Albers (Revised and Expanded Edition, 2013)

**Reference Books:**

1. "The Elements of Typographic Style" by Robert Bringhurst (Fourth Edition, 2012)
2 ."Visual Grammar" by Christian Leborg (2006)
3 ."Thinking with Type: A Critical Guide for Designers, Writers, Editors, & Students" by Ellen Lupton (Second Edition, 2010)
4 ."Creative Workshop: 80 Challenges to Sharpen Your Design Skills" by David Sherwin (2010)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1. | Introduction to Design Studio | CLO 1 |
| 2. | shaping | CLO 1,2 |
| 3. | Color wheel and Toner charts | CLO 1,2 |
| 4. | Patterns and Motifs (Geometrical, Ornamental and Abstract | CLO 2,3 |
| 5. | Patterns and Motifs (Geometrical, Ornamental and Abstract | CLO 2,3,4 |
| 6. | Shapes and Patterns from Nature | CLO 2,3,4 |
| 7 | Shapes and Patterns from Nature | CLO 3,4 |
| 8. | Division ( Composition and Layout) | CLO 2,3,4 |
| 9. | Mid-Term Exam | |
| 10. | Calligraphy charts ( Oriental / Occidental) | CLO 2,3,4 |
| 11. | Greeting Cards | CLO 2,3,4 |
| 12. | Gifts Presentations | CLO 2,3,4 |
| 13. | Photo frames | CLO 3,4 |
| 14. | Texture formation | CLO 2,3,4 |
| 15. | Contrast through shape and color | CLO 2,3,4 |

| | | |
|---|---|---|
| 16. | Tile Design | CLO 2,3,4 |
| 17 | Border Design | CLO 2,,3,4 |
| 18. | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Drafting I (Studio)**
Course Code: VCD 102
Pre-Requisite: None
Semester: 01

Course Type: Disciplinary
Credit Hours: 03
Program: BS
Instructor:

**Course Descriptions:**

"Drawing (Live and Still Life)" is a foundational course within the Bachelor of Science in Visual Communication curriculum, designed to equip students with essential skills in observational drawing. Throughout the course, students engage in dynamic sessions capturing live models in motion as well as meticulously composed still life arrangements. The curriculum emphasizes mastering techniques for accurately representing form, proportion, perspective, and lighting. Students explore a variety of drawing mediums and tools, from traditional graphite and charcoal to digital platforms, fostering versatility and adaptability in their artistic practice. Through hands-on exercises and projects, students develop a keen eye for detail and a nuanced understanding of visual composition. This course serves as a vital step in cultivating the fundamental abilities necessary for effective visual communication across a range of creative disciplines.

**Course Objectives:**

The course objective of "Drawing (Live and Still Life)" for a Bachelor of Science in Visual Communication encompasses developing fundamental skills in observational drawing within both dynamic live settings and static still life arrangements. Through this course, students will hone their abilities to perceive, analyze, and translate the visual world onto paper or digital platforms with accuracy and expressive depth. Emphasis is placed on understanding form, proportion, perspective, light, and shadow through direct observation of real-life subjects. Students will explore various drawing techniques, mediums, and tools, cultivating a versatile toolkit for visual communication across diverse creative contexts. By the course's end, students will have gained a solid foundation in drawing that serves as a cornerstone for their broader studies and professional pursuits in visual communication.

| Course Learning Outcome (CLOs): | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1. Proficiency in observational drawing techniques, including accurate depiction of form, proportion, perspective, light, and shadow. | PLO 4 |
| 2. Mastery of various drawing mediums and tools, both traditional and digital, to effectively communicate visual ideas. | PLO 7 |
| 3. Ability to analyze and interpret live subjects and still life arrangements, translating observations into expressive and dynamic drawings. | PLO 6 |
| 4. Develop a critical eye for composition, emphasizing balance, harmony, and focal points within drawings. | PLO 3,4 |

**Text Books:**

1. Drawing for the Absolute and Utter Beginner" by Claire Watson Garcia - 2nd Edition (2022)
2. "Keys to Drawing" by Bert Dodson - 3rd Edition (2021)
3. "The Natural Way to Draw: A Working Plan for Art Study" by KimonNicolaïdes - Revised Edition (2019)

**Reference Books:**

1. "Drawing Lessons from the Great Masters" by Robert Beverly Hale and Terence Coyle -Reprint Edition (2020)
2. "Everyday Sketching and Drawing: Five Steps to a Unique and Personal Sketchbook Habit" by Steven B. Reddy - 2nd Edition (2023)
3. "Drawing on the Right Side of the Brain" by Betty Edwards - 4th Edition (2021)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1. | Basic shapes and Architectural Drawing | CLO 1 |
| 2. | Principal of Technical Drawing | CLO 1,2 |
| 3. | Understanding Drafting tools and materials | CLO 1,2 |
| 4. | Line types and Line weight in Drafting | CLO 1,2 |
| 5. | Isometric and Axonometric Drafting | CLO 1,2 |
| 6. | Perspective Drawing | CLO 1,2 |
| 7 | Digital Drafting Technique and workflow | CLO 1,2 |
| 8. | Drafting for Multimedia platforms | CLO 1,2 |
| 9. | Mid-Term Exam | |
| 10. | Drafting for print and Publication | CLO 1,2 |
| 11. | Drafting for Web and Interactive Media | CLO 2, 3 |
| 12. | Symbolism and Iconography in Drafting | CLO 1,2 |
| 13. | Drafting for Illustration and storyboarding | CLO 1,2 |
| 14. | Drafting for Animation and Motion Graphics | CLO 1,2 |
| 15. | Typography in Drafting and Layout Design | CLO 1,2 |
| 16. | Color Theory and Application in Drafting | CLO 1,2 |
| 17 | Professional practice in Drafting: Standard and Ethics | CLO 2,3 |
| 18. | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Drawing (Live & Still Live)**
Course Type: Major
Course Code: VCD 101
Credit Hours: 03
Pre-Requisite:
Program: BS
Semester: 01
Instructor:

**Course Descriptions:**

The "Drawing (Live and Still Life)" course offers students in the Bachelor of Science program in Visual Communication an immersive exploration of drawing techniques essential to their creative development. Through a blend of theory and practice, students will delve into the art of capturing live subjects and still life arrangements with precision and expression. From mastering fundamental drawing elements such as line, shape, and texture to tackling complex anatomy and dynamic figure drawing, students will hone their observational skills and technical proficiency. They will also venture into the realm of digital drawing, learning to adapt traditional techniques to contemporary tools and platforms. Throughout the course, students will engage in critiques, workshops, and hands-on projects, fostering a deep understanding of drawing's role in visual storytelling and communication. By the course's conclusion, students will emerge with a diverse portfolio and a solid foundation poised for success in the dynamic field of visual communication.

**Course Objectives:**

The course "Drawing (Live and Still Life)" within the Bachelor of Science in Visual Communication aims to equip students with the foundational skills, techniques, and conceptual understanding necessary to excel in various visual communication fields. Through a combination of theoretical knowledge and practical exercises, students will develop proficiency in observational drawing, still life rendering, anatomy depiction, and digital drawing tools. By engaging with live subjects and exploring diverse drawing methods, students will enhance their ability to communicate ideas visually and creatively problem-solve through drawing. Through critiques, guest lectures, and portfolio development, students will also cultivate their ability to give and receive constructive feedback, refine their personal artistic voice, and prepare for future professional endeavors in the dynamic world of visual communication.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| After successful completion of the program, students should be able to: | **PLO** |
| 1. Develop proficiency in observational drawing of live subjects and still life arrangements. | PLO 2 |
| 2. Understand and apply fundamental drawing techniques such as line, shape, and texture. | PLO 1,2 |
| 3. To give local tone and texture of white and Gray objects translated into color | PLO 4 |
| 4. Adapt traditional drawing skills to digital platforms, preparing for diverse roles in visual communication. | PLO 7 |

**Text Books:**

1. "Drawing for the Absolute and Utter Beginner" by Claire Watson Garcia - 2nd Edition (2022)
2. "Keys to Drawing" by Bert Dodson - 3rd Edition (2021)
3. "The Natural Way to Draw: A Working Plan for Art Study" by KimonNicolaides - Revised Edition (2020)

**Reference Books:**

1. "Figure Drawing for Artists: Making Every Mark Count" by Steve Huston - 2nd Edition (2023)
2. "Drawing on the Right Side of the Brain" by Betty Edwards - 4th Edition (2021)
3. "Dynamic Figure Drawing" by Burne Hogarth (2017)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1. | Introduction to Drawing | CLO 1 |
| 2. | Study of human figure in quick sketching with special emphasis on environment | CLO 1,2 |
| 3. | Study of human figure in quick sketching with special emphasis on proportions | CLO 2,3 |
| 4. | Study of human figure in quick sketching with special emphasis on perspective | CLO 2,3 |
| 5. | Materials and tools | CLO 2,3 |
| 6. | Observational Drawing | CLO 2,3 |
| 7 | Still life drawing | CLO 2, 3, |
| 8. | Anatomy drawing | CLO 2,3 |
| 9. | Mid-Term Exam | |
| 10. | Live Modal Drawing | CLO 3,4 |
| 11. | Experimental drawing Techniques | CLO 3,4 |
| 12. | Study of central axis of human body, balance and movement | CLO 2,3 |
| 13. | Digital drawing tools and Techniques | CLO 2,3 |
| 14. | Study of shapes, proportion and relationship of parts of body | CLO 1,2,3 |
| 15. | Professional practice in drawing | CLO 3, 4 |
| 16. | Drawing in different contexts | CLO 2,3 4 |
| 17 | Figure composition in details | CLO 1,2 |
| 18. | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **History of Art** Course Type: GE
Course Code: AAD 101 Credit Hours: 02
Pre-Requisite: Program: BS
Semester: 01 Instructor:

**Course Descriptions:**

Explore the rich tapestry of artistic expression throughout history, from prehistoric cave paintings to contemporary global art movements. Analyze iconic works of art within their cultural, historical, and socio-political contexts, gaining a deeper understanding of human creativity and expression. Investigate the intersections between art history and visual communication, examining how images shape and communicate ideas across diverse cultures and time periods. Develop critical thinking skills through visual analysis and interpretation, preparing for a dynamic career in visual communication and the arts.

**Course Objectives:**

This course aims to provide students with a comprehensive understanding of the history of art, spanning from prehistoric times to contemporary global art movements. Through visual analysis and critical interpretation, students will develop the skills to recognize, analyze, and contextualize artworks within their cultural, historical, and socio-political contexts. Additionally, students will explore the intersections between art history and visual communication, gaining insight into the role of images in shaping and communicating ideas across different cultures and time periods.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1 .Demonstrate a comprehensive understanding of major art historical periods, movements, and key artworks. | PLO 1 |
| 2 .Apply critical analysis skills to interpret and contextualize artworks within their cultural and historical frameworks. | PLO 8 |
| 3 .Evaluate the role of visual communication in art history, recognizing the impact of images on society and culture. | PLO 5 |
| 4. Communicate effectively about art, demonstrating proficiency in discussing and analyzing artworks in both written and verbal forms. | PLO 2 |

**Text Books:**

1. Gardner's Art through the Ages: A global History by Fred S .Kleiner (16th edition 2021)
2. Art History by Marilyn Stokstad and Michael W. Cothren (6th Edition 2018)
3. The Story of Art by E.H. Gombrich (16th edition 2020)

**Reference Books:**

1. Art in Theory 1900-2000: An Anthology of changing ideas by Charles Harrison and Paul Wood (3rd edition 2012)
2. Art since 1940: Strategies of being by Jonathon Fienberg (4thedition 2019)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1. | Introduction to Art history | CLO 1 |
| 2. | Understanding key concept and terminology in Art history | CLO 1,2 |
| 3. | Introduction to visual analysis and interpretation | CLO 1,2,3 |
| 4. | Prehistoric and ancient Art | CLO 1,2 |
| 5. | Classical Art | CLO 1,2 |
| 6. | Medieval Art | CLO 1,2 |
| 7 | Renaissance Art | CLO 1,2 |
| 8. | Baroque and Rococo Art | CLO 1,2 |
| 9. | Mid-Term Exam | |
| 10. | Neoclassical and Romanticism | CLO1,2 |
| 11. | 19th century Art | CLO 1,2 |
| 12. | Modern Art | CLO 1,2 |
| 13. | Contemporary Art | CLO 1,2 |
| 14. | Global perspective in Art | CLO2,3,4 |
| 15. | Contemporary global art movements and exhibitions | CLO 2,3,4 |
| 16. | The role of visual communication in historical context | CLO2,3,4 |
| 17 | Case studies on the use of images for propaganda, advertising, and social change | CLO2,3,4 |
| 18. | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **History of Design (Theory)** Course Type: Compulsory
Course Code: AAD 103 Credit Hours: 02
Pre-Requisite:__________ Program: BS
Semester: 01 Instructor: __________

**Course Descriptions:**

Explore the fascinating journey of design evolution through the lens of history in this dynamic course. From ancient civilizations to contemporary global perspectives, delve into the rich tapestry of design movements, key figures, and cultural influences. Uncover the transformative power of design as it intersects with societal, technological, and ethical realms. Engage in critical analysis, case studies, and hands-on projects to develop a holistic understanding of design's profound impact on visual communication and society.

**Course Objectives:**

The History of Design course aims to provide students with a comprehensive understanding of the evolution of design principles, movements, and practices throughout history. Through critical analysis and exploration of key periods and figures, students will develop the ability to contextualize contemporary design within its historical and cultural framework. By examining the intersections of design with societal, technological, and ethical considerations, students will cultivate a nuanced perspective on the role of design in shaping human experiences and addressing global challenges. Through engaging with case studies and hands-on projects, students will develop the skills necessary to apply historical knowledge to their own visual communication practice, fostering a deep appreciation for the richness and diversity of design history.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1. Demonstrate a comprehensive understanding of the historical evolution of design principles, movements, and practices across diverse cultures and time periods. | PLO 1 |
| 2. Apply critical analysis skills to interpret the contextual significance of design within social, political, technological, and ethical frameworks. | PLO 5 |
| 3. Evaluate the influence of historical design movements and key figures on contemporary visual communication practices, fostering a nuanced appreciation for design's impact on society. | PLO 8 |
| 4. Synthesize historical knowledge with practical application, demonstrating the ability to integrate insights from design history into creative problem-solving and innovative visual communication solutions. | PLO 9 |

**Text Books:**

1. "A History of Graphic Design" by Philip B. Meggs and Alston W. Purvis - 7th Edition (2023)
2. "Design: The Definitive Visual History" by DK - 2nd Edition (2021)
3. "Meggs' History of Graphic Design" by Philip B. Meggs and Alston W. Purvis - 6th Edition (2020)

**Reference Books:**

1. "The Story of Design: From the Paleolithic to the Present" by Charlotte Fiell and Peter Fiell - Revised Edition (2022)
2. "Graphic Design: A New History" by Stephen J. Eskilson (2019)
3. "History of Modern Design" by David Raizman (2018)

**Weekly Lecture Plan**

| **Week #** | **Topic Covered** | **CLO Covered** |
|---|---|---|
| 1. | Introduction to Design history | CLO 1,2 |
| 2. | Prehistoric and Ancient Design | CLO 1,2 |
| 3. | Medieval Design and Manuscript Illumination | CLO 1,2 |
| 4. | Renaissance and Baroque Design | CLO 1,2 |
| 5. | 18th and 19th century Design movements | CLO 1,2 |
| 6. | Modernism and Bauhaus Movement | CLO 1,2 |
| 7 | Art Deco and Streamline Modern | CLO1,2 |
| 8. | Post modernism and contemporary design | CLO 1,2 |

| | | |
|---|---|---|
| 9. | Mid-Term Exam | |
| 10. | Global perspectives on Design history | CLO 1,2 |
| 11. | Design Ethics and Sustainability | CLO 1,2,3 |
| 12. | Analysis of specific design movements, objects or design in depth | CLO 3,4 |
| 13. | Exploration of the cultural, political and social context that influenced design decisions | CLO 4 |
| 14. | Examination of lasting impact and legacy of selected case studies | CLO 4 |
| 15. | Application of historical knowledge to contemporary design project | CLO 3,4 |
| 16. | Integration of historical research method into design practice | CLO3,4 |
| 17 | Development of critical thinking skills through the analysis of historical and contemporary design examples | CLO 2,3,4 |
| 18. | Final Exam | |

**Assessment Plan**

| **Assessment** | **Total Marks** |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Sculpture I**
Course Type: Disciplinary
Course Code: VCD 103
Credit Hours: 03
Pre-Requisite: ______
Program: BS
Semester: 01
Instructor: ______

**Course Descriptions:**

This course explores the art of sculpture within the context of visual communication. Students will study the history, techniques and contemporary practices of sculpting with various materials and tools. Through projects and critiques, students will develop their artistic voice and conceptual thinking, preparing them to create impactful sculptural works. Emphasis will be placed on the role of sculptural in public places and its integration with digital technology.

**Course Objectives:**

The course objective is to develop a deep understanding of sculptural techniques, materials and concepts, enabling students to create compelling three dimensional art works through hand- on practice and critical analysis. Students will cultivate their artistic vision, preparing them to engage with contemporary sculptural practice and contribute meaningfully to the field of visual communication.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1. Demonstrate proficiency in sculpting techniques and materials. | PLO 1,2 |
| 2. Develop a cohesive body of sculptural work reflecting personal artistic vision. | PLO 3 |
| 3. Collaborate effectively and present sculptural works professionally. | PLO 2 |

**Text Books:**

1. Sculpture Now by Anna Moszynska(2nd edition 2014)
2. Sculpture Today by Judith Collins (2nd edition2014)
3. The complete Sculpture by Alberto Giacometti (New edition2016)

**Reference Books:**

1. "Understanding Sculpture" by Herbert Read (2019)
2. "Sculpture Since 1945" by Andrew Causey (2018)
3. "Sculpture Today" by PhaidAon Editors (2015)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1. | Introduction to sculpture: History and overview | CLO 1 |
| 2. | Sculpture material and techniques | CLO 1,2 |
| 3. | Sculpture material and techniques | CLO 1,2 |
| 4. | Sculpture tools and equipment | CLO 1,2,3 |
| 5. | Sculpture tools and equipment | CLO 1,2 ,3 |
| 6. | Three dimensional design principles | CLO 1,2,3 |
| 7 | Three dimensional design principles | CLO 1,2,3 |
| 8. | Sculpture and space : Site specific Art | CLO 1,2,3 |
| 9. | Mid-Term Exam | |
| 10. | Sculpture and technology: Digital sculpture | CLO 1,2,3 |
| 11. | Elements of Sculpture | CLO 2, 3, |
| 12. | Contemporary trends in sculpture | CLO 2,4 |
| 13. | Relief sculpture | CLO 1,2 |
| 14. | Carving | CLO 1,2 |
| 15. | Additive sculpture | CLO 1,2 |
| 16. | Sculpture Exhibition and presentation | CLO 2,3,4 |
| 17 | Sculpture in the context of visual communication | CLO 2,3,4 |
| 18. | Final Exam | |

**Assessment Plan**

| **Assessment** | **Total Marks** |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Drawing II (Live & Still Live)** Course Type: Major
Course Code: VCD 111 Credit Hours: 03
Pre-Requisite:_______ Program: BS
Semester: 02 Instructor: _______

**Course Descriptions:**

"Drawing II (Live and Still Life)" is a continuation of the exploration of drawing techniques essential for students in the Bachelor of Science program in Visual Communication. This course expands upon the principles introduced in Drawing I, emphasizing advanced drawing methods and conceptual development. Students will engage in a series of practical exercises, workshops, and projects aimed at refining their observational skills, expressive rendering techniques, and understanding of human anatomy. Through in-depth critiques and portfolio development, students will deepen their artistic voice and prepare for diverse career paths in visual communication.

**Course Objectives:**

The course "Drawing II (Live and Still Life)" within the Bachelor of Science in Visual Communication aims to advance students' skills, techniques, and conceptual understanding acquired in Drawing I. Building upon foundational knowledge, students will delve deeper into various drawing methods, emphasizing expressive rendering, advanced anatomy depiction, and experimentation with diverse mediums. Through live subject studies, still life arrangements, and exploration of digital tools, students will refine their visual communication abilities and develop a personal artistic style. The course will also focus on critical thinking, problem-solving, and preparing students for professional challenges in visual communication fields.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| After successful completion of the program, students should be able to: | **PLO** |
| 1. Develop proficiency in observational drawing of live subjects and still life arrangements. | PLO 2 |
| 2. Understand and apply fundamental drawing techniques such as line, shape, and texture. | PLO 1,2 |
| 3. Explore anatomy drawing to capture the human form accurately and dynamically. | PLO 5 |
| 4. Adapt traditional drawing skills to digital platforms, preparing for diverse roles in visual communication. | PLO 7 |

**Text Books:**

1. "The Artist's Guide to Human Anatomy" by Gottfried Bammes - 3rd Edition (2023)
2. "Dynamic Anatomy" by Burne Hogarth - 3rd Edition (2022)
3. "Digital Drawing for Visual Communication" by Lawrence Zeegen - 2nd Edition (2021)

**Reference Books:**

1. "Drawing Lessons from the Great Masters" by Robert Beverly Hale - Revised Edition (2020)
2. "Expressive Drawing" by Steven Aimone - 2nd Edition (2019)
3. "Figure Drawing: Design and Invention" by Michael Hampton - 3rd Edition (2022)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1. | Advanced Drawing Techniques | CLO 1, 2 |
| 2. | Expressive Rendering | CLO 2,3 |
| 3. | Mood and Atmosphere in Drawing | CLO 2,3 |
| 4. | Advanced Still Life Drawing | CLO 1,2 |
| 5. | Dynamic Anatomy Studies | CLO 3,4 |
| 6. | Creative Figure Drawing | CLO 3,4 |
| 7 | Digital Drawing Mediums | CLO 2,4 |
| 8. | Conceptual Drawing Development | CLO 2,3 |

| | | |
|---|---|---|
| 9. | Mid-Term Exam | |
| 10. | Live Model Studies | CLO 3,4 |
| 11. | Experimentation with Mediums | CLO 3,4 |
| 12. | Portfolio Development | CLO 2,3 |
| 13. | Professional Practices in Drawing | CLO 2,3 |
| 14. | Drawing in Narrative Contexts | CLO 1,2,3 |
| 15. | Critique and Feedback | CLO 3, 4 |
| 16. | Industry Insights and Guest Lectures | CLO 2,3 4 |
| 17 | Workshop: Advanced Drawing Techniques | CLO 1,2 |
| 18. | Final Exam | |

**Assessment Plan**

| **Assessment** | **Total Marks** |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Design Studio II (Studio)**
Course Code: VCD 113
Pre-Requisite:
Semester: 02

Course Type: Major
Credit Hours: 03
Program: BS
Instructor:

**Course Descriptions:**

"Design Studio II" is an advanced exploration of design principles and methodologies essential to effective will explore advanced topics such as visual language, communication, and critical thinking in design. The course will also focus on portfolio development, professional ethics, industry trends, visual communication. Building upon the concepts introduced in Design Studio I, students will engage in a series of hands-on projects and collaborative exercises aimed at further developing their design sensibilities and technical skills. Through a combination of traditional and digital mediums, students and emerging technologies impacting design practice.

**Course Objectives:**

In "Design Studio II," the primary objective is to build upon the foundation established in Design Studio I, further immersing students in advanced design principles and methodologies relevant to visual communication. Through hands-on projects and collaborative exercises, students will deepen their creative problem-solving skills while exploring diverse mediums, techniques, and conceptual approaches. Emphasis will be placed on fostering adaptability, innovation, and critical thinking within a collaborative studio environment. Additionally, students will gain proficiency in utilizing industry-standard design software and tools to translate their creative vision into tangible visual outcomes.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1. To demonstrate a comprehensive understanding of fundamental design principles such as balance, contrast, rhythm, and hierarchy, enabling them to | PLO 2 |

| | |
|---|---|
| effectively communicate messages visually. | |
| 2. To creatively address design challenges by exploring diverse mediums, techniques, and conceptual approaches, fostering adaptability and innovation in their design practice. | PLO 6 |
| 3.To gain proficiency in utilizing industry-standard design software and tools, empowering them to efficiently translate their creative vision into tangible visual outcomes. | PLO 8 |
| 4.To evaluate design solutions, will be able to thoughtfully assess their own work and that of their peers within a collaborative studio environment. | PLO 8 |

**Text Books:**

1. "Designing for Emotion" by Aarron Walter (Second Edition, 2015)
2. "The Non-Designer's Design Book" by Robin Williams (Fourth Edition, 2014)
3. "Grid Systems in Graphic Design" by Josef Müller-Brockmann (Revised Edition, 2020)

**Reference Books:**

1. Universal Principles of Design" by William Lidwell et al. (Second Edition, 2010)
2. "Creative Strategy and the Business of Design" by Douglas Davis (2016)
3. "The Graphic Design Idea Book: Inspiration from 50 Masters" by Steven Heller and Gail Anderson (2016)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1. | Introduction to studio- Based practice | CLO 1 |
| 2. | Design Process and Methodologies | CLO 1,2 |
| 3. | Visual language and Communication | CLO 1,2 |
| 4. | Studio tools and Technologies | CLO 2,3 |
| 5. | Critical thinking and decision making in design | CLO 2,3,4 |
| 6. | Collaborative Studio Projects | CLO 2,3,4 |
| 7 | Critique and feedback | CLO 3,4 |
| 8. | Portfolio Development | CLO 2,3,4 |
| 9. | Mid-Term Exam | |
| 10. | Ethics and Professional practice | CLO 2,3,4 |
| 11. | Industry Trends and Career Pathways | CLO 2,3,4 |
| 12. | Networking and Professional development resources | CLO 2,3,4 |
| 13. | Guest lectures and workshops by industry professionals | CLO 3,4 |
| 14. | Emerging technologies and their impact on design practice | CLO 2,3,4 |
| 15. | Cultural and Social aspect of design | CLO 2,3,4 |
| 16. | Independent and collaborative project demonstrating mastery of Studio based practice | CLO 2,3,4 |
| 17 | Research, Conceptualization, execution and presentation of the Final project | CLO 2,,3,4 |
| 18. | Final Exam | |

**Assessment Plan**

| **Assessment** | **Total Marks** |
|---|---|
| Quizzes | 15 |

| | |
|---|---|
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Drafting II (Studio)** Course Type: Major
Course Code: VCD 112 Credit Hours: 03
Pre-Requisite: Program: BS
Semester: 02 Instructor:

**Course Descriptions:**
"Drafting II (Studio)" is an advanced course within the Bachelor of Science in Visual Communication curriculum, designed to build upon the foundational principles introduced in Drafting I. Throughout the course, students engage in hands-on exercises and projects focused on applying technical drawing concepts to various multimedia platforms. The curriculum emphasizes mastery of drafting tools, materials, and techniques essential for effective visual communication in print, web, and interactive media contexts. Students explore advanced topics such as isometric and axonometric drafting, perspective drawing, symbolism, iconography, typography, and color theory. Through practical assignments and critiques, students develop a nuanced understanding of drafting for animation, motion graphics, illustration, and layout design.

**Course Objectives:**
The course objective of "Drafting II (Studio)" for a Bachelor of Science in Visual Communication encompasses advancing students' skills in technical drawing and drafting principles within various multimedia platforms. Through this course, students will deepen their understanding of technical drawing tools, techniques, and workflows applicable to print, web, and interactive media. Emphasis is placed on developing proficiency in isometric, axonometric, and perspective drawing, as well as symbolism, iconography, and typography within drafting contexts. Students will explore digital drafting techniques and learn to apply color theory effectively in drafting for animation, motion graphics, and multimedia platforms. By the course's end, students will have expanded their drafting toolkit, ready to tackle complex projects across diverse creative disciplines.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1. Proficiency in observational drawing techniques, including accurate depiction of form, proportion, perspective, light, and shadow. | PLO 4 |
| 2. Mastery of various drawing mediums and tools, both traditional and digital, to effectively communicate visual ideas. | PLO 7 |
| 3. Ability to analyze and interpret live subjects and still life arrangements, translating observations into expressive and dynamic drawings. | PLO 6 |
| 4. Develop a critical eye for composition, emphasizing balance, harmony, and focal points within drawings. | PLO 3,4 |

**Text Books:**
1. "Technical Drawing with Engineering Graphics" by Frederick E. Giesecke et al. - 16th Edition (2022)
2. "Design Drawing" by Francis D.K. Ching and Steven P. Juroszek - 3rd Edition (2021)
3. "Digital Drafting for Visual Communication" by Lawrence Zeegen - 2nd Edition (2021)

**Reference Books:**

1. "Technical Drawing with Engineering Graphics" by Frederick E. Giesecke et al. - 16th Edition (2022)
2. "Design Drawing" by Francis D.K. Ching and Steven P. Juroszek - 3rd Edition (2021)
3. "Digital Drafting for Visual Communication" by Lawrence Zeegen - 2nd Edition (2021)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1. | Advanced Technical Drawing Techniques | CLO 1 |
| 2. | Multimedia Drafting Tools and Workflows | CLO 1,2 |
| 3. | Isometric and Axonometric Drafting | CLO 1,2 |
| 4. | Perspective Drawing Techniques | CLO 1,2 |
| 5. | Drafting for Print and Publication | CLO 1,2 |
| 6. | Drafting for Web and Interactive Media | CLO 1,2 |
| 7 | Symbolism and Iconography in Drafting | CLO 1,2 |
| 8. | Typography in Drafting and Layout Design | CLO 1,2 |
| 9. | Mid-Term Exam | |
| 10. | Drafting for Illustration and Storyboarding | CLO 1,2 |
| 11. | Drafting for Animation and Motion Graphics | CLO 2, 3 |
| 12. | Color Theory and Application in Drafting | CLO 1,2 |
| 13. | Digital Drafting Techniques and Workflow | CLO 1,2 |
| 14. | Layout Design for Multimedia Platforms | CLO 1,2 |
| 15. | Critique and Feedback | CLO 1,2 |
| 16. | Industry Standards and Ethics in Drafting | CLO 1,2 |
| 17 | Professional Practices in Drafting | CLO 2,3 |
| 18. | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **History& philosophy of design of Art (Theory)** Course Type: Compulsory
Course Code: AAD 106 Credit Hours: 02
Pre-Requisite:__________ Program: BS
Semester: 02 Instructor: __________

**Course Descriptions:**

Explore the evolution of design theory and practice from historical and philosophical perspectives, tracing the development of design movements, ideologies, and methodologies. Analyze iconic design works within their cultural, social, and philosophical contexts, gaining insight into the role of design in shaping human experience and perception. Investigate the intersections between design and philosophy, examining how philosophical concepts influence design thinking and aesthetics. Develop critical thinking skills through philosophical inquiry and analysis, preparing for a dynamic career in design and visual communication.

**Course Objectives:**
This course aims to provide students with a comprehensive understanding of the history and philosophy of design, exploring its evolution from ancient to contemporary practices. Through critical analysis and philosophical inquiry, students will develop the skills to interpret and contextualize design movements, ideologies, and methodologies. Additionally, students will explore the relationship between design and society, investigating how cultural, social, and philosophical factors influence design practices and aesthetics.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1.Demonstrate a comprehensive understanding of major art historical periods, movements, and key artworks. | PLO 1 |
| 2.Apply critical analysis skills to interpret and contextualize artworks within their cultural and historical frameworks. | PLO 8 |
| 3.Evaluate the role of visual communication in art history, recognizing the impact of images on society and culture. | PLO 5 |
| 4.Communicate effectively about art, demonstrating proficiency in discussing and analyzing artworks in both written and verbal forms. | PLO 2 |

**Text Books:**
1. Meggs' History of Graphic Design by Philip B. Meggs and Alston W. Purvis (6th Edition 2016)
2. A History of Interior Design by John F. Pile (3rd Edition 2013)
3. The Philosophy of Design by Glenn Parsons (2019)

**Reference Books:**
1. Design as Art by Bruno Munari (2009)
2. The Design of Everyday Things by Don Norman (Revised and Expanded Edition, 2013)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1. | Introduction to History and Philosophy of Design | CLO 1 |
| 2. | Understanding Key Concepts and Terminology in Design History | CLO 1,2 |
| 3. | Introduction to Visual Analysis and Interpretation in Design | CLO 1,2,3 |
| 4. | Prehistoric and Ancient Design | CLO 1,2 |
| 5. | Classical Design | CLO 1,2 |
| 6. | Medieval Design | CLO 1,2 |
| 7 | Renaissance Design | CLO 1,2 |
| 8. | Baroque and Rococo Design | CLO 1,2 |
| 9. | Mid-Term Exam | |
| 10. | Neoclassical and Romanticism Design | CLO1,2 |
| 11. | 19th century Design | CLO 1,2 |
| 12. | Modern Design | CLO 1,2 |
| 13. | Contemporary Design | CLO 1,2 |

| | | |
|---|---|---|
| 14. | Global Perspective in Design | CLO2,3,4 |
| 15. | Contemporary Global Design Movements and Exhibitions | CLO 2,3,4 |
| 16. | The Role of Visual Communication in Historical Context | CLO2,3,4 |
| 17 | Case Studies on the Use of Images for Propaganda, Advertising, and Social Change | CLO2,3,4 |
| 18. | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Marketing & outreach (Theory)**
Course Code: AAD 107
Pre-Requisite:
Semester: 02
Course Type: Compulsory
Credit Hours: 02
Program: BS
Instructor:

**Course Descriptions:**
Explore the dynamic landscape of marketing strategy and outreach in the context of visual communication. From market analysis to campaign execution, delve into the intricacies of developing comprehensive marketing plans tailored to visual communication projects. Learn to harness the power of digital and traditional marketing channels to reach target audiences effectively. Investigate outreach techniques and engagement strategies to foster connections with diverse communities and amplify project impact.

**Course Objectives:**
The Marketing Strategy and Outreach course aims to equip students with a comprehensive understanding of marketing principles and strategies tailored to the visual communication industry. Through theoretical insights and practical applications, students will learn to develop effective marketing plans, analyze target audiences, and utilize various marketing channels to promote visual communication projects. Additionally, students will explore outreach techniques and engagement strategies to connect with diverse audiences and enhance project visibility.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1. Demonstrate a comprehensive understanding of the historical evolution of design principles, movements, and practices across diverse cultures and time periods. | PLO 1 |
| 2. Apply critical analysis skills to interpret the contextual significance of design within social, political, technological, and ethical frameworks. | PLO 5 |
| 3. Evaluate the influence of historical design movements and key figures on contemporary visual communication practices, fostering a nuanced appreciation for design's impact on society. | PLO 8 |

| | |
|---|---|
| 4. Synthesize historical knowledge with practical application, demonstrating the ability to integrate insights from design history into creative problem-solving and innovative visual communication solutions. | PLO 9 |

**Text Books:**

1. "Principles of Marketing" by Philip Kotler and Gary Armstrong - 18th Edition (2022)
2. "Marketing Management" by Kevin Lane Keller and Philip Kotler - 16th Edition (2021)

**Reference Books:**

1. "Contemporary Marketing" by Louis E. Boone and David L. Kurtz - 19th Edition (2020)
2. "Digital Marketing Strategy: An Integrated Approach to Online Marketing" by Simon Kingsnorth (2019)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1. | Introduction to Marketing Strategy and Outreach | CLO 1,2 |
| 2. | Market Analysis and Target Audience Identification | CLO 1,2 |
| 3. | Developing Effective Marketing Plans | CLO 1,2 |
| 4. | Digital Marketing Channels and Strategies | CLO 1,2 |
| 5. | Traditional Marketing Channels and Strategies | CLO 1,2 |
| 6. | Social Media Marketing and Content Strategy | CLO 1,2 |
| 7 | Email Marketing and CRM Techniques | CLO1,2 |
| 8. | Search Engine Optimization (SEO) and Search Engine Marketing (SEM) | CLO 1,2 |
| 9. | Mid-Term Exam | |
| 10. | Outreach Techniques and Engagement Strategies | CLO 1,2 |
| 11. | Community Engagement and Partnership Building | CLO 1,2,3 |
| 12. | Event Marketing and Sponsorship | CLO 3,4 |
| 13. | Content Marketing and Storytelling Techniques | CLO 4 |
| 14. | Influencer Marketing and Collaborations | CLO 4 |
| 15. | Analytics and Performance Measurement | CLO 3,4 |
| 16. | Developing Creative Marketing Campaigns | CLO3,4 |
| 17 | Implementation of Outreach Initiatives | CLO 2,3,4 |
| 18. | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Sculpture II (Studio)**
Course Type: Major
Course Code: VCD 114
Credit Hours: 03
Pre-Requisite: ____
Program: BS
Semester: 02
Instructor: ____

**Course Descriptions:**

"Sculpture II (Studio)" builds upon the foundation laid in Sculpture I, further exploring the art of sculpture within the context of visual communication. Students will delve into advanced sculptural techniques, materials, and contemporary practices through a series of projects and critiques. The curriculum emphasizes the development of a cohesive body of sculptural work that reflects personal artistic vision and engages with relevant themes in visual communication. Topics such as sculpture in public places, digital sculpture, and contemporary trends will be explored in-depth.

**Course Objectives:**

The course objective of "Sculpture II (Studio)" for a Bachelor of Science in Visual Communication is to advance students' understanding and practice of sculptural techniques, materials, and concepts. Through hands-on exploration and critical analysis, students will deepen their artistic vision and engagement with contemporary sculptural practices. Emphasis will be placed on developing a cohesive body of sculptural work that reflects personal artistic vision and is suitable for professional presentation. Students will also explore the integration of sculpture with digital technology and its role in public spaces.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1. Demonstrate proficiency in sculpting techniques and materials. | PLO 1,2 |
| 2. Develop a cohesive body of sculptural work reflecting personal artistic vision. | PLO 3 |
| 3. Collaborate effectively and present sculptural works professionally. | PLO 2 |

**Text Books:**

1. "Sculpture Today" by Judith Collins - 3rd Edition (2022)
2. "Contemporary Sculpture: An Evolution in Volume and Space" by PETER MORSY (2023)
3. "The Complete Sculpture" by Alberto Giacometti - Revised Edition (2020)

**Reference Books:**

1. "Understanding Sculpture" by Herbert Read - 2nd Edition (2018)
2. "Sculpture since 1950" by Andrew Causey - 4th Edition (2021)
3. "Sculpture Now" by Anna Moszynska - 3rd Edition (2023)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1. | Advanced Sculptural Techniques and Materials | CLO 1 |
| 2. | Exploring Form and Space in Sculpture | CLO 1,2 |
| 3. | Sculptural Concept Development | CLO 2 |
| 4. | Sculpture Tools and Equipment | CLO 1,3 |
| 5. | Three-Dimensional Design Principles | CLO 1,2 ,3 |
| 6. | Sculpture and Technology: Digital Sculpture | CLO 1,2,3 |

| | | |
|---|---|---|
| 7 | Sculpture in Public Places | CLO 1,2,3 |
| 8. | Contemporary Trends in Sculpture | CLO 1,2,3 |
| 9. | Mid-Term Exam | |
| 10. | Critique and Analysis of Sculptural Works | CLO 1,2,3 |
| 11. | Portfolio Development | CLO 3,4 |
| 12. | Professional Presentation of Sculptural Works | CLO 2,4 |
| 13. | Exhibition Planning and Preparation | CLO 3,4 |
| 14. | Sculpture Installation and Presentation | CLO 3,4 |
| 15. | Sculpture in the Context of Visual Communication | CLO 3,4 |
| 16. | Guest Lectures and Industry Insights | CLO 2,3,4 |
| 17 | Collaborative Sculptural Projects | CLO 2,3,4 |
| 18. | Final Exam | |

**Assessment Plan**

| **Assessment** | **Total Marks** |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Analytical Reasoning Techniques I**
Course Type: GE
Course Code: AAD 114
Credit Hours: 03
Pre-Requisite: None
Program: BS
Semester: III
Instructor: ____________

**Course Descriptions:**

This course provides a foundation in analytical reasoning techniques essential for effective decision making in professional settings. Students will learn how to approach problems systematically, interpret data accurately, and draw logical conclusion. Through a combination of theoretical knowledge and practical exercises, students will develop their analytical skills to navigate complex challenges efficiently.

**Course Objectives:**

Students will develop critical thinking skills essential for effective decision making in the field. Through practical applications and theoretical frameworks, students will learn to analyze complex problems, evaluate information and formulate logical conclusions. Emphasis will be placed on applying these techniques to visual communication contexts, such as interpreting data for design projects, understanding audience perspectives and making informed design choices. By the end of the course, students will have a solid foundation in analytical reasoning, enhancing their abilities to create impactful visual communication solutions.

| Course Learning Outcome (CLOs): | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1. Utilize various analytical tools and methods to solve problems effectively | PLO 9 |
| 2. Analyze and evaluate information critically to make informed decision | PLO 3 |
| 3. Demonstrate proficiency in constructing logical arguments | PLO 1 |
| 4. Apply quantitative and qualitative reasoning skills in diverse context | PLO 7 |

**Text Books:**

1. "How to Solve It: A New Aspect of Mathematical Method" by George Pólya, 1957, 2nd edition.
2. "Thinking, Fast and Slow" by Daniel Kahneman, 2011, 1st edition.
3. "The Art of Thinking Clearly" by Rolf Dobelli, 2011, 1st edition.

**Reference Books:**

1. "Critical Thinking: An Introduction" by Alec Fisher, 2001, 1st edition.
2. "Super Thinking: The Big Book of Mental Models" by Gabriel Weinberg and Lauren McCann, 2019, 1st edition.
3. "An Illustrated Book of Bad Arguments" by Ali Almossawi, 2013, 1st edition.

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1. | Introduction to Analytical Reasoning Techniques | CLO 1,2 |
| 2. | Problem analysis and identification | CLO 1,2,3 |
| 3. | Data Interpretation and decision making | CLO 1,2,3 |
| 4. | Logical arguments and Fallacies | CLO 1,2,3 |
| 5. | Statistical reasoning and Probability | CLO 1,2,3 |
| 6. | Case studies and Application Exercises | CLO 1,2,3,4 |
| 7 | Problem solving strategies | CLO1,2,3 |
| 8. | Decision trees and Risk Analysis | CLO 1,2,3 |
| 9. | Mid-Term Exam | |
| 10. | Quantitative and qualitative Analysis | CLO 1,2,3 |
| 11. | Cognitive Biases and Heuristics | CLO 1,2,3 |
| 12. | Ethical considerations in Analytical reasoning | CLO 3,4 |
| 13. | Analytical Tools for Design Decisions | CLO,3 4 |
| 14. | Techniques for analyzing the target audience in visual communication | CLO,3, 4 |
| 15. | Integration of Analytical Reasoning in Visual Communication Practice | CLO 3,4 |
| 16. | Capstone project | CLO3,4 |
| 17 | Presentation of project outcomes and reflection on the learning process | CLO 2,3,4 |
| 18. | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Drawing for Design I** Course Type: Disciplinary
Course Code: VCD 204 Credit Hours: 03
Pre-Requisite: None Program: BS
Semester: III Instructor: ____________

**Course Descriptions:**

Drawing for Design is a foundational course aimed at developing essential drawing skills crucial for aspiring designers. Through a combination of practical exercises and theoretical insights, students learn various drawing techniques, including line work, shading, perspective, and composition. Emphasis is placed on cultivating observational skills and enhancing the ability to translate ideas into visual form. Students explore the role of drawing in the design process and its significance in communicating concepts effectively. By the end of the course, students gain confidence in their drawing abilities and acquire a solid foundation for further studies in design.

**Course Objectives:**

The course objective of Drawing for Design 1 in the BS in Visual Communication program is to develop fundamental drawing skills essential for visual communication designers. Through hands-on practice and theoretical exploration, students will learn various techniques such as line, shape, form, texture, and perspective drawing. Emphasis is placed on understanding composition, proportion, and spatial relationships to effectively convey ideas visually. By the end of the course, students will have honed their observational and rendering abilities, enabling them to translate concepts into compelling visual representations across a range of mediums. This foundational course sets the stage for further exploration and refinement of drawing skills in subsequent courses within the program.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1. Students will demonstrate mastery in fundamental drawing techniques such as line work, shading, and perspective, enabling them to effectively depict objects, spaces, and compositions. | PLO 2 |
| 2. Through hands-on practice and exploration, students will develop the ability to communicate ideas visually, understanding the role of drawing as a primary tool for conveying concepts in design. | PLO 7 |
| 3 Students will refine their observational skills, learning to analyze and interpret visual information accurately, which is essential for creating meaningful and impactful designs. | PLO 7 |

| | |
|---|---|
| 4 By engaging in various drawing exercises and projects, students will enhance their creative problem-solving abilities, gaining the confidence to generate and execute innovative solutions to design challenges. | PLO 8 |

**Text Books:**

1. "Drawing for Designers" by Alan Pipes, 2014, 2nd edition.
2. "Keys to Drawing" by Bert Dodson, 1985, revised edition.
3. "The Fundamentals of Drawing: A Complete Professional Course for Artists" by Barrington Barber, 2004, 1st edition.

**Reference Books:**

1. "Drawing on the Right Side of the Brain" by Betty Edwards, 1979, revised and expanded edition.
2. "Drawing: Structure and Vision" by Fritz Drury and Joanne Stryker, 2008, 1st edition.
3. "Figure Drawing: Design and Invention" by Michael Hampton, 2010, 1st edition.

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1. | Introduction to Drawing | CLO 1 |
| 2. | Line Drawing | CLO 1,2 |
| 3. | Shape and form | CLO 1,2 |
| 4. | Perspective Drawing | CLO 2,3 |
| 5. | Composition | CLO 2,3,4 |
| 6. | Still life Drawing | CLO 2,3,4 |
| 7 | Figure Drawing | CLO 3,4 |
| 8. | Texture and Details | CLO 2,3,4 |
| 9. | Mid-Term Exam | |
| 10. | Experimental Drawing | CLO 2,3,4 |
| 11. | Drawing from observation | CLO 2,3,4 |
| 12. | Color theory in Drawing | CLO 2,3,4 |
| 13. | Concept development | CLO 3,4 |
| 14. | Digital Drawing tools | CLO 2,3,4 |
| 15. | Critique and Feedback | CLO 2,3,4 |
| 16. | Portfolio Development | CLO 2,3,4 |
| 17 | Application of Drawing for Design | CLO 2,,3,4 |
| 18. | Final Exam | |

**Assessment Plan**

| **Assessment** | **Total Marks** |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Illustration I (non- digital)**
Course Type: Disciplinary
Course Code: VCD 203
Credit Hours: 03
Pre-Requisite: None
Program: BS
Semester: III
Instructor:

**Course Descriptions:**

In the Illustration 1(non -digital) course, students explore the fundamentals of Illustration through traditional non digital methods. Emphasizing hands-on techniques, students learn to create Illustration using various mediums such as pencil, ink, watercolor and gouache. Through a series of projects, students develop their drawing skills, learn about composition and storytelling and gain an understanding of how to effectively convey ideas visually. The course also covers the historical and contemporary context of Illustration, exposing students to arrange of styles and approaches. By the end of the course, students will have a portfolio of work that demonstrates their understanding of Illustration principles and techniques.

**Course Objectives:**

In the Illustration I (non-digital) course for the BS program in Visual Communications, students focus on mastering traditional illustration techniques using non digital tools and materials. The course aims to develop students' observational and rendering skills, teaching them to effectively use line, shape forms, texture and color to create visually compelling illustrations. Through a series of projects and exercises, students learn to conceptualize and execute illustrations that communicate ideas and narratives effectively. Additionally, the course explores various illustration styles, techniques and media, providing students with a solid foundation in traditional illustration methods.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1. Develop proficiency in traditional illustration techniques, including drawing, rendering and use of various media to effectively communicate ideas and concepts visually. | PLO 1,2 |
| 2. Cultivate creative thinking and problem- solving skills through the development of original illustrations that demonstrate a personal style and artistic voice. | PLO 8 |
| 3. Gain the ability to use visual elements such as line, shape, color and texture to create illustrations that effectively communicate messages, narratives and emotions to a target audience. | PLO 5 |

**Text Books:**

1. Illustration: A Visual History" by Steven Heller and Seymour Chwast, 2018, 1st Edition
2. "The Fundamentals of Illustration" by Lawrence Zeegen, 2019, 2nd Edition
3. "Drawing for Illustration: A Guide to Drawing Techniques for Creative Visualization" by Brian Curtis, 2017, 1st Edition

**Reference Books:**

1. "Illustration School: Let's Draw Plants and Small Creatures" by Sachiko Umoto, 2008, 1st Edition
2. "Color and Light: A Guide for the Realist Painter" by James Gurney, 2010, 1st Edition

3. "Illustrating Children's Books: Creating Pictures for Publication" by Martin Salisbury, 2004, 1st

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1. | Product illustration for this historical product in a modern style | CLO 1 |
| 2. | Reproducing and altering illustration styles to help develop and enrich your own style | CLO 1,2,3 |
| 3. | Use of dry and wet media and techniques and Grid technique sampler | CLO 1,2,3 |
| 4. | Illustrations in brushwork, pen and ink mixed media and examine non-objective and portraits | CLO 1,2,3 |
| 5. | Visual puns in illustration and Various illustration styles and Basic drawing techniques | CLO 1,2 ,3 |
| 6. | Different black and white media and composition | CLO 1,2,3 |
| 7 | Design contrasts: thick/thin line, volume, texture, dark/light, transparent/opaque | CLO 1,2,3 |
| 8. | From doodle to comprehensive Stage | CLO 1,2,3 |
| 9. | Mid-Term Exam | |
| 10. | Conceptual/narrative illustration | CLO 1,2,3 |
| 11. | Advertising/editorial illustration styles, Comics/cartoon/caricature illustrations | CLO 2, 3,4 |
| 12. | Themes and clichés/portraits and self-portraits | CLO 2,4 |
| 13. | Alternative, new wave, cutting edge, fringe, grunge = modern | CLO 1,2 |
| 14. | Product Illustration for Advertising | CLO ,2,3,4 |
| 15. | Advertising illustrations for products and Scratchboard technique | CLO ,2,3,4 |
| 16. | Modify an existing product illustration | CLO 2,3,4 |
| 17 | Dimensional, extended, peripheral techniques | CLO 2,3,4 |
| 18. | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Marketing and outreach course** Course Type: ID
Course Code: VCD 201 Credit Hours: 03
Pre-Requisite: None Program: BS
Semester: III Instructor: 

**Course Descriptions:**

This course covers the core marketing concepts including marketing analysis, consumer behavior, branding, product development, pricing, distribution, advertising, and digital marketing. Through lectures, discussions, and hand-on projects, students will gain practical skills for developing integrated marketing plans, campaigns and materials.

**Course Objectives:**

The marketing and outreach course for the BS program in Visual Communications aim to equip students with the fundamental concepts, strategies and tools needed to effectively promote visual content and engage with target audiences. Through this course, students will explore various marketing channels, such as social media, advertising and public relations, learning how to develop integrated marketing campaigns that leverage visual elements to communicates messages effectively. Students will also learn how to analyze audience behavior, conduct, market research, and use data driven insight to refine their marketing strategies. Ultimately, the course seeks to prepare students to navigate the ever-evolving landscape of visual communications, enabling them to create compelling visual narratives that resonate with diverse audience.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1. Analyze the marketing environment, competitors, and consumer for a given product of service. | PLO 2 |
| 2. Target appropriate markets for a product or service | PLO 2 |
| 3. Develop positioning and branding strategies for a product or service | PLO 8 |
| 4. Design effective marketing materials including advertisements, brochures, websites, emails, and social media campaigns | PLO 7 |

**Text Books**

1. "Marketing: An Introduction" by Gary Armstrong and Philip Kotler, 2021, 14th edition.
2. "Contagious: How to Build Word of Mouth in the Digital Age" by Jonah Berger, 2013, 1st edition.
3. "Influence: The Psychology of Persuasion" by Robert B. Cialdini, 1984, revised edition.

**Reference Books:**

1. "Made to Stick: Why Some Ideas Survive and Others Die" by Chip Heath and Dan Heath, 2007, 1st edition.
2. "Purple Cow: Transform Your Business by Being Remarkable" by Seth Godin, 2003, 1st edition.
3. "Building a Story Brand: Clarify Your Message So Customers Will Listen" by Donald Miller, 2017, 1st edition.

**Weekly Lecture Plan**

| **Week #** | **Topic Covered** | **CLO Covered** |
|---|---|---|
| 1. | Introduction to Marketing | CLO 1,2 |
| 2. | Marketing environment and research | CLO 1,2 |
| 3. | Consumer behavior | CLO 1,2 |
| 4. | Segmentation, Targeting & Positioning | CLO 1,2 |
| 5. | Branding and Product strategy | CLO 1,2 |
| 6. | Pricing strategy | CLO 1,2 |
| 7 | Marketing channels and distribution | CLO1,2 |

| | | |
|---|---|---|
| 8. | Integrated Marketing Communication | CLO 1,2 |
| 9. | Mid-Term Exam | |
| 10. | Advertising and Public relations | CLO 1,2 |
| 11. | Digital and social media marketing | CLO 1,2,3 |
| 12. | Personal selling & Sales management | CLO 3,4 |
| 13. | Marketing Plan development | CLO 4 |
| 14. | Marketing Plan presentation | CLO 4 |
| 15. | Services and Nonprofit Marketing | CLO 3,4 |
| 16. | Global Marketing | CLO3,4 |
| 17 | Marketing Matrix & Analytics | CLO 2,3,4 |
| 18. | Final Exam | |

**Assessment Plan**

| **Assessment** | **Total Marks** |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Photography I** Course Type: GE
Course Code: AAD 110 Credit Hours: 03
Pre-Requisite: None Program: BS
Semester: III Instructor: ______

**Course Descriptions:**

In the Photography 1 course for the BS program, students are introduced to the fundamental concepts and techniques of Photography. Through a combination of theoretical studies and hand-on practical exercises, students learn about camera operations, exposure control, composition and lighting. They explore the basic principles of visual storytelling and develop an understanding of how to use Photography as a medium of creative expression and communication. Additionally, students are introduced to history of Photography and its role in shaping contemporary visual culture. By the end of the course, students will have acquired the skills and knowledge necessary to create compelling photographs that effectively convey their intended messages.

**Course Objectives:**

Photography - I is a beginning course that addresses photographic theory, technical issues, applications, composition, practice and history. This course provides the basis for advanced film photography, digital photography, video and film making. The content offers the student the opportunity to elevate the quality of your photographs appreciation of art by providing a better understanding and use of these mediums. Students will be able to read, understand and communicate in the language of graphic design. They will be able to use technology such as Photoshop, Illustrator, internet browsers, online portfolio websites, etc. Students will learn to demonstrate positive work behavior. Students will learn to solve problems using critical thinking. Upon successful completion of the program, students should be able to demonstrate artistry by creating images that evoke an emotional response. Apply the principles of lighting and color theory to a variety of photographic scenarios by measuring, evaluating, and adjusting light and color to create quality images. Apply the mechanics of exposure to control light and influence the final product. Apply the principles of composition to produce professional images. Select and use photographic equipment and technologies appropriate to the tasked expression

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1 Develop a solid foundation in camera operation, exposure control and image editing, enabling students to produce technically sound photographs. | PLO 1 |
| 2 Cultivate a technical eye for composition, lighting and visual storytelling, allowing students to create photographs with strong aesthetic and narrative qualities. | PLO 8 |
| 3 Gain an understanding of the conceptual and theoretical framework of photography, including its historical and contemporary contexts, enabling students to approach their work with depth and meaning. | PLO 7 |
| 4. Explore various photographic genres and styles, encouraging students to experiment with different techniques and approaches to expand their creative horizons. | PLO 8 |

**Text Books:**

1. Peterson, B. (2016). Understanding exposure: how to shoot great photographs with any camera. Canada: Am Photo books.
2. Hallett, T. (2011). Close-up & macro photography, London: Ammonite Press

**Reference Books:**

1. Carter, R., Meggs, P. B., & Day, B. (2011). Typographic design: form and communication.
2. Hoboken: John Wiley & Sons.
3. Bringhurst, R. (2004). The elements of typographic style. Vancouver: Hartley & Marks
4. Ctein. (2000). Post exposure: advanced techniques for the photographic printer. Milton: Taylor & Francis.

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1. | Introduction to Photography | CLO 1 |
| 2. | A Step Back in Time: The Film & Digital Process | CLO 1,2 |
| 3. | What is Visual Art? Why Go Digital? | CLO 1,2,3 |
| 4. | How to Use Your Camera (Shutters, Aperture & Their Relationships, Exposure & Metering) | CLO 1,2 |
| 5. | Photography Principles, Developing Your Eye | CLO 1,2 |
| 6. | Image Capture (Elements of Composition, Golden Ratio vs. Rule of Thirds) | CLO 1,2 |
| 7 | Workflow and Image Editing (Retouching, Resolution & Printing) | CLO 1,2 |
| 8. | Harnessing the Light | CLO 1,2 |
| 9. | Mid term exam | |
| 10. | Artificial Light-Flash, Light & Color, A Mix of Things: Macro Photography | CLO1,2 |

| | | |
|---|---|---|
| 11. | Lines and Symmetry (Vertical vs. Horizontal, The Importance of the Horizon) | CLO 1,2 |
| 12. | Depth of Field and Distance (Background, Middle ground and Foreground) | CLO 1,2 |
| 13. | Developing Your Visual Signature, Natural and Available Light, Artificial Light-Continuous | CLO 1,2 |
| 14. | Space and Balance | CLO2,3,4 |
| 15. | Photographing People and Places | CLO 2,3,4 |
| 16. | Revisualization, Basic Portrait lighting, Studio Portraiture, Environmental Portraiture | CLO2,3,4 |
| 17 | Landscape and Travel Photography, Decisive Moment Photography | CLO2,3,4 |
| 18. | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Typography & Calligraphy I** Course Type: Disciplinary
Course Code: VCD 202 Credit Hours: 03
Pre-Requisite: None Program: BS
Semester: III Instructor: ________________

**Course Descriptions:**
In the Typography and Calligraphy course within the BS program in Visual communications, students delve into the art and science of designing with type. They explore the history, theory and practical application of typography, learning to effectively use typefaces, spacing and layout to convey meaning and create visual impact. Additionally, students study Calligraphy, honing their skills in the hand-rendering of letter forms to develop a deeper appreciation for the nuances of written communication. Through hand-on projects and critical analysis, students cultivate their aesthetic sensibilities and develop a comprehensive understanding of the role Typography and Calligraphy play in Visual Communication.

**Course Objectives:**
In the Typography and Calligraphy course within the BS program in Visual communications, students delve into the art and science of type design and the expressive potential of Calligraphy. The course aims to cultivate a deep understanding of Typography as a fundamental element of visual communication, emphasizing its role in conveying its meaning mood, and hierarchy. Through hands-on practice and theoretical study, students explore the history of type, its cultural impacts and its application in contemporary design. They learn to manipulate type effectively, experimenting with various styles, sizes and arrangements enhance the visual appeal and legibility of their designs. By mastering the principles of Typography and Calligraphy, students develop the skills necessary to create compelling and communicative visual messages in diverse media context.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1. Students will develop a deep understanding of Typography principles, including type anatomy, classification and hierarchy, enabling them to effectively select and manipulate typefaces to enhance communication in design projects. | PLO 1 |
| 2. Students will acquire the skills necessary to create well-crafted calligraphic letterforms, demonstrating proficiency in traditional and contemporary calligraphic style. | PLO 2 |
| 3. Students will apply typographic and Calligraphic principles to create visually engaging and meaningful designs that effectively communicates messages to target audiences. | PLO 3 |
| 4. Students will explore the historical and cultural influences, gaining a broader perspective on the evolution of these art forms and their impact on visual communication. | PLO 8 |

**Text Books:**

1. Shepherd, M. (2013). Learn calligraphy: the complete book of lettering and design. New York: Watson -Guptill.
2. Massoudy, H. (2012). The calligrapher's garden. London: Saqi Books

**Reference Books:**

1. Massoudy, H. (2017). Calligraphies of love. London: Saqi Books.
2. Oweis, F. (2018). Pocket guide to arabic script. New York: Hippocrene Books.
3. Nasr, S. H. (1990). Islamic art and spirituality. New York: Suny Press.
4. Massoudy, H. (2015). Islamic art of illumination: classical tazhib from Ottoman to Contemporary times. New York: Blue Dome Press

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1. | 1. History of Handwriting | CLO 1 |
| 2. | 2. History of Calligraphy | CLO 1,2 |
| 3. | Rules of Naskh letters, and how to write them. | CLO 1,2 |
| 4. | Sulus Style | CLO 1,2 |
| 5. | Nastaliq Style | CLO 1,2 |
| 6. | Introduction to Japanese Calligraphy | CLO 1,2 |
| 7 | Islamic Calligraphy | CLO 1,2 |
| 8. | Arabic Calligraphy Design | CLO 1,2 |
| 9. | Mid Term | |
| 10. | Classic & Modern styles | CLO 1,2 |
| 11. | Advertising Naskh | CLO 2, 3 |
| 12. | Contemporary Calligraphy | CLO 1,2 |
| 13. | Kufi Calligraphy | CLO 1,2 |
| 14. | Chinese Calligraphy Style | CLO 1,2 |
| 15. | Dewani Calligraphy | CLO 1,2 |

| | | |
|---|---|---|
| 16. | Running script, Cursive script and clerical script | CLO 1,2 |
| 17 | Black letter and western calligraphy | CLO 2,3 |
| 18. | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Visual Communication Design I**
Course Type: Disciplinary
Course Code: VCD 201
Credit Hours: 03
Pre-Requisite: VCD 114
Program: BS
Semester: III
Instructor:

**Course Descriptions:**

This course provides an overview of visual communication design, covering topics such as typography, color theory, layout design and image manipulation. Students will engage in practical projects and assignments to enhance their design skills and creativity. Through a series of lectures, workshops, and projects, students explore topics such as graphic design, typography, and branding, advertising and multimedia design. Emphasis is placed on developing both technical skills, such as using design software and tools, conceptual skills such as critical thinking and creative problem solving, students are encouraged to experiment with different design approaches and media formats to effectively convey messages and ideas.

**Course Objectives:**

The course objective of Visual communication Design for a BS in Visual communication is to develop students' understanding and application of visual language in various media contexts. Through a combination of theoretical learning and practical projects, students learn to effectively communicate ideas, information and messages using visual elements such as typography, color, imagery, and layout. The course aims to equip students with the skills to create visually compelling designs that engage and inform audiences across different platforms, including print, digital and interactive media. Additionally, students are encouraged to explore the ethical, cultural, and social implications of visual communication in contemporary society.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| After successful completion of the program, students should be able to: | **PLO** |
| 1. Understand the Principles of Visual Communication design | PLO 2 |
| 2. Apply design elements effectively in Various Projects. | PLO 6 |
| 3. Demonstrate proficiency in using design software. | PLO 1 |
| 4. Create visually compelling design solutions. | PLO 7 |

**Textbooks:**

1. "Visual Communication: From Theory to Practice" by Jonathan Baldwin and Lucienne Roberts, 2012, 1st Edition

2. "Designing Visual Interfaces: Communication Oriented Techniques" by Kevin Mullet and Darrell Sano, 1995, 1st Edition
3. "Visual Communication: Images with Messages" by Paul Martin Lester, 2014, 7th Edition

**Reference Books:**

1. The Visual Display of Quantitative Information" by Edward R. Tufte, 2001, 2nd Edition
2. "Graphic Design: The New Basics" by Ellen Lupton and Jennifer Cole Phillips, 2015, 2nd Edition
3. "Visual Thinking: for Design" by Colin Ware, 2008, 1st Edition

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1. | Introduction to Visual communication Design | CLO 1 |
| 2. | Elements of Visual language | CLO 1,2 |
| 3. | Principles of Design | CLO 1 |
| 4. | Typography: Anatomy and Terminology | CLO 2,3 |
| 5. | Typographic Hierarchy and Composition | CLO 2,3 |
| 6. | Introduction to Layout design | CLO 2,3 |
| 7 | Grid system and Layout structure | CLO 2, 3, |
| 8. | Color theory and Application | CLO 2,3 |
| 9. | Mid-Term Exam | |
| 10. | Advanced design tools and techniques | CLO 3, |
| 11. | Hands on Project: Brand Identity design | CLO 3, |
| 12. | Hands on Project: Editorial layout Design | CLO ,3, |
| 13. | Hands on project: Poster Design | CLO ,3 |
| 14. | Digital Marketing and Design integration | CLO ,3 |
| 15. | Critique and feedback session | CLO 3, |
| 16. | Portfolio Development | CLO 2,3 |
| 17 | Hands on project: Digital Media Design | CLO 1,2 |
| 18. | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Poster design project | 15 |
| Mid Term | 25 |
| Editorial Layout design | 10 |
| Brand identity design project | 20 |
| Digital media design project | 20 |
| Portfolio Development | 10 |
| Total | 100 |

Course Title: **Visual Communication Design II** Course Type: Major
Course Code: VCD 211 Credit Hours: 03
Pre-Requisite: VCD I Program: BS
Semester: 04 Instructor: ______

**Course Descriptions:**

"Visual Communication Design II (Live & Still Life)" is a continuation of the exploration of drawing techniques essential for students in the Bachelor of Science program in Visual Communication. This course expands upon the principles introduced in Drawing I, emphasizing advanced drawing methods and conceptual development. Students will engage in a series of practical exercises, workshops, and projects aimed at refining their observational skills, expressive rendering techniques, and understanding of human anatomy. Through in-depth critiques and portfolio development, students will deepen their artistic voice and prepare for diverse career paths in visual communication.

**Course Objectives:**

The course "Visual Communication Design II (Live & Still Life)" aims to advance students' skills, techniques, and conceptual understanding acquired in Drawing I. Building upon foundational knowledge, students will delve deeper into various drawing methods, emphasizing expressive rendering, advanced anatomy depiction, and experimentation with diverse mediums. Through live subject studies, still life arrangements, and exploration of digital tools, students will refine their visual communication abilities and develop a personal artistic style. The course will also focus on critical thinking, problem-solving, and preparing students for professional challenges in visual communication fields.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| After successful completion of the program, students should be able to: | **PLO** |
| 1. Develop proficiency in observational drawing of live subjects and still-life arrangement | PLO 2 |
| 2. Understand and apply fundamental drawing techniques such as line, shape, and texture. | PLO 1,2 |
| 3. Explore anatomy drawing to capture the human form accurately and dynamically. | PLO 5 |
| 4. Adapt traditional drawing skills to digital platforms, preparing for diverse roles in visual communication. | PLO 7 |

**Text Books:**

1. "The Artist's Guide to Human Anatomy" by Gottfried Bammes - 3rd Edition (2023)
2. "Dynamic Anatomy" by Burne Hogarth - 3rd Edition (2022)
3. "Digital Drawing for Visual Communication" by Lawrence Zeegen - 2nd Edition (2021)

**Reference Books:**

1. "Drawing Lessons from the Great Masters" by Robert Beverly Hale - Revised Edition (2020)
2. "Expressive Drawing" by Steven Aimone - 2nd Edition (2019)
3. "Figure Drawing: Design and Invention" by Michael Hampton - 3rd Edition (2022)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1 | Advanced Typography and layout Design | CLO 1, 2 |
| 2 | Branding Strategies and identity design | CLO 2, 3 |
| 3 | User experience design: Principles and processes | CLO 2, 3 |
| 4 | Interactive design and Prototyping | CLO 1, 2 |
| 5 | Dynamic Anatomy Studies | CLO 3, 4 |

| | | |
|---|---|---|
| 6 | Creative Figure Drawing | CLO 3, 4 |
| 7 | Digital Drawing Mediums | CLO 2, 4 |
| 8 | Conceptual Drawing Development | CLO 2, 3 |
| 9 | Mid-Term Exam | |
| 10 | Hands on Project: Brand Identity design | CLO 3, 4 |
| 11 | Hands on Project: Motion Graphic Animation | CLO 3, 4 |
| 12 | Portfolio Development | CLO 2, 3 |
| 13 | Professional Practices in Drawing | CLO 2, 3 |
| 14 | Hands on Project: Interactive website Design | CLO 2, 3 |
| 15 | Critique and Feedback | CLO 3, 4 |
| 16 | Industry Insights and Guest Lectures | CLO 2, 3, 4 |
| 17 | Workshop: Advanced Drawing Techniques | CLO 2,3 |
| 18 | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Mid Term Exam | 25 |
| Brand Identity Design Project | 15 |
| User interface Design Project | 15 |
| Interactive Website design Project | 15 |
| Final | 30 |
| Total | 100 |

Course Title: **Typography and Calligraphy II** Course Type: Major
Course Code: VCD 212 Credit Hours: 03
Pre-Requisite: Program: BS
Semester: 04 Instructor:

**Course Descriptions:**

"Typography and Calligraphy II" is a continuation of the exploration of typographic and calligraphic techniques essential for students in the Bachelor of Science program in Visual Communication. This course expands upon the principles introduced in Typography and Calligraphy I, emphasizing advanced typographic methods and conceptual development. Students will engage in a series of practical exercises, workshops, and projects aimed at refining their typographic compositions, calligraphic letterforms, and understanding of typographic history. Through in-depth critiques and portfolio development, students will deepen their typographic voice and prepare for diverse career paths in visual communication.

**Course Objectives:**

The course "Typography and Calligraphy II" aims to advance students' skills, techniques, and conceptual understanding acquired in Typography and Calligraphy I. Building upon foundational knowledge, students will delve deeper into various typographic methods, emphasizing expressive typography, advanced calligraphy techniques, and experimentation with diverse styles. Through practical exercises, workshops, and projects, students will refine their typographic and calligraphic abilities, develop a keen eye for detail, and explore the historical and cultural significance of type and lettering. The course will also focus on critical thinking, problem-solving, and preparing students for professional challenges in visual communication fields.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| After successful completion of the program, students should be able to: | **PLO** |
| 1. Develop proficiency in observational drawing of live subjects and still life arrangements. | PLO 2 |
| 2. Understand and apply fundamental drawing techniques such as line, shape, and texture. | PLO 1,2 |
| 3. Explore anatomy drawing to capture the human form accurately and dynamically. | PLO 5 |
| 4. Adapt traditional drawing skills to digital platforms, preparing for diverse roles in visual communication. | PLO 7 |

**Text Books:**

1. "The Elements of Typographic Style" by Robert Bringhurst - 4th Edition (2022)
2. "Calligraphy: A Comprehensive Guide to Beautiful Lettering" by Julien Chazal - Revised Edition (2021)
3. "Typography Workbook: A Real-World Guide to Using Type in Graphic Design" by Timothy Samara - 2nd Edition (2020)

**Reference Books:**

1. "The Stroke: Theory of Writing" by Gerrit Noordzij - 3rd Edition (2019)
2. "The ABC of Custom Lettering: A Practical Guide to Drawing Letters" by Ivan Castro - Revised Edition (2020)
3. "Scripts: Elegant Lettering from Design's Golden Age" by Steven Heller - 2nd Edition (2021)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1 | Expressive Typography | CLO 1, 2 |
| 2 | Advanced Calligraphy Techniques | CLO 1, 2 |
| 3 | Typographic Hierarchy and Composition | CLO 2 |
| 4 | Historical Context of Typography | CLO 3 |
| 5 | Grid Systems and Layout Design | CLO 2 |
| 6 | Contemporary Calligraphy Styles | CLO 1, 4 |
| 7 | Digital Typography Tools and Techniques | CLO 4 |
| 8 | Conceptual Typographic Development | CLO 2, 3 |
| 9 | Mid-Term Exam | |
| 10 | Expressive Lettering Projects | CLO 1, 2, 4 |
| 11 | Experimental Typographic Expressions | CLO 1, 4 |
| 12 | Portfolio Development | CLO 2, 3 |
| 13 | Professional Practices in Typography | CLO 2, 4 |
| 14 | Typography in Narrative Contexts | CLO 3 |
| 15 | Critique and Feedback | CLO 3, 4 |
| 16 | Industry Insights and Guest Lectures | CLO 2, 3, 4 |
| 17 | Workshop: Advanced Calligraphy Techniques | CLO 1, 2 |
| 18 | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Photography II** Course Type: Major
Course Code: VCD 210 Credit Hours: 03
Pre-Requisite: Program: BS
Semester: 04 Instructor:

**Course Descriptions:**

"Photography II" is a continuation of the exploration of photography techniques essential for students in the Bachelor of Science program in Visual Communication. This course expands upon the principles introduced in Photography I, emphasizing advanced photography methods and conceptual development. Students will engage in a series of practical exercises, workshops, and projects aimed at refining their compositional skills, lighting techniques, and understanding of photographic subjects. Through in-depth critiques and portfolio development, students will deepen their photographic voice and prepare for diverse career paths in visual communication.

**Course Objectives:**

The course "Photography II" aims to advance students' skills, techniques, and conceptual understanding acquired in Photography I. Building upon foundational knowledge, students will delve deeper into various photography methods, emphasizing expressive composition, advanced lighting techniques, and experimentation with diverse subjects. Through live photo shoots, studio setups, and exploration of digital editing tools, students will refine their visual communication abilities and develop a personal photographic style. The course will also focus on critical thinking, problem-solving, and preparing students for professional challenges in visual communication fields.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| After successful completion of the program, students should be able to: | **PLO** |
| 1. Develop proficiency in observational drawing of live subjects and still life arrangements. | PLO 2 |
| 2. Understand and apply fundamental drawing techniques such as line, shape, and texture. | PLO 1,2 |
| 3. Explore anatomy drawing to capture the human form accurately and dynamically. | PLO 5 |
| 4. Adapt traditional drawing skills to digital platforms, preparing for diverse roles in visual communication. | PLO 7 |

**Text Books:**

1. "The Photographer's Eye: Composition and Design for Better Digital Photos" by Michael Freeman - 3rd Edition (2023)

2. "Light Science & Magic: An Introduction to Photographic Lighting" by Fil Hunter, Steven Biver, and Paul Fuqua - 5th Edition (2022)
3. "Adobe Photoshop CC Classroom in a Book" by Andrew Faulkner and Conrad Chavez - 2021 Edition (2021)

**Reference Books:**

1. "Understanding Exposure: How to Shoot Great Photographs with Any Camera" by Bryan Peterson - 4th Edition (2020)
2. "On Photography" by Susan Sontag - Revised Edition (2018)
3. "The Digital Photography Book" by Scott Kelby - Part 1 (2022)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1 | Advanced Composition Techniques | CLO 1, 2 |
| 2 | Expressive Lighting | CLO 1, 2 |
| 3 | Mood and Atmosphere in Photography | CLO 1, 3 |
| 4 | Advanced Still Life Photography | CLO 1, 2 |
| 5 | Dynamic Subject Studies | CLO 3, 4 |
| 6 | Portrait Photography Techniques | CLO 3, 4 |
| 7 | Digital Editing Mediums | CLO 2, 4 |
| 8 | Conceptual Photography Development | CLO 2, 3 |
| 9 | Mid-Term Exam | |
| 10 | Live Model Photography | CLO 3, 4 |
| 11 | Experimental Photography Techniques | CLO 1, 4 |
| 12 | Portfolio Development | CLO 2, 3 |
| 13 | Professional Practices in Photography | CLO 2, 3 |
| 14 | Photography in Narrative Contexts | CLO 1, 2, 3 |
| 15 | Critique and Feedback | CLO 3, 4 |
| 16 | Industry Insights and Guest Lectures | CLO 2, 3, 4 |
| 17 | Workshop: Advanced Photography Techniques | CLO 1, 2, 3, 4 |
| 18 | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Illustration II** Course Type: Major
Course Code: VCD 213 Credit Hours: 03
Pre-Requisite: Program: BS
Semester: 04 Instructor:

**Course Descriptions:**

"Illustration II" is a continuation of the exploration of illustration techniques essential for students in the Bachelor of Science program in Visual Communication. This course expands upon the principles introduced in Illustration I, emphasizing advanced illustration methods and conceptual development. Students will engage in a series of practical exercises, workshops, and projects aimed at refining their observational skills, expressive rendering techniques, and understanding of visual storytelling. Through in-depth critiques and portfolio development, students will deepen their illustrative voice and prepare for diverse career paths in visual communication.

**Course Objectives:**
The course "Illustration II" aims to advance students' skills, techniques, and conceptual understanding acquired in Illustration I. Building upon foundational knowledge, students will delve deeper into various illustration methods, emphasizing expressive rendering, advanced composition, and experimentation with diverse mediums. Through live subject studies, thematic illustrations, and exploration of digital tools, students will refine their visual communication abilities and develop a personal artistic style. The course will also focus on critical thinking, problem-solving, and preparing students for professional challenges in visual communication fields.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| After successful completion of the program, students should be able to: | **PLO** |
| 1. Develop proficiency in observational drawing of live subjects and still life arrangements. | PLO 2 |
| 2. Understand and apply fundamental drawing techniques such as line, shape, and texture. | PLO 1,2 |
| 3. Explore anatomy drawing to capture the human form accurately and dynamically. | PLO 5 |
| 4. Adapt traditional drawing skills to digital platforms, preparing for diverse roles in visual communication. | PLO 7 |

**Text Books:**

1. "Illustration Workshop: A Guide and Workbook for Creating Magical Art" by Mary Kate McDevitt - 2nd Edition (2023)
2. "The Elements of Illustration" by Jessica Hische - Revised Edition (2022)
3. "Digital Illustration Basics: A Comprehensive Guide to Creating Successful Illustrations" by Samwise Diamond - 3rd Edition (2021)

**Reference Books:**

1. "The Illustrator's Bible: The Complete Sourcebook of Tips, Tricks, and Time-Saving Techniques in Illustration" by Rob Howard - 4th Edition (2020)
2. "Illustrating Children's Books: Creating Pictures for Publication" by Martin Salisbury and Morag Styles - 3rd Edition (2019)
3. "Visual Storytelling: Infographic Design in News" by Liu Yikun and Dong Zhao - 2nd Edition (2022)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1 | Advanced Illustration Techniques | CLO 1, 2 |
| 2 | Expressive Composition | CLO 2, 3 |
| 3 | Mood and Emotion in Illustration | CLO 2, 3 |
| 4 | Advanced Theme Illustration | CLO 1, 2 |

| | | |
|---|---|---|
| 5 | Dynamic Character Studies | CLO 3, 4 |
| 6 | Narrative Illustration Techniques | CLO 3, 4 |
| 7 | Digital Illustration Mediums | CLO 2, 4 |
| 8 | Conceptual Illustration Development | CLO 2, 3 |
| 9 | Mid-Term Exam | |
| 10 | Theme-based Illustration Projects | CLO 3, 4 |
| 11 | Experimentation with Mediums | CLO 3, 4 |
| 12 | Portfolio Development | CLO 2, 3 |
| 13 | Professional Practices in Illustration | CLO 2, 3 |
| 14 | Illustration in Narrative Contexts | CLO 1, 2, 3 |
| 15 | Critique and Feedback | CLO 3, 4 |
| 16 | Industry Insights and Guest Lectures | CLO 2, 3, 4 |
| 17 | Workshop: Advanced Illustration Techniques | CLO 1, 2, 3, 4 |
| 18 | Final Exam | |

**Assessment Plan**

| **Assessment** | **Total Marks** |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Drawing for Design II** Course Type: Major
Course Code: VCD 214 Credit Hours: 03
Pre-Requisite: Program: BS
Semester: 04 Instructor:

**Course Descriptions:**

"Drawing for Design II" is a continuation of the exploration of drawing techniques essential for students in the Bachelor of Science program in Visual Communication. This course expands upon the principles introduced in Drawing for Design I, emphasizing their application in design projects. Students will engage in a series of practical exercises, workshops, and projects aimed at refining their drawing skills, understanding of design principles, and ability to communicate visually. Through in-depth critiques and portfolio development, students will deepen their understanding of drawing's role in design and prepare for diverse career paths in visual communication.

**Course Objectives:**

The course "Drawing for Design II" aims to advance students' skills, techniques, and conceptual understanding acquired in Drawing for Design I. Building upon foundational knowledge, students will delve deeper into various drawing methods, emphasizing their application in design contexts. Through live subject studies, still life arrangements, and exploration of digital tools, students will refine their drawing abilities and develop a keen eye for design aesthetics. The course will also focus on critical thinking, problem-solving, and preparing students for professional challenges in visual communication fields.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| After successful completion of the program, students should be able to: | **PLO** |

| | |
|---|---|
| 1. Develop proficiency in observational drawing of live subjects and still life arrangements. | PLO 2 |
| 2. Understand and apply fundamental drawing techniques such as line, shape, and texture. | PLO 1,2 |
| 3. Explore anatomy drawing to capture the human form accurately and dynamically. | PLO 5 |
| 4. Adapt traditional drawing skills to digital platforms, preparing for diverse roles in visual communication. | PLO 7 |

**Text Books:**

1. "Drawing for Design: Understanding the Creative Process" by Alan Pipes - 2nd Edition (2023)
2. "Drawing Ideas: A Hand-Drawn Approach for Better Design" by Mark Baskinger and William Bardel - Revised Edition (2022)
3. "Digital Drawing for Designers: A Visual Guide to AutoCAD" by Douglas R. Seidler - 3rd Edition (2021)

**Reference Books:**

1. "Drawing for Urban Design" by Lorraine Farrelly - 2nd Edition (2020)
2. "Sketching for Architecture + Interior Design" by Stephanie Travis - 3rd Edition (2019)
3. "Visual Communication for Landscape Architecture" by Trudi Entwistle and Tom Porter - Revised Edition (2022)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1 | Advanced Drawing Techniques for Design | CLO 1, 2 |
| 2 | Expressive Rendering in Design | CLO 2, 3 |
| 3 | Mood and Atmosphere in Design Drawing | CLO 2, 3 |
| 4 | Advanced Still Life Drawing for Design | CLO 1, 2 |
| 5 | Dynamic Drawing Studies for Design | CLO 3, 4 |
| 6 | Creative Figure Drawing for Design | CLO 3, 4 |
| 7 | Digital Drawing Tools for Design | CLO 2, 4 |
| 8 | Conceptual Drawing for Design Development | CLO 2, 3 |
| 9 | Mid-Term Exam | |
| 10 | Live Model Studies for Design | CLO 3, 4 |
| 11 | Experimentation with Drawing Mediums for Design | CLO 3, 4 |
| 12 | Portfolio Development for Design | CLO 2, 3 |
| 13 | Professional Practices in Drawing for Design | CLO 2, 3 |
| 14 | Drawing in Narrative Contexts for Design | CLO 1, 2, 3 |
| 15 | Critique and Feedback for Design | CLO 3, 4 |
| 16 | Industry Insights and Guest Lectures for Design | CLO 2, 3, 4 |
| 17 | Workshop: Advanced Drawing Techniques for Design | CLO 1, 2, 3, 4 |
| 18 | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |

| | |
|---|---|
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **The Influence of AI on Visual Landscape**
Course Type: Major
Course Code: VCD 113
Credit Hours: 02
Pre-Requisite:
Program: BS
Semester: 04
Instructor:

**Course Descriptions:**

"The Influence of AI on Visual Landscape: Bridging Digital and Traditional Drawing" examines the intersection of artificial intelligence and traditional drawing practices within the context of visual communication. The course explores how AI technologies are revolutionizing the creation, interpretation, and dissemination of visual content, challenging conventional notions of authorship and creativity. Through hands-on workshops, experimentation with AI tools, and critical analysis of AI-generated art, students will develop skills in integrating AI-driven approaches with traditional drawing techniques. The course will also address ethical considerations and societal implications of AI in the visual arts, empowering students to navigate and contribute to this rapidly evolving field.

**Course Objectives:**

The course "The Influence of AI on Visual Landscape: Bridging Digital and Traditional Drawing" aims to explore the impact of Artificial Intelligence (AI) on the visual communication landscape and its integration with traditional drawing techniques. Through theoretical discussions and practical exercises, students will examine how AI technologies such as machine learning and generative algorithms are reshaping visual creation processes. The course will emphasize the fusion of digital and traditional drawing methods, fostering creativity and innovation in visual communication practices. Students will develop a critical understanding of AI's role in contemporary art and design contexts and explore its potential for enhancing artistic expression.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| After successful completion of the program, students should be able to: | **PLO** |
| 1. Develop proficiency in observational drawing of live subjects and still life arrangements. | PLO 2 |
| 2. Understand and apply fundamental drawing techniques such as line, shape, and texture. | PLO 1,2 |
| 3. Explore anatomy drawing to capture the human form accurately and dynamically. | PLO 5 |
| 4. Adapt traditional drawing skills to digital platforms, preparing for diverse roles in visual communication. | PLO 7 |

**Text Books:**

1. "The Age of AI: Artificial Intelligence and the Future of Humanity" by Henry Kissinger and Eric Schmidt - 1st Edition (2023)
2. "Artificial Unintelligence: How Computers Misunderstand the World" by Meredith Broussard - Revised Edition (2022)

3. "Drawing with Code: The AI Artist's Handbook" by Janelle Shane - 2nd Edition (2021)

**Reference Books:**

1. "The Creativity Code: Art and Innovation in the Age of AI" by Marcus du Sautoy - Revised Edition (2020)
2. "Artificial Intelligence and the Visual Arts: The Challenge of GANs" by Anne Collins Goodyear and Margaret Weitekamp - 3rd Edition (2019)
3. "Drawing in the Digital Age: An Observational Method for Artists and Animators" by Wei Xu - 2nd Edition (2022)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1 | Introduction to AI in Visual Communication | CLO 1 |
| 2 | Understanding Machine Learning and Generative Algorithms | CLO 1, 2 |
| 3 | Traditional Drawing Techniques and AI Integration | CLO 2, 3 |
| 4 | AI-Driven Artistic Exploration | CLO 2, 3 |
| 5 | Hands-on Workshop: AI Tools for Visual Creation | CLO 3, 4 |
| 6 | Ethical Considerations in AI Art | CLO 4 |
| 7 | AI-Generated Art: Analysis and Critique | CLO 1, 4 |
| 8 | Conceptualizing AI-Integrated Art Projects | CLO 2, 3 |
| 9 | Mid-Term Exam | |
| 10 | AI in Contemporary Design Practices | CLO 1, 2, 4 |
| 11 | Collaborative Project: AI and Traditional Drawing | CLO 2, 3, 4 |
| 12 | Exploring AI-Driven Visual Narratives | CLO 2, 3 |
| 13 | AI Ethics and Societal Impact | CLO 4 |
| 14 | Guest Lecture: Innovations in AI Art | CLO 1, 2, 4 |
| 15 | Final Project Presentations | CLO 2, 3, 4 |
| 16 | Reflection and Future Directions | CLO 1, 4 |
| 17 | Workshop: Advanced Techniques in AI Art | CLO 3, 4 |
| 18 | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Analytical Reasoning Techniques for Design Improvement**
Course Type: Major
Course Code: AAD 114 Credit Hours: 02
Pre-Requisite: Program: BS
Semester: 04 Instructor:

**Course Descriptions:**

"Analytical Reasoning Techniques for Design Improvement" focuses on developing students' ability to analyze and evaluate visual communication designs effectively. The course explores different analytical approaches, including formal analysis, comparative analysis, and user-centered analysis, to assess the effectiveness and impact of design solutions. Through case studies, group discussions, and hands-on exercises, students will learn how to deconstruct design elements, identify underlying design principles, and propose informed recommendations for design enhancement. The course emphasizes critical thinking, problem-solving, and communication skills essential for success in the field of visual communication.

**Course Objectives:**

The course "Analytical Reasoning Techniques for Design Improvement" aims to equip students with the analytical skills necessary to enhance their design practice. Through a combination of theoretical concepts and practical exercises, students will learn how to critically analyze design problems, identify strengths and weaknesses in visual compositions, and develop strategies for improvement. The course will cover various analytical frameworks and methodologies used in the field of visual communication, empowering students to approach design challenges with clarity and precision. By the end of the course, students will have gained a deeper understanding of design principles and the ability to apply analytical reasoning to their creative process.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| After successful completion of the program, students should be able to: | **PLO** |
| 1. Develop proficiency in observational drawing of live subjects and still life arrangements. | PLO 2 |
| 2. Understand and apply fundamental drawing techniques such as line, shape, and texture. | PLO 1,2 |
| 3. Explore anatomy drawing to capture the human form accurately and dynamically. | PLO 5 |
| 4. Adapt traditional drawing skills to digital platforms, preparing for diverse roles in visual communication. | PLO 7 |

**Text Books:**

1. "Designing Design" by Kenya Hara - 2nd Edition (2023)
2. "The Elements of Typographic Style" by Robert Bringhurst - 4th Edition (2022)
3. "Visual Grammar" by Christian Leborg - Revised Edition (2021)

**Reference Books:**

1. "Universal Principles of Design" by William Lidwell, Kritina Holden, and Jill Butler - 3rd Edition (2020)
2. "Thinking with Type" by Ellen Lupton - 2nd Edition (2019)
3. "Graphic Design: The New Basics" by Ellen Lupton and Jennifer Cole Phillips - 2nd Edition (2022)

**Weekly Lecture Plan**

| **Week #** | **Topic Covered** | **CLO Covered** |
|---|---|---|
| 1 | Introduction to Analytical Reasoning in Design | CLO 1 |
| 2 | Formal Analysis: Understanding Design Elements | CLO 1, 2 |
| 3 | Comparative Analysis: Assessing Design Solutions | CLO 1, 2 |
| 4 | User-Centered Analysis: Evaluating Design Usability | CLO 1, 2 |
| 5 | Case Studies: Analyzing Successful Design Campaigns | CLO 1, 3 |
| 6 | Group Exercise: Analyzing Design Samples | CLO 1, 2, 3 |
| 7 | Critique and Feedback: Improving Design Solutions | CLO 3, 4 |

| | | |
|---|---|---|
| 8 | Data Visualization: Communicating Analytical Insights | CLO 4 |
| 9 | Mid-Term Exam | |
| 10 | Advanced Analytical Techniques in Design | CLO 1, 2, 3 |
| 11 | Interactive Workshop: Applying Analytical Frameworks | CLO 1, 3 |
| 12 | Design Critique Session: Peer Evaluation | CLO 3, 4 |
| 13 | Design Thinking Approaches | CLO 1, 2, 3 |
| 14 | Guest Lecture: Industry Insights in Design Analysis | CLO 1, 4 |
| 15 | Final Project: Design Analysis Report | CLO 1, 2, 3, 4 |
| 16 | Presentation of Final Project | CLO 4 |
| 17 | Workshop: Practical Applications of Analytical Reasoning | CLO 1, 3, 4 |
| 18 | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Current Trends in Visual Communication** Design Course Type: GE
Course Code: AAD 112 Credit Hours: 03
Pre-Requisite: Graphic design, Typography Program: BS
Semester: V Instructor:

**Course Descriptions:**
This course provides a foundation in analytical reasoning techniques essential for effective decision making in professional settings. Students will learn how to approach problems systematically, interpret data accurately, and draw logical conclusion. Through a combination of theoretical knowledge and practical exercises, students will develop their analytical skills to navigate complex challenges efficiently.

**Course Objectives:**
Students will develop critical thinking skills essential for effective decision making in the field. Through practical applications and theoretical frameworks, students will learn to analyze complex problems, evaluate information and formulate logical conclusions. Emphasis will be placed on applying these techniques to visual communication contexts, such as interpreting data for design projects, understanding audience perspectives and making informed design choices. By the end of the course, students will have a solid foundation in analytical reasoning, enhancing their abilities to create impactful visual communication solutions.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1. Utilize various analytical tools and methods to solve problems effectively | PLO 9 |
| 2. Analyze and evaluate information critically to make informed decision | PLO 3 |

| | |
|---|---|
| 3. Demonstrate proficiency in constructing logical arguments | PLO 1 |
| 4. Apply quantitative and qualitative reasoning skills in diverse context | PLO 7 |

**Text Books:**
1."A History of Graphic Design" by Philip B. Meggs and Alston W. Purvis - 7th Edition (2023)
2."Design: The Definitive Visual History" by DK - 2nd Edition (2021)
3."Meggs' History of Graphic Design" by Philip B. Meggs and Alston W. Purvis - 6th Edition (2020)

**Reference Books:**
1. "The Story of Design: From the Paleolithic to the Present" by Charlotte Fiell and Peter Fiell - Revised Edition (2022)
2. "Graphic Design: A New History" by Stephen J. Eskilson (2019)
3. "History of Modern Design" by David Raizman (2018)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1. | Introduction to Analytical Reasoning Techniques | CLO 1,2 |
| 2. | Problem analysis and identification | CLO 1,2,3 |
| 3. | Data Interpretation and decision making | CLO 1,2,3 |
| 4. | Logical arguments and Fallacies | CLO 1,2,3 |
| 5. | Statistical reasoning and Probability | CLO 1,2,3 |
| 6. | Case studies and Application Exercises | CLO 1,2,3,4 |
| 7 | Problem solving strategies | CLO1,2,3 |
| 8. | Decision trees and Risk Analysis | CLO 1,2,3 |
| 9. | Mid-Term Exam | |
| 10. | Quantitative and qualitative Analysis | CLO 1,2,3 |
| 11. | Cognitive Biases and Heuristics | CLO 1,2,3 |
| 12. | Ethical considerations in Analytical reasoning | CLO 3,4 |
| 13. | Analytical Tools for Design Decisions | CLO,3 4 |
| 14. | Techniques for analyzing the target audience in visual communication | CLO,3, 4 |
| 15. | Integration of Analytical Reasoning in Visual Communication Practice | CLO 3,4 |
| 16. | Capstone project | CLO3,4 |
| 17 | Presentation of project outcomes and reflection on the learning process | CLO 2,3,4 |
| 18. | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Design Shaping** Course Type: Disciplinary
Course Code: AAD 111 Credit Hours: 03
Pre-Requisite: None Program: BS
Semester: V Instructor:

**Course Descriptions:**
This introductory design course provides a broad overview of core concept and skills in 2D and 3D design. Through studio projects, students will gain proficiency in the creative process, from conceptualization of final execution. Topics include color theory, perspective, anatomy, digital painting, modeling and more. Students will build a portfolio demonstrating their technical abilities and creative perspective.

**Course Objectives:**
The objective of the course “Design Shaping” is to provide students with the fundamental knowledge in design composition, principles, and techniques. It will develop students’ skills in drawing, painting, digital art and 3D modeling. This course will enable students to apply design principles to concept art, storyboarding, character and environment design. By the end of the course, students will be prepared for advanced course work and career in design, animation and fields.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1. Apply design principles to original composition and design. | PLO 2 |
| 2. Demonstrate proficient drawing and digital painting techniques | PLO 2 |
| 3. Design original 2D concept art assets including characters, environments, and props. | PLO 8 |
| 4. Modal and texture basic 3D assets and scenes. | PLO 7 |
| 5. Develop ideation skills for storyboarding and character design | PLO 3 |
| 6. Provide constructive feedback to peers during studio critiques. | PLO 6 |
| 7. Discuss design principles and art techniques using appropriate vocabulary. | PLO 7 |

**Text Books:**
1."Design: The Definitive Visual History" by DK - 2nd Edition (2021)
2."Meggs' History of Graphic Design" by Philip B. Meggs and Alston W. Purvis - 6th Edition (2020)

**Reference Books:**
1."The Story of Design: From the Paleolithic to the Present" by Charlotte Fiell and Peter Fiell - Revised Edition (2022)
2."Graphic Design: A New History" by Stephen J. Eskilson (2019)
3."History of Modern Design" by David Raizman (2018)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1. | Introduction to Design principles | CLO 1,7 |
| 2. | 2D design and Composition | CLO 1,7 |
| 3. | Color Theory | CLO 1,7 |
| 4. | Digital Painting Techniques | CLO 2,7 |

| | | |
|---|---|---|
| 5. | Perspective and Lighting | CLO 1,4,7 |
| 6. | Figure Drawing and Gestures | CLO 2,5,7 |
| 7 | Character design | CLO 3,5,7 |
| 8. | Environment design | CLO 3,7 |
| 9. | Mid-Term Exam | |
| 10. | Intro to 3D modeling | CLO 1,2 |
| 11. | 3D Asset Creation | CLO 4,7 |
| 12. | Texturing and Lighting | CLO 4,7 |
| 13. | Storyboarding | CLO 5,7,8 |
| 14. | Concept Art for Animation | CLO 3,6,7 |
| 15. | Rendering and Presentation | CLO 2,4.7 |
| 16. | Building a Design Portfolio | CLO 1-8 |
| 17 | Traditional Media | CLO 1,5,7 |
| 18. | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Drawing for Design III (Studio)** Course Type: Major
Course Code: VCD 224 Credit Hours: 03
Pre-Requisite: VCD 214 Program: BS
Semester: V Instructor:

**Course Descriptions:**
This course builds upon the core drawing skills develop in Drawing for Design II. Students will continue to advance their technical proficiency in drawing while also integrating their personal voice and style. A variety of traditional and digital media will be explored, with an emphasis on composition, perspective, light, color, anatomy, and artistic expression. Assignments and critiques will help students develop their own aesthetic and conceptual approaches to Drawing for Design.

**Course Objectives:**
In this course of Drawing for Design III, the objective is to further develop students' drawing skills and techniques for design applications and enable them to apply Principles of composition, perspective, light and color to drawing. Students will develop proficiency in integrating individual expression into drawings as well as they will practice gesture, forms, and anatomy drawing. By the end of the course, students will be able to explore traditional and digital drawing tools and techniques.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1. Demonstrate proficiency in observational drawing techniques, including perspective, light, and form. | PLO 2 |
| 2. Apply color theory and compositional principles to create dynamic drawing | PLO 7 |

| | |
|---|---|
| 3. Utilize anatomy and gesture drawing to capture figures and characters. | PLO 7 |
| 4. Integrate digital and traditional drawing tools and techniques. | PLO 8 |
| 5. Develop an individual style and artistic voice in drawing | PLO 4 |

**Text Books:**

1. "Graphic Design: The New Basics" by Ellen Lupton and Jennifer Cole Phillips (Second Edition, 2015)
2. "Designing Brand Identity: An Essential Guide for the Whole Branding Team" by Alina Wheeler (Fifth Edition, 2017)
3. "Layout Essentials: 100 Design Principles for Using Grids" by Beth Tondreau (Revised Edition, 2011)
4. "Interaction of Color: 50th Anniversary Edition" by Josef Albers (Revised and Expanded Edition, 2013)

**Reference Books:**

1."The Elements of Typographic Style" by Robert Bringhurst (Fourth Edition, 2012)
2 ."Visual Grammar" by Christian Leborg (2006)
3 ."Thinking with Type: A Critical Guide for Designers, Writers, Editors, & Students" by Ellen Lupton (Second Edition, 2010)
4 ."Creative Workshop: 80 Challenges to Sharpen Your Design Skills" by David Sherwin (2010)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1. | Introduction and drawing fundamentals | CLO 1 |
| 2. | Line and shape | CLO 1 |
| 3. | Value and form | CLO 1 |
| 4. | Perspective and space | CLO 1 |
| 5. | Composition and design | CLO 2, |
| 6. | Gesture and drawing | CLO 2,3 |
| 7 | Figure drawing | CLO 3,4 |
| 8. | Digital drawing tools | CLO 4 |
| 9. | Mid Term Exam | |
| 10. | Color Theory | CLO 2 |
| 11. | Expressive Mark Making | CLO 5 |
| 12. | Digital Painting | CLO ,4 |
| 13. | Developing style and voice | CLO ,5 |
| 14. | Concept and Narrative drawing | CLO 5 |
| 15. | Portfolio development | CLO 2,3,4 |
| 16. | Career preparation | CLO 2,3,4 |
| 17 | Exhibition installation | CLO 2,,3,4 |
| 18. | Final Exam | |

**Assessment Plan**

| **Assessment** | **Total Marks** |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |

| | |
|---|---|
| Final Paper | 40 |
| Total | 100 |

Course Title: **Illustration III**
Course Code: VCD 223
Pre-Requisite: VCD 213
Semester: V
Course Type: Disciplinary
Credit Hours: 03
Program: BS
Instructor:

**Course Descriptions:**

This advanced illustration course builds on skills developed illustration I and II. Students will continue to refine their creative voice and technical abilities across a range of media, while tackling more complex concept and subject matter. Projects focus on editorials, advertising, entertainment and visual development illustration. Emphasis is placed on imaginative problem solving, professional practices, and a cohesive body of work.

**Course Objectives:**

In this course of Illustration III, the aim is to develop advanced illustration skills and techniques in a variety of media. Students will be able to apply principles of composition, color theory, anatomy and perspective to illustration works. Students will be able to create original illustrations for editorials, advertising, entertainment and visual development .Furthermore, and this course will enable them to utilize digital tools and software for illustration and concept art. By the end of the course, students will be able to build a professional portfolio of their illustration works.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1. Produce illustrations demonstrating proficiency with principles of composition, perspective, color theory, staging, and anatomy. | PLO 1,2 |
| 2. Apply illustration skills to a variety of professional contexts including editorials, advertising, entertainment, and visual development. | PLO 8 |
| 3. Utilize digital tools and software to enhance efficiency, creativity and professionalism of illustration works. | PLO 5 |
| 4. Develop and refine creative voice, style and technical abilities through practice and experimentation. | PLO 2 |
| 5. Assemble a professional portfolio of illustration work targeting specific industries and clients. | PLO 4 |

**Text Books:**

1.Digolo, O., & Mazrui, O. (1988). Art & design forms 1 and 2. Kenya, East Africa: East African Publishers.
2. Zeegen, L. (2012). The fundamentals of illustration. New York, USA: Bloomsbury Publishing.

**Reference Books:**

1. Guptill, A. L. (2014). Rendering in pen and ink: the classic book on pen and ink techniques for artists, illustrators, architects, and designers. New York: Watson-Guptill.
2. Lawrence Z, C. (2005). The fundamental of illustration. London: Thrift Books UK.

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1. | Introduction to course, overview of illustration genres | CLO 1,2 |
| 2. | Editorial illustration | CLO 1,2,3 |
| 3. | Advertising illustration | CLO 1,2,3 |
| 4. | Entertainment illustration | CLO 1,2,3 |
| 5. | Visual Development illustration | CLO 1,2 ,3 |
| 6. | Advance perspective | CLO 1 |
| 7 | Advance color theory | CLO 1 |
| 8. | Advance Anatomy | CLO 1 |
| 9. | Mid-Term Exam | |
| 10. | Digital Printing Technique | CLO 3 |
| 11. | Digital Sculpting Technique | CLO 3 |
| 12. | Building a professional Portfolio | CLO 5 |
| 13. | Business Practices for illustration | CLO 5 |
| 14. | Development Personal voice and Style | CLO ,4 |
| 15. | Senior project proposal | CLO 4,5 |
| 16. | Senior project work time | CLO 4,5 |
| 17 | Senior project presentation | CLO 4,5 |
| 18. | Final Exam | |

**Assessment Plan**

| **Assessment** | **Total Marks** |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Typography & Calligraphy III Course** Type: Major
Course Code: VCD 222 Credit Hours: 0+ 3
Pre-Requisite: VCD 212 Program: BS
Semester: V Instructor: ______

**Course Descriptions:**

This course advances students' typographic skills and knowledge through challenging projects across a variety of applications. Building on the fundamentals, students will gain greater control over typographic variables, develop their creative voice, and start tackling client briefs. Exploration of new tools, techniques, and surfaces expands their repertoire.

**Course Objectives:**

This course is built upon previous knowledge of typography and calligraphy to advance skills and techniques. Students will be able to explore a wider range of typefaces, styles, and applications and will be able to develop proficiency in typographic layout, hierarchy, and composition. They will gain experience with different tools, mediums, and surfaces for typographic work. This course will help them to gain Strengthen eye for detail, consistency, and quality of letterforms. By the end of the semester, students will be able to gain expand knowledge of typography history and classification and apply knowledge of typography history and classification.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1. Execute typefaces consistently with refined attention to spacing, alignment, hierarchy and composition. | PLO 1 |
| 2. Confidently handle a wide range of type classifications and styles. | PLO 2 |
| 3. Conceptualize and design effective typographic solution for posters, publications, packaging and more. | PLO 3 |
| 4. Choose appropriate tools, mediums, and surface to fulfill typographic intentions. | PLO 8 |

**Text Books:**

1. Shepherd, M. (2013). Learn calligraphy: the complete book of lettering and design. New York: Watson -Guptill.
2. Massoudy, H. (2012). The calligrapher's garden. London: Saqi Books

**Reference Books:**

1. Massoudy, H. (2017). Calligraphies of love. London: Saqi Books.
2. Oweis, F. (2018). Pocket guide to arabic script. New York: Hippocrene Books.
3. Nasr, S. H. (1990). Islamic art and spirituality. New York: Suny Press.
4. Massoudy, H. (2015). Islamic art of illumination: classical tazhib from Ottoman to contemporary times. New York: Blue Dome Press

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1. | Introduction and foundation | CLO 1,5 |
| 2. | Type Classification | CLO 1,2,5 |
| 3. | Typographic Variables | CLO 1,2 |
| 4. | Hierarchy and Composition | CLO 1,3 |
| 5. | Tools and Surface | CLO 4 |
| 6. | Posters | CLO 1,3,4 |
| 7 | Packaging | CLO 1,3.4 |
| 8. | Publications | CLO 1,3.4 |
| 9. | Mid-term Exam | |
| 10. | Signage and Environmental | CLO 1,2,4 |
| 11. | Experimental Typography | CLO 2, 3,4 |
| 12. | Typographic History | CLO 5 |
| 13. | Contemporary Trends | CLO ,2,5 |
| 14. | Clients Projects | CLO 1,3,6 |
| 15. | Portfolio development | CLO 1,2,3,4 |
| 16. | Exhibition preparation | CLO 1,23,6 |
| 17 | Final Critique | CLO 2,3,4,5 |
| 18. | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Visual Communication Design III** Course Type: Disciplinary
Course Code: VCD 221 Credit Hours: 3
Pre-Requisite: VCD 211 Program: BS
Semester: V Instructor: ____________

**Course Descriptions:**
This advanced visual communication design course focuses on refining techniques in digital and traditional media to develop imaginative concept art and professional quality illustrations. Students will utilize principles of Composition, color, light and form to emphasize story and dramatize characters. Research, brainstorming and interactive approaches will strengthen creative problem-solving skills. Students will also expend their skills in 3D modeling and rendering. It culminates in a portfolio demonstrating proficiency in visual communication for entertainment and storytelling.

**Course Objectives:**
The course objective of Visual communication Design for a BS in Visual communication is to develop students' understanding and application of visual language in various media contexts. Through a combination of theoretical learning and practical projects, students learn to effectively communicate ideas, information and messages using visual elements such as typography, color, imagery, and layout. The course aims to equip students with the skills to create visually compelling designs that engage and inform audiences across different platforms, including print, digital and interactive media. Additionally, students are encouraged to explore the ethical, cultural, and social implications of visual communication in contemporary society.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| After successful completion of the program, students should be able to: | **PLO** |
| 1. Understand the Principles of Visual Communication design | PLO 2 |
| 2. Apply design elements effectively in Various Projects. | PLO 6 |
| 3. Demonstrate proficiency in using design software. | PLO 1 |
| 4. Create visually compelling design solutions. | PLO 7 |

**Text Books:**
1. "Visual Communication: From Theory to Practice" by Jonathan Baldwin and Lucienne Roberts, 2012, 1st Edition
2. "Designing Visual Interfaces: Communication Oriented Techniques" by Kevin Mullet and Darrell Sano, 1995, 1st Edition
3. "Visual Communication: Images with Messages" by Paul Martin Lester, 2014, 7th Edition

**Reference Books:**
1. The Visual Display of Quantitative Information" by Edward R. Tufte, 2001, 2nd Edition

2. "Graphic Design: The New Basics" by Ellen Lupton and Jennifer Cole Phillips, 2015, 2nd Edition
3. "Visual Thinking: for Design" by Colin Ware, 2008, 1st Edition

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1. | Review of Composition, color, form | CLO 1 |
| 2. | Digital Painting Techniques | CLO 1,2 |
| 3. | Concept Art workflows | CLO 1.2.3 |
| 4. | Character Design | CLO 1 2,4 |
| 5. | Environment Design | CLO 1,2 |
| 6. | Creature design | CLO 1, 2, |
| 7 | Storyboarding fundamentals | CLO, 3,4 |
| 8. | 3D Modeling overview | CLO 4 |
| 9. | Mid-Term Exam | |
| 10. | Digital sculpting | CLO 3,4 |
| 11. | UV mapping and texturing | CLO 3,4 |
| 12. | Character Modeling | CLO 2,3,4 |
| 13. | Environment Modeling | CLO 2,3 |
| 14. | Lighting and Rendering | CLO 1,2,3 |
| 15. | Animation Principles | CLO 3, 4 |
| 16. | Animation Exercises | CLO 2,3 4 |
| 17 | Portfolio review | CLO 4 |
| 18. | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Visual Communication Design IV**
Course Code: VCD 231
Pre-Requisite:
Semester: 06
Course Type: Major
Credit Hours: 03
Program: BS
Instructor:

**Course Descriptions:**

Visual Communication Design IV builds upon the knowledge and skills acquired in earlier courses to provide students with a comprehensive understanding of advanced design principles and practices. The course will cover a range of topics, including brand identity design, user experience design, and design ethics. Through a combination of lectures, workshops, and studio projects, students will develop their design process, from conceptualization to execution, while also exploring the ethical and social implications of their work. By the end of the course, students will have produced a portfolio of sophisticated design projects that demonstrate their ability to create compelling visual communication solutions.

**Course Objectives:**

Visual Communication Design IV aims to further enhance students' skills and knowledge in visual communication design. Building upon the foundational concepts covered in previous courses, this advanced course will delve into more complex design principles and techniques. Students will explore advanced topics such as branding, interactive design, and design for social impact. Through hands-on projects and critical analysis of contemporary design trends, students will develop a deeper understanding of the role of visual communication in society and prepare for professional practice in diverse design fields.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| After successful completion of the program, students should be able to: | **PLO** |
| 1. Develop proficiency in observational drawing of live subjects and still life arrangements. | PLO 2 |
| 2. Understand and apply fundamental drawing techniques such as line, shape, and texture. | PLO 1,2 |
| 3. Explore anatomy drawing to capture the human form accurately and dynamically. | PLO 5 |
| 4. Adapt traditional drawing skills to digital platforms, preparing for diverse roles in visual communication. | PLO 7 |

**Text Books:**

1. "Designing Brand Identity" by Alina Wheeler - 5th Edition (2023)
2. "Don't Make Me Think" by Steve Krug - 4th Edition (2022)
3. "The Design of Everyday Things" by Don Norman - Revised and Expanded Edition (2021)

**Reference Books:**

1. "Graphic Design: A New History" by Stephen J. Eskilson - 3rd Edition (2020)
2. "Interaction Design: Beyond Human-Computer Interaction" by Jennifer Preece, Yvonne Rogers, and Helen Sharp - 5th Edition (2019)
3. "The Ethics of Design: Principles" by Ann Marie Barry and Laura Fisher Kaiser - 2nd Edition (2022)

**Weekly Lecture Plan**

| **Week #** | **Topic Covered** | **CLO Covered** |
|---|---|---|
| 1 | Introduction to Advanced Visual Communication Design | CLO 1, 4, 5 |
| 2 | Brand Identity Design: Principles and Practices | CLO 1, 2, 5 |
| 3 | Logo Design and Brand Collateral | CLO 1, 2 |
| 4 | Typography in Visual Communication | CLO 1, 4 |
| 5 | User Experience Design: Principles and Process | CLO 3 |
| 6 | Interactive Design for Web and Mobile Platforms | CLO 3 |
| 7 | Motion Graphics and Animation in Visual Communication | CLO 1, 3 |
| 8 | Design Thinking and Problem-Solving | CLO 1, 2, 4, 5 |
| 9 | Mid-Term Exam | |
| 10 | Design for Social Impact | CLO 4, 5 |
| 11 | Environmental and Sustainable Design | CLO 4, 5 |
| 12 | Design Ethics and Responsibility | CLO 4, 5 |
| 13 | Portfolio Development | CLO 1, 2, 3, 4, 5 |

| | | |
|---|---|---|
| 14 | Critique and Feedback | CLO 1, 4, 5 |
| 15 | Industry Insights and Guest Lectures | CLO 1, 4, 5 |
| 16 | Final Project Presentations | CLO 1, 2, 3, 4, 5 |
| 17 | Workshop: Advanced Design Techniques | CLO 1, 2, 3, 4, 5 |
| 18 | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Animation**
Course Type: Major
Course Code: ANI 101
Credit Hours: 03
Pre-Requisite:
Program: BS
Semester: 06
Instructor:

**Course Descriptions:**
"Animation in Visual Communication" provides students with a comprehensive understanding of animation principles and techniques. The course covers the history of animation, including key figures and milestones, as well as contemporary trends and practices in the animation industry. Students will learn to create animated sequences using both traditional and digital tools, gaining practical experience in character animation, motion graphics, and visual effects. Through individual and group projects, students will develop their animation skills and produce portfolio-worthy work that demonstrates their creativity and technical proficiency.

**Course Objectives:**
The course "Animation in Visual Communication" is designed to introduce students to the fundamentals of animation as a powerful tool for visual storytelling and communication. Through theoretical study and hands-on practice, students will learn the principles of animation, including timing, spacing, and movement. They will explore various animation techniques, including traditional hand-drawn animation and digital animation using industry-standard software. The course will also cover the application of animation in different contexts, such as advertising, entertainment, and educational media, preparing students for careers in animation and related fields.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| After successful completion of the program, students should be able to: | **PLO** |
| 1. Develop proficiency in observational drawing of live subjects and still life arrangements. | PLO 2 |
| 2. Understand and apply fundamental drawing techniques such as line, shape, and texture. | PLO 1,2 |
| 3. Explore anatomy drawing to capture the human form accurately and dynamically. | PLO 5 |
| 4. Adapt traditional drawing skills to digital platforms, preparing for diverse roles in visual communication. | PLO 7 |

**Text Books:**

1. "The Animator's Survival Kit" by Richard Williams - Expanded Edition (2023)
2. "Character Animation Crash Course!" by Eric Goldberg - 3rd Edition (2022)
3. "Animation from Pencils to Pixels: Classical Techniques for the Digital Animator" by Tony White - 4th Edition (2021)

**Reference Books:**

1. "The Illusion of Life: Disney Animation" by Frank Thomas and Ollie Johnston - Revised Edition (2020)
2. "Timing for Animation" by Harold Whitaker and John Halas - 2nd Edition (2019)
3. "The Animator's Eye: Composition and Design for Better Animation" by Francis Glebas - 3rd Edition (2022)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1 | Introduction to Animation Principles | CLO 1, 5 |
| 2 | History of Animation | CLO 1 |
| 3 | Traditional Animation Techniques | CLO 1, 2 |
| 4 | Digital Animation Software | CLO 1, 2 |
| 5 | Character Animation | CLO 2, 3 |
| 6 | Motion Graphics and Visual Effects | CLO 2, 4 |
| 7 | Storyboarding and Scripting | CLO 3, 4 |
| 8 | Principles of Timing and Spacing | CLO 1, 2, 4 |
| 9 | Mid-Term Exam | |
| 10 | Animated Advertising | CLO 3, 4 |
| 11 | Animation for Entertainment | CLO 3, 4 |
| 12 | Animation for Education | CLO 3, 4 |
| 13 | Visual Effects and Compositing | CLO 2, 4 |
| 14 | Industry Trends and Career Opportunities | CLO 1, 3, 5 |
| 15 | Critique and Feedback | CLO 5 |
| 16 | Guest Lectures and Industry Insights | CLO 1, 3, 5 |
| 17 | Workshop: Advanced Animation Techniques | CLO 2, 4 |
| 18 | Final Project Presentations | CLO 1, 2, 3, 4, 5 |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Photography IV** Course Type: Major
Course Code: AAD410 Credit Hours: 02
Pre-Requisite: Program: BS
Semester: 06 Instructor:

**Course Descriptions:**
"Photography in Visual Communication" explores the role of photography as a powerful tool for conveying messages and telling stories visually. Students will learn the technical aspects of photography, including camera operation, exposure control, and image editing using industry-standard software. Emphasis will be placed on developing a critical eye for composition, light, and color, as well as understanding the ethical and cultural implications of photographic representation. Through hands-on assignments and projects, students will explore various genres of photography, such as portrait, landscape, documentary, and conceptual photography, and develop a portfolio of original work.

**Course Objectives:**
The course "Photography in Visual Communication" is designed to equip students with the knowledge and skills necessary to create compelling photographic images for various visual communication purposes. Building upon foundational principles, students will learn advanced techniques in photography, including composition, lighting, and visual storytelling. Through practical exercises and projects, students will develop their creative vision and technical proficiency in digital photography, preparing them for careers in photography and related fields.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| After successful completion of the program, students should be able to: | **PLO** |
| 1. Develop proficiency in observational drawing of live subjects and still life arrangements. | PLO 2 |
| 2. Understand and apply fundamental drawing techniques such as line, shape, and texture. | PLO 1,2 |
| 3. Explore anatomy drawing to capture the human form accurately and dynamically. | PLO 5 |
| 4. Adapt traditional drawing skills to digital platforms, preparing for diverse roles in visual communication. | PLO 7 |

**Text Books:**

1. "The Photographer's Eye: Composition and Design for Better Digital Photos" by Michael Freeman - 3rd Edition (2023)
2. "Understanding Exposure" by Bryan Peterson - 5th Edition (2022)
3. "Adobe Photoshop CC Classroom in a Book" by Adobe Creative Team - 2021 Release (2021)


**Reference Books:**

1. "On Photography" by Susan Sontag - Revised Edition (2020)
2. "Light Science & Magic: An Introduction to Photographic Lighting" by Fil Hunter, Steven Biver, and Paul Fuqua - 5th Edition (2019)
3. "National Geographic: The Photographs" by Leah Bendavid-Val - Updated Edition (2022)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1 | Introduction to Photography Principles | CLO 1, 5 |
| 2 | Camera Operation and Exposure Control | CLO 2 |
| 3 | Composition and Framing | CLO 1, 2 |
| 4 | Lighting Techniques | CLO 1, 2 |
| 5 | Portrait Photography | CLO 3, 4 |
| 6 | Landscape Photography | CLO 3, 4 |
| 7 | Documentary Photography | CLO 3, 4 |
| 8 | Conceptual Photography | CLO 3, 4 |
| 9 | Mid-Term Exam | |
| 10 | Image Editing Techniques | CLO 2 |
| 11 | Ethical Considerations in Photography | CLO 1, 5 |
| 12 | Fashion and Advertising Photography | CLO 3, 4 |
| 13 | Fine Art Photography | CLO 3, 4 |
| 14 | Photographic Projects and Assignments | CLO 2, 4, 5 |
| 15 | Critique and Feedback | CLO 5 |
| 16 | Guest Lectures and Industry Insights | CLO 1, 3, 5 |
| 17 | Workshop: Advanced Photography Techniques | CLO 2, 3, 4 |
| 18 | Final Portfolio Presentation | CLO 1, 2, 3, 4, 5 |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Digital Drawing**
Course Type: Major
Course Code: VCD 323
Credit Hours: 03
Pre-Requisite:
Program: BS
Semester: 06
Instructor:

**Course Descriptions:**

"Digital Drawing II" is a continuation of the exploration of digital drawing techniques essential for students in the Bachelor of Science program in Visual Communication. This course expands upon the principles introduced in Drawing I, emphasizing advanced digital drawing methods and conceptual development. Students will engage in a series of practical exercises, workshops, and projects aimed at refining their digital drawing skills, expressive rendering techniques, and understanding of human anatomy in a digital context. Through in-depth critiques and portfolio development, students will deepen their artistic voice and prepare for diverse career paths in digital visual communication.

**<u>Course Objectives</u>:**

The course "Digital Drawing II" aims to advance students' skills, techniques, and conceptual understanding acquired in Drawing I. Building upon foundational knowledge, students will delve deeper into digital drawing methods, emphasizing expressive rendering, advanced anatomy depiction, and experimentation with diverse digital mediums. Through practical exercises, workshops, and projects, students will refine their digital drawing abilities and develop a personal artistic style. The course will also focus on critical thinking, problem-solving, and preparing students for professional challenges in digital visual communication fields.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| After successful completion of the program, students should be able to: | **PLO** |
| 1. Develop proficiency in observational drawing of live subjects and still life arrangements. | PLO 2 |
| 2. Understand and apply fundamental drawing techniques such as line, shape, and texture. | PLO 1,2 |
| 3. Explore anatomy drawing to capture the human form accurately and dynamically. | PLO 5 |
| 4. Adapt traditional drawing skills to digital platforms, preparing for diverse roles in visual communication. | PLO 7 |

**Text Books:**

1. "Digital Drawing for Visual Communication" by Lawrence Zeegen - 2nd Edition (2021)
2. "Digital Painting Techniques" by 3dtotal Publishing - Updated Edition (2023)
3. "The Photoshop and Painter Artist Tablet Book: Creative Techniques in Digital Painting Using Wacom and the iPad" by Cher Threinen-Pendarvis - 3rd Edition (2022)

**Reference Books:**

1. "Digital Art Masters: Volume 9" by 3dtotal Publishing - 9th Edition (2021)
2. "Beginner's Guide to Digital Painting in Procreate" by 3dtotal Publishing - 2nd Edition (2022)
3. "The Anatomy of Style: Figure Drawing Techniques" by Patrick J. Jones - Revised Edition (2020)

**Weekly Lecture Plan**

| **Week #** | **Topic Covered** | **CLO Covered** |
|---|---|---|
| 1 | Advanced Digital Drawing Techniques | CLO 1, 4, 5 |
| 2 | Expressive Rendering in Digital Art | CLO 1, 2, 4, 5 |
| 3 | Digital Anatomy Drawing Techniques | CLO 3, 4, 5 |
| 4 | Character Design in Digital Art | CLO 3, 4, 5 |
| 5 | Digital Landscape and Environment Design | CLO 1, 4, 5 |
| 6 | Creative Figure Drawing in Digital Medium | CLO 3, 4, 5 |
| 7 | Digital Portrait Techniques | CLO 1, 3, 4, 5 |
| 8 | Conceptual Drawing in the Digital Realm | CLO 1, 4, 5 |
| 9 | Mid-Term Exam | |
| 10 | Digital Still Life Drawing | CLO 1, 4, 5 |
| 11 | Experimental Digital Drawing Techniques | CLO 1, 2, 4, 5 |

| | | |
|---|---|---|
| 12 | Digital Illustration Styles | CLO 1, 4, 5 |
| 13 | Portfolio Development in Digital Drawing | CLO 1, 4, 5 |
| 14 | Professional Practices in Digital Art | CLO 1, 4, 5 |
| 15 | Critique and Feedback | CLO 1, 4, 5 |
| 16 | Industry Insights and Guest Lectures | CLO 1, 4, 5 |
| 17 | Workshop: Advanced Digital Drawing Techniques | CLO 1, 4, 5 |
| 18 | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **UI/UX Explorations**
Course Type: Major
Course Code: VCD 411
Credit Hours: 03
Pre-Requisite:
Program: BS
Semester: 06
Instructor:

**Course Descriptions:**
"UI/UX Explorations" is designed as a continuation of the exploration of design techniques essential for students in the Bachelor of Science program in Visual Communication. This course expands upon the principles introduced in Drawing I, emphasizing the application of design principles to digital interfaces. Students will engage in a series of practical exercises, workshops, and projects aimed at refining their UI/UX design skills, understanding user behaviors, and creating intuitive digital experiences. Through in-depth critiques and portfolio development, students will deepen their design skills and prepare for diverse career paths in digital design and user experience.

**Course Objectives:**
The course "UI/UX Explorations" aims to advance students' skills, techniques, and conceptual understanding acquired in Drawing I. Building upon foundational knowledge, students will delve into the principles and practices of User Interface (UI) and User Experience (UX) design. Emphasizing the integration of visual communication principles with digital interfaces, students will explore various design methods, tools, and technologies. Through practical exercises, workshops, and projects, students will refine their UI/UX design abilities and develop a deep understanding of user-centered design principles. The course will also focus on critical thinking, problem-solving, and preparing students for professional challenges in digital design fields.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| After successful completion of the program, students should be able to: | **PLO** |
| 1. Develop proficiency in observational drawing of live subjects and still life arrangements. | PLO 2 |
| 2. Understand and apply fundamental drawing techniques such as line, shape, and texture. | PLO 1,2 |

| | |
|---|---|
| 3. Explore anatomy drawing to capture the human form accurately and dynamically. | PLO 5 |
| 4. Adapt traditional drawing skills to digital platforms, preparing for diverse roles in visual communication. | PLO 7 |

**Text Books:**

1. "Don't Make Me Think: A Common sense Approach to Web Usability" by Steve Krug - 3rd Edition (2022)
2. "The Design of Everyday Things" by Don Norman - Revised and Expanded Edition (2021)
3. "Sketching User Experiences: The Workbook" by Saul Greenberg, Sheelagh Carpendale, Nicolai Marquardt, and Bill Buxton - 2nd Edition (2020)

**Reference Books:**

1. "Interaction Design: Beyond Human-Computer Interaction" by Jenny Preece, Helen Sharp, Yvonne Rogers - 5th Edition (2023)
2. "UI is Communication: How to Design Intuitive, User Centered Interfaces by Everett McKay - 2nd Edition (2021)
3. "100 Things Every Designer Needs to Know About People" by Susan Weinschenk - 2nd Edition (2018)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1 | Introduction to UI/UX Design | CLO 1, 2, 4, 5 |
| 2 | User-Centered Design Principles | CLO 2, 3, 4 |
| 3 | Wireframing and Prototyping | CLO 1, 2, 4, 5 |
| 4 | Information Architecture | CLO 2, 3, 4 |
| 5 | Visual Hierarchy and Typography | CLO 1, 2, 5 |
| 6 | Color Theory in UI/UX Design | CLO 1, 2, 5 |
| 7 | Interaction Design | CLO 1, 2, 4 |
| 8 | Usability Testing and Evaluation | CLO 3, 4, 5 |
| 9 | Mid-Term Exam | |
| 10 | Mobile UI/UX Design | CLO 1, 2, 4, 5 |
| 11 | Web UI/UX Design | CLO 1, 2, 4, 5 |
| 12 | Design Thinking | CLO 1, 2, 3, 5 |
| 13 | UI/UX for Emerging Technologies | CLO 1, 2, 4, 5 |
| 14 | Portfolio Development in UI/UX Design | CLO 1, 2, 5 |
| 15 | Professional Practices in UI/UX Design | CLO 1, 2, 3, 5 |
| 16 | Industry Insights and Guest Lectures | CLO 1, 2, 3, 4, 5 |
| 17 | Workshop: UI/UX Design Tools and Techniques | CLO 1, 2, 4, 5 |
| 18 | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Photography IV** Course Type: Major
Course Code: AAD 410 Credit Hours: 02
Pre-Requisite: Program: BS
Semester: 07 Instructor:

**Course Descriptions:**
"Photography IV" offers students an immersive exploration of advanced photographic techniques and concepts. Through theoretical study and hands-on practice, students will delve into various genres of photography, including documentary, portrait, landscape, and experimental photography. Building upon fundamental skills, students will explore advanced camera techniques, lighting setups, composition, and post-processing methods to create compelling and visually impactful images. The course will also cover critical analysis of contemporary photographic practices, ethical considerations, and the role of photography in shaping culture and society. By the end of the course, students will have developed a diverse portfolio and a deeper understanding of photography's role in visual communication.

**Course Objectives:**
The course "Photography IV" aims to advance students' skills and knowledge in the art and practice of photography within the context of visual communication. Building upon foundational concepts, students will explore advanced techniques, theoretical frameworks, and contemporary practices in photography. Through a combination of theoretical study, practical assignments, and creative projects, students will deepen their understanding of photographic aesthetics, storytelling, and visual language. Emphasis will be placed on developing a personal photographic style, critical thinking, and preparing students for professional opportunities in various fields of visual communication.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| After successful completion of the program, students should be able to: | **PLO** |
| 1. Develop proficiency in observational drawing of live subjects and still life arrangements. | PLO 2 |
| 2. Understand and apply fundamental drawing techniques such as line, shape, and texture. | PLO 1,2 |
| 3. Explore anatomy drawing to capture the human form accurately and dynamically. | PLO 5 |
| 4. Adapt traditional drawing skills to digital platforms, preparing for diverse roles in visual communication. | PLO 7 |

**Text Books:**
1. "Photography: A Cultural History" by Mary Warner Marien - 5th Edition (2023)
2. "The Photographer's Eye: Composition and Design for Better Digital Photographs" by Michael Freeman - 2nd Edition (2021)
3. "On Photography" by Susan Sontag - Revised Edition (2020)

**Reference Books:**
1. "Magnum Contact Sheets" edited by Kristen Lubben (2017)
2. "Photography: The Definitive Visual History" by Tom Ang - 3rd Edition (2022)
3. "National Geographic: The Photographs" by Leah Bendavid-Val (2021)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1 | Introduction to Advanced Photography | CLO 1, 2 |
| 2 | Advanced Camera Techniques | CLO 1, 2 |
| 3 | Lighting and Composition | CLO 1, 2 |
| 4 | Documentary Photography | CLO 2, 3, 4 |
| 5 | Portrait Photography | CLO 2, 3, 4 |
| 6 | Landscape Photography | CLO 2, 3, 4 |
| 7 | Experimental Photography | CLO 2, 3, 4 |
| 8 | Post-processing Techniques | CLO 1, 2 |
| 9 | Mid-Term Exam | |
| 10 | Visual Storytelling | CLO 2, 3, 4 |
| 11 | Ethical Considerations in Photography | CLO 2, 4 |
| 12 | Contemporary Photographic Practices | CLO 2, 4 |
| 13 | Portfolio Development | CLO 3 |
| 14 | Critique and Feedback | CLO 1, 2, 3, 4 |
| 15 | Professional Practice in Photography | CLO 3, 4 |
| 16 | Photography in Social Contexts | CLO 2, 4 |
| 17 | Guest Lectures and Workshops | CLO 1, 2, 3, 4 |
| 18 | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Visual Communication Design V**
Course Code: VCD 331
Pre-Requisite:
Semester: 07
Course Type: Major
Credit Hours: 03
Program: BS
Instructor:

**Course Descriptions:**

"Visual Communication Design V" offers students an immersive exploration of advanced design principles and practices. Through theoretical study and hands-on projects, students will delve into topics such as typography, grid systems, information design, and user experience design. Building upon fundamental design skills, students will explore advanced techniques for visual storytelling, brand identity development, and digital design. The course will also cover topics related to design ethics, sustainability, and the role of design in shaping culture and society. By the end of the course, students will have developed a diverse portfolio showcasing their ability to conceptualize and execute effective design solutions.

**Course Objectives:**

The course "Visual Communication Design V" aims to provide students with advanced skills and knowledge in the field of visual communication design. Building upon foundational concepts, students will explore advanced design principles, typography, layout, and digital design tools. Through a combination of theoretical study and practical projects, students will develop proficiency in conceptualizing and executing design solutions for various communication contexts. Emphasis will be placed on creative problem-solving, critical thinking, and preparing students for professional practice in visual communication design.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| After successful completion of the program, students should be able to: | **PLO** |
| 1. Develop proficiency in observational drawing of live subjects and still life arrangements. | PLO 2 |
| 2. Understand and apply fundamental drawing techniques such as line, shape, and texture. | PLO 1,2 |
| 3. Explore anatomy drawing to capture the human form accurately and dynamically. | PLO 5 |
| 4. Adapt traditional drawing skills to digital platforms, preparing for diverse roles in visual communication. | PLO 7 |

**Text Books:**

1. "Thinking with Type" by Ellen Lupton - 2nd Edition (2023)
2. "Grid Systems in Graphic Design" by Josef Müller-Brockmann - 3rd Edition (2022)
3. "The Elements of Typographic Style" by Robert Bringhurst - 5th Edition (2021)
4.

**Reference Books:**

1. "Information Design Workbook: Graphic approaches, solutions, and inspiration + 30 case studies" by Kim Baer (2020)
2. "Designing Brand Identity: An Essential Guide for the Whole Branding Team" by Alina Wheeler - 5th Edition (2023)
3. "Universal Principles of Design" by William Lidwell, Kritina Holden, Jill Butler - 3rd Edition (2018)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1 | Introduction to Visual Communication Design | CLO 1, 2 |
| 2 | Advanced Design Principles | CLO 1, 2 |
| 3 | Typography and Type Design | CLO 1, 2 |
| 4 | Layout Design | CLO 1, 2 |
| 5 | Information Design | CLO 2, 3, 4 |
| 6 | Brand Identity Design | CLO 2, 3, 4 |
| 7 | User Experience Design | CLO 2, 3, 4 |
| 8 | Digital Design | CLO 1, 2 |
| 9 | Mid-Term Exam | |
| 10 | Visual Storytelling | CLO 2, 3, 4 |
| 11 | Sustainability in Design | CLO 1, 4 |
| 12 | Ethics in Design | CLO 1, 4 |
| 13 | Critique and Feedback | CLO 1, 2, 3, 4 |
| 14 | Professional Practice in Design | CLO 3, 4 |

| | | |
|---|---|---|
| 15 | Design for Social Impact | CLO 2, 4 |
| 16 | Designing for Diversity and Inclusion | CLO 1, 3, 4 |
| 17 | Guest Lectures and Workshops | CLO 1, 2, 3, 4 |
| 18 | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Design Research**
Course Code: VCD 500
Pre-Requisite:
Semester: 07
Course Type: Major
Credit Hours: 03
Program: BS
Instructor:

**Course Descriptions:**
"Design Research" offers students an in-depth exploration of research methods and practices in the context of visual communication design. Through a combination of lectures, workshops, and hands-on projects, students will learn how to formulate research questions, design research studies, collect and analyze data, and communicate research findings effectively. Topics covered will include qualitative and quantitative research methods, literature review, case study analysis, and ethical considerations in design research. By the end of the course, students will have developed the skills necessary to conduct independent research projects and contribute to the advancement of knowledge in the field of visual communication design.

**Course Objectives:**
The course "Design Research" aims to provide students with the knowledge and skills necessary to conduct research in the field of visual communication design. Through theoretical study and practical exercises, students will learn research methodologies, data collection techniques, and analysis methods relevant to design inquiry. Emphasis will be placed on understanding the role of research in informing design decisions, solving design problems, and shaping the future of visual communication practice.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| After successful completion of the program, students should be able to: | **PLO** |
| 1. Develop proficiency in observational drawing of live subjects and still life arrangements. | PLO 2 |
| 2. Understand and apply fundamental drawing techniques such as line, shape, and texture. | PLO 1,2 |
| 3. Explore anatomy drawing to capture the human form accurately and dynamically. | PLO 5 |
| 4. Adapt traditional drawing skills to digital platforms, preparing for diverse roles in visual communication. | PLO 7 |

**Text Books:**

1. "Research Design: Qualitative, Quantitative, and Mixed Methods Approaches" by John W. Creswell - 5th Edition (2023)
2. "Visual Research: An Introduction to Research Methodologies in Graphic Design" by Ian Noble and Russell Bestley - 3rd Edition (2022)
3. "Design Research Methods: 150 Ways to Investigate Culture, Society, and Human Behavior" by Brenda Laurel - 2nd Edition (2021)

**Reference Books:**

1. "The Design of Everyday Things" by Don Norman - Revised and Expanded Edition (2020)
2. "Research Methods for Graphic Design" by Wendy Jedlicka (2019)
3. "Designing for Interaction: Creating Innovative Applications and Devices" by Dan Saffer - 3rd Edition (2022)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1 | Introduction to Design Research | CLO 1 |
| 2 | Research Methods in Visual Communication Design | CLO 1, 2 |
| 3 | Formulating Research Questions | CLO 1, 2 |
| 4 | Literature Review | CLO 1, 2 |
| 5 | Qualitative Research Methods | CLO 1, 2 |
| 6 | Quantitative Research Methods | CLO 1, 2 |
| 7 | Case Study Analysis | CLO 2, 3 |
| 8 | Data Collection Techniques | CLO 2, 3 |
| 9 | Mid-Term Exam | |
| 10 | Data Analysis Methods | CLO 2, 3 |
| 11 | Research Ethics | CLO 4 |
| 12 | Communicating Research Findings | CLO 3 |
| 13 | Visual Research Methods | CLO 1, 2, 3 |
| 14 | Research Project Proposal | CLO 1, 2 |
| 15 | Workshop: Research Skills | CLO 1, 2, 3, 4 |
| 16 | Workshop: Data Analysis | CLO 2, 3 |
| 17 | Guest Lectures and Workshops | CLO 1, 2, 3, 4 |
| 18 | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Digital Drawing (Raster)**
Course Code: VCD 423
Pre-Requisite:
Semester: 07

Course Type: Major
Credit Hours: 03
Program: BS
Instructor:

**Course Descriptions:**
"Digital Drawing (Raster)" offers students an immersive exploration of digital drawing techniques using raster-based software. Through a blend of theory and practice, students will delve into the world of digital art creation, focusing on raster-based software tools such as Adobe Photoshop, Corel Painter, and Procreate. From mastering basic digital drawing techniques to exploring advanced digital rendering methods, students will hone their skills in creating digital artworks with precision and expression. They will also learn about digital file formats, resolution, and color management, ensuring their digital artworks meet industry standards. Throughout the course, students will engage in critiques, workshops, and hands-on projects, fostering a deep understanding of digital drawing's role in visual storytelling and communication. By the course's conclusion, students will emerge with a diverse portfolio of digital artworks and a solid foundation poised for success in the dynamic field of visual communication.

**Course Objectives:**
The course "Digital Drawing (Raster)" aims to equip students with the necessary skills and techniques to create digital drawings using raster-based software. Through theoretical understanding and practical exercises, students will develop proficiency in digital drawing tools, techniques, and workflows. By engaging with raster-based software and exploring various digital drawing methods, students will enhance their ability to create visually compelling artworks digitally. Through critiques, workshops, and hands-on projects, students will also refine their digital drawing skills, receive constructive feedback, and prepare for future professional endeavors in the field of visual communication.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| After successful completion of the program, students should be able to: | **PLO** |
| 1. Develop proficiency in observational drawing of live subjects and still life arrangements. | PLO 2 |
| 2. Understand and apply fundamental drawing techniques such as line, shape, and texture. | PLO 1,2 |
| 3. Explore anatomy drawing to capture the human form accurately and dynamically. | PLO 5 |
| 4. Adapt traditional drawing skills to digital platforms, preparing for diverse roles in visual communication. | PLO 7 |

**Text Books:**
1. "Digital Painting for the Complete Beginner" by Carlyn Beccia - 2nd Edition (2022)
2. "Photoshop Artistry: For Photographers Using Adobe Photoshop" by Barry Haynes - 3rd Edition (2021)
3. "Procreate: The Ultimate Beginner's Guide to Digital Drawing" by James Moore - Revised Edition (2020)

**Reference Books:**

1. "Digital Painting Techniques" by 3dtotal Publishing - 2nd Edition (2023)
2. "The Photoshop Workbook: Professional Retouching and Compositing Tips, Tricks, and Techniques" by Glyn Dewis - 4th Edition (2021)
3. "Mastering Procreate: Advanced Tips and Techniques for Digital Illustration" by Howard Pinsky (2019)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1 | Introduction to Digital Drawing | CLO 1 |
| 2 | Overview of Raster-Based Software | CLO 1, 2 |
| 3 | Digital Drawing Techniques | CLO 1, 2 |
| 4 | Layering and Masking Techniques | CLO 1, 2 |
| 5 | Blending Modes and Brushes | CLO 1, 2 |
| 6 | Digital Rendering Methods | CLO 3 |
| 7 | Advanced Digital Rendering Techniques | CLO 3 |
| 8 | Color Management in Digital Drawing | CLO 4 |
| 9 | Mid-Term Exam | |
| 10 | Digital Illustration | CLO 1, 2, 3, 4 |
| 11 | Digital Painting Techniques | CLO 1, 2, 3 |
| 12 | Concept Development in Digital Drawing | CLO 1, 2, 3 |
| 13 | Digital Drawing Workflow | CLO 1, 2, 3 |
| 14 | Critique and Feedback | CLO 1, 2, 3, 4 |
| 15 | Professional Practices in Digital Drawing | CLO 4 |
| 16 | Digital Drawing for Visual Communication | CLO 4 |
| 17 | Guest Lectures and Workshops | CLO 1, 2, 3, 4 |
| 18 | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: Computer Graphics for Art & Design
Course Code: AAD 201
Pre-Requisite:
Semester: 07
Course Type: Compulsory
Credit Hours: 03
Program: BS
Instructor:

**Course Descriptions:**

Computer Graphics for Art & Design introduces students to the principles and techniques of digital image creation and manipulation. Through a series of practical exercises and projects, students will learn how to use industry-standard software tools to create, edit, and enhance digital artwork for various visual communication purposes. Topics covered include raster and vector graphics, image editing, typography, color theory, and layout design. Emphasis will be placed on developing practical skills and creative problem-solving abilities in a digital environment.

**Course Objectives:**

Computer Graphics for Art & Design aims to equip students with practical skills in digital image creation, manipulation, and design using industry-standard software tools. Through hands-on projects and exercises, students will learn essential techniques for creating and editing digital artwork, preparing them for advanced coursework and professional practice in the field of visual communication. By gaining proficiency in computer graphics software, students will expand their creative capabilities and enhance their effectiveness as visual communicators.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to: PLO** | |
| 1. Utilize computer graphics software tools to create and manipulate digital images for visual communication purposes. | PLO 1 |
| 2. Apply design principles and techniques to develop aesthetically pleasing and effective digital artwork. | PLO 2 |
| 3. Demonstrate proficiency in digital image editing, typography, color theory, and layout design. | PLO 3 |

**Text Books:**

1. "Adobe Photoshop Classroom in a Book" by Adobe Creative Team (2021)
2. "Illustrator CC Digital Classroom" by Jennifer Smith and AGI Creative Team (2019)

**Reference Books:**

1. "The Non-Designer's Design Book" by Robin Williams (2014)
2. "Design Basics" by David A. Lauer and Stephen Pentak (2017)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1 | Introduction to Computer Graphics | CLO 1 |
| 2 | Raster Graphics and Image Editing | CLO 1 |
| 3 | Introduction to Adobe Photoshop | CLO 1 |
| 4 | Selections and Layers in Photoshop | CLO 1 |
| 5 | Image Adjustment and Retouching | CLO 1 |
| 6 | Typography in Digital Design | CLO 2 |
| 7 | Mid-Term Exam | - |
| 8 | Vector Graphics and Adobe Illustrator | CLO 1 |
| 9 | Drawing and Painting in Illustrator | CLO 1 |
| 10 | Color Theory and Application in Digital Design | CLO 3 |
| 11 | Layout Design Principles | CLO 2 |
| 12 | Designing for Print and Digital Media | CLO 2 |
| 13 | Special Effects and Filters in Photoshop | CLO 1 |
| 14 | Advanced Techniques in Illustrator | CLO 1 |
| 15 | Portfolio Development Workshop | CLO 2, 3 |
| 16 | Final Project: Digital Artwork Creation | CLO 2, 3 |
| 17 | Final Project Presentation | CLO 2, 3 |
| 18 | Final Exam | - |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Visual Communication Design II**
Course Type: Disciplinary
Course Code: AAD 510
Credit Hours: 02
Pre-Requisite:
Program: BS
Semester: 08
Instructor:

**Course Descriptions:**

Photography V builds upon the foundational knowledge and skills acquired in previous photography courses, offering students an opportunity to delve into more advanced topics and techniques. Through a combination of theoretical discussions, practical exercises, and hands-on projects, students will explore various genres and styles of photography, including portrait, landscape, still life, and documentary photography. Emphasis will be placed on refining composition, mastering lighting techniques, and developing a distinct visual style. Additionally, students will learn advanced camera operations and digital editing techniques using industry-standard software. By engaging in critiques and peer feedback sessions, students will refine their artistic vision and develop a critical eye for evaluating photographic work within a professional context. Ultimately, this course aims to empower students to create compelling visual narratives and establish themselves as skilled and versatile photographers in the field of visual communication.

**Course Objectives:**

In the Photography V course for the BS in Visual Communication, our primary objective is to further develop students' skills and understanding of advanced photography techniques and concepts. Through practical assignments and projects, we aim to deepen students' proficiency in composition, lighting, and visual storytelling. Students will explore specialized areas of photography such as portrait, landscape, still life, and documentary photography, honing their ability to capture compelling images that communicate effectively. Additionally, the course will focus on the use of advanced camera equipment and post-processing techniques to enhance and manipulate images creatively. By the end of the course, students will have expanded their artistic vision and technical expertise in photography, preparing them for professional practice in the field of visual communication.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| After successful completion of the program, students should be able to: | **PLO** |
| 1. To understand elements and Principles of Design through practical assignments | PLO 2 |
| 2. To study 2D space and its organization possibilities PLO 6 | PLO 6 |
| 3. To introduce technical terms related to design. | PLO 8 |
| 4. To evaluate design solutions, will be able to thoughtfully assess their own work and that of their peers within a collaborative studio environment | PLO 8 |

**Text Books:**

1. "The Photographer's Eye: Composition and Design for Better Digital Photos" by Michael Freeman (Third Edition, 2014)
2. "Light Science & Magic: An Introduction to Photographic Lighting" by Fil Hunter, Steven Biver, and Paul Fuqua (Fifth Edition, 2015)
3. "The Digital Photography Book" by Scott Kelby (Volume 1, 2006)
4. "Understanding Exposure: How to Shoot Great Photographs with Any Camera" by Bryan Peterson (Fourth Edition, 2016)

**Reference Books:**

1. "On Photography" by Susan Sontag (1977)
2. "National Geographic: The Photographs" by Leah Bendavid-Val (2008)
3. "Ansel Adams: 400 Photographs" by Ansel Adams and Andrea G. Stillman (2011)
4. "Steve McCurry: The Iconic Photographs" by Steve McCurry (2012)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1 | Advanced Composition Techniques | CLO 1 |
| 2 | Advanced Lighting Techniques | CLO 1,2 |
| 3 | Portraiture Photography | CLO 1,2 |
| 4 | Landscape Photography | CLO 2,3 |
| 5 | Still Life Photography | CLO 2,3,4 |
| 6 | Documentary Photography | CLO 3,4 |
| 7 | Advanced Camera Operations | CLO 3,4 |
| 8 | Post-processing and Digital Editing | CLO 3,4 |
| 9 | Mid-Term Exam | |
| 10 | Advanced Portrait Lighting | CLO 2,3,4 |
| 11 | Advanced Landscape Composition | CLO 2,3,4 |
| 12 | Advanced Still Life Setup | CLO 3,4 |
| 13 | Advanced Documentary Storytelling | CLO 3,4 |
| 14 | Portfolio Development | CLO 3,4 |
| 15 | Professional Practices in Photography | CLO 3,4 |
| 16 | Preparing for Final Exhibition | CLO 3,4 |
| 17 | Final Project Presentations | CLO 3,4 |
| 18 | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Visual Communication Design VI**
Course Code: VCD 211
Pre-Requisite:
Semester: 08
Course Type: Disciplinary
Credit Hours: 02
Program: BS
Instructor:

**Course Descriptions:**

"Visual Communication Design VI" is a comprehensive exploration of advanced design principles and methodologies essential for students in the Bachelor of Science program in Visual Communication. This course builds upon the knowledge and skills acquired in previous design courses, focusing on conceptual development, typographic expression, and visual storytelling. Students will engage in a series of practical assignments and projects that challenge them to apply design theories to real-world scenarios, fostering creativity, innovation, and critical thinking. Through critiques, presentations, and portfolio development, students will refine their design sensibilities and prepare for professional practice in the dynamic field of visual communication.

**Course Objectives:**

The course "Visual Communication Design VI" aims to advance students' skills, techniques, and conceptual understanding acquired in previous design courses. Building upon foundational knowledge, students will delve deeper into various aspects of visual communication, emphasizing advanced design principles, typographic expression, and creative problem-solving. Through a series of practical projects and critiques, students will explore interdisciplinary approaches to design, integrating research, concept development, and execution. The course will prepare students for professional practice in diverse fields of visual communication, fostering creativity, innovation, and critical thinking.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| Illustrate advanced proficiency in design principles and techniques. | PLO 2 |
| Apply typographic expression effectively in visual communication projects. | PLO 4 |
| Develop creative solutions to complex design problems. | PLO 6 |
| Integrate interdisciplinary approaches to design, incorporating research, concept development, and execution. | PLO 8 |

**Text Books:**

1. "Grid Systems: Principles of Organizing Type" by Kimberly Elam - 2nd Edition (2021) "Typography Workbook: A Real-World Guide to Using Type in Graphic Design" by Timothy Samara - 4th Edition (2022) "Visual Storytelling: Infographic Design in News" by Liu Yikun and Dong Zhao - 3rd Edition (2023)

**Reference Books:**

1. "Designing Brand Identity: An Essential Guide for the Whole Branding Team" by Alina Wheeler - 6th Edition (2024)
2. "Creative Workshop: 80 Challenges to Sharpen Your Design Skills" by David Sherwin - 2nd Edition (2025)
3. "Layout Essentials: 100 Design Principles for Using Grids" by Beth Tondreau - Revised Edition (2022)

**Weekly Lecture Plan**

| **Week #** | **Topic Covered** | **CLO Covered** |
|---|---|---|
| 1 | Advanced Design Principles | CLO 1, 3 |

| | | |
|---|---|---|
| 2 | Typographic Expression | CLO 2 |
| 3 | Visual Narrative Development | CLO 3, 4 |
| 4 | Interdisciplinary Design Approaches | CLO 4 |
| 5 | Dynamic Anatomy Studies | CLO 3, 4 |
| 6 | Creative Figure Drawing | CLO 3, 4 |
| 7 | Digital Drawing Mediums | CLO 2, 4 |
| 8 | Conceptual Drawing Development | CLO 2, 3 |
| 9 | Mid-Term Exam | |
| 10 | Live Model Studies | CLO 3, 4 |
| 11 | Experimentation with Mediums | CLO 3, 4 |
| 12 | Portfolio Development | CLO 2, 3 |
| 13 | Professional Practices in Drawing | CLO 2, 3 |
| 14 | Drawing in Narrative Contexts | CLO 1, 2, 3 |
| 15 | Critique and Feedback | CLO 3, 4 |
| 16 | Industry Insights and Guest Lectures | CLO 2, 3, 4 |
| 17 | Workshop: Advanced Drawing Techniques | CLO 1, 2 |
| 18 | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Poetry and Illustration in Art & Design**
Course Type: Elective-I
Course Code: AAD 601
Credit Hours: 03
Pre-Requisite: None
Program: BS
Semester: VI
Instructor:

**Course Descriptions:**

Poetry and Illustration in Art & Design offers students the opportunity to explore the creative synergy between poetry and visual art. Through the analysis of classic and contemporary poetry, students will gain insights into poetic forms, themes, and imagery. They will then apply this understanding to the creation of original illustrations that complement and enhance the poetic narrative. Emphasis will be placed on developing students' creative and interpretive abilities, as well as their technical skills in illustration.

**Course Objectives:**

Poetry and Illustration in Art & Design aims to explore the intersection of poetry and visual communication through the medium of illustration. Students will delve into various poetic forms and themes, examining how they can be translated into visual imagery. Through a combination of theoretical study, creative exploration, and practical exercises, students will develop their understanding of the relationship between text and image, and hone their skills in visual storytelling and expression.

| Course Learning Outcome (CLOs): | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1. Interpret and analyze poetic texts, identifying themes, imagery, and mood. | PLO 1 |
| 2. Translate poetic themes and narratives into visual imagery through the medium of illustration. | PLO 2 |
| 3.Demonstrate proficiency in various illustration techniques and styles, applying them to create expressive and evocative artworks. | PLO 3 |

**Text Books:**

1. "The Poetry Handbook: A Guide to Reading Poetry for Pleasure and Practical Criticism" by John Lennard (2016)
2. "Illustrating Children's Books: Creating Pictures for Publication" by Martin Salisbury (2017)

**Reference Books:**

1. "Poem crazy: Freeing Your Life with Words" by Susan Goldsmith Wooldridge (2009)
2. "Illustration School: Let's Draw Happy People" by Sachiko Umoto (2010)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1 | Introduction to Poetry and Illustration | CLO 1 |
| 2 | Understanding Poetic Forms and Themes | CLO 1 |
| 3 | Analyzing Poetic Imagery and Symbolism | CLO 1 |
| 4 | Introduction to Illustration Techniques | CLO 2 |
| 5 | Visualizing Poetic Narratives | CLO 2 |
| 6 | Mid-Term Exam | - |
| 7 | Exploring Illustration Styles and Mediums | CLO 3 |
| 8 | Drawing and Sketching Techniques | CLO 3 |
| 9 | Digital Illustration Techniques | CLO 3 |
| 10 | Collaborative Project: Illustrated Poetry Anthology | CLO 1, 2, 3 |
| 11 | Visual Narrative and Storyboarding | CLO 2, 3 |
| 12 | Character Design and Development | CLO 2, 3 |
| 13 | Color Theory and Mood in Illustration | CLO 2, 3 |
| 14 | Portfolio Development Workshop | CLO 2, 3 |
| 15 | Final Project: Illustrated Poetry Collection | CLO 1, 2, 3 |
| 16 | Final Project Presentation | CLO 1, 2, 3 |
| 17 | Exhibition of Illustrated Poetry Collection | CLO 1, 2, 3 |
| 18 | Final Exam | - |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Exploring Virtual Realities in Art & Design** Course Type: Disciplinary
Course Code: AAD 602 Credit Hours: 03
Pre-Requisite: None Program: BS
Semester: VI Instructor:

**Course Descriptions:**

Exploring Virtual Realities in Art & Design offers students the opportunity to delve into the immersive world of virtual reality technology and its creative applications. Through a combination of theoretical study and practical experimentation, students will learn about the principles of VR hardware and software, immersive storytelling techniques, and interactive design principles. They will then apply this knowledge to the creation of their own virtual reality experiences, exploring concepts such as 3D modeling, animation, and user experience design.

**Course Objectives:**

Exploring Virtual Realities in Art & Design aims to introduce students to the exciting world of virtual reality (VR) and its applications in art and design. Through theoretical study and hands-on exploration, students will learn about the principles of VR technology, immersive storytelling, and interactive design. By creating their own virtual reality experiences, students will develop skills in 3D modeling, animation, and user experience design, preparing them for careers at the forefront of digital innovation in the visual communication field

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1. Understand the principles and technologies of virtual reality (VR) and their applications in art and design. | PLO 1 |
| 2. Create immersive and interactive virtual reality experiences using 3D modeling, animation, and user experience design principles. | PLO 3 |
| 3. Analyze and critique virtual reality artworks and experiences, demonstrating a nuanced understanding of their creative and technical aspects. | PLO 5 |
| 4. Understand the principles and technologies of virtual reality (VR) and their applications in art and design. | PLO 1 |

**Text Books:**

1. "Virtual Reality Insider: Guidebook for the VR Industry" by Sky Nite (2020)
2. "Unity Virtual Reality Projects: Explore the world of Virtual Reality by building immersive and fun VR projects using Unity 3D" by Jonathan Linowes (2015)

**Reference Books:**

1. "The VR Book: Human-Centered Design for Virtual Reality" by Jason Jerald (2015)
2. "Creating Augmented and Virtual Realities: Theory and Practice for Next-Generation Spatial Computing" by Erin Pangilinan, Steve Lukas, Vasanth Mohan (2019)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1 | Introduction to Virtual Reality Technology | CLO 1 |
| 2 | Principles of Immersive Design | CLO 1 |
| 3 | VR Hardware and Software Platforms | CLO 1 |

| | | |
|---|---|---|
| 4 | 3D Modeling for Virtual Environments | CLO 2 |
| 5 | Animation Techniques for VR | CLO 2 |
| 6 | Mid-Term Exam | - |
| 7 | User Experience Design for VR | CLO 2 |
| 8 | Interactive Storytelling in Virtual Reality | CLO 2 |
| 9 | Creating Audio and Soundscapes for VR | CLO 2 |
| 10 | VR Art and Aesthetics | CLO 3 |
| 11 | Case Studies: Virtual Reality Art Installations | CLO 3 |
| 12 | Ethics and Social Implications of VR Art | CLO 3 |
| 13 | Portfolio Development Workshop | CLO 2, 3 |
| 14 | Hands-on Lab: Building VR Experiences | CLO 2, 3 |
| 15 | Final Project: Immersive VR Experience | CLO 1, 2, 3 |
| 16 | Final Project Presentation | CLO 1, 2, 3 |
| 17 | Exhibition of VR Projects | CLO 1, 2, 3 |
| 18 | Final Exam | - |

**Assessment Plan**

| **Assessment** | **Total Marks** |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title **Crafting Narratives with Animation** Course Type: Elective-III
Course Code: AAD 703 Credit Hours: 03
Pre-Requisite: None Program: BS
Semester: VII Instructor: ____________

**Course Descriptions:**
Crafting Narratives with Animation in Art & Design offers students the opportunity to explore the creative potential of animation as a storytelling medium. Through a combination of theoretical study and practical exercises, students will learn about the principles of animation, narrative structure, and character development. They will then apply this knowledge to the creation of their own animated narratives, focusing on concepts such as storyboarding, character design, and motion graphics

**Course Objectives:**
Crafting Narratives with Animation in Art & Design aims to explore the art of storytelling through the medium of animation. Students will learn about the principles of animation, narrative structure, and character development, and apply this knowledge to create engaging animated narratives. Through hands-on projects and critical analysis, students will develop their skills in animation production, storytelling, and visual communication, preparing them for careers in animation, film, and digital media.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1. Understand the principles and techniques of animation production, | PLO 1 |

| | |
|---|---|
| including keyframe animation, motion graphics, and 3D animation. | |
| 2. Create compelling animated narratives that effectively communicate ideas, emotions, and themes. | PLO 3 |
| 3. Analyze and critique animated narratives, demonstrating a nuanced understanding of their creative and technical aspects. | PLO 5 |
| 4. Understand the principles and techniques of animation production, including keyframe animation, motion graphics, and 3D animation. | PLO 1 |

**Text Books:**
1. "The Animator's Survival Kit" by Richard Williams (2009)
2. "Animation: The Whole Story" by Howard Beckerman (2019)

**Reference Books:**
1. "Character Animation Crash Course!" by Eric Goldberg (2008)
2. "Creating Character Animation with Blender" by Roger Wickes (2011)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1 | Introduction to Animation Principles | CLO 1 |
| 2 | Basics of Traditional Animation | CLO 1 |
| 3 | Principles of Character Animation | CLO 1 |
| 4 | Storytelling Techniques in Animation | CLO 2 |
| 5 | Character Design and Development | CLO 2 |
| 6 | Mid-Term Exam | - |
| 7 | Storyboarding and Narrative Structure | CLO 2 |
| 8 | Motion Graphics and Visual Effects | CLO 1, 2 |
| 9 | 2D Animation Techniques | CLO 1, 2 |
| 10 | 3D Animation Techniques | CLO 1, 2 |
| 11 | Sound Design and Audio Production | CLO 1, 2 |
| 12 | Experimental Animation | CLO 1, 2 |
| 13 | Portfolio Development Workshop | CLO 1, 2 |
| 14 | Hands-on Lab: Animation Production | CLO 1, 2 |
| 15 | Final Project: Animated Narrative | CLO 1, 2, 3 |
| 16 | Final Project Presentation | CLO 1, 2, 3 |
| 17 | Exhibition of Animated Narratives | CLO 1, 2, 3 |
| 18 | Final Exam | - |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Archiving using Art & Design**
Course Type: Elective-IV
Course Code: AAD 704
Credit Hours: 03
Pre-Requisite:
Program: BS
Semester: 08
Instructor:

**Course Descriptions:**
Archiving using Art & Design offers students the opportunity to explore the role of archives in preserving cultural heritage and documenting creative practices. Through a combination of theoretical study and hands-on projects, students will learn about the principles of archival management, including cataloging, digitization, and preservation. They will then apply this knowledge to the creation of their own archival projects, focusing on topics such as artist archives, design collections, and digital repositories.

**Course Objectives:**
Archiving using Art & Design aims to introduce students to the principles and practices of archiving as applied to visual communication and design. Through theoretical study and practical exercises, students will learn about the importance of archival methods in preserving cultural heritage and documenting creative processes. By creating their own archival projects, students will develop skills in research, curation, and digital preservation, preparing them for roles in museums, galleries, and cultural institutions.

**Course Descriptions:**

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1. Understand the principles and practices of archival management as applied to visual communication and design. | PLO 1 |
| 2. Create and maintain archival collections, demonstrating proficiency in cataloging, digitization, and preservation techniques. | PLO 3 |
| 3. Analyze and critique archival projects, demonstrating a nuanced understanding of their cultural, historical, and artistic significance. | PLO 5 |
| 4. Understand the principles and practices of archival management as applied to visual communication and design. | PLO 1 |

**Text Books:**
1. "Archives: Principles and Practices" by Laura Agnes Millar (2017)
2. "Managing Archives" by Caroline Williams (2006)

**Reference Books:**
1. "Archival Theory, Records, and the Public" by Dr. Lisa Ennis (2018)
2. "Archives: Recordkeeping in Society" by Sue McKemmish, Michael Piggott, Barbara Reed (2005)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1 | Introduction to Archival Management | CLO 1 |
| 2 | Principles of Archival Appraisal and Selection | CLO 1 |
| 3 | Cataloging and Metadata Standards | CLO 1 |
| 4 | Digitization Techniques and Best Practices | CLO 2 |

| | | |
|---|---|---|
| 5 | Preservation Methods and Conservation | CLO 2 |
| 6 | Mid-Term Exam | |
| 7 | Archiving Design Collections | CLO 2 |
| 8 | Artist Archives and Creative Process Documentation | CLO 2 |
| 9 | Digital Archives and Online Repositories | CLO 2 |
| 10 | Case Studies: Archival Projects | CLO 3 |
| 11 | Ethics and Legal Issues in Archiving | CLO 3 |
| 12 | Archiving Cultural Heritage | CLO 3 |
| 13 | Portfolio Development Workshop | CLO 1, 2 |
| 14 | Hands-on Lab: Creating an Archival Project | CLO 1, 2 |
| 15 | Final Project: Archival Collection | CLO 1, 2, 3 |
| 16 | Final Project Presentation | CLO 1, 2, 3 |
| 17 | Exhibition of Archival Projects | CLO 1, 2, 3 |
| 18 | Final Exam | |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Thinking through Material in Art & Design**
Course Type: Elective-V
Course Code: AAD 705
Credit Hours: 03
Pre-Requisite:
Program: BS
Semester: 08
Instructor:

**Course Descriptions:**
Thinking through Material in Art & Design offers students the opportunity to explore the expressive possibilities of materials in visual communication and design. Through a combination of theoretical study and practical experimentation, students will learn about the properties, capabilities, and cultural meanings of a wide range of materials, including traditional and innovative materials. They will then apply this knowledge to the creation of their own material-based projects, focusing on concepts such as texture, form, and process.

**Course Objectives:**
Thinking through Material in Art & Design aims to explore the creative potential of materials in visual communication and design. Through theoretical study and hands-on experimentation, students will learn about the properties, capabilities, and cultural meanings of different materials. By engaging in material-based projects, students will develop their skills in material selection, manipulation, and expression, fostering a deeper understanding of materiality and its role in the creative process.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1.Understand the properties, capabilities, and cultural meanings of different | PLO 1 |

| | |
|---|---|
| materials used in visual communication and design. | |
| 2.Select and manipulate materials effectively to achieve desired artistic and communicative outcomes. | PLO 3 |
| Analyze and critique material-based projects, demonstrating a nuanced understanding of their conceptual and aesthetic qualities. | PLO 5 |
| 4. Understand the properties, capabilities, and cultural meanings of different materials used in visual communication and design. | PLO 1 |

**Text Books:**

1. "The Substance of Style: How the Rise of Aesthetic Value Is Remaking Commerce, Culture, and Consciousness" by Virginia Postrel (2003)
2. "Material Matters: New Materials in Design" by Philip Howes (2013)

**Reference Books:**

1. "Materiality" by Petra Lange-Berndt (2015)
2. "The Materiality of Stone: Explorations in Landscape Phenomenology" by Christopher Tilley (2004)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1 | Introduction to Materiality in Art & Design | CLO 1 |
| 2 | Understanding Material Properties and Characteristics | CLO 1 |
| 3 | Traditional vs. Innovative Materials | CLO 1 |
| 4 | Material Culture and Cultural Significance | CLO 1 |
| 5 | Texture and Surface | CLO 2 |
| 6 | Form and Structure | CLO 2 |
| 7 | Color and Material Expression | CLO 2 |
| 8 | Mid-Term Exam | - |
| 9 | Material Experimentation and Prototyping | CLO 2 |
| 10 | Material Transformation and Manipulation | CLO 2 |
| 11 | Material Sustainability and Environmental Impact | CLO 1, 3 |
| 12 | Material-Based Art and Design Movements | CLO 1, 3 |
| 13 | Portfolio Development Workshop | CLO 1, 2 |
| 14 | Hands-on Lab: Material-Based Projects | CLO 1, 2 |
| 15 | Final Project: Material Exploration | CLO 1, 2, 3 |
| 16 | Final Project Presentation | CLO 1, 2, 3 |
| 17 | Exhibition of Material-Based Projects | CLO 1, 2, 3 |
| 18 | Final Exam | - |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

Course Title: **Reality Reshaped via Visual Narratives**
Course Type: Elective-VI
Course Code: AAD 706
Credit Hours: 03
Pre-Requisite:
Program: BS
Semester: 08
Instructor:

**Course Descriptions:**
Reality Reshaped via Visual Narratives in Art & Design offers students the opportunity to explore the role of visual narratives in reshaping perceptions of reality. Through a combination of theoretical study and practical exercises, students will investigate the ways in which artists and designers use narrative techniques, such as symbolism, allegory, and sequential storytelling, to construct, deconstruct, and reimagine reality. They will then apply this knowledge to the creation of their own visual narratives, focusing on topics such as identity, memory, and social justice.

**Course Objectives:**
Reality Reshaped via Visual Narratives in Art & Design aims to explore the transformative power of visual narratives in shaping perceptions of reality. Through theoretical study and practical exercises, students will investigate the ways in which artists and designers use narrative techniques to construct, deconstruct, and reimagine reality. By creating their own visual narratives, students will develop skills in storytelling, visual communication, and critical thinking, enabling them to engage with contemporary issues and challenges through the lens of art and design.

| **Course Learning Outcome (CLOs):** | |
|---|---|
| **After successful completion of the program, students should be able to:** | **PLO** |
| 1. Understand the principles and techniques of visual storytelling and narrative construction. | PLO 1 |
| 2. Apply narrative techniques to communicate complex ideas and concepts through visual media. | PLO 3 |
| 3. Analyze and critique visual narratives, demonstrating a nuanced understanding of their thematic, stylistic, and cultural significance. | PLO 5 |
| 4. Understand the principles and techniques of visual storytelling and narrative construction. | PLO 1 |

**Text Books:**
1. "Understanding Comics: The Invisible Art" by Scott McCloud (1993)
2. "Narrative Across Media: The Languages of Storytelling" edited by Marie-Laure Ryan (2004)

**Reference Books:**
1. "Graphic Storytelling and Visual Narrative" by Will Eisner (2008)
2. "The Art of Immersion: How the Digital Generation Is Remaking Hollywood, Madison Avenue, and the Way We Tell Stories" By Frank Rose (2011)

"Layout Essentials: 100 Design Principles for Using Grids" by Beth Tondreau - Revised Edition (2022)

**Weekly Lecture Plan**

| Week # | Topic Covered | CLO Covered |
|---|---|---|
| 1 | Introduction to Visual Narratives | CLO 1 |
| 2 | Understanding Narrative Structures | CLO 1 |

| | | |
|---|---|---|
| 3 | Symbolism and Allegory in Visual Narratives | CLO 1 |
| 4 | Sequential Storytelling Techniques | CLO 1 |
| 5 | Character Development and World-Building | CLO 2 |
| 6 | Theme and Motif | CLO 2 |
| 7 | Mid-Term Exam | - |
| 8 | Visual Storytelling in Film and Animation | CLO 2 |
| 9 | Interactive Narratives and New Media | CLO 2 |
| 10 | Identity and Memory in Visual Narratives | CLO 3 |
| 11 | Social Justice and Advocacy | CLO 3 |
| 12 | Visual Narratives in Advertising and Branding | CLO 3 |
| 13 | Portfolio Development Workshop | CLO 1, 2 |
| 14 | Hands-on Lab: Creating Visual Narratives | CLO 1, 2 |
| 15 | Final Project: Visual Narrative | CLO 1, 2, 3 |
| 16 | Final Project Presentation | CLO 1, 2, 3 |
| 17 | Exhibition of Visual Narratives | CLO 1, 2, 3 |
| 18 | Final Exam | - |

**Assessment Plan**

| Assessment | Total Marks |
|---|---|
| Quizzes | 15 |
| Mid Term | 25 |
| Group Project/Presentation/Assignment | 20 |
| Final Paper | 40 |
| Total | 100 |

**Appendage 4616**

**BAHRIA UNIVERSITY POLICY FOR PSYCHOLOGICAL SERVICES CENTRES**

**1. Preamble**

1.1 The Psychological Services Centres (also named *Umeed e Nau* and *Well-Being Centre*) are units of Bahria University that provide essential mental health services to BU students, employees, their families and the general public for community well-being. Each Centre aims to address educational, social, emotional and psychological issues that may hinder the personal or professional development and growth of those seeking its support.

**2. Services to be Provided by Psychological Services Centres**

2.1 Bahria University is committed to providing high-quality, problem-focused, ethical professional psychological services at all its CUs offering degree programmes in Clinical Psychology. Accordingly, an integrated and cohesive approach will be adopted at the Psychological Services Centre (PSC) of each CU to provide professional support for different emotional and psychological issues that may hinder the normal functioning and performance of an individual. Services that will be provided by the PSC include:

a. Psychological assessment for all types of developmental/ psychological issues and problem conditions by using the latest psychological tests with a complete written report (where required).
b. Psychotherapeutic intervention and psychological services by applying traditional and latest psychotherapies for different emotional and other issues, like academic difficulties or career choices, etc.
c. Training programmes for self-management and self-improvement.

**3. Objectives of PSCs**

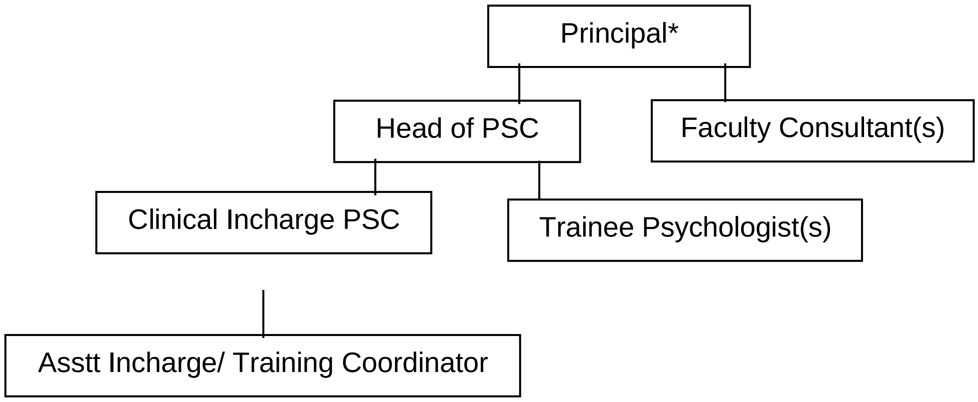
3.1 In order to provide the aforementioned services, the following objectives have been set for PSC:

a. To provide standardised psychological assessments, counselling and psychotherapy to BU students, addressing their psychosocial, emotional, behavioural, educational and career issues; and to BU employees, addressing their work-life stressors and other mental health-related challenges.
b. To deliver community services across a spectrum of psychological domains (ranging from awareness camps to intervention-based projects, as per the available resources) including but not limited to clinical, educational, organisational and social issues.
c. To offer training and development opportunities to all BU postgraduate students of Psychology through specialisation-based internships and rotations at external locations, where required.
d. To offer regulated and supervised paid internships during the summer to external postgraduate/ graduated students/ scholars specialising in Clinical Psychology.

e. To create community awareness through outreach activities by involving BU students of Psychology, including undergraduate students for CSP hours and observership, and postgraduate students for internships.

**4. Organisation**

4.1 The following organogram will be adopted at each Psychological Service Centre:




* Where a Principal is not appointed, the PSC will be headed by the respective Head of Department.

**5. Selection Criteria and Duties/ Responsibilities for PSC Administration**

5.1 The PSCs are to be administrated/ managed professionally and ethically while adhering to the guidelines covered in this Policy.

5.2 **Head of PSC.** Is to be appointed as per the procedure for the HODs, based on the following criteria to discharge the undermentioned responsibilities.

5.2.1 **Criteria**

a. Permanent Faculty Member (PFM) of the concerned CU, with course load allocation as applicable to other HODs).
b. Doctorate in Clinical/ Counselling Psychology **OR** assessed eligible for psychological clinical work.
c. Demonstrated ability and appropriate experience to supervise and train clinical trainees and interns.
d. Demonstrated ability to conduct clinical interviews, psychological assessment, case conceptualisation, and treatment plan formulation.

5.2.2 **Duties/ Responsibilities**

a. Supervise and ensure the administrative and functional requirements at the Psychological Services Centre.
b. Responsible for the regular preparation of biannual reports on performance, records and audits, and presenting them to higher authorities when required.
c. Any other task assigned by the Principal/ HCU.

**5.3 Clinical In-charge PSC.** Is to be appointed by the respective Head of CU on the recommendation of the respective Head of PSC, to fulfil the responsibilities outlined below.

5.3.1 **Criteria**

a. Permanent Faculty Member (PFM) of the concerned CU, with course load allocation as per prevailing policy.

b. At least MS/ MPhil degree in Clinical/ Counselling Psychology **OR** assessed eligible for psychological clinical work.
c. Demonstrated ability and appropriate experience to supervise and train clinical trainees and interns.
d. Demonstrated ability to conduct clinical interviews, psychological assessment, case conceptualisation and treatment plan formulation.

5.3.2 **Duties/ Responsibilities**

a. Ensure that the quality of clinical and other psychological services provided by supervisees meet established standards, guidelines and regulations, as applicable. This would include observation of sessions, review of documentation, preparation of audit reports, preparation of audit reports, and other supervisory activities to assure quality of care as per established standards.
b. Ensure that supervisees operate within their scope of expertise and practice.
c. Provide clinical supervision, training and direction for supervisees.
d. Communicate deficiencies, concerns and achievements of supervisees to the Head of Psychological Services.
e. Manage/ administer day-to-day affairs/ activities of the PSC.

**5.4 Assistant Clinical In-charge/ Training Coordinator.** Is to be nominated by the Head of PSC based on the following criteria for the following responsibilities.

5.4.1 **Criteria**

a. Intern from already enrolled senior students of the postgraduate programme, approved by the HCU.
b. At least BS degree in Psychology and enrolled in BU MS/ MPhil (Clinical) programme in Psychology.
c. Demonstrated ability and appropriate understanding of psychological services.
d. Demonstrated ability to conduct intake clinical interviews and preliminary psychological assessment.

5.4.2 **Duties/ Responsibilities**

a. Assist Clinical In-charge/ Training Coordinator in administrative/ managerial affairs and supervisory commitments, including appointments/ session scheduling, etc.
b. Communicate deficiencies and concerns of clients and supervisees to the In-charge/ Training Coordinator.
c. Any other task assigned by the Clinical In-charge.

**5.5 Faculty Consultant.** Any regular faculty member who can provide consultation in the psychological domain may be considered a Faculty Consultant for the PSC; usually a senior PFM of the Bahria University. The list of consultants for conducting consultancy services at PSC will be approved by the HCU, on the recommendation of the Head of the PSC. These recommendations will be based on the clients assigned by the In-charge/ Training Coordinator as per reported/ available slots and specifications. General criteria for the Faculty Consultants and his/ her associated duties is covered in the following clauses.

5.5.1 **Criteria**

a. At least MPhil/ MS degree in the specialised field of Professional Psychology, i.e. Clinical, Organizational, Educational, etc.
b. Demonstrated ability and appropriate understanding of professional services in the relevant field.

5.5.2 **Duties/ Responsibilities**

a. Provide psychological services as per his/ her specialised areas of expertise, while strictly adhering to established standards.
b. Provide necessary psychological services to the client if recommended or referred by the Head of PSC or Clinical In-charge/ Training Coordinator due to any ethical or emergency reason.
c. Maintain and adhere to the ethical considerations for paid clients after regular hours, i.e. seeing personally referred private clients **after** serving the regular clients who have approached the PSC for availing the offered psychological services.

5.5.3 A Faculty Consultant is eligible to use the available counselling unit to serve paid clients/ patients after the regular counselling hours, with the prior approval of the respective HCU on the recommendation of the Head of PSC.

**5.6 Trainee Psychologist.** Is the student of PhD/ MPhil/ MS in Professional Psychology/ Clinical Psychology of a BU programme, attached to the PSC for programme-related training.

**6. Operation of PSC**

6.1 Instructions for the operation of PSC are to be issued by the respective Head of PSC with the approval of the concerned HCU through the respective Director/ Principal/ HOD (in case of BULC only). Following guidelines are to be adhered to in this regard:

a. All sessions are to be properly scheduled and approved by the Head of PSC/ Clinical In-charge, except for emergency clients.
b. Session logs are to be maintained and kept confidential.
c. Records of psychological services provided are to be retained for 2 years after the closure of the case.
d. Timings for internal/ external clients are to be regularly announced on weekly/ monthly basis or as and when required.
e. Day-to-day coordination and other operational aspects are to be handled by the concerned In-charge/ Training Coordinator as per the Policy.

6.2 **Client.** Any person who contacts the Psychological Services Centre to seek psychological services in the form of psychological assessment and guidance will be considered a potential client/ patient.

**7. Consultation Schedule**

7.1 Psychological consultation schedule will be prepared for each semester (Spring/ Fall) and Summer Sessions by the respective Head of PSC and approved by the respective HCU. Faculty members would be allowed to have one to two days of consultancy with a maximum of four hours per day in each week, after 1300 hrs, without affecting the students/ ongoing teaching sessions and other academic research activity. The schedule thus prepared is to include the following:

a. Consultation hours (including limited slots during working hours).
b. After-hours consultation.
c. Specified days for internal and external clients.
d. Specified days and hours per week during the Regular Semesters and Summer Sessions.

**8. Internship**

8.1 The internship provided by the PSC will be carefully regulated and supervised to guarantee ethical conduct and prevent malpractices, ensuring a high standard of professional development and ethical responsibility.

8.2 Internships at external locations will be subject to availability and the nature of MOUs with different organisations. Accordingly, procedures for the same may vary across the CUs, depending on the context of the internship and the extent of agreements with external organisations.

8.3 Internships against payment will generally be offered to external PG candidates during the Summer sessions.

**9. Referral System for Psychological Services**

9.1 To maximize the university-wide utilization of PSC, faculty members must recommend/ refer students for behavioural counselling and psychological services through their respective departmental heads.

9.2 Faculty members are to utilise the referral form in **Annexure A** to document their behavioural concerns. Upon completion, the referral form must be submitted to the concerned HOD. Subsequently, the HOD will undertake the cross-verification and forward the referral form to the respective Head of PSC.

9.3 Informed consent of the client/ patient as per **Annexure B** would be mandatory for managing ethical parameters in the counselling.

9.4 The Heads of the Disciplinary Committee can also refer cases to the Head of PSC through respective HOD, using the form in **Annexure A**.

9.5 The introduction of this structured referral system – based on informed consent via **Annexure B** – aims to offer timely support to students facing behavioural challenges, contributing to a conducive learning environment for all.

9.6 Faculty members, staff, other employees, and their families are encouraged to directly contact the PSC for any psychological problems requiring professional help and attention.

**10. Conditions for Referral**

10.1 **Behavioural/ Conduct Related Issues.** Faculty members may refer students through respective HOD for counselling when observing behavioural or conduct-related issues affecting their academic environment.

10.2 **Academic Difficulties.** Students with a CGPA below the minimum requirement for respective degree programme may be referred to the PSC for assessment regarding academic difficulties, career guidance and counselling for smooth completion of their degree programme as a proactive measure to address their personal and educational challenges, while conforming with the BU policy for academically underperforming students.

10.3 **Disciplinary Cases.** Referrals for counselling may also occur in cases involving disciplinary issues, to provide support and guidance in navigating and addressing the associated challenges faced by the students/ scholars/ employees.

10.4 **Self-Referrals.** Students, faculty members and other BU employees as well as external clients are encouraged to make self-referrals for counselling; fostering a holistic approach to psychological services for comprehensive support.

**11. Reporting and Monitoring Process for Behavioural Counselling**

11.1 After the referral and intake, the counselling plan (number of sessions, time duration, termination, etc) is to be shared with the individual and referring individual (if required).

11.2 Feedback and monitoring will be managed and provided by the Clinical In-charge (if and where required) through the relevant Faculty Consultant.

11.3 Where considered essential, parents may be involved following the Disciplinary Committee's protocols. This involvement would be contingent upon exceptional circumstances identified by the concerned Disciplinary Committee and consented by the respective Principal/ HCU, ensuring compliance with confidentiality conditions as per the standards adopted for the psychological services being offered.

**12. Ethical Standards**

12.1 Following ethical standards are to be ensured at all PSCs:

a. As per professional ethics, any information shared in the context of professional psychological assessment is considered confidential. However, the client should be notified in case the psychologist believes that the client is suicidal or is in danger of harming another person, in which case the expectation of confidentiality may not be the same.
b. During the consultation period, the therapeutic relationship will be strictly maintained. Personal meetings between the concerned Faculty Consultants and the clients outside the Centre and the exchange of gifts or other items between them are to be avoided.
c. Any complaints from a client or any observation of violation of policy guidelines should be recorded in written form. The Psychological Services Ethics Committee (PSEC) formed at each Campus will make the required decisions and communicate the same to the concerned person(s) and higher authorities. Details of the same are covered in clause 13 below.
d. The PSC will be committed to self-evaluation to maintain the high quality and effectiveness of its services. It will be the responsibility of the Head of the PSC to compile an annual statistical report for quality assurance, documentation of services rendered, and dissemination of information regarding service utilization and needs assessment.
e. PSC reports are to be submitted to the concerned Principal/HOD monthly, the respective HCU quarterly and the BUHO (through Dean PP) annually.

**13. Psychological Services Ethics Committee (PSEC)**

13.1 Each Campus will have an Ethics Committee comprising the following members to ensure the above-stated ethics at respective PSC:

a. Dean PP – President
b. Concerned Principal/ HOD – Member
c. Head of Psychological Services Centre – Member
d. In-Charge Psychological Services Centre – Member
e. Any other faculty member, co-opted by the President of PSEC

13.2 In the absence of Dean PP, the senior most Principal/ HOD will head the PSEC.

**13.3 Objective of the PSEC.** To address ethical issues within the clinical setting, encompassing concerns related to clients, their families, allocated supervisors, and interns' adherence to rules and regulations, including the submission of log hours and batteries (psychological assessment reports).

13.4 **Scope of Responsibility.** The PSEC will evaluate and address issues such as falsifying data, non-submission of required materials, attendance concerns, and any other ethical challenges arising during training and supervision.

13.5 **PSEC Meetings.** The PSEC will conduct meetings at least once in each academic year and on a case-to-case basis, with the frequency and duration determined by the complexity and urgency of the issues at hand.

13.6 **Scheduling of PSEC Meetings.** The PSEC meetings will be scheduled by the Head of the Committee in collaboration with the concerned Head of PSC.

13.7 **Coordination and Documentation.** The Clinical In-Charge PSC will be responsible for coordinating all aspects of the PSEC meetings, including documentation such as minutes and reports.

13.8 **Reporting Structure.** The PSEC is to provide recommendations to the President of the Committee regarding identified ethical irregularities within the clinical setting at any PSC. Minutes of Meetings of PSEC are to be documented along with decisions and recommendations and signed by the President.

**Note.** The above-stated terms of reference are designed to guide the PSEC in addressing ethical concerns, promoting a transparent and ethical environment within the clinical setting. The flexibility of meeting frequency and length ensures adaptability to the varying nature of ethical issues that may arise.

**14. Financial Aspects**

14.1 Fee structure for all psychological services for internal clients (BU students, faculty, staff) will be as approved by the BUHO.

14.2 Fee structure for external clients will be as per the approved rates for specific requirements, which may be reviewed by the Dean PP from time to time and approved by the concerned HCU. The exact fee amount to be paid by the client will be finalized according to the number of tests administered and the financial capacity of the client (determined from the Fee Discount Form filled by the client, as per the format at **Annexure C**).

14.3 Income generated from clients is to be deposited in a separate bank account maintained by the CUs for respective PSC. All expenditures to be incurred from this account are to be with prior approval of the concerned HCU as per BU Financial Regulations.

14.4 In case a client is unable to afford the psychological service fee, he/ she may be treated free of cost on the basis of strong reasons/ justification, subject to approval by the concerned HCU. Such an approval is to be properly maintained in PSC record.

14.5 Payment for internship by external PG candidates will be made through cash/ cheque to the respective designated PSC bank account. Amplifying instructions in this regard may be promulgated by the respective CUs.

**15. Remuneration to Consultants**

15.1 Remuneration to Faculty Consultants will be paid for the consultancy provided in the PSC as per the approved BU policy.

15.2 Fee paid by external clients will be deposited in the designated bank account of the respective CU. The payment for consultancy to the FMs and any other expenditure from this account will be paid with the approval of the respective HCU as per the approved policy.

15.3 Consultancy fee may be revised with the consent of Dean PP and approved by the Rector BU as and when required, through respective HCU on the recommendation of the Dean PP.

**Annexure A**

## BEHAVIOURAL COUNSELLING REFERRAL FORM

**Student's Information**

Name: ____________________________________________________

Gender: ___________________________________________________

Enrolment Number: __________________________________________

Semester Details: ____________________________________________

Academic Performance: ______________________________________________________

______________________________________________________________________

**Behavioural Concerns (tick all that apply and specify details including incidents)**

☐ Inattention / Daydreaming in Class

______________________________________________________________________

_________________________________________________________________

☐ Irritability / Anger Outbursts

______________________________________________________________________

_________________________________________________________________

☐ Persistent Low Mood / Crying Spells

______________________________________________________________________

_________________________________________________________________

☐ High Anxiety Levels / Panic Symptoms

___________________________________________________________________________

_________________________________________________________________

☐ Misconduct not Classified as General Indiscipline

___________________________________________________________________________

_________________________________________________________________

☐ Complaints by Peers

☐ Issues in Teamwork / Group Collaboration

___________________________________________________________________________

_________________________________________________________________

☐ Solitary Behaviour

___________________________________________________________________________

_________________________________________________________________

☐ Any other Observation

___________________________________________________________________________

_________________________________________________________________

☐ Additional Comments (including views on Academic Performance)

___________________________________________________________________________

_________________________________________________________________

**Referring Faculty Member**

Name ________________________________________
Department ___________________________________
Contact Information ____________________________
Signature ____________________________________
Date ________________________________________

**Head of Department (HoD) Verification**

HoD Name _________________________________
Signature __________________________________
Date ______________________________________

**Annexure B**

## COUNSELLING / THERAPY CONSENT FORM

As a (student / staff / FM) in the (____________________ Department/ School/ Institute), I acknowledge my upcoming assessment / counselling/ therapy sessions, supervised by senior Expert Clinicians at the Psychological Services Centre.

I am aware that failure to attend or cancel an appointment with less than 24 hours' notice will result in rescheduling. Missing three consecutive appointments will be considered a drop-out from therapy/ psychological services.

I recognize that these services aim to support students/ staff/ faculty in overcoming emotional and psychological challenges. All information shared with the clinician is confidential, with exceptions for imminent danger, suspicion of abuse, or court-ordered disclosures.

For any questions about this consent or the services, I can discuss them with my therapist/In-Charge at the Psychological Services Centre. I commit to full cooperation, and any concerns will be communicated confidentially to the Head of the Department.

I have read and understood the above, consenting to participate in the evaluation and/ treatment, with the understanding that I may stop treatment at any time.

Signature & Date:____________________________

Student Registration No:______________________

**Appendage 4632**

10/22/2024

## Approval of BU Academic Rules 2024

1

## Scheme of Presentation

- Review of Updated Contents
- Recommendation

2

## Review of Updated Contents Draft BUAR 2024

Table of Contents



3

## Review of Updated Contents
### General/ Common Amendments

- Incorporation of already approved amendments, notified till July 2024 and approved in the last/ 47th ACM.
- Rephrasing of clauses as per the current procedures and policies, including review of complete contents by the Legal Adviser and the DQA.
- Minor grammatical corrections and rephrasing through proofreading.
- Inclusion of minor changes decided in the reviews chaired by the Rector on 20 May and 19 September 2024.

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## Review of Updated Contents
### Chapter 1 – Preamble & Definitions

- **1.1.1** Preamble opening sentence rephrased as proposed by the Legal Adviser for better fluency.
- **1.3.2** Clause for **Academic Adviser** rephrased for **Class Adviser** in alignment with revised clause 3.22 (**Advising, Mentoring and Counselling Students**).
- **1.3.7** Clause for **Chance** deleted as per revised Probation Policy.
- **1.3.8** Definition of **Course or Subject** rephrased for more appropriate connotation.
- **1.3.41** Clause related to the procedure for time bar waiver shifted from **Definitions** to Chapter 3, under the heading **Graduation Timeframe**.
- **1.3.40** In lieu of above, previous definition of **Time Beyond Extended Programme Duration** included in **Definitions**.
- **1.3.45** Clause for **Trimester** deleted due to discontinuation as per HEC instructions.

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## Review of Updated Contents(contd.)
### Chapter 2 – Admissions, Exemptions & Credit Transfers

- **Table 1** Weightages for PG admissions interviews retained as per existing.
- **Table 2** Associate Degree programme included in criteria for Migration.
- **2.5** New clause included for Transfer of Credit for exchange programmes.
- **2.6.1** Rephrasing of clause for new admissions Undertaking by the students to be Online; approved on case file; to be ratified by the Academic Council.

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1

## Review of Updated Contents(contd.)
### Chapter 3 – General Academic Rules

- **3.5.3** New clause included for reg of add'l courses by the students availing Exch Prog.
- **3.8.2** *Students Career Services Manual* referred for Internships/ Field Experience.
- **3.10.4** Procedure for Time Bar Waiver shifted from Chapter 2 to this Chapter.
- **3.11.1.2** Provision of full fee refund prior final exams in exceptional circumstances included.
- **3.11.1.7** New clause included for issuance of new Enrl No. to fresh students who avail semester freeze in the 1st semester owing to circumstances beyond their control.
- **3.14** Credit Hours-Contact Hours equivalence for practical work standardised for all progs, as 1 x CH duration of Practical/ Lab Work equalling 3 x Contact Hours per week.
- **Table 3** containing Faculty Course Load deleted to avoid duplication with *BU HR Policy Manual*.
- **Clause 3.19.2** pertaining to authorised additional duties of PFMs deleted to avoid duplication with *BU HR Policy Manual*.

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## Review of Updated Contents(contd.)
### Chapter 4 – Programme Specific Academic Rules

- **4.3.1** Provision of MBA students availing common electives with BBA students deleted.
- **Table 4** Associate Degree programme included in programmes credit hours.
- **4.12.2** HEC instructions w.r.t improvement of academic & research environment iaw Islamic principles and values/ ideology of Pakistan incorporated in related clause.
- **4.14** Clauses related to the launch of new programmes shifted from Chapter 12 to this Chapter.
- **4.14.3** Requirements of Relevance Assessment Committee included in related clauses.
- **4.15.1** New clause included for the launch of non-credited diploma/ certificate courses by the CUs, in consent with the related committee.
- **4.15.2** New clause included for the launch of credited diploma/ certificate courses by the LPDC.
- **4.15.3** Clause for certificate courses from regular programmes shifted from Chapter 3.

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## Review of Updated Contents(contd.)
### Chapter 5 – Fee

- **5.3.6.1** Sub-clauses pertaining to fee refund of HS programmes simplified/ condensed.
- **5.6.2** Clause pertaining to the inclusion of PM&DC registration fee in fee chalan of MBBS/ BDS students included.

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## Review of Updated Contents(contd.)
### Chapter 6 – Quality Assurance

- **Clauses** pertaining to academic audits, QA Committees, Periodic Self-Assessments, Internal Sel-Audits, Academic Mock Audits updated/ rephrased by the DQA as per current practices/ procedures.
- **Table 6** Format of Audit Report removed as proposed by DQA.
- **6.6.4** New clause included as per the HEC instructions for QEC to establish if necessary steps have been taken by the CUs/ faculties to improve their academic and research environment in accordance with the BU Rules, social values and the ideology of Pakistan.

10

## Review of Updated Contents(contd.)
### Chapter 7 – Examinations

- Complete chapter reviewed/ updated for alignment with the recently revised BU Examinations Policy.
- **7.2** New clause included as per HEC instructions for the Exams Dte to evolve a mechanism to periodically evaluate the quizzes under subjects/ disciplines such as languages, Islamic Studies, History, etc. to evaluate if the contents, expressions, and questions are framed appropriately and avoid controversial topics, and conform to religious, cultural, ethnic, ethical and social values and considerations.
- Description of,Grade A-, B-, C- and D+ included.
- **Table 9** Minimum CGPA requirement for Associate Degree included.

11

## Review of Updated Contents(contd.)
### Chapter 8 – Degrees and Transcripts

- **8.3** Procedure for preparation and award of degrees updated as per the current procedure.
- **8.5** Procedure for Duplicate Degree updated as per the current procedure.
- **Table 10** Signing authorities for academic documents updated for certificate courses and workshops.
- **Table 10** Signing authorities for academic documents updated as per the amended designations.

12

## Review of Updated Contents(contd.)
### Chapter 9 – Honours and Awards

- Complete Chapter amended and approved in 45th ACM (ratified in 20th ECM)

13

## Review of Updated Contents(contd.)
### Chapter 10 – Scholarships

- **10.3.1.1** Merit scholarship for 3rd position holders in BDS (Rs 50,000) included in related clause, as decided in the BUAR 21024 review on 20 May 24.
- Following additional conditions included for Student Study Loan:
  - **10.15.4.3** The Loan will be drawn in favor of respective CUs of Bahria University and not in favour of the student.
  - **10.15.4.4** If a student fails to repay the study loan, the final transcript and degree will not be issued until all loan payments are cleared.
- **10.16** Clauses included for Students Welfare Fund and Special Scholarships.
- **10.17** Clause for scholarships for Federal Govt employees and their wards updated as per the current policy (25 x 50% each).

14

## Review of Updated Contents(contd.)
### Chapter 11 – Community Support Programme

- Small amendments as per actual or proposed in proofreading
- **11.5.4** Clause reviewed/ rephrased to remove perceived contradiction, as indicated below:

  CSP shall be carried out in semesters 3-6~~, spread over any number of semesters from one to four~~.

15

## Review of Updated Contents(contd.)
### Chapter 12 – Academic Rules on Miscellaneous Subjects

- **12.2** New clause included for Conduct of Online Classes as per adopted practice.
- **12.3** New clause included for Classes through Smart Classrooms as per adopted procedure.
- Clauses **12.3** & **12.4** pertaining to launching of new programmes shifted to Chapter 4 due being more relevant in that chapter.
- Clause **12.5** pertaining to Mission, Objectives & Outcomes of Academic Programmes shifted to Chapter 4 due being more relevant in that chapter.
- **12.6.3** New clause included as per HEC instructions for preparation of smart/ attractive MOOCs promotional material for adhering to the Islamic cultural principles/ valus and the ideology of Pakistan.

16

## Review of Updated Contents(contd.)
### Chapter 13 – Academic Honesty

- **Table 12** Copy of Warning Letters to parents/ guardian included in Penalties for Academic Misconduct.

17

## Review of Updated Contents(contd.)
### Chapter 14 – Students' Conduct and Discipline

- **14.4.1** Copy of Warning Letters to parents/ guardian included for Disciplinary Penalties.
- **14.4.2** Clause pertaining to Penalties updated for multiple times application during a semester in case of repetition of an offence.
- **Table 13** The penalty **Removal from Classroom** amplified as 'without marking attendance'.
- **Table 13** Authority for Expulsion from Educational Visits/ Sports Tours amended from DD (Admin & Coord) to as per current designations (DAdmin/ DC).
- **14.5** Clause for Smoking amplified with inclusion of vape or any other alternative means/ device.
- **14.7.4** Sub-clause included to bar the students under rustication from entering the University premises till readmitted, unless allowed for a specific reason by concerned Principal/ HOD.
- **14.7.5** BUKC proposal to place restrictions on Rusticated students rephrased as proposed by the Legal Adviser *to bar admission into any other/ same programme during the* ***Rustication***.
- **14.12.5** Dress code for transgenders included as discussed in the presentation on 19 Sep 24 (as per the gender mentioned on the CNIC).

18

## Review of Updated Contents(contd.)
### Chapter 15 – Faculty Members' Conduct

- **15.1.1** PhD Fellowship included in the FMs Code of Conduct, as per the latest instructions.
- **15.1.1.c.** New sub-clause included as per the HEC instructions for adherence to the religious, cultural and social values and norms while developing and delivering lectures, and preparing assessment tools.
- **15.9.4.1** Sub-clauses pertaining to **Gift Policy** simplified for better comprehension, as rephrased by the Legal Adviser.
- **15.10** Requirements pertaining to Course File/ Folder on LMS updated as proposed by the DQA.

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19

## Review of Revised Contents(contd.)
### Annexures

- Following clauses added in Annexure A (Academic Details):
  - Additional Infrastructure Required
  - Maturity Period of the Programme
  - Marketing campaign Requirements
- Following clauses added in Annexure A (Financial Details):
  - Cost-Benefits Analysis including other universities
- Following clauses added in Annexure B (Document Check List):
  - NQF and mapping with the UN SDGs
  - PhD Thesis Review Policy (as per prevailing BU Rules)
  - Area of specialisation, with relevancy of the PhD faculty by the RAC
- Annexure C (Template for LPDC Proposal for Corporate Training Programme) removed to avoid duplication with the Corporate Training Services Policy

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## Recommendations

BUAR 2024 as presented may be approved
by the Academic Council
for ratification by the Executive Committee

21

21

# Thank You

22

22

4

**Appendage 4701-A**

# Pakistan Engineering Council

*(Constituted under Pakistan Engineering Council Act, 1976 enacted by the Parliament)*

Secretary / Registrar
Engr. Dr. Nasir Mahmood Khan

**Engineering Accreditation Department (EAD)**
**(Curriculum & Development Section)**

PEC/EAD/Curr./Phase-II/2024/03

May 31, 2024

**The Vice Chancellors/ Rectors/ Heads of**
**Universities/ Higher Education Institutions (HEIs)**
**In Pakistan**

Subject: **Implementation of Five Undergraduate Engineering Program Curricula (Phase-II)**

Pakistan Engineering Council under its mandate is promoting quality engineering education in the country and took up the challenge of curriculum review and development for engineering programs in collaboration with HEC. A high-level Engineering Curriculum Review and Development Committee (ECRDC) comprised of eminent engineers from industry and academia was constituted to oversee the task of curricula review and development besides setting relevant policies and guidelines.

PEC revised its engineering education guidelines/ framework document, based on the synthesis and mapping in the light of HEC Undergraduate Education Policy-2023.These curriculum document would serve as a guideline whereas allowing HEIs to tame/ change within the framework by introducing courses in support of local/ required industrial demand as well as satisfying the revised 11 Graduate Attributes (GAs) and 13 Professional Competencies (PCs) covering core and elective courses, considered as beauty of OBE system in the international arena. At the same time, this curriculum framework would fulfill the purpose of meeting our national, social and economic needs leading towards attainment of United Nations Sustainable Development Goals (UN-SDGs-2030). It would also provide the level of competency specified in Pakistan Qualification Framework to make it compatible with international educational standards.

Under OBE based curriculum review and development framework, PEC held national and regional levels stakeholders and industrial consultation meetings by engaging HEIs, industry and technical organizations. The experts' feedback and suggestions were translated into the curriculum review process while taking into consideration of the dynamics of technological advancement, industrial needs and management-cum-soft skills for engineering graduates.

During Phase-II, PEC and HEC has jointly worked (developed and reviewed) on 5 undergraduate engineering programs curricula in 2023 as listed below and being forwarded to all HEIs for implementation from Fall-2024 & onwards. These curricula were considered by PEC EAB in its 113th meeting held on January 25, 2024 and approved by ECRDC-main in its meeting held on March 14, 2024. Consequently, these curricula were published and uploaded on PEC Website in May, 2024.

| | | |
|---|---|---|
| Chemical Engineering | Food Engineering | |
| Civil Engineering | Electrical Engineering | Information Security Engineering |

The soft copies of the these curricula be accessed on PEC website via link (https://www.pec.org.pk/curriculum-fee-structure/all-curriculums/) for information and implementation, please.

**Engr. Dr. Nasir M. Khan (PoP)**
Secretary/ Registrar, PEC

**<u>Copy for Information to:</u>**

- The Convener PEC Engineering Accreditation Board (EAB)
- The Convener ECRDC-Main/ Rector NUST, Islamabad
- All PEC Departments/ Regional/ Branch Offices
- PS to Chairman, PEC

**Appendage 4701-B**

Program Title: **Bachelor of Electrical Engineering (BEE)**
Duration: **4 Years**
Total Credit Hours: **136**

## Summary of Credit Hours (PEC Alignment)

| Sr. No. | Category as per PEC Revised Guidelines | Credit Hours/Contact Hours | |
|---|---|---|---|
| | | PEC Revised Guidelines | BEE Roadmap BU |
| 1. | General Education | Min 38 | 38 |
| 2. | Engineering | Min 72 | 76 |
| 3. | Multidisciplinary | Min 06 | 06 |
| 4. | FYDP Capstone Project | 06 | 06 |
| 5. | Flexible Engineering/ Non Engineering Courses (may be adjusted as per the requirements) | 8 14 | 10 |
| | **Total:** | **130 136** | **136** |

| Sr. No. | Description/ Attributes | HEC Policy | Revised PEC Guidelines for Fall 2023 & onwards | BU Compliance |
|---|---|---|---|---|
| 1. | Nomenclature | • Bachelor of Science or Bachelor of Studies (BS) Professional Councils will follow their own approved nomenclature to remain synchronize with their service rules. | • B.E, B.S Engineering and B.Sc. Engineering. | Bachelor of Electrical Engineering (Electronics/Telecommunication/Power/Electrical Vehicles/Computer Systems) |
| 2. | Program Credits | • Total 120 144 Credit Hours<br>• General Education: Min 30 (Arts & humanities, Social Sci, Natural Sci, Quantitative Reasoning, Expository Writing, Computer Courses, Entrepreneurship, Pak Studies, Islamic Studies/ Ethics)<br>• Major Courses: Min 72<br>• Minor Courses: Min 12<br>• Inter Disc/ Distribution: Min 12 | • Total 130 -136 Credit Hours<br>• General Education for Engineering Disciplines = Min 38 (After readjusting non engineering courses)<br>• Engineering = Min 72 (Including Computer Courses, foundation, breadth depth/ Major)<br>• FYDP/ Capstone Project= 06<br>• Multi Disciplinary Engineering Courses= Min 06<br>• 08 14 Credit Hours (Flexible Engineering/ Non Engineering Courses) may be adjusted as per the requirements | Total Credit Hours: 136<br>General Education: 38<br>Engineering: 76<br>FYDP: 6<br>Multi Disciplinary Engineering Courses: 6 |

| | | | | |
|---|---|---|---|---|
| 3 | Admission | In the Department (In the 1st semester) | In the program/ department (In the First Semester) As per PEC Regulations for Engineering Education in Pakistan | Already in Compliance with PEC Guidelines |
| 4 | General Education Courses | HEI may offer during first 4 semesters | Spread over 8 semesters/ program | Already in Compliance with PEC Guidelines |
| 5 | Academic Advisory | Proposed by HEC | Already included in PEC Policies | Already in Compliance with PEC Guidelines |
| 6. | Guidance on General Education | To be provided by the Curriculum Division, HEC for degrees | Already included in PEC Policies | Already in Compliance with PEC Guidelines |
| 7. | Field Experience (Mandatory) | At least 06 08 weeks, (preferably undertaken during semester or summer break of 03 Credit Hours (Graded) | Mandatory and qualifying Industrial Internship of 06 08 Weeks as per PEC Accreditation Manual 2019 | Already in Compliance with PEC Guidelines |
| 8. | Capstone Project (Mandatory) | Till completion of the BS program (03 Credit Hours) | FYDP/ Capstone (06 Credit Hours)/ Spread over Final Year (7th & 8th Semester)<br>The FYDP shall include complex engineering problems and design of systems, components or processes integrating core areas and meeting specified needs with appropriate consideration for public health and safety along with cultural, societal, and environmental considerations encompassing the UN SDGs.<br>A project of this nature should invariably lead to an integration of the knowledge and practical skills as mandated in the GAS. | Already in Compliance with PEC Guidelines |
| 9. | Admission in 5th Semester | Allowed (Councils will decide to allow or not) | Not Allowed (as concept of Associate Degree in Engineering Discipline is not approved by PEC) | Already in Compliance with PEC Guidelines |
| 10. | Exit after 4th Semester | Allowed with Associate Degree (Councils will decide to allow or not) | Not Allowed (as concept of Associate Degree in Engineering Discipline is not approved by PEC) | Already in Compliance with PEC Guidelines |

**Program Educational Objectives (PEOs)**

**PEO 1**: To provide viable solutions to complex engineering problems based on systematic theoretical and technical approaches in the field of electrical engineering.
**PEO 2**: To manage and develop sustainable electrical systems to meet desired objectives and explore new entrepreneurial possibilities in a multidisciplinary environment.
**PEO 3**: To pursue academic and professional growth by taking up higher studies, discovering new technologies and developing proficiency in the usage of latest tools.

**PEO 4**: To work in a multicultural environment and be responsive to ethical, moral, and societal issues showing leadership in their domain.

## Program Learning Outcomes (PLOs)

| Previous PLOs | | New PLOs aligned with PEC guidelines | |
|---|---|---|---|
| **No.** | **Program Learning Outcomes (PLOs)** | **No.** | **Program Learning Outcomes (PLOs)** |
| **PLO 1** | **Engineering Knowledge:** An ability to apply knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. | **PLO 1** | **Engineering Knowledge:** Apply knowledge of mathematics, natural science, engineering fundamentals and Engineering specialization to the solution of complex engineering problems |
| **PLO 2** | **Problem Analysis**: An ability to identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. | **PLO 2** | **Problem Analysis:** Identify, formulate, conduct research literature, and analyse complex Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences |
| **PLO 3** | **Design/Development of Solutions:** An ability to design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations. | **PLO 3** | **Design/Development of Solutions:** An ability to design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations |
| **PLO 4** | **Investigation:** An ability to investigate complex engineering problems in a methodical way including literature survey, design and conduct of experiments, analysis and interpretation of experimental data, and synthesis of information to derive valid conclusions. | **PLO 4** | **Investigation:** Conduct investigation of complex Engineering problems using research based knowledge and research methods, including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions |
| **PLO 5** | **Modern Tool Usage**: An ability to create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities, with an understanding of the limitations. | **PLO 5** | **Tool Usage:** Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex Engineering problems, with an understanding of the limitations |
| **PLO 6** | **The Engineer and Society:** An ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solution to complex engineering problems. | **PLO 6** | **The Engineer and the World:** Analyze and evaluate sustainable development impacts to society, the economy, sustainability, health and safety, legal frameworks, and the environment while solving complex engineering problems |

| | | | |
|---|---|---|---|
| **PLO 7** | **Environment and Sustainability:** An ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development. | **PLO 7** | **Ethics:** Apply ethical principles and commit to professional ethics and norms of engineering practice and adhere to relevant national and international laws. Demonstrate an understanding of the need for diversity and inclusion |
| **PLO 8** | **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice. | **PLO 8** | **Individual and Collaborative Team Work:** Function effectively as an individual, and as a member or leader in diverse and inclusive teams and in multi disciplinary, face to face, remote and distributed settings |
| **PLO 9** | **Individual and Team Work:** An ability to work effectively, as an individual or in a team, on multifaceted and /or multidisciplinary settings. | **PLO 9** | **Communication:** Communicate effectively and inclusively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, and make effective presentations, taking into account cultural, language, and learning differences |
| **PLO 10** | **Communication:** An ability to communicate effectively, orally as well as in writing, on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. | **PLO 10** | **Project Management and Finance:** Demonstrate knowledge and understanding of engineering management principles and economic decision making and apply these to one's own work, as a member and leader in a team, to manage projects in multidisciplinary environments |
| **PLO 11** | **Project Management:** An ability to demonstrate management skills and apply engineering principles to one's own work, as a member and/or leader in a team, to manage projects in a multidisciplinary environment. | **PLO 11** | **Lifelong Learning:** Recognize the need for, and have the preparation and ability for i) independent and life long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change |
| **PLO 12** | **Lifelong Learning:** An ability to recognize the need for, and have the preparation and ability to engage in, independent and life long learning in the broadest context of technological change. | | |

## Professional Competence Profile

| EC no | Professional Competence Profile |
|---|---|
| **EC 1** | **Comprehend and apply universal knowledge**: Comprehend and apply advanced Engineering knowledge of the widely applied principles underpinning good practices. |
| **EC 2** | **Comprehend and apply local knowledge**: Comprehend and apply advanced Engineering knowledge of the widely applied principles underpinning good practice specific to the jurisdiction of practices. |
| **EC 3** | **Problem analysis**: Define, investigate and analyze complex Engineering problems using data and information technologies where applicable. |

| | |
|---|---|
| **EC 4** | **Design and development of solutions**: Design or develop solutions to complex Engineering problems considering a variety of perspectives and taking account of stakeholder views |
| **EC 5** | **Evaluation**: Evaluate the outcomes and impacts of complex Engineering activities. |
| **EC 6** | **Protection of society**: Recognize the foreseeable economic, social, and environmental effects of complex Engineering activities and seek to achieve sustainable outcomes. |
| **EC 7** | **Legal, regulatory, and cultural**: Meet all legal, regulatory, and cultural requirements and protect public health and safety in the course of all Engineering activities. |
| **EC 8** | **Ethics:** Conduct Engineering activities ethically. |
| **EC 9** | **Manage engineering activities**: Manage part or all of one or more complex Engineering activities. |
| **EC 10** | **Communication and Collaboration**: Communicate and collaborate using multiple media clearly and inclusively with a broad range of stakeholders in the course of all Engineering activities. |
| **EC 11** | **Continuing Professional Development (CPD) and Lifelong learning**: Undertake CPD activities to maintain and extend competences and enhance the ability to adapt to emerging technologies and the ever changing nature of work. |
| **EC 12** | **Judgement:** Recognize complexity and assess alternatives in light of competing requirements and incomplete knowledge. Exercise sound judgement in the course of all complex Engineering activities. |
| **EC 13** | **Responsibility for decisions:** Be responsible for making decisions on part or all of the complex Engineering activities. |

## Courses of Non Engineering Domain

| **Knowledge Profile** | **Knowledge Area** | **Sub Area** | **Name of Course** | **Theory Cr. Hrs** | **Lab Cr. Hrs** | **Total** | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | **Cr. Hrs** | **No. of Courses** | **No. of Cr. Hrs** |
| **[WK 1, WK 2]** | **Natural Science** | **Mathematics** | Applied Calculus and Analytical Geometry | 3 | 0 | 3 | 3 | 9 |
| | | | Complex Variables & Transforms | 3 | 0 | 3 | | |
| | | | Linear Algebra & Differential Equations | 3 | 0 | 3 | | |
| | | **Natural Sciences (Physics, Chemistry, Math)** | Applied Physics | 3 | 1 | 4 | 2 | 7 |
| | | | Chemistry [Non – Credited for ICS Students] | | | | | |
| | | | Maths/Natural Science Elective | 3 | 0 | 3 | | |
| **[WK 1,WK 5, WK 7,** | **Humanities** | **English** | Functional English | 3 | 0 | 3 | 2 | 6 |
| | | | Expository Writing | 3 | 0 | 3 | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Culture | Culture Elective I | 2 | 0 | 2 | 3 | 6 |
| | | | Tajweed* | 0 | 0 | 0 | | |
| | | | Understanding Quran I* | 0 | 0 | 0 | | |
| | | | Understanding Quran II* | 0 | 0 | 0 | | |
| | | | Understanding Quran III* | 0 | 0 | 0 | | |
| | | | Understanding Quran IV* | 0 | 0 | 0 | | |
| | | | Understanding Quran V* | 0 | 0 | 0 | | |
| | | | Seerah I* | 0 | 0 | 0 | | |
| | | | Seerah II* | 0 | 0 | 0 | | |
| | | | Culture Elective II | 2 | 0 | 2 | | |
| | | | Culture Elective III | 2 | 0 | 2 | | |
| | | Social Sciences | Social Sciences Elective I | 2 | 0 | 2 | 2 | 4 |
| | | | Social Sciences Elective II | 2 | 0 | 2 | | |
| | Management Sciences | Professional Practice | Management Elective I | 2 | 0 | 2 | 2 | 4 |
| | | | Management Elective II | 2 | 0 | 2 | | |
| | Computer Sciences | Basic Computing | Application of ICT | 1 | 1 | 2 | 1 | 2 |
| **Total General Education/ Non Engineering Domain** | | | | | | | **15** | **38** |

## Courses of Engineering Domain

| Knowledge Profile | Knowledge Area | Sub Area | Name of Course | Theory Cr. Hrs. | Lab Cr. Hrs. | Total Cr. Hrs. | Total: No. of Courses | Total: No. of Cr. Hrs. |
|---|---|---|---|---|---|---|---|---|
| [WK 2, WK 4, WK 5, WK | Advanced Computer & Infor | ICT/AI / Data Science/ | Programming Fundamentals | 2 | 1 | 3 | 3 | 10 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | CIS Elective I | 3 | 1 | 4 | | |
| | | | CIS Elective II | 3 | 0 | 3 | | |
| [WK 2, WK 3] | Electrical Engineering Foundation Courses | | Workshop Practice | 0 | 1 | 1 | 9 | 28 |
| | | | Linear Circuit Analysis | 3 | 1 | 4 | | |
| | | | Digital Logic Design | 3 | 1 | 4 | | |
| | | | Electronic Devices and Circuits | 3 | 1 | 4 | | |
| | | | Electrical Network Analysis | 3 | 1 | 4 | | |
| | | | Signals and Systems | 3 | 1 | 4 | | |
| | | | Electromagnetic Field Theory | 3 | 0 | 3 | | |
| | | | Probability Methods in Engineering | 3 | 0 | 3 | | |
| | | | Engineering Drawing & CAD | 0 | 1 | 1 | | |
| [WK 1, WK 2, WK 4] | Electrical Engineering Major Based Core (Breadth) | | Communication Systems | 3 | 1 | 4 | 5 | 20 |
| | | | Embedded Systems Design | 3 | 1 | 4 | | |
| | | | Electrical Machines | 3 | 1 | 4 | | |
| | | | Linear Control Systems | 3 | 1 | 4 | | |
| | | | Power Distribution and Utilization | 3 | 1 | 4 | | |
| [WK 5, WK 6] | Electrical Engineering Major Based Core (Depth) | | Depth Elective Core I | 3 | 1 | 4 | 5 | 18 |
| | | | Depth Elective Core II | 3 | 1 | 4 | | |
| | | | Depth Elective III | 3 | 1 | 4 | | |
| | | | Depth Elective IV | 3 | 0 | 3 | | |
| | | | Depth Elective V | 3 | 0 | 3 | | |
| [WK 1, WK 2, WK 3, WK 4] | Multidisciplinary Engineering Electives | | MDEE I | 2 | 0 | 2 | 3 | 6 |
| | | | MDEE II | 3 | 0 | 3 | | |
| | | | Occupational Health and Safety | 1 | 0 | 1 | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| **[WK 6, WK 7, WK 8]** | **Final Year Design Project** | | Project I | 0 | 2 | 2 | 2 | 6 |
| | | | Project II | 0 | 4 | 4 | | |
| **[WK 6, WK 7, WK 9]** | **Industrial Training** | | **06 08 Weeks Mandatory (Non Credit)** | Mandatory & Qualifying | | | | |
| | **Community Service** | | **Community Service (Non Credit)** | | | | | |
| **Total Engineering Domain** | | | | | | | 27 | 88 |
| **[WK 1 WK 9]** | | Flexible Engineering/ Non Engineering Courses) may be adjusted as per the requirements | Flexible Elective I | 3 | 0 | 3 | 3 | 10 |
| | | | Digital Signal Processing | 3 | 1 | 4 | | |
| | | | CIS Elective III | 3 | 0 | 3 | | |
| **Total Credit Hours** | | | | **136** | | | | |

## Semester wise Road map

### Semester 1

| Sr. No. | Existing Road Map | | | | | | Sr. No | Proposed Road Map aligned with PEC Roadmap 2023 and HEC | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment |
| **1** | None | GSC 110 | Applied Calculus and Analytical Geometry | 3+0 | Quantitative Reasoning (Gen. Education) | SDG 4, SDG 9 | 1 | None | GSC 110 | Applied Calculus and Analytical Geometry | 3 | Quantitative Reasoning (Gen. Education) | SDG 4, SDG 9 |
| **2** | None | CSC 111 | Introduction to Computing | 1+1 | Applications of Information & Communication Technologies (ICT) (Gen. Education) | SDG 4, SDG 9 | 2 | None | CSC 111 | Introduction to Computing | 1 | Applications of Information & Communication Technologies (ICT) (Gen. Education) | SDG 4, SDG 9 |
| **3** | None | CSL 111 | Introduction to Computing | 1+1 | Applications of Information & Communication Technologies (ICT) (Gen. Education) | SDG 4, SDG 9 | 3 | None | CSL 111 | Introduction to Computing Lab | 1 | Applications of Information & Communication Technologies (ICT) (Gen. Education) | SDG 4, SDG 9 |
| **4** | None | ENG 105 | Functional English | 3+0 | Functional English (Gen. Education) | SDG 4 | 4 | None | ENG 105 | Functional English | 3 | Functional English (Gen. Education) | SDG 4 |
| **5** | None | XXX | Culture Elective I | 2+0 | Islamic Studies or Ethics (Gen. Education) | SDG 4, SDG 5, SDG 10, SDG 16 | 5 | None | XXX | Culture Elective I | 2 | Islamic Studies or Ethics (Gen. Education) | SDG 4, SDG 5, SDG 10, SDG 16 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **6** | None | XXXX | MDEE I | 2+0 | Interdisciplinary | Mentioned in relevant Electives | 6 | None | XXXX | MDEE I | 2 | Interdisciplinary | Mentioned in relevant Electives |
| **7** | None | GSC 113 | Applied Physics | 3+1 | Natural Sciences (Gen. Education) | SDG 7, SDG 9 | 7 | None | GSC 113 | Applied Physics | 3 | Natural Sciences (Gen. Education) | SDG 7, SDG 9 |
| **8** | None | GSC 113 | Applied Physics | 3+1 | Natural Sciences (Gen. Education) | SDG 7, SDG 9 | 8 | None | GSL 113 | Applied Physics Lab | 1 | Natural Sciences (Gen. Education) | SDG 7, SDG 9 |
| **9** | None | EEL 112 | Workshop Practice | 0+1 | Major/Disciplinary | SDG 9 | 9 | None | EEL 112 | Workshop Practice | 1 | Major/Disciplinary | SDG 9 |
| **10** | None | ISL 107 | Tajweed* | 0 | Religious Education (Gen. Education) | SDG 4, SDG 5, SDG 10, SDG 16 | 10 | None | ISL 107 | Tajweed* | 0 | Religious Education (Gen. Education) | SDG 4, SDG 5, SDG 10, SDG 16 |
| **10** | None | GSC 340 | Chemistry | Non credited 2 hrs per week (ICS students) | Natural Sciences (Gen. Education) | SDG 4, SDG 6 | 10 | None | GSC 340 | Chemistry | Non credited 2 hrs per week (ICS students) | Natural Sciences (Gen. Education) | SDG 4, SDG 6 |
| **Total Credit Hours** | | | | **16** | | | Total Credit Hours | | | | **17** | | |

**Semester 2**

| **Sr. No.** | **Existing Road Map** | | | | | | **Sr. No.** | **Proposed Road Map aligned with PEC Roadmap 2023 and HEC** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignm ent |
| **1** | None | EEL 121 | Engineering Drawing & CAD | 0+1 | ICT (Gen. Education) | SDG 9 | 1 | None | EEL 121 | Engineering Drawing & CAD | 1 | ICT (Gen. Education) | SDG 9 |
| **2** | GSC 110 | GSC | Linear Algebra Differential | 3+0 | Natural Science (Gen. Education) | SDG 4, SDG 9 | 2 | GSC 110 | GSC | Linear Algebra & Differential | 3 | Natural Science | SDG 4, SDG 9 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 123 | Equations & | | | | | | 123 | Equations | | (Gen. Education) | |
| **3** | CSC 111 | CSC 112 | Programming Fundamentals | 2+1 | Interdisciplinary | SDG 4, SDG 9 | 3 | CSC 111 | CSC 112 | Programming Fundamentals | 2 | Interdisciplinary | SDG 4, SDG 9 |
| **4** | CSC 111 | CSC 112 | Programming Fundamentals | 2+1 | Interdisciplinary | SDG 4, SDG 9 | 4 | CSC 111 | CSL 112 | Programming Fundamentals LAB | 1 | Interdisciplinary | SDG 4, SDG 9 |
| **5** | None | EEN 110 | Linear Circuit Analysis | 3+1 | Major/Disciplinary | SDG 7, SDG 9 | 5 | None | EEN 110 | Linear Circuit Analysis | 3 | Major/Disciplinary | SDG 7, SDG 9 |
| **6** | None | CEN 120 | Digital Logic Design | 3+1 | Major/Disciplinary | SDG 9 | 6 | None | CEN 120 | Digital Logic Design | 3 | Major/Disciplinary | SDG 9 |
| **7** | None | CEN 120 | Digital Logic Design | 3+1 | Major/Disciplinary | SDG 9 | 7 | None | CEL 120 | Digital Logic Design Lab | 1 | Major/Disciplinary | SDG 9 |
| **8** | None | PAK XXX | Culture Elective II | 2+0 | Ideology and Constitution of Pakistan (Gen. Education) | SDG 4, SDG 16 | 8 | None | PAK XXX | Culture Elective II | 2 | Ideology and Constitution of Pakistan (Gen. Education) | SDG 4, SDG 16 |
| **9** | None | ENV 101 | Occupational Health and Safety | 1+0 | Interdisciplinary | SDG 3 | 9 | None | ENV 101 | Occupational Health and Safety | 1 | Interdisciplinary | SDG 3 |
| **10** | None | ISL 108 | Understanding Quran I* | 0 | Religious Education (Gen. Education) | SDG 4, SDG 5, SDG 10, SDG 16 | 10 | None | ISL 108 | Understanding Quran I* | 0 | Religious Education (Gen. Education) | SDG 4, SDG 5, SDG 10, SDG 16 |
| | | | **Total Credit Hours** | **17** | | | | | | Total Credit Hours | **18** | | |

**Semester 3**

| Sr. No. | Existing Road Map | | | | | | Sr. No. | Proposed Road map aligned with PEC Roadmap 2023 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment |
| **1** | XXXX | XXXX | Culture Elective III | 2+0 | Arts & Humanities (Gen. Education) | SDG 4, SDG 8 | 1 | XXXX | XXXX | Culture Elective III | 2 | Arts & Humanities (Gen. Education) | SDG 4, SDG 8 |
| **2** | EEN 110 | EEN 224 | Electronic Devices and Circuits | 3+1 | Major/Disciplinary | SDG 9 | 2 | EEN 110 | EEN 224 | Electronic Devices and Circuits | 3 | Major/Disciplinary | SDG 9 |
| **3** | EEN 110 | EEN 224 | Electronic Devices and Circuits | 3+1 | Major/Disciplinary | SDG 9 | 3 | EEN 110 | EEL 224 | Electronic Devices and Circuits Lab | 1 | Major/Disciplinary | SDG 9 |
| **4** | EEN 110 | EEN 211 | Electrical Network Analysis | 3+1 | Major/Disciplinary | SDG 7, SDG 9 | 4 | EEN 110 | EEN 211 | Electrical Network Analysis | 3 | Major/Disciplinary | SDG 7, SDG 9 |
| **5** | EEN 110 | EEN 211 | Electrical Network Analysis | 3+1 | Major/Disciplinary | SDG 7, SDG 9 | 4 | EEN 110 | EEL 211 | Electrical Network Analysis LAB | 1 | Major/Disciplinary | SDG 7, SDG 9 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **6** | XXXX | XXXX | CIS Elective I | 3+1 | Interdisciplinary | SDG 9 | 6 | xxxx | xxxx | CIS Elective I | 3+1 | Interdisciplinary | SDG 9 |
| **7** | GSC 110 | GSC 220 | Complex Variables and Transforms | 3+0 | Natural Science (Gen. Education) | SDG 4, SDG 9 | 7 | GSC 110 | GSC 220 | Complex Variables and Transforms | 3 | Natural Science (Gen. Education) | SDG 4, SDG 9 |
| **8** | ISL 108 | ISL 109 | Understanding Quran II* | 0 | Religious Education (Gen. Education) | SDG 4, SDG 5, SDG 10, SDG 16 | 8 | None | ISL 109 | Understanding Quran II* | 0 | Religious Education (Gen. Education) | SDG 4, SDG 5, SDG 10, SDG 16 |
| **Total Credit Hours** | | | | **17** | | | Total Credit Hours | | | | **17** | | |

**Semester 4**

| **Sr. No.** | **Existing Road Map** | | | | | | **Sr. No.** | **Proposed Road Map aligned with PEC Roadmap 2023 and HEC** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment |
| 1 | CEN 120 | CEN 440 | Embedded systems Design | 3+1 | Major/Disciplinary | SDG 4, SDG 8 | 1 | CEN 120 | CEN 440 | Embedded systems Design | 3 | Major/Disciplinary | SDG 4, SDG 8 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | CEN 120 | CEN 440 | Embedded systems Design | 3+1 | Major/Disciplinary | SDG 4, SDG 8 | 2 | CEN 120 | CEL 440 | Embedded systems Design Lab | 1 | Major/Disciplinary | SDG 4, SDG 8 |
| 3 | None | XXXX | Social Science Elective I | 2+0 | Humanities/ Social Sciences (Gen. Education) | Mentioned in relevant Electives | 3 | None | XXXX | Social Science Elective I | 2 | Humanities/ Social Sciences (Gen. Education) | Mentioned in relevant Electives |
| 4 | GSC 220 | EEN 313 | Signals and Systems | 3+1 | Major/Disciplinary | SDG 9 | 4 | GSC 220 | EEN 313 | Signals and Systems | 3 | Major/Disciplinary | SDG 9 |
| 5 | GSC 220 | EEN 313 | Signals and Systems | 3+1 | Major/Disciplinary | SDG 9 | 5 | GSC 220 | EEL 313 | Signals and Systems Lab | 1 | Major/Disciplinary | SDG 9 |
| 6 | EEN 224 | EEN 225 | Electronic Circuit Design | 3+1 | Major/Disciplinary | SDG 9 | 6 | None | ENG 123 | Expository Writing | 3+0 | Humanities/ Social Sciences (Gen. Education) | SDG 4 |
| 7 | GSC 110 | EEN 226 | Probability Methods in Engineering | 3+0 | Major/Disciplinary | SDG 4 | 7 | GSC 110 | EEN 226 | Probability Methods in Engineering | 3 | Major/Disciplinary | SDG 4 |
| 8 | ISL 109 | ISL 110 | Understanding Quran III* | 0 | Religious Education (Gen. Education) | SDG 4, SDG 5, SDG 10, SDG 16 | 8 | None | ISL 110 | Understanding Quran III* | 0 | Religious Education (Gen. Education) | SDG 4, SDG 5, SDG 10, SDG 16 |
| | | | | | | | 9 | - | - | Professional Practice / Management Elective I | 2 | General Education | Mentioned in relevant Electives |
| | | | **Total Credit Hours** | **17** | | | | | | **Total Credit Hours** | **18** | | |

**Semester 5**

| Sr. No. | Existing Road Map | | | | | | Sr. No. | Proposed Road Map aligned with PEC Roadmap 2023 and HEC | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment (please mention relevant SDG No. | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment (please mention relevant SDG No. |
| **1** | GSC 110 | EEN 311 | Electromagnetic Field Theory | 3+0 | Major/Disciplinary | SDG 9 | 1 | GSC 110 | EEN 311 | Electromagnetic Field Theory | 3 | Major/Disciplinary | SDG 9 |
| **2** | XXXX | XXXX | CIS Elective II | 3+0 | Major/Disciplinary | SDG 9 | 2 | XXXX | XXXX | CIS Elective II | 3 | Major/Disciplinary | SDG 9 |
| **3** | XXXX | XXXX | Math Elective | 3+0 | Natural Sciences (Gen. Education) | Mentioned in relevant Electives | 3 | XXXX | XXXX | Math/ Natural Science Elective | 3 | Natural Sciences (Gen. Education) | Mentioned in relevant Electives |
| **4** | EEN 313 | EET 321 | Communication Systems | 3+1 | Major/Disciplinary | SDG 9 | 4 | EEN 313 | EET 321 | Communication Systems | 3 | Major/Disciplinary | SDG 9 |
| **5** | EEN 313 | EET 321 | Communication Systems | 3+1 | Major/Disciplinary | SDG 9 | 5 | EEN 313 | EEL 321 | Communication Systems Lab | 1 | Major/Disciplinary | SDG 9 |
| **6** | EEN 211 | EEN 312 | Electrical Machines | 3+1 | Major/Disciplinary | SDG 7, SDG 9 | 6 | EEN 211 | EEN 312 | Electrical Machines | 3 | Major/Disciplinary | SDG 7, SDG 9 |
| **7** | EEN 211 | EEN 312 | Electrical Machines | 3+1 | Major/Disciplinary | SDG 7, SDG 9 | 7 | EEN 211 | EEL 312 | Electrical Machines | 1 | Major/Disciplinary | SDG 7, SDG 9 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Lab | | | |
| **8** | ISL 110 | ISL 111 | Understanding Quran IV* | 0 | Religious Education (Gen. Education) | SDG 4, SDG 5, SDG 10, SDG 16 | 9 | None | ISL 111 | Understanding Quran IV* | 0 | Religious Education (Gen. Education) | SDG 4, SDG 5, SDG 10, SDG 16 |
| | | | **Total Credit Hours** | **17** | | | | | | Total Credit Hours | **17** | | |

**Semester 6**

| **Sr. No.** | **Existing Road Map** | | | | | | **Sr. No.** | **Proposed Road Map aligned with PEC Roadmap 2023 and HEC** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment |
| **1** | XXXX | EEXXX | Breadth Core I | 3+1 | Major/Disciplinary | Mentioned in relevant Electives | 1 | EEN 313 | EEN 325 | Digital Signal Processing | 3 | Major/Disciplinary | SDG 9 |
| **2** | XXXX | EEXXX | Breadth Core I | 3+1 | Major/Disciplinary | Mentioned in relevant Electives | 2 | EEN 313 | EEL 325 | Digital Signal Processing Lab | 1 | Major/Disciplinary | SDG 9 |
| **3** | EEN 313 | EEN 412 | Linear Control Systems | 3+1 | Major/Disciplinary | SDG 9 | 3 | EEN 313 | EEN 412 | Linear Control Systems | 3 | Major/Disciplinary | SDG 9 |
| **4** | EEN 313 | EEN 412 | Linear Control Systems | 3+1 | Major/Disciplinary | SDG 9 | 4 | EEN 313 | EEL 412 | Linear Control Systems Lab | 1 | Major/Disciplinary | SDG 9 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **5** | XXXX | XXXX | Management Sciences Elective I | 2+0 | General Education | Mentioned in relevant Electives | 5 | - | - | Professional Practice / Management Elective II | 2 | General Education | Mentioned in relevant Electives |
| **6** | XXXX | EEXXXX | Depth Elective 1 | 3+0 | Major/Disciplinary | Mentioned in relevant Electives | 6 | - | - | Depth Elective Core 1 | 3+1 | Major/Disciplinary | Mentioned in relevant Electives |
| **7** | XXXX | EEXXXX | Breadth Core II | 3+1 | Major/Disciplinary | Mentioned in relevant Electives | 7 | EEN 312 | EEN 433 | Power Distribution and Utilization | 3 | Major/Disciplinary | SDG 7 SDG 9 |
| **8** | XXXX | EEXXXX | Breadth Core II | 3+1 | Major/Disciplinary | Mentioned in relevant Electives | 8 | EEN 312 | EEL 433 | Power Distribution and Utilization Lab | 1 | Major/Disciplinary | SDG 7 SDG 9 |
| **9** | ISL 111 | ISL 112 | Understanding Quran V* | 0 | Religious Education (Gen. Education) | SDG 4, SDG 5, SDG 10, SDG 16 | 9 | None | ISL 112 | Understanding Quran V* | 0 | Religious Education (Gen. Education) | SDG 4, SDG 5, SDG 10, SDG 16 |
| **Total Credit Hours** | | | | **17** | | | Total Credit Hours | | | | **18** | | |

**Semester 7**

| **Sr. No.** | **Existing Road Map** | | | | | | **Sr. No.** | **Proposed Road Map aligned with PEC Roadmap 2023 and HEC** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Prerequisite | Course Code | Course Title | Credit Hour | HEC Category | 17 UN SDGs alignmen | | Prerequisite | Course Code | Course Title | Credit Hour | HEC Category | 17 UN SDGs alignmen |

| | Course Code | | | s | | t | | Course Code | | | s | | t |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | None | ESC 498 | Project – I | 0+3 | Capstone Project | SDG 3, SDG 6, SDG 7, SDG 9, SDG 11, SDG 12, SDG 13 | 1 | None | ESC 496 | Project – I | 2 | Capstone Project | SDG 3, SDG 6, SDG 7, SDG 9, SDG 11, SDG 12, SDG 13 |
| **2** | None | ENG 321 | Technical Writing & Presentation Skills | 3+0 | Expository Writing (Gen. Education) | SDG 4, SDG 17 | 2 | None | EEXX X | Flexible Elective I | 3 | Major/Disciplinary | Mentioned in relevant Electives |
| **3** | XXXX | EEXX X | Depth Elective 2 | 3+1 | Major/Disciplinary | Mentioned in relevant Electives | 3 | XXXX | EEXX X | Depth Elective 2 | 3+1 | Major/Disciplinary | Mentioned in relevant Electives |
| **4** | XXXX | EEXX X | Depth Elective 3 | 3+1 | Major/Disciplinary | Mentioned in relevant Electives | 4 | XXXX | EEXX X | Depth Elective 3 | 3+1 | Major/Disciplinary | Mentioned in relevant Electives |
| **5** | XXXX | XXXX | MDEE II | 3+0 | Interdisciplinary | Mentioned in relevant Electives | 5 | XXXX | XXXX | Depth Elective 4 | 3 | Interdisciplinary | Mentioned in relevant Electives |
| **6** | None | ISL 113 | Seerah I* | 0 | Religious Education (Gen. Education) | SDG 4, SDG 5, SDG 10, SDG 16 | 6 | None | ISL 113 | Seerah I* | 0 | Religious Education (Gen. Education) | SDG 4, SDG 5, SDG 10, SDG 16 |

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|---|---|---|---|---|---|---|---|
| **Total Credit Hours** | **17** | | | Total Credit Hours | **16** | | |

| Sr. No. | Existing Road Map | | | | | | Sr. No. | Proposed Road Map aligned with PEC Roadmap 2023 and HEC | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment |
| **1** | XXXX | ESC 499 | Project II | 0+3 | Capstone Project | SDG 3, SDG 6, SDG 7, SDG 9, SDG 11, SDG 12, SDG 13 | 1 | XXXX | ESC 497 | Project II | 4 | Capstone Project | SDG 3, SDG 6, SDG 7, SDG 9, SDG 11, SDG 12, SDG 13 |
| **2** | None | HSSXXX | Social Science Elective II | 2+0 | Humanities & Social Sciences (Gen. Education) | Mentioned in relevant Electives | 2 | None | HSSXXX | Social Science Elective II | 2 | Humanities & Social Sciences (Gen. Education) | Mentioned in relevant Electives |
| **3** | None | XXXX | Management Sciences Elective II | 3+0 | General Education | Mentioned in relevant Electives | 3 | None | XXXX | MDEE II | 3 | General Education | Mentioned in relevant Electives |
| **4** | XXXX | EEXXXX | Depth Elective 4 | 3+1 | Major/Disciplinary | Mentioned in relevant Electives | 4 | None | EEXXXX | CIS Elective III | 3 | Major/Disciplinary | Mentioned in relevant Electives |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **5** | XXXX | EEXXXX | Depth Elective 5 | 3+1 | Major/Disciplinary | Mentioned in relevant Electives | 5 | XXXX | EEXXXX | Depth Elective 5 | 3+1 | Major/Disciplinary | Mentioned in relevant Electives |
| **6** | ISL 113 | ISL 114 | Seerah II* | 0 | Religious Education (Gen. Education) | SDG 4, SDG 5, SDG 10, SDG 16 | 6 | None | ISL 114 | Seerah II* | 0 | Religious Education (Gen. Education) | SDG 4, SDG 5, SDG 10, SDG 16 |
| **Total Credit Hours** | | | | **16** | | | Total Credit Hours | | | | **15** | | |

**<u>* For Muslim Students only</u>**

A. **<u>List of Natural Science (Math) Electives</u>**

| **Sr. No.** | **Existing Road Map** | | | | | | **Sr. No.** | **Proposed Road Map aligned with PEC Roadmap 2023 and HEC** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Prerequisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment | | Prerequisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment. |
| **1** | GSC 110 | GSC 211 | Multivariable Calculus | 3+0 | Natural Sciences (Gen. Education) | SDG 4, SDG 12 | 1 | GSC 110 | GSC 211 | Multivariable Calculus | 3 | Natural Sciences (Gen. Education) | SDG 4, SDG 12 |
| **2** | GSC 210 | GSC 320 | Numerical Analysis | 3+0 | Natural Sciences (Gen. Education | SDG 4, SDG 9 | 2 | GSC 210 | GSC 320 | Numerical Analysis | 3 | Natural Sciences (Gen. Education | SDG 4, SDG 9 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ) | | | | | | | ) | |
| **3** | None | GSC 221 | Discrete Mathematic s | 3+0 | Natural Sciences (Gen. Education ) | SDG 4, SDG 12 | 3 | None | GSC 221 | Discrete Mathematic s | 3 | Natural Sciences (Gen. Education ) | SDG 4, SDG 12 |

**B. List of Humanities and Social Science Electives**

| **Sr. No.** | **Existing Road Map** | | | | | | **Sr. No.** | **Proposed Road Map aligned with PEC Roadmap 2023 and HEC** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment |
| **Humanities (Culture)** | | | | | | | **Humanities (Culture)** | | | | | | |
| **1** | None | ISL 101 | Islamic Studies | 2+0 | Islamic Studies (Gen. Education) | SDG 4, SDG 5, SDG 10, SDG 16 | 1 | None | ISL 101 | Islamic Studies | 2 | Islamic Studies (Gen. Education) | SDG 4, SDG 5, SDG 10, SDG 16 |
| **2** | None | HSS 116 | Ethics (For non Muslims only) | 2+0 | Ethics (Gen. Education) | SDG 4, SDG 5, SDG 10, SDG 16 | 2 | None | HSS 116 | Ethics (For non Muslims only) | 2 | Ethics (Gen. Education) | SDG 4, SDG 5, SDG 10, SDG 16 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **3** | None | PAK 103 | Pakistan Studies & Global Perspective | 2+0 | Ideology and Constitution of Pakistan (Gen. Education) | SDG 4, SDG 16 | 3 | None | PAK 103 | Pakistan Studies & Global Perspective | 2 | Ideology and Constitution of Pakistan (Gen. Education) | SDG 4, SDG 16 |
| **4** | None | PAK 105 | Pakistan Studies | 2+0 | Ideology and Constitution of Pakistan (Gen. Education) | SDG 4, SDG 16 | 4 | None | PAK 105 | Pakistan Studies | 2 | Ideology and Constitution of Pakistan (Gen. Education) | SDG 4, SDG 16 |
| **5** | None | ENG 134 | Communication Skills | 2+0 | Arts & Humanities (Gen. Education) | SDG 4, SDG 8 | 5 | None | ENG 134 | Communication Skills | 2 | Arts & Humanities (Gen. Education) | SDG 4, SDG 8 |
| **6** | None | HSS 462 | Foreign Language | 2+0 | Arts & Humanities (Gen. Education) | SDG 4, SDG 8 | 6 | None | HSS 462 | Foreign Language | 2 | Arts & Humanities (Gen. Education) | SDG 4, SDG 8 |
| **Social Science** | | | | | | | **Social Science** | | | | | | |
| | | | | | | | 7 | None | HSS 219 | Civics and Community Engagement | 2 | Social Sciences (Gen. Education) | SDG 3 SDG 11 |
| **7** | None | HSS 413 | Sociology for Engineers | 2+0 | Social Sciences (Gen. Education) | SDG 10 | 8 | None | HSS 413 | Sociology for Engineers | 2 | Social Sciences (Gen. Education) | SDG 10 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **8** | None | SOC 112 | Critical Reasoning & Logic | 2+0 | Social Sciences (Gen. Education) | SDG 4 | 9 | None | SOC 112 | Critical Reasoning & Logic | 2 | Social Sciences (Gen. Education) | SDG 4 |
| **9** | None | HSS 119 | Introduction to International Relations | 2+0 | Social Sciences (Gen. Education) | SDG 16 | 10 | None | HSS 119 | Introduction to International Relations | 2 | Social Sciences (Gen. Education) | SDG 16 |
| **10** | None | PSY 102 | Introduction to Psychology | 2+0 | Social Sciences (Gen. Education) | SDG 3 | 11 | None | PSY 102 | Introduction to Psychology | 2 | Social Sciences (Gen. Education) | SDG 3 |
| **11** | None | HSS 424 | Engineering Ethics | 2+0 | Civics and Community Engagement (Gen. Education) | SDG 16 | 12 | None | HSS 424 | Engineering Ethics | 2 | Civics and Community Engagement (Gen. Education) | SDG 16 |
| **12** | None | MGT 421 | Leadership | 2+0 | Civics and Community Engagement (Gen. Education) | SDG 4, SDG 8 | 13 | None | MGT 421 | Leadership | 2 | Civics and Community Engagement (Gen. Education) | SDG 4, SDG 8 |
| **13** | None | MGT 422 | Personal Grooming | 2+0 | Civics and Community Engagement (Gen. Education) | SDG 8 | 14 | None | MGT 422 | Personal Grooming | 2 | Civics and Community Engagement (Gen. Education) | SDG 8 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **14** | None | HSS 456 | Organizational Behavior | 2+0 | Civics and Community Engagement (Gen. Education) | SDG 8 | 15 | None | HSS 541 | Organizational Behavior | 2 | Civics and Community Engagement (Gen. Education) | SDG 8 |

**C. List of Management Science Electives**

| **Sr. No.** | **Existing Road Map** | | | | | | **Sr. No.** | **Proposed Road Map aligned with PEC Roadmap 2023 and HEC** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment |
| **1** | None | HSS 412 | Engineering Economics | 2+0 | Entrepreneurship (Gen. Education) | SDG 8 | 1 | None | HSS 412 | Engineering Economics | 2 | Entrepreneurship (Gen. Education) | SDG 8 |
| **2** | None | HSS 423 | Entrepreneurship | 2+0 | Entrepreneurship (Gen. Education) | SDG 12 | 2 | None | HSS 423 | Entrepreneurship | 2 | Entrepreneurship (Gen. Education) | SDG 12 |
| **3** | None | MGT 426 | Sales and Marketing Strategies for Engineers | 2+0 | Entrepreneurship (Gen. Education) | SDG 8, SDG 9 | 3 | None | MGT 426 | Sales and Marketing Strategies for Engineers | 2 | Entrepreneurship (Gen. Education) | SDG 8, SDG 9 |
| **4** | None | MGT 111 | Principles of Management | 2+0 | General Education | SDG 8, SDG 9 | 4 | None | EMG 111 | Principles of Management | 2 | General Education | SDG 8, SDG 9 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **5** | None | MGT 423 | Engineering Management | 2+0 | General Education | SDG 8, SDG 9 | 5 | None | MGT 427 | Engineering Management | 2 | General Education | SDG 8, SDG 9 |
| **6** | None | MGT 425 | Project Management in Engineering | 2+0 | General Education | SDG 8, SDG 9 | 6 | None | MGT 428 | Project Management in Engineering | 2 | General Education | SDG 8, SDG 9 |

**Engineering Domain Electives**

**A. <u>List of Computing and Information Science Elective Courses</u>**

| **Sr. No.** | **Existing Road Map** | | | | | | **Sr. No.** | **Proposed Road Map aligned with PEC Roadmap 2023 and HEC** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Prerequisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment | | Prerequisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment |
| 1. | CSC 112 | CSC 210 | Object Oriented Programming | 3+1 | Interdisciplinary | SDG 4, SDG 9 | 1. | CSC 112 | CSC 210 | Object Oriented Programming | 3 | Interdisciplinary | SDG 4, SDG 9 |
| 2. | CSC 112 | CSC 210 | Object Oriented Programming | 3+1 | Interdisciplinary | SDG 4, SDG 9 | 2. | CSC 112 | CSL 210 | Object Oriented Programming Lab | 1 | Interdisciplinary | SDG 4, SDG 9 |
| 3. | CSC 112 | CSC 221 | Data structure and | 3+1 | Interdisciplinary | SDG 4, SDG 9 | 3. | CSC 112 | CSC 221 | Data structure and | 3 | Interdisciplinary | SDG 4, SDG 9 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Algorithm | | | | | | | Algorithm | | | |
| 4. | CSC 112 | CSC 221 | Data structure and Algorithm | 3+1 | Interdisciplinary | SDG 4, SDG 9 | 4. | CSC 112 | CSL 221 | Data structure and Algorithm Lab | 1 | Interdisciplinary | SDG 4, SDG 9 |
| 5. | None | CSC 320 | Operating Systems | 3+1 | Interdisciplinary | SDG 4, SDG 9 | 5. | None | CSC 320 | Operating Systems | 3 | Interdisciplinary | SDG 4, SDG 9 |
| 6. | None | CSC 320 | Operating Systems | 3+1 | Interdisciplinary | SDG 4, SDG 9 | 6. | None | CSL 320 | Operating Systems Lab | 1 | Interdisciplinary | SDG 4, SDG 9 |
| 7. | None | EET 462 | Cryptography and Network Security | 3+0 | Interdisciplinary | SDG 9, SDG 16 | 7. | None | EET 462 | Cryptography and Network Security | 3 | Interdisciplinary | SDG 9, SDG 16 |
| 8. | None | ITC 411 | Cyber Security | 3+0 | Interdisciplinary | SDG 9, SDG 16 | 8. | None | ITC 411 | Cyber Security | 3 | Interdisciplinary | SDG 9, SDG 16 |
| 9. | None | CEN 409 | Artificial Intelligence & Machine Learning | 3+0 | Interdisciplinary | SDG 4, SDG 9 | 9. | None | CEN 409 | Artificial Intelligence & Machine Learning | 3 | Interdisciplinary | SDG 4, SDG 9 |
| | | | | | | | 10. | None | CSC 488 | Big Data Analytics | 3 | Interdisciplinary | SDG 4, SDG 9 |

**List of MDEE Elective Courses**

| Sr. No. | Existing Road Map | | | | | | Sr. No. | Proposed Road Map aligned with PEC Roadmap 2023 and HEC | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment |
| **1** | None | ESC 111 | Basic Mechanical Engineering | 2+0 | Interdisciplinary | SDG 7, SDG 9 | 1 | None | ESC 111 | Basic Mechanical Engineering | 2 | Interdisciplinary | SDG 7, SDG 9 |
| **2** | None | GSC 104 | Surveying and Leveling | 2+0 | Interdisciplinary | SDG 9 | 2 | None | GSC 486 | Geographical Information System | 2 | Interdisciplinary | SDG 11, SDG 15 |
| **3** | None | GSC 486 | Geographical Information System | 2+0 | Interdisciplinary | SDG 11, SDG 15 | 3 | None | ENV 440 | Energy and Environment | 2 | Interdisciplinary | SDG 7, SDG 13 |
| **4** | None | ENV 440 | Energy and Environment | 2+0 | Interdisciplinary | SDG 7, SDG 13 | 4 | None | MTE 101 | Maritime Technologies | 2 | Interdisciplinary | SDG 14 |
| **5** | None | MTE 101 | Maritime Technologies | 2+0 | Interdisciplinary | SDG 14 | 5 | None | EEN 450 | Introduction to Sports Engineering | 3 | Interdisciplinary | SDG 9 |
| **6** | None | EEN 450 | Introduction to Sports Engineering | 3+0 | Interdisciplinary | SDG 9 | 6 | None | EEN 438 | Introduction to Biomedical Engineering | 3 | Interdisciplinary | SDG 3, SDG 9 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **7** | None | EEN 438 | Introduction to Biomedical Engineering | 3+0 | Interdisciplinary | SDG 3, SDG 9 | 7 | None | CSC 410 | Introduction to Cloud Computing | 3 | Interdisciplinary | SDG 9 |
| **8** | None | CSC 488 | Big Data Analytics | 3+0 | Interdisciplinary | SDG 9, SDG 17 | 8 | None | EET 461 | Industrial Internet Of Things (IIoTs) | 3 | Interdisciplinary | SDG 9 |
| **9** | None | CSC 410 | Introduction to Cloud Computing | 3+0 | Interdisciplinary | SDG 9 | | | | | | | |
| **10** | None | EET 461 | Industrial Internet Of Things (IIoTs) | 3+0 | Interdisciplinary | SDG 9 | | | | | | | |

**A. <u>List of Breadth Core Elective Courses</u>**

**1. Electronics Engineering**

| **Sr. No.** | **Existing Road Map** | | | | | | **Sr. No.** | **Proposed Road Map aligned with PEC Roadmap 2023 and HEC** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment |
| 1. | EEN 224 | EEP 468 | Power Electronics | 3+1 | Major/Disciplinary | SDG 7, SDG 9 | 1. | EEN 224 | EEP 468 | Power Electronics | 3 | Major/Disciplinary | SDG 7, SDG 9 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2. | EEN 224 | EEP 468 | Power Electronics | 3+1 | Major/Disciplinary | SDG 7, SDG 9 | 2. | EEN 224 | EEL 468 | Power Electronics Lab | 1 | Major/Disciplinary | SDG 7, SDG 9 |
| 3. | EEN 313 | EEN 325 | Digital Signal Processing | 3+1 | Major/Disciplinary | SDG 9 | 3. | EEN 224 | EEN 225 | Electronic Circuit Design | 3 | Major/Disciplinary | SDG 9 |
| 4. | EEN 313 | EEN 325 | Digital Signal Processing | 3+1 | Major/Disciplinary | SDG 9 | 4. | EEN 224 | EEL 225 | Electronic Circuit Design Lab | 1 | Major/Disciplinary | SDG 9 |

**2. Telecommunication Engineering**

| **Sr. No.** | **Existing Road Map** | | | | | | **Sr. No.** | **Proposed Road Map aligned with PEC Roadmap 2023 and HEC** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment |
| 1. | None | CEN 223 | Computer Communication & Networks | 3+1 | Major/Disciplinary | SDG 9 | 1. | None | CEN 223 | Computer Communication & Networks | 3 | Major/Disciplinary | SDG 9 |
| 2. | None | CEN 223 | Computer Communication & Networks | 3+1 | Major/Disciplinary | SDG 9 | 2. | None | CEL 223 | Computer Communication & Networks Lab | 1 | Major/Disciplinary | SDG 9 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3. | EEN 313 | EEN 325 | Digital Signal Processing | 3+1 | Major/Disciplinary | SDG 9 | 3. | EEN 224 | EEN 225 | Electronic Circuit Design | 3 | Major/Disciplinary | SDG 9 |
| 4. | EEN 313 | EEN 325 | Digital Signal Processing | 3+1 | Major/Disciplinary | SDG 9 | 4. | EEL 224 | EEN 225 | Electronic Circuit Design Lab | 1 | Major/Disciplinary | SDG 9 |

**3. Power Engineering**

| **Sr. No.** | **Existing Road Map** | | | | | | **Sr. No.** | **Proposed Road Map aligned with PEC Roadmap 2023 and HEC** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Prerequisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment | | Prerequisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment |
| **1.** | EEN 211 | EEP 331 | Power System Analysis | 3+1 | Major/Disciplinary | SDG 7, SDG 9 | 1. | EEN 211 | EEP 331 | Power System Analysis | 3 | Major/Disciplinary | SDG 7, SDG 9 |
| **2.** | EEN 211 | EEP 331 | Power System Analysis | 3+1 | Major/Disciplinary | SDG 7, SDG 9 | 2. | EEN 211 | EEL 331 | Power System Analysis Lab | 1 | Major/Disciplinary | SDG 7, SDG 9 |
| **3.** | EEN 219 | EEN 433 | Power Distribution and Utilization | 3+1 | Major/Disciplinary | SDG 7, SDG 11 | 3. | EEN 312 | EEP 442 | Power Generation | 3 | Major/Disciplinary | SDG 7, SDG 9 SDG 11 |
| **4.** | EEN 312 | EEN 433 | Power Distribution and Utilization | 3+1 | Major/Disciplinary | SDG 7, SDG 11 | 4. | EEN 312 | EEL 472 | Power Generation Lab | 1 | Major/Disciplinary | SDG 7, SDG 9 SDG 11 |

**4. Electrical Vehicles**

| Sr. No. | Proposed Road Map aligned with PEC Roadmap 2023 and HEC | | | | | |
|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment |
| **1.** | EEN XXX | EEN 409 | Automotive Engineering | 3 | Major/Disciplinary | SDG 7, SDG 9 |
| **2.** | EEN XXX | EEL 409 | Automotive Engineering Lab | 1 | Major/Disciplinary | SDG 7, SDG 9 |
| **3.** | EEN XXX | EEV 410 | EV Charging Devices and Technologies | 3 | Major/Disciplinary | SDG 7, SDG 9, SDG 11 |
| **4.** | EEN XXX | EEL 410 | EV Charging Devices and Technologies Lab | 1 | Major/Disciplinary | SDG 7, SDG 9, SDG 11 |

**5. Computer Systems**

| Sr. No. | Proposed Road Map aligned with PEC Roadmap 2023 and HEC | | | | | |
|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment |
| **1.** | None | CEN 223 | Computer Communication & Networks | 3 | Major/Disciplinary | SDG 7, SDG 9 |
| **2.** | None | CEL 223 | Computer Communication & Networks | 1 | Major/Disciplinary | SDG 7, SDG 9 |
| **3.** | None | CSC 320 | Operating Systems | 3 | Major/Disciplinary | SDG 7, SDG 11 |
| **4.** | None | CSL 320 | Operating Systems Lab | 1 | Major/Disciplinary | SDG 7, SDG 11 |

**B. List of Depth Elective Courses (3+0/1)/Flexible Elective I (3+0)**

**1. Electronics Engineering**

| Sr. No. | Existing Road Map | | | | | | Sr. No. | Proposed Road Map aligned with PEC Roadmap 2023 and HEC | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment |
| 1. | EEN 224 | EEN 466 | Introduction to Nano Technology | 3+0 | Major/Disciplinary | SDG 9 | 1. | EEN 224 | EEN 466 | Introduction to Nano Technology | 3 | Major/Disciplinary | SDG 9 |
| 2. | EEN 313 | CEN 444 | Digital Image Processing | 3+0 | Major/Disciplinary | SDG 9 | 2. | EEN 313 | CEN 444 | Digital Image Processing | 3 | Major/Disciplinary | SDG 9 |
| 3. | EEN 325 | ESC 471 | Biomedical Instrumentation | 3+0 | Major/Disciplinary | SDG 3, SDG 9 | 3. | EEN 325 | ESC 471 | Biomedical Instrumentation | 3 | Major/Disciplinary | SDG 3, SDG 9 |
| 4. | None | ESC 472 | Medical Robots | 3+0 | Major/Disciplinary | SDG 3, SDG 9 | 4. | None | ESC 472 | Medical Robots | 3 | Major/Disciplinary | SDG 3, SDG 9 |
| 5. | None | CSC 464 | Computer Vision | 3+0 | Major/Disciplinary | SDG 9 | 5. | None | CSC 464 | Computer Vision | 3 | Major/Disciplinary | SDG 9 |
| 6. | None | EEN 451 | System Engineering | 3+0 | Major/Disciplinary | SDG 9 | 6. | None | EEN 451 | System Engineering | 3 | Major/Disciplinary | SDG 9 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7. | EEN 224 | EEN 316 | Instrumentation and measurement | 3+1 | Major/Disciplinary | SDG 9 | 7. | EEN 224 | EEN 316 | Instrumentation and measurement | 3 | Major/Disciplinary | SDG 9 |
| 8. | EEN 224 | EEN 316 | Instrumentation and measurement | 3+1 | Major/Disciplinary | SDG 9 | 8. | EEN 224 | EEL 316 | Instrumentation and measurement Lab | 1 | Major/Disciplinary | SDG 9 |
| 9. | EEN 224 | EEN 462 | Integrated Electronics | 3+1 | Major/Disciplinary | SDG 9 | 9. | EEN 224 | EEN 462 | Integrated Electronics | 3 | Major/Disciplinary | SDG 9 |
| 10. | EEN 224 | EEN 462 | Integrated Electronics | 3+1 | Major/Disciplinary | SDG 9 | 10. | EEN 224 | EEL 462 | Integrated Electronics Lab | 1 | Major/Disciplinary | SDG 9 |
| 11. | None | EEN 441 | Industrial Process Control | 3+1 | Major/Disciplinary | SDG 9 | 11. | None | EEN 441 | Industrial Process Control | 3 | Major/Disciplinary | SDG 9 |
| 12. | None | EEN 441 | Industrial Process Control | 3+1 | Major/Disciplinary | SDG 9 | 12. | None | EEL 441 | Industrial Process Control Lab | 1 | Major/Disciplinary | SDG 9 |
| 13. | EEN 224 | EEN 442 | Digital Electronics | 3+1 | Major/Disciplinary | SDG 9 | 13. | EEN 224 | EEN 442 | Digital Electronics | 3 | Major/Disciplinary | SDG 9 |
| 14. | EEN 224 | EEN 442 | Digital Electronics | 3+1 | Major/Disciplinary | SDG 9 | 14. | EEN 224 | EEL 442 | Digital Electronics Lab | 1 | Major/Disciplinary | SDG 9 |
| 15. | EEN 224 | EEN 444 | Opto Electronics | 3+1 | Major/Disciplinary | SDG 9 | 15. | EEN 224 | EEN 444 | Opto Electronics | 3 | Major/Disciplinary | SDG 9 |
| 16. | EEN 224 | EEN 444 | Opto Electronics | 3+1 | Major/Disciplinary | SDG 9 | 16. | EEN 224 | EEL 444 | Opto Electronics Lab | 1 | Major/Disciplinary | SDG 9 |
| 17. | EEN 224 | CEN 452 | VLSI Design | 3+1 | Major/Disciplinary | SDG 9 | 17. | EEN 224 | CEN 452 | VLSI Design | 3 | Major/Disciplinary | SDG 9 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18. | EEN 224 | CEN 452 | VLSI Design | 3+1 | Major/Disciplinary | SDG 9 | 18. | EEN 224 | CEL 452 | VLSI Design Lab | 1 | Major/Disciplinary | SDG 9 |
| 19. | EEN 224 | EEN 445 | Industrial Electronics | 3+1 | Major/Disciplinary | SDG 9 | 19. | EEN 224 | EEN 445 | Industrial Electronics | 3 | Major/Disciplinary | SDG 9 |
| 20. | EEN 224 | EEN 445 | Industrial Electronics | 3+1 | Major/Disciplinary | SDG 9 | 20. | EEN 224 | EEL 445 | Industrial Electronics Lab | 1 | Major/Disciplinary | SDG 9 |
| 21. | CEN 120 | CEN 442 | Digital System Design | 3+1 | Major/Disciplinary | SDG 9 | 21. | CEN 120 | CEN 442 | Digital System Design | 3 | Major/Disciplinary | SDG 9 |
| 22. | CEN 120 | CEN 442 | Digital System Design | 3+1 | Major/Disciplinary | SDG 9 | 22. | CEN 120 | CEL 442 | Digital System Design Lab | 1 | Major/Disciplinary | SDG 9 |
| 23. | EEN 224 | EEN 469 | Linear Integrated Circuits & Applications | 3+1 | Major/Disciplinary | SDG 9 | 23. | EEN 224 | EEN 469 | Linear Integrated Circuits & Applications | 3 | Major/Disciplinary | SDG 9 |
| 24. | EEN 224 | EEN 469 | Linear Integrated Circuits & Applications | 3+1 | Major/Disciplinary | SDG 9 | 24. | EEN 224 | EEL 469 | Linear Integrated Circuits & Applications Lab | 1 | Major/Disciplinary | SDG 9 |
| 25. | EEN 224 | EEN 435 | Solid State Devices | 3+1 | Major/Disciplinary | SDG 9 | 25. | EEN 224 | EEN 435 | Solid State Devices | 3 | Major/Disciplinary | SDG 9 |
| 26. | EEN 224 | EEN 435 | Solid State Devices | 3+1 | Major/Disciplinary | SDG 9 | 26. | EEN 224 | EEL 435 | Solid State Devices Lab | 3 | Major/Disciplinary | SDG 9 |
| 27. | EEN 412 | EEN 437 | Digital Control Systems | 3+1 | Major/Disciplinary | SDG 9 | 27. | EEN 412 | EEN 437 | Digital Control Systems | 3 | Major/Disciplinary | SDG 9 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28. | EEN 412 | EEN 437 | Digital Control Systems | 3+1 | Major/Disciplinary | SDG 9 | 28. | EEN 412 | EEL 437 | Digital Control Systems Lab | 1 | Major/Disciplinary | SDG 9 |
| 29. | EEN 312 | EEN 433 | Power Distribution and Utilization | 3+1 | Major/Disciplinary | SDG 7, SDG 11 | 29. | CEN 120 | CEN 441 | FPGA Based System Design | 3 | Major/Disciplinary | SDG 9 |
| 30. | EEN 312 | EEN 433 | Power Distribution and Utilization | 3+1 | Major/Disciplinary | SDG 7, SDG 11 | 30. | CEN 120 | CEL 441 | FPGA Based System Design Lab | 1 | Major/Disciplinary | SDG 9 |
| 31. | CEN 120 | CEN 441 | FPGA Based System Design | 3+1 | Major/Disciplinary | SDG 9 | 31. | EEN 312 | EEN 420 | Industrial Automation | 3 | Major/Disciplinary | SDG 9 |
| 32. | CEN 120 | CEN 441 | FPGA Based System Design | 3+1 | Major/Disciplinary | SDG 9 | 32. | EEN 312 | EEL 420 | Industrial Automation Lab | 1 | Major/Disciplinary | SDG 9 |
| 33. | EEN 219 | EEN 420 | Industrial Automation | 3+1 | Major/Disciplinary | SDG 9 | 33. | EEN 224 | EEN 471 | Microelectronics Technology | 3 | Major/Disciplinary | SDG 9 |
| 34. | EEN 312 | EEN 420 | Industrial Automation | 3+1 | Major/Disciplinary | SDG 9 | 34. | EEN 224 | EEL 471 | Microelectronics Technology Lab | 1 | Major/Disciplinary | SDG 9 |
| 35. | EEN 224 | EEN 471 | Microelectronics Technology | 3+1 | Major/Disciplinary | SDG 9 | 35. | None | CEN 223 | Computer Communication & Networking | 3 | Major/Disciplinary | SDG 9 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36. | EEN 224 | EEN 471 | Microelectronics Technology | 3+1 | Major/Disciplinary | SDG 9 | 36. | None | CEL 223 | Computer Communication & Networking Lab | 1 | Major/Disciplinary | SDG 9 |
| 37. | None | CEN 223 | Computer Communication & Networking | 3+1 | Major/Disciplinary | SDG 9 | 37. | None | CEN 458 | Robotics | 3 | Major/Disciplinary | SDG 9 |
| 38. | None | CEN 223 | Computer Communication & Networking | 3+1 | Major/Disciplinary | SDG 9 | 38. | None | CEL 458 | Robotics Lab | 1 | Major/Disciplinary | SDG 9 |
| 39. | None | CEN 458 | Robotics | 3+1 | Major/Disciplinary | SDG 9 | 39. | EEN 311 | EET 451 | Wave Propagation and Antennas | 3 | Major/Disciplinary | SDG 9 |
| 40. | None | CEN 458 | Robotics | 3+1 | Major/Disciplinary | SDG 9 | 40. | EEN 311 | EEL 451 | Wave Propagation and Antennas Lab | 1 | Major/Disciplinary | SDG 9 |
| 41. | EEN 311 | EET 451 | Wave Propagation and Antennas | 3+1 | Major/Disciplinary | SDG 9 | 41. | EEN 311 | EEN 431 | RF and Microwave Engineering | 3 | Major/Disciplinary | SDG 9 |
| 42. | EEN 311 | EET 451 | Wave Propagation and Antennas | 3+1 | Major/Disciplinary | SDG 9 | 42. | EEN 311 | EEL 431 | RF and Microwave Engineering Lab | 1 | Major/Disciplinary | SDG 9 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 43. | EEN XXX | EEN 453 | Micro Electromechanical Systems (MEMS) | 3 | Major/Disciplinary | SDG 9 |
| | | | | | | | 44. | EEN XXX | EEL 453 | Micro Electromechanical Systems (MEMS) Lab | 1 | Major/Disciplinary | SDG 9 |

## 2. Telecommunication Engineering

| Sr. No. | Existing Road Map | | | | | | Sr. No. | Proposed Road Map aligned with PEC Roadmap 2023 and HEC | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment. | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment. |
| 1. | None | EET 471 | Emerging Wireless Technologies and RF planning | 3+0 | Major/Disciplinary | SDG 9 | 1. | None | EET 471 | Emerging Wireless Technologies and RF planning | 3 | Major/Disciplinary | SDG 9 |
| 2. | None | EET 472 | Telecommunication policies and standards | 3+0 | Major/Disciplinary | SDG 9 | 2. | None | EET 472 | Telecommunication policies and standards | 3 | Major/Disciplinary | SDG 9 |
| 3. | None | EET 459 | Introduction to Block chain | 3+0 | Major/Disciplinary | SDG 9 | 3. | None | EET 459 | Introduction to Block chain | 3 | Major/Disciplinary | SDG 9 |
| 4. | None | EEN 451 | System Engineering | 3+0 | Major/Disciplinary | SDG 9 | 4. | None | EEN 451 | System Engineering | 3 | Major/Disciplinary | SDG 9 |
| 5. | None | CSC 464 | Computer Vision | 3+0 | Major/Disciplinary | SDG 9 | 5. | None | CSC 464 | Computer Vision | 3 | Major/Disciplinary | SDG 9 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6. | None | EET 456 | Telecom Transmission and Switching Systems | 3+0 | Major/Disciplinary | SDG 9 | 6. | None | EET 456 | Telecom Transmission and Switching Systems | 3 | Major/Disciplinary | SDG 9 |
| 7. | EEN 313 | CEN 444 | Digital Image Processing | 3+0 | Major/Disciplinary | SDG 9 | 7. | EEN 313 | CEN 444 | Digital Image Processing | 3 | Major/Disciplinary | SDG 9 |
| 8. | EEN 311 | EEN 431 | RF and Microwave Engineering | 3+1 | Major/Disciplinary | SDG 9 | 8. | EEN 311 | EEN 431 | RF and Microwave Engineering | 3 | Major/Disciplinary | SDG 9 |
| 9. | EEN 311 | EEN 431 | RF and Microwave Engineering | 3+1 | Major/Disciplinary | SDG 9 | 9. | EEN 311 | EEL 431 | RF and Microwave Engineering Lab | 1 | Major/Disciplinary | SDG 9 |
| 10. | None | EET 463 | Optical Fiber Communication | 3+1 | Major/Disciplinary | SDG 9 | 10. | None | EET 463 | Optical Fiber Communication | 3 | Major/Disciplinary | SDG 9 |
| 11. | None | EET 463 | Optical Fiber Communication | 3+1 | Major/Disciplinary | SDG 9 | 11. | None | EEL 463 | Optical Fiber Communication Lab | 1 | Major/Disciplinary | SDG 9 |
| 12. | EEN 311 | EET 447 | Radar Systems | 3+1 | Major/Disciplinary | SDG 9 | 12. | EEN 311 | EET 447 | Radar Systems | 3 | Major/Disciplinary | SDG 9 |
| 13. | EEN 311 | EET 447 | Radar Systems | 3+1 | Major/Disciplinary | SDG 9 | 13. | EEN 311 | EEL 447 | Radar Systems Lab | 1 | Major/Disciplinary | SDG 9 |
| 14. | EET 321 | EEN 436 | Wireless and Mobile Communication | 3+1 | Major/Disciplinary | SDG 9 | 14. | EET 321 | EEN 436 | Wireless and Mobile Communication | 3 | Major/Disciplinary | SDG 9 |
| 15. | EET 321 | EEN 436 | Wireless and Mobile Communication | 3+1 | Major/Disciplinary | SDG 9 | 15. | EET 321 | EEL 436 | Wireless and Mobile Communication Lab | 1 | Major/Disciplinary | SDG 9 |
| 16. | EET 321 | EET 449 | Satellite Communications | 3+1 | Major/Disciplinary | SDG 9 | 16. | EET 321 | EET 449 | Satellite Communications | 3 | Major/Disciplinary | SDG 9 |
| 17. | EET 321 | EET 449 | Satellite Communications | 3+1 | Major/Disciplinary | SDG 9 | 17. | EET 321 | EEL 449 | Satellite Communications | 1 | Major/Disciplinary | SDG 9 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Lab | | | |
| 18. | EEN 311 | EET 451 | Wave Propagation and Antennas | 3+1 | Major/Disciplinary | SDG 9 | 18. | EEN 311 | EET 451 | Wave Propagation and Antennas | 3 | Major/Disciplinary | SDG 9 |
| 19. | EEN 311 | EET 451 | Wave Propagation and Antennas | 3+1 | Major/Disciplinary | SDG 9 | 19. | EEN 311 | EEL 451 | Wave Propagation and Antennas Lab | 1 | Major/Disciplinary | SDG 9 |
| 20. | CEN 223 | EET 452 | Multimedia Communications | 3+1 | Major/Disciplinary | SDG 9 | 20. | CEN 223 | EET 452 | Multimedia Communications | 3 | Major/Disciplinary | SDG 9 |
| 21. | CEN 223 | EET 452 | Multimedia Communications | 3+1 | Major/Disciplinary | SDG 9 | 21. | CEN 223 | EEL 452 | Multimedia Communications Lab | 1 | Major/Disciplinary | SDG 9 |
| 22. | None | CSC 453 | Information Theory | 3+1 | Major/Disciplinary | SDG 9 | 22. | None | CSC 453 | Information Theory | 3 | Major/Disciplinary | SDG 9 |
| 23. | None | CSC 453 | Information Theory | 3+1 | Major/Disciplinary | SDG 9 | 23. | None | CSL 453 | Information Theory Lab | 1 | Major/Disciplinary | SDG 9 |
| 24. | CEN223 | EEN 434 | Computer Networks | 3+1 | Major/Disciplinary | SDG 9 | 24. | CEN223 | EEN 434 | Computer Networks | 3 | Major/Disciplinary | SDG 9 |
| 25. | CEN223 | EEN 434 | Computer Networks | 3+1 | Major/Disciplinary | SDG 9 | 25. | CEN223 | EEL 434 | Computer Networks Lab | 1 | Major/Disciplinary | SDG 9 |
| 26. | EET 321 | EET 411 | Digital Communications | 3+1 | Major/Disciplinary | SDG 9 | 26. | EET 321 | EET 411 | Digital Communications | 3 | Major/Disciplinary | SDG 9 |
| 27. | EET 321 | EET 411 | Digital Communications | 3+1 | Major/Disciplinary | SDG 9 | 27. | EET 321 | EEL 411 | Digital Communications Lab | 1 | Major/Disciplinary | SDG 9 |
| 28. | CEN 120 | CEN 441 | FPGA Based System Design | 3+1 | Major/Disciplinary | SDG 9 | 28. | CEN 120 | CEN 441 | FPGA Based System Design | 3 | Major/Disciplinary | SDG 9 |
| 29. | CEN 120 | CEN 441 | FPGA Based System Design | 3+1 | Major/Disciplinary | SDG 9 | 29. | CEN 120 | CEL 441 | FPGA Based System Design Lab | 1 | Major/Disciplinary | SDG 9 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30. | EEN 224 | EEN 469 | Linear Integrated Circuits and Applications | 3+1 | Major/Disciplinary | SDG 9 | 30. | EEN 224 | EEN 469 | Linear Integrated Circuits and Applications | 3 | Major/Disciplinary | SDG 9 |
| 31. | EEN 224 | EEN 469 | Linear Integrated Circuits and Applications | 3+1 | Major/Disciplinary | SDG 9 | 31. | EEN 224 | EEL 469 | Linear Integrated Circuits and Applications | 1 | Major/Disciplinary | SDG 9 |
| 32. | EEN 224 | EEN 316 | Instrumentation and measurement | 3+1 | Major/Disciplinary | SDG 9 | 32. | EEN 224 | EEN 316 | Instrumentation and measurement | 3 | Major/Disciplinary | SDG 9 |
| 33. | EEN 224 | EEN 316 | Instrumentation and measurement | 3+1 | Major/Disciplinary | SDG 9 | 33. | EEN 224 | EEL 316 | Instrumentation and measurement Lab | 1 | Major/Disciplinary | SDG 9 |
| 34. | None | EEN 464 | Introduction to Quantum Computing Reorganization | 3+1 | Major/Disciplinary | SDG 9 | 34. | None | EEN 464 | Introduction to Quantum Computing Reorganization | 3 | Major/Disciplinary | SDG 9 |
| 35. | None | EEN 464 | Introduction to Quantum Computing Reorganization | 3+1 | Major/Disciplinary | SDG 9 | 35. | None | EEL 464 | Introduction to Quantum Computing Reorganization Lab | 1 | Major/Disciplinary | SDG 9 |
| | | | | | | | 36. | EET 321 | EET 407 | Next Generation Networks | 3 | Major/Disciplinary | SDG 9 |
| | | | | | | | 37. | EET 321 | CEN 449 | Internet of Things | 3 | Major/Disciplinary | SDG 9 |

### 3. Power Engineering

| Sr. No | Existing Road Map | | | | | | Sr. No | Proposed Road Map aligned with PEC Roadmap 2023 and HEC | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre | Cours | Course Title | Cred | HEC Category | 17 UN | | Pre | Cours | Course Title | Cred | HEC Category | 17 UN |

| . | requisite Course Code | e Code | | it Hours | | SDGs alignment | . | requisite Course Code | e Code | | it Hours | | SDGs alignment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | EEP 331 | EEP 445 | Power System Stability & Control | 3+0 | Major/Disciplinary | SDG 7, SDG 9 | 1. | EEP 331 | EEP 445 | Power System Stability & Control | 3 | Major/Disciplinary | SDG 7, SDG 9 |
| 2. | None | EEP 474 | Smart Grid | 3+0 | Major/Disciplinary | SDG 7, SDG 9 | 2. | None | EEP 474 | Smart Grid | 3 | Major/Disciplinary | SDG 7, SDG 9 |
| 3. | None | EEN 441 | Industrial Process Control | 3+0 | Major/Disciplinary | SDG 9 | 3. | None | EEN 441 | Industrial Process Control | 3 | Major/Disciplinary | SDG 9 |
| 4. | None | EEP 449 | Distributed Generation and its Grid Integration | 3+0 | Major/Disciplinary | SDG 7, SDG 9 | 4. | None | EEP 449 | Distributed Generation and its Grid Integration | 3 | Major/Disciplinary | SDG 7, SDG 9 |
| 5. | None | EEP 450 | Power System Economics | 3+0 | Major/Disciplinary | SDG 8, SDG 9 | 5. | None | EEP 450 | Power System Economics | 3 | Major/Disciplinary | SDG 8, SDG 9 |
| 6. | None | EEP 451 | Optimization Methods in Modern Power Systems | 3+0 | Major/Disciplinary | SDG 9 | 6. | None | EEP 451 | Optimization Methods in Modern Power Systems | 3 | Major/Disciplinary | SDG 9 |
| 7. | None | EEP 452 | LV and HV Electrical Installation guides and | 3+0 | Major/Disciplinary | SDG 9 | 7. | None | EEP 452 | LV and HV Electrical Installation guides and | 3 | Major/Disciplinary | SDG 9 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Standards | | | | | | | Standards | | | |
| 8. | EEN 224 | EEN 316 | Instrumentation and measurement | 3+1 | Major/Disciplinary | SDG 9 | 8. | EEN 224 | EEN 316 | Instrumentation and measurement | 3 | Major/Disciplinary | SDG 9 |
| 9. | EEN 224 | EEN 316 | Instrumentation and measurement | 3+1 | Major/Disciplinary | SDG 9 | 9. | EEN 224 | EEL 316 | Instrumentation and measurement Lab | 1 | Major/Disciplinary | SDG 9 |
| 10. | EEN 312 | EEP 441 | Advanced Electrical Machines | 3+1 | Major/Disciplinary | SDG 9 | 10. | EEN 312 | EEP 441 | Advanced Electrical Machines | 3 | Major/Disciplinary | SDG 9 |
| 11. | EEN 312 | EEP 441 | Advanced Electrical Machines | 3+1 | Major/Disciplinary | SDG 9 | 11. | EEN 312 | EEL 471 | Advanced Electrical Machines Lab | 1 | Major/Disciplinary | SDG 9 |
| 12. | EEN 312 | EEP 442 | Power Generation | 3+1 | Major/Disciplinary | SDG 7, SDG 9 | 12. | EEN 312 | EEP 442 | Power Generation | 3 | Major/Disciplinary | SDG 7, SDG 9 |
| 13. | EEN 312 | EEP 442 | Power Generation | 3+1 | Major/Disciplinary | SDG 7, SDG 9 | 13. | EEN 312 | EEL 472 | Power Generation Lab | 1 | Major/Disciplinary | SDG 7, SDG 9 |
| 14. | EEN 433 | EEP 443 | Electrical Power Transmission | 3+1 | Major/Disciplinary | SDG 7, SDG 9 | 14. | EEN 433 | EEP 443 | Electrical Power Transmission | 3 | Major/Disciplinary | SDG 7, SDG 9 |
| 15. | EEN 433 | EEP 443 | Electrical Power Transmission | 3+1 | Major/Disciplinary | SDG 7, SDG 9 | 15. | EEN 433 | EEL 473 | Electrical Power Transmission Lab | 1 | Major/Disciplinary | SDG 7, SDG 9 |
| 16. | EEN | EEP | Power | 3+1 | Major/Disciplin | SDG 7, | 16. | EEN | EEP | Power | 3 | Major/Disciplin | SDG 7, |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 224 | 468 | Electronics | | ary | SDG 9 | | 224 | 468 | Electronics | | ary | SDG 9 |
| 17. | EEN 224 | EEP 468 | Power Electronics | 3+1 | Major/Disciplin ary | SDG 7, SDG 9 | 17. | EEN 224 | EEL 468 | Power Electronics Lab | 1 | Major/Disciplin ary | SDG 7, SDG 9 |
| 18. | EEP 331 | EEP 444 | Power System Protection | 3+1 | Major/Disciplin ary | SDG 7, SDG 9 | 18. | EEP 331 | EEP 444 | Power System Protection | 3 | Major/Disciplin ary | SDG 7, SDG 9 |
| 19. | EEP 331 | EEP 444 | Power System Protection | 3+1 | Major/Disciplin ary | SDG 7, SDG 9 | 19. | EEP 331 | EEL 474 | Power System Protection Lab | 1 | Major/Disciplin ary | SDG 7, SDG 9 |
| 20. | EEN 312 | EEP 471 | Electrical Machine Design and Maintenance | 3+1 | Major/Disciplin ary | SDG 9 | 20. | EEN 312 | EEP 471 | Electrical Machine Design and Maintenance | 3 | Major/Disciplin ary | SDG 9 |
| 21. | EEN 312 | EEP 471 | Electrical Machine Design and Maintenance | 3+1 | Major/Disciplin ary | SDG 9 | 21. | EEN 312 | EEL 471 | Electrical Machine Design and Maintenance Lab | 1 | Major/Disciplin ary | SDG 9 |
| 22. | EEN 211 | EEP 446 | High Voltage Engineering | 3+1 | Major/Disciplin ary | SDG 7, SDG 9 | 22. | EEN 211 | EEP 446 | High Voltage Engineering | 3 | Major/Disciplin ary | SDG 7, SDG 9 |
| 23. | EEN 211 | EEP 446 | High Voltage Engineering | 3+1 | Major/Disciplin ary | SDG 7, SDG 9 | 23. | EEN 211 | EEL 476 | High Voltage Engineering Lab | 1 | Major/Disciplin ary | SDG 7, SDG 9 |
| 24. | EEN 313 | EEN 325 | Digital Signal Processing | 3+1 | Major/Disciplin ary | SDG 9 | 24. | EEN 313 | EEN 325 | Digital Signal Processing | 3 | Major/Disciplin ary | SDG 9 |
| 25. | EEN 313 | EEN 325 | Digital Signal Processing | 3+1 | Major/Disciplin ary | SDG 9 | 25. | EEN 313 | EEL 325 | Digital Signal Processing | 1 | Major/Disciplin ary | SDG 9 |

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| 26. | EEN 224 | EEP 472 | Industrial Drives | 3+1 | Major/Disciplinary | SDG 9 | 26. | EEN 224 | EEP 472 | Industrial Drives | 3 | Major/Disciplinary | SDG 9 |
| 27. | EEN 224 | EEP 472 | Industrial Drives | 3+1 | Major/Disciplinary | SDG 9 | 27. | EEN 224 | EPL 472 | Industrial Drives Lab | 1 | Major/Disciplinary | SDG 9 |
| 28. | EEP 331 | EEP 475 | FACTS and HVDC Transmission | 3+1 | Major/Disciplinary | SDG 7, SDG 9 | 28. | EEP 331 | EEP 475 | FACTS and HVDC Transmission | 3 | Major/Disciplinary | SDG 7, SDG 9 |
| 29. | EEP 331 | EEP 475 | FACTS and HVDC Transmission | 3+1 | Major/Disciplinary | SDG 7, SDG 9 | 29. | EEP 331 | EPL 475 | FACTS and HVDC Transmission Lab | 1 | Major/Disciplinary | SDG 7, SDG 9 |
| 30. | None | CEN 223 | Computer Communication & Networking | 3+1 | Major/Disciplinary | SDG 9 | 30. | None | CEN 223 | Computer Communication & Networking | 3 | Major/Disciplinary | SDG 9 |
| 31. | None | CEN 223 | Computer Communication & Networking | 3+1 | Major/Disciplinary | SDG 9 | 31. | None | CEL 223 | Computer Communication & Networking Lab | 1 | Major/Disciplinary | SDG 9 |
| 32. | EEN 412 | EEN 437 | Digital Control System | 3+1 | Major/Disciplinary | SDG 9 | 32. | EEN 412 | EEN 437 | Digital Control System | 3 | Major/Disciplinary | SDG 9 |
| 33. | EEN 412 | EEN 437 | Digital Control System | 3+1 | Major/Disciplinary | SDG 9 | 33. | EEN 412 | EEL 437 | Digital Control System Lab | 1 | Major/Disciplinary | SDG 9 |
| 34. | EET 321 | EET 474 | Digital Communication System | 3+1 | Major/Disciplinary | SDG 9 | 34. | EET 321 | EET 474 | Digital Communication System | 3 | Major/Disciplinary | SDG 9 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35. | EET 321 | EET 474 | Digital Communication System | 3+1 | Major/Disciplinary | SDG 9 | 35. | EET 321 | ETL 474 | Digital Communication System Lab | 1 | Major/Disciplinary | SDG 9 |
| 36. | EEN 224 | EEN 469 | Linear Integrated Circuits and Applications | 3+1 | Major/Disciplinary | SDG 9 | 36. | EEN 224 | EEN 469 | Linear Integrated Circuits and Applications | 3 | Major/Disciplinary | SDG 9 |
| 37. | EEN 224 | EEN 469 | Linear Integrated Circuits and Applications | 3+1 | Major/Disciplinary | SDG 9 | 37. | EEN 224 | EEL 469 | Linear Integrated Circuits and Applications Lab | 1 | Major/Disciplinary | SDG 9 |
| 38. | EEN 224 | EEP 474 | PLC and Industrial Drives | 3+1 | Major/Disciplinary | SDG 9 | 38. | EEN 224 | EEP 476 | PLC and Industrial Drives | 3 | Major/Disciplinary | SDG 9 |
| 39. | EEN 224 | EEP 474 | PLC and Industrial Drives | 3+1 | Major/Disciplinary | SDG 9 | 39. | EEN 224 | EPL 476 | PLC and Industrial Drives Lab | 1 | Major/Disciplinary | SDG 9 |
| 40. | EEN 224 | EEN 445 | Industrial Electronics | 3+1 | Major/Disciplinary | SDG 7, SDG 9 | 40. | EEN 224 | EEN 445 | Industrial Electronics | 3 | Major/Disciplinary | SDG 7, SDG 9 |
| 41. | EEN 224 | EEN 445 | Industrial Electronics | 3+1 | Major/Disciplinary | SDG 7, SDG 9 | 41. | EEN 224 | EEL 445 | Industrial Electronics Lab | 1 | Major/Disciplinary | SDG 7, SDG 9 |
| 42. | None | EEN 434 | Computer Networks | 3+1 | Major/Disciplinary | SDG 9 | 42. | None | EEN 434 | Computer Networks | 3 | Major/Disciplinary | SDG 9 |
| 43. | None | EEN 434 | Computer Networks | 3+1 | Major/Disciplinary | SDG 9 | 43. | None | EEL 434 | Computer Networks Lab | 1 | Major/Disciplinary | SDG 9 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 44. | None | EEP 448 | Renewable Energy Systems | 3+1 | Major/Disciplinary | SDG 7, SDG 9 | 44. | None | EEP 448 | Renewable Energy Systems | 3 | Major/Disciplinary | SDG 7, SDG 9 |
| 45. | None | EEP 448 | Renewable Energy Systems | 3+1 | Major/Disciplinary | SDG 7, SDG 9 | 45. | None | EEL 448 | Renewable Energy Systems Lab | 1 | Major/Disciplinary | SDG 7, SDG 9 |

## 4. Electrical Vehicles

| Sr. No. | Proposed Road Map aligned with PEC Roadmap 2023 and HEC | | | | | |
|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment |
| 1. | EEN 224 | RIS 241 | Sensors and Actuators | 3 | Major/Disciplinary | SDG 9 |
| 2. | None | EEV 402 | Autonomous Vehicles | 3 | Major/Disciplinary | SDG 8, SDG 9 |
| 3. | EEN 313 | EEV 403 | Vehicular Networking | 3 | Major/Disciplinary | SDG 9, SDG 11 |
| 4. | GSC 113 | EEP 452 | LV and HV Electrical Installation guides and Standards | 3 | Major/Disciplinary | SDG 7, SDG 9 |
| 5. | EEN 312 | EEV 409 | Automotive Engineering | 3 | Major/Disciplinary | SDG 8, SDG 9 |
| 6. | EEN 433 | EEV 404 | EV batteries and Ancillaries | 3 | Major/Disciplinary | SDG 9 |
| 7. | EEN 433 | EVL 404 | EV batteries and Ancillaries Lab | 1 | Major/Disciplinary | SDG 9 |
| 8. | EEN 412 | EEV 405 | EV Control Systems | 3 | Major/Disciplinary | SDG 8, SDG 9 |
| 9. | EEN 412 | EVL 405 | EV Control Systems Lab | 1 | Major/Disciplinary | SDG 8, SDG 9 |
| 10. | EEN 412 | EEV 405 | EV Control Systems | 3 | Major/Disciplinary | SDG 8, SDG 9 |
| 11. | EEN 412 | EVL 405 | EV Control Systems Lab | 1 | Major/Disciplinary | SDG 8, SDG 9 |
| 12. | None | EEV 407 | EV Body and Chassis Design | 3 | Major/Disciplinary | SDG 9 |

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|---|---|---|---|---|---|---|
| 13. | None | EVL 407 | EV Body and Chassis Design Lab | 1 | Major/Disciplinary | SDG 9 |
| 14. | EEN 312 | EEV 408 | EV Dynamics | 3 | Major/Disciplinary | SDG 7, SDG 9 |
| 15. | EEN 312 | EVL 408 | EV Dynamics Lab | 1 | Major/Disciplinary | SDG 7, SDG 9 |
| 16. | EEN 224 | EEN 316 | Instrumentation and Measurements | 3 | Major/Disciplinary | SDG 9 |
| 17. | EEN 224 | EEL 316 | Instrumentation and Measurements Lab | 1 | Major/Disciplinary | SDG 9 |
| 18. | EEN 312 | EEP 441 | Advanced Electrical Machines | 3 | Major/Disciplinary | SDG 9 |
| 19. | EEN 312 | EEL 471 | Advanced Electrical Machines Lab | 1 | Major/Disciplinary | SDG 9 |
| 20. | EEN 312 | EEP 471 | Electrical Machine Design and Maintenance | 3 | Major/Disciplinary | SDG 9 |
| 21. | EEN 312 | EPL 471 | Electrical Machine Design and Maintenance Lab | 1 | Major/Disciplinary | SDG 9 |
| 22. | EEN 224 | EEP 472 | Industrial Drives | 3 | Major/Disciplinary | SDG 9 |
| 23. | EEN 224 | EPL 472 | Industrial Drives Lab | 1 | Major/Disciplinary | SDG 9 |
| 24. | EEP 331 | EEP 475 | FACTS and HVDC Transmission | 3 | Major/Disciplinary | SDG 9 |
| 25. | EEP 331 | EPL 475 | FACTS and HVDC Transmission Lab | 1 | Major/Disciplinary | SDG 9 |
| 26. | None | CEN 223 | Computer Communication & Networking | 3 | Major/Disciplinary | SDG 9 |

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|---|---|---|---|---|---|---|
| 27. | None | CEL 223 | Computer Communication & Networking Lab | 1 | Major/Disciplinary | SDG 9 |
| 28. | EEN 412 | EEN 437 | Digital Control System | 3 | Major/Disciplinary | SDG 9 |
| 29. | EEN 412 | EEL 437 | Digital Control System Lab | 1 | Major/Disciplinary | SDG 9 |
| 30. | EET 321 | EET 474 | Digital Communication System | 3 | Major/Disciplinary | SDG 9 |
| 31. | EET 321 | ETL 474 | Digital Communication System Lab | 1 | Major/Disciplinary | SDG 9 |
| 32. | EEN 224 | EEN 469 | Linear Integrated Circuits and Applications | 3 | Major/Disciplinary | SDG 9 |
| 33. | EEN 224 | EEL 469 | Linear Integrated Circuits and Applications Lab | 1 | Major/Disciplinary | SDG 9 |
| 34. | EEN 224 | EEP 476 | PLC and Industrial Drives | 3 | Major/Disciplinary | SDG 9 |
| 35. | EEN 224 | EPL 476 | PLC and Industrial Drives Lab | 1 | Major/Disciplinary | SDG 9 |
| 36. | EEN 224 | EEN 445 | Industrial Electronics | 3 | Major/Disciplinary | SDG 9 |
| 37. | EEN 224 | EEL 445 | Industrial Electronics Lab | 1 | Major/Disciplinary | SDG 9 |

**5. Computer Systems**

| Sr. No. | Proposed Road Map aligned with PEC Roadmap 2023 and HEC | | | | | |
|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment |
| 1. | CSC 112 | CSC 401 | Data base systems | 3 | Major/Disciplinary | SDG 9 |
| 2. | CEN 223 | CEN 444 | Digital Image Processing | 3 | Major/Disciplinary | SDG 9 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3. | None | CEN 222 | Data Communication and Networking | 3 | Major/Disciplinary | SDG 9 |
| 4. | None | CEL 222 | Data Communication and Networking Lab | 1 | Major/Disciplinary | SDG 9 |
| 5. | None | CSC 444 | Computer Graphics | 3 | Major/Disciplinary | SDG 9 |
| 6. | None | CSC 464 | Computer Vision | 3 | Major/Disciplinary | SDG 9 |
| 7. | EEN 313 | CSC 402 | Image and Video Coding | 3 | Major/Disciplinary | SDG 9 |
| 8. | EEN 313 | CSL 402 | Image and Video Coding Lab | 1 | Major/Disciplinary | SDG 9 |
| 9. | None | EET 473 | Network Protocols and Standards | 3 | Major/Disciplinary | SDG 9 |
| 10. | None | EEL 479 | Network Protocols and Standards Lab | 1 | Major/Disciplinary | SDG 9 |
| 11. | None | CEN 408 | System and Network Security | 3 | Major/Disciplinary | SDG 9 |
| 12. | None | CEL 408 | System and Network Security Lab | 1 | Major/Disciplinary | SDG 9 |
| 13. | CEN 120 | CSC 403 | Computer Organization | 3 | Major/Disciplinary | SDG 9 |
| 14. | None | CSC 327 | Computer Architecture | 3 | Major/Disciplinary | SDG 9 |
| 15. | None | CEN 442 | Digital System Design | 3 | Major/Disciplinary | SDG 9 |
| 16. | None | CEL 442 | Digital System Design Lab | 1 | Major/Disciplinary | SDG 9 |
| 17. | None | CEN 458 | Robotics | 3 | Major/Disciplinary | SDG 9 |
| 18. | None | CEL 458 | Robotics Lab | 1 | Major/Disciplinary | SDG 9 |
| 19. | None | EEN 452 | Unmanned Aerial Vehicles | 3 | Major/Disciplinary | SDG 9 |
| 20. | EEN 412 | EEN 437 | Digital Control System | 3 | Major/Disciplinary | SDG 9 |
| 21. | EEN 412 | EEL 437 | Digital Control System Lab | 1 | Major/Disciplinary | SDG 9 |
| 22. | EET 321 | CEN 449 | Internet of Things | 3 | Major/Disciplinary | SDG 9 |

## Course Outlines

| Course Name | Internet of Things (IoTs) | Credit Hours | 3 |
|---|---|---|---|
| **Course Code** | **EET 408** | **Prerequisite(s)** | **Communication Systems** |
| **Knowledge Domain** | **WK 4** | **SDGs** | **9** |
| Course Objective | This course provides a sound introduction to the Internet of Things (IoT) technologies and system design concepts. The course will focus on important IoT topics, which includes industrial standards, sensor/actuator/data devices, hardware, software, security, system design and performance analysis techniques. In future, IoT is expected to revolutionize many areas of human life i.e., agriculture, healthcare, transportation, manufacturing, engineering etc. This undergraduate course covers the conceptual understanding of IoT fundamentals. | | |

| Course Learning Outcome and mapping to PLOs | CLO | LEVEL | PLO |
|---|---|---|---|
| | CLO1: Understand the concept and capabilities of smart thing/object/device identification, and physical principles of sensing. Differentiate IoT enabling technologies, architectures, and standards | C2 | PLO2 |
| | CLO2: Apply IoT knowledge and skills acquired during the course to implement small scale IoT Project | C3 | PLO2 |
| | CLO3: Design smart solutions using IoT Protocol stack and data analytics that can revolutionize human life | C4 | PLO3 |

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| Course Outline | What is IOT?<br>Basics of IOT<br>Elements of an IoT ecosystem<br>IOT Industrial Applications<br>How large is the IOT Market<br>Latest updates in the IOT industry.<br>Basics of Wireless Sensor Networks<br>Introduction of IoT with Raspberry Pi<br>MAC Layer of Wireless Networks<br>Routing Layer of Wireless Networks<br>Application Layer Protocol – MQTT<br>Application Layer Protocol – CoAP<br>Network Layer Protocol – 6LoWPAN<br>Routing Protocol – RPL, Service Discovery Protocol – mDNS<br>Service Discovery Protocol – DNS SD<br>Cloud computing and IOT<br>Signal processing, real time and local analytics<br>Databases, cloud analytics and applications<br>Introduction to Arduino Programming<br>Calculating Distance using Ultrasonic Sensor<br>Fetching Humidity and Temperature using DHT 11 Sensor<br>Smoke and Gas Detection Using MQ2 Sensor<br>Using ThingSpeak, Adafruit and Blynk IOT Platforms. |

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|---|---|
| Resources | Textbook:<br>Dian, F. J. (2022). *"Fundamentals of Internet of Things: For Students and Professionals"*. John Wiley & Sons.<br>Reference Book:<br>Jamali, J., Bahrami, B., Heidari, A., Allahverdizadeh, P., & Norouzi, F. (2020). Towards the internet of things. Springer International Publishing. |
| Tools | Software: MATLAB/Simulink/Tiny OS/Raspian OS<br>Hardware: Hardware projects as Complex Engineering Problem |

| Grading Rubrics | Assignment Method | CLO1 | CLO2 | CLO3 |
|---|---|---|---|---|
| | Final Exam (50) | × | 25 | 25 |
| | Mid Exam (20) | 15 | 5 | × |
| | Assignments (20) | 5 | 5 | 10 |
| | Quizzes (10) | 2 | 4 | 4 |
| | Total (100) | 22 | 39 | 39 |

| Course Name | Next Generation Networks | Credit Hours | 3 |
|---|---|---|---|
| Course Code | EET 407 | Prerequisite(s) | Communication Systems |
| Knowledge Domain | WK 4 | SDGs | 9 |
| Course Objective | This course introduces Next Generation Networks (NGN) and a better understanding of the drivers to migrate to NGN and possible influences on regulatory considerations, which are caused by technology innovation, especially impacts to the telecommunication regulatory frameworks. The regulatory impacts and issues caused by NGNs will also be covered. | | |

| Course Learning Outcome and mapping to PLOs | CLO | LEVEL | PLO |
|---|---|---|---|
| | CLO1: Understand the operation and organization of next generation networks and implement small scale applications for transferring information and services through them | C3 | PLO2 |
| | CLO2: Apply tools for the analysis and the evaluation of the performance of next generation networks, as well as mechanisms and methods for optimal operation, toward robust and secure transfer of information and services. | C4 | PLO2 |
| | CLO3: Design solutions for the implementation and maintenance of broadband networks, and techniques for enhancing the performance, based on widespread international standards. | C5 | PLO3 |

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| Course Outline | Circuit switching, packet switching, Frame Relay, optical switching, synchronous Digital Hierarchy (SDH / SONET).<br>Broadband Integrated Services Network Architectures (B ISDN), Digital Subscriber Line (xDSL).<br>• Asynchronous Transfer Mattress (ATM), ATM Adjustment Mattress (AAL).<br>• Telecommunication traffic characterization and standards.<br>• Resource management, connection control, usage parameters and control algorithms, traffic shaping.<br>• VoIP and IPTV Services, IPV6 Based NGN<br>• Wireless broadband networks (UMTS, WiMax, LTE), access networks, passive optical broadband networks (RON), local and metropolitan High Speed Networks.<br>• Convergence of Internet technologies (All IP), Multipurpose tag switching (MPLS), separation of control and packet forwarding., labelling routers (LSR, LER).<br>• Compatibility with ATM technology, tunneling and multipath delivery, Interconnection and interoperability of networks, quality of service (QoS), MPLS and differentiated services, MPLS and integrated services.<br>• Software defined networks, virtual switches & controllers, Openflow stack/protocol, network virtualization, network abstractions / overlays, network function virtualization (NFV).<br>• Virtual network functions, mapping of VNF's requirements to network resource and vice versa, the ETSI MANO standard and its individual components. |
| Resources | Textbook:<br>"Next Generation Networks: Perspectives and Potentials", John Wiley and Sons 1 st Edition, , ISBN: 978 0470516492<br>Reference Book:<br>"Broadband Access Networks: Technologies and Deployments", Springer, 2009, ISBN: 978 0 387 92131 0. |
| Tools | Software: MATLAB/Simulink<br>Hardware: Hardware projects as Complex Engineering Problem |

| Grading Rubrics | | | |
|---|---|---|---|
| Assignment Method | CLO1 | CLO2 | CLO3 |
| Final Exam (50) | × | 25 | 25 |
| Mid Exam (20) | 15 | 5 | × |
| Assignments (20) | 5 | 5 | 10 |
| Quizzes (10) | 2 | 4 | 4 |
| Total (100) | 22 | 39 | 39 |

| Course Name | Autonomous Vehicles | Credit Hours | 3 |
|---|---|---|---|
| Course Code | EEV 402 | Prerequisite(s) | None |
| Knowledge Domain | WK 5 | SDGs | 9 |
| Course Objective | This course provides an in depth exploration of autonomous vehicle technologies. Students will gain an understanding of the principles and practices involved in the design, development, and deployment of autonomous vehicles. The course aims to equip students with the skills necessary to work on various aspects of autonomous driving systems, including perception, localization, planning, and control. | | |
| Course Learning | CLO | LEVEL | PLO |

| | | | |
|---|---|---|---|
| Outcome and mapping to PLOs | CLO1:  Explain the fundamental principles and technologies underlying autonomous vehicle systems, including sensor integration, perception algorithms, and decision making processes. | C2 | PLO1 |
| | CLO2: Analyze the performance and limitations of various autonomous vehicle architectures and subsystems, such as navigation, control, and communication systems, to identify potential areas for improvement. | C3 | PLO2 |
| | CLO3: Apply the basic autonomous vehicle functionalities for the design and development of autonomous EVs. | C4 | PLO3 |

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| Course Outline | Introduction to Autonomous Vehicles<br>  Overview of autonomous vehicle technology<br>  History and evolution<br>Sensors and Perception in Autonomous Vehicles<br>  Types of sensors (LiDAR, RADAR, Cameras)<br>  Sensor fusion techniques<br>Computer Vision for Autonomous Driving<br>  Basics of computer vision<br>  Object detection and recognition<br>Machine Learning in Autonomous Vehicles<br>  Introduction to machine learning<br>  Applications in autonomous driving<br>Localization Techniques<br>  GPS and GNSS systems<br>  Simultaneous Localization and Mapping (SLAM)<br>Mapping and Environmental Modeling<br>  Creating and updating maps<br>  3D modeling of environments<br>Path Planning for Autonomous Vehicles<br>  Algorithms for path planning<br>  Avoidance of obstacles and dynamic environments<br>Decision Making in Autonomous Driving<br>  Autonomous decision making processes<br>  Scenario analysis and prediction<br>Control Systems in Autonomous Vehicles<br>  Basics of control systems<br>  Implementation in autonomous driving<br>Vehicle to Everything (V2X) Communication<br>  V2V, V2I, and V2P communication<br>  Importance in autonomous systems<br>Human Machine Interaction in Autonomous Vehicles<br>  Interface design for user interaction<br>  Managing driverless vehicle interactions<br>Safety and Reliability in Autonomous Systems<br>  Safety standards and testing procedures<br>  Redundancy and fail safes<br>Ethical Considerations in Autonomous Vehicles<br>  Ethical dilemmas in autonomous driving<br>  Decision making in life critical situations<br>Legal and Regulatory Issues in Autonomous Vehicles<br>  Current laws and regulations<br>  Future legal challenges<br>Future Trends in Autonomous Vehicle Technology<br>  Emerging technologies in autonomous driving<br>  Long term impact on society<br>Case Studies on Autonomous Vehicle Deployments<br>  Analysis of real world autonomous vehicle projects<br>  Lessons learned and future directions |

| | | | | |
|---|---|---|---|---|
| Resources | Textbook: Autonomous Vehicle Technology: A Guide for Policymakers by James M. Anderson, 1st Edition<br>Reference Book:<br>Handbook of Autonomous Vehicles and Aerial Systems by Ragunathan Rajkumar, 1st Edition | | | |
| Tools | Software: MATLAB/Simulink/Python/C++/ROS | | | |
| Grading Rubrics | Assignment Method | CLO1 | CLO2 | CLO3 |
| | Final Exam (50) | × | 25 | 25 |
| | Mid Exam (20) | 15 | 5 | × |
| | Assignments (20) | 5 | 5 | 10 |
| | Quizzes (10) | 2 | 4 | 4 |
| | Total (100) | 22 | 39 | 39 |

| Course Name | LV and HV Electrical Installation Guides and Standards | Credit Hours | 3 |
|---|---|---|---|
| Course Code | EEP 452 | Prerequisite(s) | Applied Physics |
| Knowledge Domain | WK 5 | SDGs | 9 |
| Course Objective | This course aims to provide a comprehensive understanding of low voltage (LV) and high voltage (HV) electrical installation practices and standards. Students will learn about the key principles, guidelines, and standards for safe and effective installation, operation, and maintenance of electrical systems in both residential and industrial environments. The course will cover both theoretical aspects and practical applications, focusing on the most widely recognized standards such as IEC, NEC, and IEEE. | | |

| Course Learning Outcome and mapping to PLOs | CLO | LEVEL | PLO |
|---|---|---|---|
| | CLO1: Explain the fundamental principles of LV and HV electrical installation practices. | C2 | PLO1 |
| | CLO2: Analyze and apply relevant electrical installation standards. | C3 | PLO2 |
| | CLO3: Evaluate the safety requirements and best practices for LV and HV installations | C5 | PLO4 |

| | |
|---|---|
| Course Outline | Introduction to Electrical Installations<br>Overview of electrical installations<br>Importance of standards and guides<br>Electrical Installation Standards and Codes<br>Introduction to IEC, NEC, and IEEE standards<br>Legal and regulatory requirements<br>LV Electrical Systems and Components<br>Overview of LV systems<br>Key components (cables, switches, circuit breakers)<br>HV Electrical Systems and Components<br>Overview of HV systems<br>Key components (transformers, circuit breakers, switchgear)<br>Installation Practices for LV Systems<br>Best practices for LV installations<br>Common challenges and solutions<br>Installation Practices for HV Systems<br>Best practices for HV installations<br>Common challenges and solutions<br>Protection Systems and Devices<br>Overview of protection devices (fuses, relays)<br>Protection coordination in LV and HV systems<br>Grounding and Bonding Techniques<br>Importance of grounding and bonding<br>Techniques for LV and HV systems<br>Inspection and Testing Procedures<br>Pre commissioning and post installation tests<br>Testing equipment and methods<br>Safety Standards and Risk Management<br>Safety standards in electrical installations<br>Risk assessment and mitigation strategies<br>Case Studies in LV Installations<br>Analysis of real world LV installation projects<br>Case Studies in HV Installations<br>Analysis of real world HV installation projects<br>Maintenance of LV and HV Installations<br>Preventive and corrective maintenance practices<br>Documentation and reporting<br>Emerging Technologies in Electrical Installations<br>Smart grids and automation<br>Trends in LV and HV installations<br>Compliance and Auditing<br>Importance of compliance<br>Auditing practices for electrical installations |
| Resources | Textbook:<br>Electrical Installation Guide by Schneider Electric, 2020 Edition<br>Reference Book:<br>IEC Standards for Electrical Installations by IEC, Latest Edition. |
| Tools | Software: MATLAB/Simulink/PLECS/Python/LabVIEW |

| Grading Rubrics | Assignment Method | CLO1 | CLO2 | CLO3 |
|---|---|---|---|---|
| | Final Exam (50) | × | 25 | 25 |
| | Mid Exam (20) | 15 | 5 | × |

| | | | | |
|---|---|---|---|---|
| | Assignments (20) | 5 | 5 | 10 |
| | Quizzes (10) | 2 | 4 | 4 |
| | Total (100) | 22 | 39 | 39 |

| Course Name | Sensors and Actuators | | Credit Hours | 3 |
|---|---|---|---|---|
| Course Code | EEV 401 | | Prerequisite(s) | EDC |
| Knowledge Domain | WK 5 | | SDGs | 9 |
| Course Objective | This course provides a thorough understanding of sensors and actuators, which are critical components in modern engineering systems. Students will explore various types of sensors and actuators, their operating principles, and applications. The course aims to equip students with the knowledge required to select, integrate, and apply sensors and actuators in engineering systems. | | | |
| Course Learning Outcome and mapping to PLOs | CLO | | LEVEL | PLO |
| | CLO1: Explain the operating principles of various sensors and actuators | | C2 | PLO1 |
| | CLO2: Analyze the performance of sensors and actuators in different applications | | C3 | PLO2 |
| | CLO3: Apply the knowledge of sensors and actuators in the design of engineering systems | | C4 | PLO3 |

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|---|---|
| Course Outline | Introduction to Sensors and Actuators<br>  Importance in modern engineering<br>Classification of Sensors and Actuators<br>  Types based on physical principles<br>  Categories by application<br>Physical Principles of Sensing<br>  Principles of operation<br>  Characteristics of different sensing methods<br>Temperature Sensors<br>  Thermocouples, RTDs, and thermistors<br>  Applications and selection criteria<br>Pressure Sensors<br>  Types of pressure sensors<br>  Applications in industry<br>Proximity and Position Sensors<br>  Inductive, capacitive, and optical sensors<br>  Applications in automation<br>Signal Conditioning and Processing<br>  Amplification, filtering, and conversion<br>  Techniques for accurate measurements<br>Interfacing Sensors with Microcontrollers<br>  Analog to digital conversion<br>  Data acquisition systems<br>Introduction to Actuators<br>  Definition and importance<br>  Types of actuators<br>Electric Actuators<br>  DC and AC motors<br>  Stepper and servo motors<br>Hydraulic and Pneumatic Actuators<br>  Principles of fluid power<br>  Applications and control strategies<br>Control Strategies for Actuators<br>  Open loop vs. closed loop control<br>  PID control and its applications<br>Applications of Sensors and Actuators in Industry<br>  Case studies in manufacturing<br>  Automation and robotics applications<br>Recent Advances in Sensor Technology<br>  Innovations in sensor design<br>  Integration with IoT systems<br>Recent Advances in Actuator Technology<br>  Innovations in actuator design<br>  Emerging applications in industry<br>Project Presentations and Case Studies<br>  Student presentations on selected topics<br>  Review and discussion |

| | | | | |
|---|---|---|---|---|
| Resources | Textbook:<br>Sensors and Actuators: Engineering System Instrumentation by Clarence W. de Silva, 1st Edition<br>Reference Book:<br>Handbook of Modern Sensors by Jacob Fraden, 5th Edition | | | |
| Tools | Software: MATLAB/Simulink/Python/LabVIEW | | | |
| Grading Rubrics | Assignment Method | CLO1 | CLO2 | CLO3 |
| | Final Exam (50) | × | 25 | 25 |
| | Mid Exam (20) | 15 | 5 | × |
| | Assignments (20) | 5 | 5 | 10 |
| | Quizzes (10) | 2 | 4 | 4 |
| | Total (100) | 22 | 39 | 39 |

| Course Name | Vehicular Networking | Credit Hours | 3 |
|---|---|---|---|
| Course Code | EEV 403 | Prerequisite(s) | Signals and Systems |
| Knowledge Domain | WK 5 | SDGs | 9 |
| Course Objective | This course provides comprehensive knowledge of vehicular networking, a key enabler for intelligent transportation systems (ITS). Students will learn about the fundamentals of vehicular communication, networking protocols, and applications of vehicular networks. The course aims to prepare students for the challenges of designing, implementing, and maintaining vehicular networks. | | |

| Course Learning Outcome and mapping to PLOs | CLO | LEVEL | PLO |
|---|---|---|---|
| | CLO1: Explain the typical architecture and components of vehicular networks. | C2 | PLO1 |
| | CLO2: Analyze various vehicular network protocols and their performance. | C3 | PLO2 |
| | CLO3: Implement and evaluate different vehicular networking solutions. | C5 | PLO4 |

| | |
|---|---|
| Course Outline | Introduction to Vehicular Networking<br>Importance in ITS<br>Vehicular Communication Architecture<br>Architecture and components<br>Layered approach to networking<br>Wireless Communication Technologies<br>Overview of wireless technologies<br>DSRC, WiFi, LTE, 5G<br>Networking Protocols for Vehicular Networks<br>MAC protocols<br>Routing protocols for V2V and V2I<br>Vehicle to Vehicle (V2V) Communication<br>Principles and protocols<br>Applications and challenges<br>Vehicle to Infrastructure (V2I) Communication<br>Communication with roadside units<br>Applications and challenges<br>Security in Vehicular Networks<br>Security threats and challenges<br>Authentication and encryption techniques<br>Privacy in Vehicular Networks<br>Privacy concerns<br>Techniques to ensure privacy<br>Applications of Vehicular Networks<br>Safety applications (collision avoidance, emergency braking)<br>Non safety applications (traffic management, infotainment)<br>Vehicular Cloud Networking<br>Concept of vehicular cloud<br>Applications in ITS<br>Simulation and Modeling of Vehicular Networks<br>Tools and techniques for simulation<br>Performance analysis<br>Inter vehicular Communication Standards<br>Overview of standards (IEEE 802.11p, ETSI)<br>Standardization bodies<br>Data Dissemination in Vehicular Networks<br>Techniques for data dissemination, Challenges and solutions<br>Mobility Management in Vehicular Networks<br>Handover and mobility models, Challenges in high mobility environments<br>Challenges and Future Trends in Vehicular Networking<br>Emerging technologies (CV2X, 6G)<br>Future trends and challenges<br>Case Studies and Project Presentations<br>Analysis of real world vehicular networking implementations |
| Resources | Textbook:<br>Vehicular Networks: Techniques, Standards, and Applications by Stephan Olariu, 1st Edition.<br><br>Reference Book:<br>Vehicular Ad Hoc Networks: Standards, Solutions, and Research by Claudia Campolo, 1st Edition. |

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|---|---|---|---|---|
| Tools | Software: MATLAB/Simulink/Python/LabVIEW | | | |
| Grading Rubrics | Assignment Method | CLO1 | CLO2 | CLO3 |
| | Final Exam (50) | × | 25 | 25 |
| | Mid Exam (20) | 15 | 5 | × |
| | Assignments (20) | 5 | 5 | 10 |
| | Quizzes (10) | 2 | 4 | 4 |
| | Total (100) | 22 | 39 | 39 |

| Course Name | EV batteries and ancillaries | Credit Hours | 3 |
|---|---|---|---|
| Course Code | EEV 404 | Prerequisite(s) | Power Distribution and Utilization |
| Knowledge Domain | WK 5 | SDGs | 7 |
| Course Objective | The objective of this course is to give the students a better understanding of various aspects related to electric vehicle batteries, including their design, production processes, management systems, and integration into power systems. Students are expect to learn about battery management systems, the full battery value chain, mechanical and electrical components involved in electric vehicles, and the importance of these systems in the overall functioning of power electronics and grid integration. | | |

| Course Learning Outcome and mapping to PLOs | CLO | LEVEL | PLO |
|---|---|---|---|
| | CLO1: Explain the basic construction of EV batteries and recognize a range of different types of battery, charging infrastructures and regulatory and safety standards. | C2 | PLO2 |
| | CLO2: Analyze and model the power electronics based control strategies for electric vehicles. | C4 | PLO2 |
| | CLO3: Design and simulate a battery management system for electric vehicles. | C5 | PLO3 |

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| Course Outline | Introduction to EV Batteries and Ancillaries<br>• The basic principles of EV batteries and ancillaries, and their role in electric vehicle systems.<br>Battery Technologies for EVs<br>• The various battery technologies used in electric vehicles. including lithium ion, lead acid, and nickel metal hydride batteries.<br>Battery Management System<br>• The design and development of battery management system (BMS) for electric vehicle batteries. including state of charge estimation. thermal management, and cell balancing.<br>Charging Infrastructure for EV Batteries<br>• The design and development of charging infrastruc1ure for EV batteries. including charging stations. on board chargers, and DC fast charging.<br>Battery Testing and Validation<br>• The testing and validation of EV batteries, including performance testing, safety testing, and life cycle testing.<br>Power Electronics for EV Batteries<br>• The power electronics components used in electric vehicle batteries, including inverters. converters. and DC DC converters.<br>Ancillary Components for EV Batteries<br>• The ancillary co1nponents used in electric vehicle batteries, including cooling systems. heating systems. and energy storage systems.<br>Battery Recycling and Second Life Applications<br>• The recycling of EV batteries and second life applications. Including repurposing used batteries for stationary energy storage.<br>Regulatory and Safety Considerations<br>• The regulatory and safety considerations for EV batteries and ancillaries. including safety standards, regulations, and certifications. |
| Resources | Textbook:<br>"Lithium ion Batteries: Science and Technologies" by Masaki Yoshio, Rolph J. Brodd, and Akiya Kozawa.<br>Reference Book:<br>"Battery Management Systems for Large Lithitun Ion Battery Packs" by David Andrea and Kandler Smith.<br>Models, Sustainability, Infrastructure and the Market" by Gianfranco Pistoia:<br>"Electric Vehicle Battery Systems" by Sandeep Dhameja.<br>"Handbook of Electric Power Calculations'' by H. Wayne Beaty and Surya Santoso |
| Tools | Software: MATLAB/Simulink<br>Hardware: Hardware projects as Complex Engineering Problem |

Grading Rubrics

| Assignment Method | CLO1 | CLO2 | CLO3 |
|---|---|---|---|
| Final Exam (50) | × | 25 | 25 |
| Mid Exam (20) | 15 | 5 | × |
| Assignments (20) | 5 | 5 | 10 |
| Quizzes (10) | 2 | 4 | 4 |
| Total (100) | 22 | 39 | 39 |

| Course Name | EV control systems | Credit Hours | 3 |
|---|---|---|---|
| Course Code | EEV 405 | Prerequisite(s) | Linear Control Systems |
| Knowledge Domain | WK 5 | SDGs | 7 |
| Course Objective | The objective of this course is to give the students a better understanding of various aspects related to electric vehicle control system, including their design, production processes, management systems, and integration into EVs. Students are expected to learn about EV Powertrain Control, Vehicle Dynamics Control, Autonomous Vehicle Control, Human Machine Interface, Energy Management Control, Control System Design and Development, Cybersecurity for EV Control Systems, mechanical and electrical components involved in electric vehicles, and the importance of these systems in the overall functioning of EVs. | | |
| Course Learning Outcome and mapping to PLOs | CLO | LEVEL | PLO |
| | CLO1: Explain the basic construction of EV control system including vehicle dynamic control, cybersecurity aspect and Human Machine Interface. | C2 | PLO2 |
| | CLO2: Analyze and model the EV Powertrain control strategies for electric vehicles. | C4 | PLO2 |
| | CLO3: Design and simulate an EV Controller. | C5 | PLO3 |
| Course Outline | Introduction to EV Control Systems<br>• The basic principles of control systems used in electric vehicles. and their role in electric vehicle systems.<br>EV Powertrain Control<br>• The control systems used in electric vehicle powertrains, including motor control. power electronics control, and battery management control.<br>Vehicle Dynamics Control<br>• The control systems used for vehicle dynamics. including steering control, braking control, and suspension control.<br>Autonomous Vehicle Control<br>• The control systems used in Autonomous vehicles, including perception, decision making, and control systems.<br>Human Machine Interface<br>• The design and development of human machine (HMI) systems for electric vehicles, including displays, controls, and user feedback systems.<br>Energy Management Control<br>• The control systems used for energy management in electric vehicles, including energy storage system control, regenerative braking control, and energy consumption optimization.<br>Control System Design and Development<br>• The process of designing and developing control systems for electric vehicles, including system modelling, control algorithm design, and hardware in the loop simulation.<br>Cybersecurity for EV Control Systems<br>• The cybersecurity considerations for electric vehicle control systems, including threat modelling, risk assessment and security testing. | | |

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|---|---|
| Resources | Textbook:<br>"Electric and Hybrid Vehicles: Control Strategies" by Amir Khajepour, Kevin L. Johnson, and M. Saber Fallah.<br>Reference Book:<br>Vehicle Dynamics and Control" by Rajesh Rajamani.<br>Advanced Control of Wheeled Inverted Pendulum Systems" by Alessandro De Luca, Giuseppe Oriolo, and Marilena Vendittelli.<br>Model Predictive Control of Automotive Powertrain Systems" by Uwe Kiencke and Lars Nielsen.<br>"Electric Drive Control of EVs" by Seung Ki Sul. |
| Tools | Software: MATLAB/Simulink<br>Hardware: Hardware projects as Complex Engineering Problem |

Grading Rubrics

| Assignment Method | CLO1 | CLO2 | CLO3 |
|---|---|---|---|
| Final Exam (50) | × | 25 | 25 |
| Mid Exam (20) | 15 | 5 | × |
| Assignments (20) | 5 | 5 | 10 |
| Quizzes (10) | 2 | 4 | 4 |
| Total (100) | 22 | 39 | 39 |

| Course Name | EV circuit and electronics | Credit Hours | 3 |
|---|---|---|---|
| Course Code | EEV 406 | Prerequisite(s) | Electrical Network Analysis |
| Knowledge Domain | WK 5 | SDGs | 7 |
| Course Objective | The objective of this course is to give the students a better understanding of various aspects related to electric vehicle circuit electronics, including its design, production processes, management systems, and integration into EVs. Students are expected to learn about EV power electronics, EV battery management system, EV motors and drives, EV safety systems, EV charging systems, mechanical and electrical components involved in electric vehicles, and the importance of these systems in the overall functioning of EVs. | | |

Course Learning Outcome and mapping to PLOs

| CLO | LEVEL | PLO |
|---|---|---|
| CLO1: Explain the basic construction and design of EV circuit and electronics including EV motors and drives, EV safety systems and EV battery management system. | C2 | PLO2 |
| CLO2: Analyze and model the EV charging system control strategies for electric vehicles. | C4 | PLO2 |
| CLO3: Design and simulate an EV electronics system. | C5 | PLO3 |

<table>
<tr><td>Course Outline</td><td>Introduction to EV Circuits and Electronics<br>• The basic principles of circuits and electronics in electric vehicles, and the importance of efficient and reliable electronics in electric vehicle design.<br>Power Electronics for EVs<br>• The power electronics used in electric vehicles, including DC DC converters, inverters, and battery chargers.<br>Control Systems for EVs<br>• The control systems used in electric vehicles. including sensors. Actuators, and control algorithms.<br>Battery Management Systems (BMS)<br>• The design and implementation of battery management systems for electric Vehicle batteries. including state of charge (SOC) estimation, balancing, and temperature control.<br>Electric Motors and Drives<br>• The electric motors and drives used in electric. vehicles, including induction motors. permanent magnet motors, and motor controllers.<br>EV Charging Systems<br>• The design and implementation of charging systems for electric vehicles, including AC and DC charging stations, charging protocols, and standards.<br>EV Safety Systems<br>• The safety systems used in electric vehicles, including fuses, circuit breakers, and ground fault protection.<br>Electromagnetic Compatibility (EMC)<br>• The design and implcn1entalion of electromagnetic compatibility {EMC) systems for electric vehicles, including electromagnetic interference (EMI) and radio frequency interference (RfI) mitigation.<br>Fault Diagnosis and Troubleshooting<br>• The techniques for fault diagnosis and trouble shooting in electric vehicle circuits and electronics</td></tr>
<tr><td>Resources</td><td>Textbook:<br>"Electric Vehicle Systems Architecture and Standardization Needs" edited by Massimo Cavazzini and Marco Picone.<br>Reference Book:<br>"Power Electronics for Electric and Hybrid Vehicles: Market Trends, Technologies. and Outlook" by Mario Paolone and Rachid Cherkaoui.<br>"Electric Vehicle Batteries: Moving from Research towards lnnovntion" Gianfranco Pistoia and Boryann Liaw.<br>"Electric Vehicle Technology for Construction, Agriculture and Off Road Vehicles" by Markus Wagner and Juergen Fleischer.</td></tr>
<tr><td>Tools</td><td>Software: MATLAB/Simulink<br>Hardware: Hardware projects as Complex Engineering Problem</td></tr>
<tr><td>Grading Rubrics</td><td><table>
<tr><th>Assignment Method</th><th>CLO1</th><th>CLO2</th><th>CLO3</th></tr>
<tr><td>Final Exam (50)</td><td>×</td><td>25</td><td>25</td></tr>
<tr><td>Mid Exam (20)</td><td>15</td><td>5</td><td>×</td></tr>
<tr><td>Assignments (20)</td><td>5</td><td>5</td><td>10</td></tr>
<tr><td>Quizzes (10)</td><td>2</td><td>4</td><td>4</td></tr>
<tr><td>Total (100)</td><td>22</td><td>39</td><td>39</td></tr>
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<table>
<tr><td>Course Name</td><td>EV Body and Chassis Design</td><td>Credit Hours</td><td colspan="2">3</td></tr>
<tr><td>Course Code</td><td>EEV 407</td><td>Prerequisite(s)</td><td colspan="2">None</td></tr>
<tr><td>Knowledge Domain</td><td>WK 5</td><td>SDGs</td><td colspan="2">7</td></tr>
<tr><td>Course Objective</td><td colspan="4">The objective of this course is to give the students a better understanding of various aspects related to electric vehicle body and chassis design, including its design, production processes, management systems, and integration into EVs. Students are expected to learn about EV vehicle architecture, chassis components, body design & materials, aerodynamics, NVH and mechanical components involved in electric vehicles, and the importance of these systems in the overall functioning of EVs.</td></tr>
<tr><td rowspan="4">Course Learning Outcome and mapping to PLOs</td><td colspan="2">CLO</td><td>LEVEL</td><td>PLO</td></tr>
<tr><td colspan="2">CLO1: Explain the basic construction and design of EV body and chassis design including EV vehicle architecture, chassis components, body design & materials.</td><td>C2</td><td>PLO2</td></tr>
<tr><td colspan="2">CLO2: Analyze and model the NVH (Noise, Vibration, and Harshness) for electric vehicles.</td><td>C4</td><td>PLO2</td></tr>
<tr><td colspan="2">CLO3: Design and simulate a EV body and chassis design.</td><td>C5</td><td>PLO3</td></tr>
<tr><td>Course Outline</td><td colspan="4">Introduction to EV Body and Chassis Design<br>• The basic principles of body and chassis design for electric vehicles and the importance of lightweight and aerodynamic design.<br>Vehicle Architecture<br>• The different types of vehicle architectures used in electric vehicles, including monocoque, spaceframe, and ladder frame.<br>Chassis Components<br>• The different components of the chassis. including suspension systems, steering systems, brakes, and wheels.<br>Body Design and materials<br>• The design and materials used for the body of electric vehicles, including steel, aluminum, and composite materials.<br>Aerodynamics<br>• The principles of aerodynamics and their application to the design of electric vehicles, including drag reduction techniques and wind tunnel testing.<br>Crashworthiness and Safety<br>• The design and develop1nent of electric vehicles for crashworthiness and Safety, including crash testing and safety regulations.<br>Vehicle Dynamics<br>• The principles of vehicle dynamics and their application to the design of electric vehicles, including handling and stability.<br>NVH (Noise, Vibration, and Harshness)<br>• The principles of NVH and their application to the design of electric vehicles including noise reduction techniques and vibration damping.<br>Manufacturing Processes<br>• The manufacturing processes used in the production of electric vehicle bodies and chassis, including stamping, welding, and bonding.</td></tr>
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|---|---|
| Resources | Textbook:<br>"Electric and Hybrid Vehicles: Design Fundamentals, Second Edition" by Iqbal Husain.<br>Reference Book:<br>"Electric Vehicle Design and Modeling: A Computational Approach" by Qiaoxing Li.<br>"Electric Vehicle integration into Modern Power Networks" by Saeid Mokhatab and William H. Kersting.<br>Vehicle Dynamics and Control" by Rajesh Rajamani.<br>"Structural Composite Materials" by F. L. Matthews. |
| Tools | Software: MATLAB/Simulink<br>Hardware: Hardware projects as Complex Engineering Problem |

| Grading Rubrics | Assignment Method | CLO1 | CLO2 | CLO3 |
|---|---|---|---|---|
| | Final Exam (50) | × | 25 | 25 |
| | Mid Exam (20) | 15 | 5 | × |
| | Assignments (20) | 5 | 5 | 10 |
| | Quizzes (10) | 2 | 4 | 4 |
| | Total (100) | 22 | 39 | 39 |

| Course Name | EV Dynamics | Credit Hours | 3 |
|---|---|---|---|
| Course Code | EEV 408 | Prerequisite(s) | Electrical Machines |
| Knowledge Domain | WK 5 | SDGs | 7 |
| Course Objective | The objective of this course is to give the students a better understanding of various aspects related to electric vehicle dynamics, including its design, production processes, management systems, and integration into EVs. Students are expected to learn about EV Powertrain, EV modelling & control, EV energy management system, electrical and mechanical components involved in electric vehicles, and the importance of these systems in the overall functioning of EVs. | | |

| Course Learning Outcome and mapping to PLOs | CLO | LEVEL | PLO |
|---|---|---|---|
| | CLO1: Explain the basic construction and design of EV electric system including EV Powertrain and EV modelling & control. | C2 | PLO2 |
| | CLO2: Analyze and model the energy management system for electric vehicles. | C4 | PLO2 |
| | CLO3: Design and simulate a EV electric system for V2G. | C5 | PLO3 |

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|---|---|
| Course Outline | Introduction to EV Dynamics<br>• This topic covers the basics of EV dynamics. including the: differences between conventional vehicles and electric vehicles, the fundamental principles of EV dynamics, and the types of electric vehicles.<br>EV Powertrain<br>• This topic covers the components of an electric vehicle powertrain, including the electric motor, battery, power electronics, and transmission system.<br>EV Modeling<br>• This topic covers the mathematical modeling of electric vehicles, including the modeling of the powertrain, tire road interaction, and vehicle dynamics.<br>EV Control<br>• This topic covers the control of electric vehicles. including the design of controllers for the powertrain, regenerative braking, and stabilityty control.<br>Battery Management System<br>• This topic covers the design and implementation of battery management systems for electric vehicles, including the monitoring of battery state of charge, state of health and temperature.<br>Charging Infrastructure<br>• This topic covers the design and operation of EV charging infrastructure, including the different types of charging stations and the communication protocols used for charging.<br>Energy Management<br>• This topic covers the optimization of energy management in electric vehicles, including the design of energy efficient driving strategics and the use of vehicle to grid (V2G) technology.<br>Simulation and Analysis<br>• This topic covers the simulation and analysis of electric vehicle dynamics using software tools, including MATLAB/Simulink, ANSYS and AVL.<br>Future Directions<br>• This topic covers the current trends and future directions in EV dynamics, including emerging technologies and research challenges. |
| Resources | Textbook:<br>"Electric and Hybrid Vehicles: Design Fundamentals, Second Edition" by Iqbal Husain.<br>Reference Book:<br>"Electric Vehicle Dynamics and Control" by Haiping Du. Zongde Fang, and Wei Liu.<br>"Advanced Electric. Drive Vehicles" by Ali Emadi.<br>Automotive Electrification: Volume 1 – Electric Powertrains and Energy Storage Systems" edited by M. K. Khodayari and C. C. Chan. |
| Tools | Software: MATLAB/Simulink<br>Hardware: Hardware projects as Complex Engineering Problem |

Grading Rubrics

| Assignment Method | CLO1 | CLO2 | CLO3 |
|---|---|---|---|
| Final Exam (50) | × | 25 | 25 |
| Mid Exam (20) | 15 | 5 | × |
| Assignments (20) | 5 | 5 | 10 |
| Quizzes (10) | 2 | 4 | 4 |
| Total (100) | 22 | 39 | 39 |

| Course Name | Computer Organization | Credit Hours | 3 |
|---|---|---|---|
| Course Code | CSC 403 | Prerequisite(s) | Digital Logic Design |
| Knowledge Domain | WK 4 | SDGs | 9 |
| Course Objective | Understand the fundamental components and operations of computer systems, including CPU architecture, memory hierarchy, instruction set, and input/output mechanisms, to analyze and design efficient computer systems. | | |

| Course Learning Outcome and mapping to PLOs | CLO | LEVEL | PLO |
|---|---|---|---|
| | CLO1: Explain the fundamental components of computer systems, including CPU, memory, and I/O devices, and their interactions and describe the structure and functionality of instruction sets, including instruction formats, addressing modes, and instruction execution. | C2 | PLO1 |
| | CLO2: Analyze and design the data path and control unit of a CPU, including arithmetic and logic units (ALUs), registers, and control signals. | C5 | PLO3 |
| | CLO3: Write and debug assembly language programs, demonstrating an understanding of how high level instructions translate to machine code. | C3 | PLO2 |

| | |
|---|---|
| Course Outline | Understand Computer Architecture: Gain a solid understanding of the basic structure and function of computer systems, including CPUs, memory, and input/output devices.<br>Digital Logic Fundamentals: Learn the principles of digital logic, including combinational and sequential circuits, and how they are used to design basic components of a computer.<br>Data Representation: Understand how data is represented within a computer system, including binary, hexadecimal, and floating point representations.<br>Instruction Set Architecture (ISA): Explore the design and function of instruction sets, including the relationship between machine language and assembly language.<br>Processor Design: Learn the fundamentals of processor design, including the design and operation of ALUs, registers, and control units.<br>Memory Hierarchy: Understand the organization and management of memory in a computer system, including cache, RAM, and secondary storage, as well as the concepts of memory hierarchy and virtual memory.<br>Input/Output Systems: Study the various methods of interfacing with peripheral devices, including interrupt handling, direct memory access (DMA), and I/O ports.<br>Performance Optimization: Analyze factors affecting computer performance, such as pipelining, parallelism, and instruction level optimization techniques.<br>Assembly Language Programming: Develop skills in low level programming using assembly language to understand the interaction between hardware and software.<br>Apply Theoretical Concepts: Apply the concepts learned to analyze, design, and optimize computer systems in real world scenarios. |
| Resources | Textbook:<br>1. "Computer Organization and Design: The Hardware/Software Interface" by David Patterson and John Hennessy<br>2."Computer Organization and Architecture: Designing for Performance" by William Stallings |

| Grading Rubrics | Assignment Method | CLO1 | CLO2 | CLO3 |
|---|---|---|---|---|
| | Final Exam (50) | 10 | 20 | 20 |
| | Mid Exam (20) | 15 | 5 | × |
| | Assignments (20) | 5 | 5 | 10 |
| | Quizzes (10) | 2.5 | 5 | 2.5 |
| | Total (100) | 32.5 | 35 | 32.5 |

<table>
<tr><td>Course Name</td><td>Database Systems</td><td>Credit Hours</td><td colspan="2">3</td></tr>
<tr><td>Course Code</td><td>CSC 401</td><td>Prerequisite(s)</td><td colspan="2">Programming Fundamentals</td></tr>
<tr><td>Knowledge Domain</td><td>WK 4</td><td>SDGs</td><td colspan="2">9</td></tr>
<tr><td>Course Objective</td><td colspan="4">To equip students with the knowledge and skills to design, implement, and manage relational database systems, including understanding data modeling, SQL, and database management concepts.</td></tr>
<tr><td rowspan="4">Course Learning Outcome and mapping to PLOs</td><td colspan="2">CLO</td><td>LEVEL</td><td>PLO</td></tr>
<tr><td colspan="2">CLO1: Explain the fundamental concepts of databases, including data models, database architectures, and the role of DBMS in managing data.</td><td>C2</td><td>PLO1</td></tr>
<tr><td colspan="2">CLO2: Develop skills in data modeling and gain proficiency in SQL.</td><td>C3</td><td>PLO2</td></tr>
<tr><td colspan="2">CLO3: Design efficient and normalized database schemes.</td><td>C5</td><td>PLO3</td></tr>
<tr><td>Course Outline</td><td colspan="4">Introduction to Database Systems<br>Definition of a Database<br>Importance of Database Systems<br>Data vs. Information<br>Types of Databases (Relational, NoSQL, etc.)<br>Database Users and Administrators<br>Database System Architecture<br>Database System Components<br>Database Management System (DBMS)<br>Database Models (Hierarchical, Network, Relational, Object Oriented)<br>Schema and Instances<br>Three Schema Architecture<br>Data Independence</td></tr>
</table>

| | |
|---|---|
| Course Outline | Data Modeling<br>Entity Relationship Model (ER Model)<br>Entities, Attributes, and Relationships<br>ER Diagrams<br>Enhanced ER (EER) Model<br>Normalization and Denormalization<br>Relational Model and Mapping ER to Relational Model<br>Relational Database Design<br>Relational Algebra and Calculus<br>SQL (Structured Query Language)<br>Data Definition Language (DDL)<br>Data Manipulation Language (DML)<br>Query Optimization<br>Integrity Constraints (Primary Key, Foreign Key, etc.)<br>Normalization<br>Functional Dependencies<br>Normal Forms (1NF, 2NF, 3NF, BCNF)<br>Decomposition and Dependency Preservation<br>Multivalued Dependencies and 4NF<br>Join Dependencies and 5NF<br>Database Indexing and Hashing<br>Indexing Structures (B Trees, Hash Indexing)<br>Multi Level Indexing<br>Clustered vs. Non Clustered Indexes<br>Indexing Performance Considerations<br>Transaction Management<br>Transactions and ACID Properties<br>Concurrency Control<br>Locking Mechanisms<br>Deadlock Detection and Resolution<br>Isolation Levels<br>Database Recovery Mechanisms<br>Database Security<br>Authentication and Authorization<br>Encryption Techniques<br>Role Based Access Control (RBAC)<br>SQL Injection and Prevention<br>Auditing and Monitoring<br><br>Distributed Databases<br>Concepts of Distributed Databases<br>Data Fragmentation, Replication, and Allocation<br>Distributed Query Processing<br>Distributed Transaction Management<br>CAP Theorem and BASE vs. ACID |
| Resources | Textbook:<br>1. "Database System Concepts" by Abraham Silberschatz, Henry F. Korth, and S. Sudarshan<br>2. "Fundamentals of Database Systems" by Ramez Elmasri and Shamkant B. Navathe |

| | | | | |
|---|---|---|---|---|
| Grading Rubrics | Assignment Method | CLO1 | CLO2 | CLO3 |
| | Final Exam (50) | 10 | 20 | 20 |
| | Mid Exam (20) | 15 | 5 | × |
| | Assignments (20) | 5 | 5 | 10 |
| | Quizzes (10) | 2.5 | 5 | 2.5 |
| | Total (100) | 32.5 | 35 | 32.5 |

| | | | |
|---|---|---|---|
| Course Name | Image and Video Coding | Credit Hours | 3 |
| Course Code | CSC 402 | Prerequisite(s) | Signals and Systems |
| Knowledge Domain | WK 4 | SDGs | 9 |
| Course Objective | The objective of the course is to provide students with a comprehensive understanding of the techniques and algorithms used for compressing and encoding visual media to achieve efficient storage and transmission. | | |

| Course Learning Outcome and mapping to PLOs | CLO | LEVEL | PLO |
|---|---|---|---|
| | CLO 1: Demonstrate an understanding of the basic principles of image and video coding, including compression techniques and the representation of multimedia data. | C3 | PLO1 |
| | CLO 2: Apply various image and video compression techniques, both lossless and lossy, to reduce data size while maintaining acceptable quality. | C3 | PLO2 |
| | CLO 3: Design and implement efficient algorithms for image and video compression. | C5 | PLO3 |

| | |
|---|---|
| Course Outline | Understand Fundamental Concepts: Grasp the basic principles of image and video coding, including compression techniques, data representation, and the role of coding in multimedia systems.<br>Learn Compression Techniques: Study various compression methods such as lossless and lossy compression, and understand how they are applied to images and video.<br>Develop Coding Algorithms: Learn to design and implement algorithms for image and video compression, including entropy coding, transform coding, and motion estimation.<br>Apply Coding Techniques: Apply image and video coding techniques to real world applications, such as streaming, broadcasting, and storage, ensuring optimal performance.<br>Understand Error Resilience: Explore methods for making coded image and video data resilient to transmission errors, including error correction and concealment strategies.<br>Stay Current with Emerging Technologies: Keep up to date with the latest advancements in image and video coding technologies and their impact on multimedia systems. |
| Resources | Textbook:<br>"Digital Video and HD: Algorithms and Interfaces" by Charles Poynton, 2nd Edition |

| | | | | |
|---|---|---|---|---|
| Grading Rubrics | Assignment Method | CLO1 | CLO2 | CLO3 |
| | Final Exam (50) | 10 | 20 | 20 |
| | Mid Exam (20) | 15 | 5 | × |
| | Assignments (20) | 5 | 5 | 10 |
| | Quizzes (10) | 2.5 | 5 | 2.5 |
| | Total (100) | 32.5 | 35 | 32.5 |

| Course Name | Unmanned Aerial Vehicles | Credit Hours | 3 |
|---|---|---|---|
| Course Code | EEN 452 | Prerequisite(s) | Digital Logic Design |
| Knowledge Domain | WK4 | SDGs | 9 |
| Course Objective | The objective of the course is to provide students with a comprehensive understanding of UAV design, operation, and applications, including the integration of flight systems, control mechanisms, and mission planning. | | |

| Course Learning Outcome and mapping to PLOs | CLO | LEVEL | PLO |
|---|---|---|---|
| | CLO1: Explain the fundamental concepts and components of UAVs, including their design, operation, and types of UAV systems. | C2 | PLO1 |
| | CLO2: Demonstrate knowledge of integrating and utilizing sensors for various UAV applications, such as imaging, navigation, and environmental monitoring. | C3 | PLO2 |
| | CLO3: Develop and execute mission plans for UAV operations, considering factors like flight paths, data collection, and mission objectives. | C3 | PLO3 |

| | |
|---|---|
| Course Outline | Understand UAV Fundamentals: Grasp the basic principles and components of unmanned aerial vehicles, including their types, classifications, and applications.<br>Navigation and Communication: Understand UAV navigation techniques, including GPS, sensors, and communication systems for autonomous and remote operations.<br>Data Collection and Analysis: Learn to collect, process, and analyze data acquired by UAVs, including imaging, mapping, and sensor data.<br>Regulations and Safety: Familiarize with legal regulations, safety protocols, and best practices for operating UAVs in various environments.<br>Application Development: Explore practical applications of UAVs in fields such as agriculture, surveillance, disaster response, and environmental monitoring.<br>Emerging Technologies: Stay updated on emerging technologies and trends in UAV systems, including advancements in autonomy, swarm technology, and AI integration. |
| Resources | Textbook:<br>"Introduction to Unmanned Aircraft Systems" by R. Kurt Barnhart, Kevin T. Morris, and Douglas M. Marshall<br>"Unmanned Aircraft Systems: UAVS Design, Development and Deployment" by Ian Moir and Allan Seabridge |

| Grading Rubrics | Assignment Method | CLO1 | CLO2 | CLO3 |
|---|---|---|---|---|
| | Final Exam (50) | 10 | 20 | 20 |
| | Mid Exam (20) | 15 | 5 | × |
| | Assignments (20) | 5 | 5 | 10 |
| | Quizzes (10) | 2.5 | 5 | 2.5 |
| | Total (100) | 32.5 | 35 | 32.5 |

**Appendage 4702**

**Revised Curriculum of MS EE**

**PROGRAM MISSION**

The mission of the MS Electrical Engineering program is to enhance graduates' knowledge through rigorous coursework and research, equipping them for successful careers in industry and academia, and enabling them to contribute to societal progress and sustainable development.

**PROGRAM OBJECTIVES**

The educational objectives of the MSEE program include the following.

The graduates will have the technical competence to be successful in the chosen specialization of electrical engineering through professional practice or research.

Graduates will possess the expertise to conduct independent, technically rigorous analyses and effectively present their findings at professional conferences or publish them in scholarly journals.

Graduates will have the technical proficiency to pursue advanced studies successfully and engage in lifelong learning through ongoing professional education.

**PROGRAM LEARNING OUTCOMES**

The MSEE program prepares students to attain educational objectives by ensuring that students demonstrate achievement of the following learning outcomes. Students should be able to:

Cultivate the ability to analyze complex problems and devise effective solutions using engineering principles, methodologies, and knowledge.

Develop the skills to clearly and concisely articulate technical concepts in both written and oral formats, with a deep understanding of research in electrical engineering and related fields.

Foster the ability to identify emerging technological advancements and commit to lifelong learning.

Exhibit strong interpersonal and teamwork skills by communicating effectively, collaborating efficiently, and resolving conflicts in both individual and group environments.

**Summary of Credit Hours**

| **Sr. No.** | **Courses as per HEC new GE Policy 2023 (All courses at MS level must be 700 level)** | **Credit Hours/Contact Hours** | |
|---|---|---|---|
| | | **Existing Road Map** | **Proposed New Road Map** |
| 1. | Core Courses | 15 | 15 |
| 2. | Electives Courses | 9 | 9 |
| 3. | Interdisciplinary courses | - | - |
| 3. | Thesis/Elective | 6 | 6 |
| 4. | Deficiency course in case of candidate from other domain or interdisciplinary domain | | 6 to 9 * |
| Total | | **30** | **30** |

*Subject to allocation of deficiency courses by admission committee.

**Semester wise Road map**

Legend

Yellow: Already presented in the course code book

Green: New Courses Added

Strike through courses no longer in roadmap

**Semester 1**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | SDG's |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Pre requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | | **Pre requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | |
| 1 | | ESC 501 | Research Methodology (Core I - University Requirement) | 3 | 1 | | ESC 701 | Research Methodology (Core I - University Requirement) | 3.0 | |
| 2 | | | Core II | 3 | 2 | | | Core II | 3 | |
| 3 | | | Core III | 3 | 3 | | | Core III | 3 | |
| **Total Credit Hours** | | | | **9** | **Total Credit Hours** | | | | **9** | |

**Semester 2**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | SDG's |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Pre requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | | **Pre requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | |
| 1 | | | Core – IV | 3 | 1 | | | Core – IV | 3 | |
| 2 | | | Core V | 3 | 2 | | | Core V | 3 | |
| 3 | | | Elective I | 3 | 3 | | | Elective I | 3 | |
| **Total Credit Hours** | | | | **9** | **Total Credit Hours** | | | | **9** | |

**Semester 3**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | SDG's |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | |
| 1 | | | Elective II | 3 | 1 | | | Elective II | 3 | |
| 2 | | | Thesis/Elective | 3 | 2 | | THS 799 / Elective Code | MS Thesis / Elective Course | 3 | |
| **Total Credit Hours** | | | | **6** | **Total Credit Hours** | | | | **6** | |

**Semester 4**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | SDG's |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | |
| 1 | | | Elective III | 3 | 1 | | | Elective III | 3 | |
| 2 | | | Thesis/Elective | 3 | 2 | | THS 799 / Elective Code | MS Thesis / Elective Course | 3 | |
| **Total Credit Hours** | | | | **6** | **Total Credit Hours** | | | | **6** | |

## MS EE (Communication Systems and IoT Networks)

### Core Courses

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | SDG's |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | |
| 1 | | ESC 501 | Research Methodology | 3 | 1 | | ESC 701 | Research Methodology | 3 | 9 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | | EEN 510 | Stochastic Process | 3 | 2 | | EEN 710 | Stochastic Process for Engineers | 3 | 9 |
| 3 | | EEN 712 | Advanced Digital Communication Systems | 3 | 3 | | EEN 712 | Advanced Digital Communication Systems | 3 | 9 |
| 4 | | EET 603 | Communication Technologies & Platforms for IoT | 3 | 4 | | EET 755 | Wireless Communication Techniques | 3 | 9 |
| 5 | | EET 724 | Optimization Techniques in Electrical Engineering | 3 | 5 | | EET 724 | Optimization Techniques in Electrical Engineering | 3 | 9 |
| Total Credit Hours | | | | 15 | Total Credit Hours | | | | 15 | |

**List of Electives Courses**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | SDG's |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Pre requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | | **Pre requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | |
| 1 | | EET 729 | Wireless Sensor Networks | 3 | 1 | | EET 729 | Wireless Sensor Networks | 3 | 9,11 |
| 2 | | EET 762 | Communication Network Architecture and Protocols | 3 | 2 | | EET 762 | Communication Network Architecture and Protocols | 3 | 9, 11 |
| 3 | | EET 766 | RF System Engineering and Design | 3 | 3 | | EET 766 | RF System Engineering and Design | 3 | 9 |
| 4 | | EET 750 | Antennas Theory, Design and Applications | 3 | 4 | | EET 750 | Antennas Theory, Design and Applications | 3 | 9 |
| 5 | | EET 768 | Cognitive & software Defined Radio | 3 | 5 | | EET 768 | Cognitive & software Defined Radio | 3 | 9 |
| 6 | | EET 755 | Wireless Communication Techniques | 3 | | | | Moved to Core Courses | | |
| 7 | | EEN 740 | Embedded System Design for Telecommunications | 3 | 6 | | EEN 740 | Embedded System Design for Telecommunications | 3 | 9,11 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 8 | | EET 756 | Telecommunication Switching Systems | 3 | 7 | | EET 756 | Telecommunication Switching Systems | 3 | 9 |
| 9 | | EET 702 | Advanced Network Security | 3 | 8 | | EET 702 | Advanced Network Security | 3 | 9,11 |
| 10 | | CEN 745 | Advanced Digital Image Processing | 3 | 9 | | CEN 745 | Advanced Digital Image Processing | 3 | 3,9, 11 |
| 11 | | ESC 716 | Advanced Topics in Wireless & Networking | 3 | 10 | | ESC 716 | Advanced Topics in Wireless & Networking | 3 | 9 |
| 12 | | EEN 725 | Advanced Digital Signal Processing | 3 | 11 | | EEN 725 | Advanced Digital Signal Processing | 3 | 3,9 |
| 13 | | EET 553 | Information Theory and Coding | 3 | 12 | | EET 770 | Advanced Information Theory and Coding | 3 | 9 |
| 14 | | EET 731 | IoT for Industry 4.0 | 3 | 13 | | EET 731 | IoT for Industry 4.0 | 3 | 9 |
| 15 | | EET 730 | AI for Internet of Things | 3 | 14 | | EET 730 | AI for Internet of Things | 3 | 3,9,11 |
| 16 | | EET 728 | Security for Internet of Things | 3 | 15 | | EET 728 | Security for Internet of Things | 3 | 9 |
| | | | | | 16 | | EET 725 | Advanced Routing & Switching | 3 | 9 |
| | | | | | 17 | | EEP 712 | Advanced Power Electronics | 3 | 9 |
| | | | | | 18 | | CEN 752 | Advanced VLSI System Desing | 3 | 9 |
| | | | | | 19 | | CSC 711 | Advanced Artificial Intelligence | 3 | 9 |
| | | | | | 20 | | EET 757 | Mobile Computing | 3 | 9 |
| | | | | | 21 | | EET 769 | Mobile/Vehicular Adhoc Network | | 9, 11 |
| | | | | | 22 | | EET 771 | IoE & Digital Ecosystems | 3 | 9, 11 |
| | | | | | 23 | | EET 772 | Data Networks & Security Technologies | 3 | 9 |

**MS EE (Automation and Control)**

**Core Courses**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | SDG's |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course | Course Code | Course Title | Credit Hours | | Pre requisite Course | Course Code | Course Title | Credit Hours | |

| | Code | | | | | Code | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | ESC 501 | Research Methodology | 3 | 1 | | ESC 701 | Research Methodology | 3 | 9 |
| 2 | | EEN 510 | Stochastic Process | 3 | 2 | | EEN 710 | Stochastic Process for Engineers | 3 | 9 |
| 3 | | EEA 600 | Artificial Intelligence for Control Systems | 3 | 3 | | EEA 712 | AI Enhanced Control Systems | 3 | 9 |
| 4 | | EEN 726 | Modern Control Theory | 3 | 4 | | EEN 726 | Modern Control Theory | 3 | 9 |
| 5 | | EET 724 | Optimization Techniques in Electrical Engineering | 3 | 5 | | EET 724 | Optimization Techniques in Electrical Engineering | 3 | 9 |
| **Total Credit Hours** | | | | **15** | **Total Credit Hours** | | | | **15** | |

## List of Electives Courses

| **Sr. No.** | **Existing Road Map** | | | | **Sr. No.** | **Proposed Road map aligned with HEC new PG Policy** | | | | **SDG's** |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Prerequisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | | **Prerequisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | |
| 1 | | EEA 713 | Robust Multivariable Control System | 3 | 1 | | EEA 713 | Robust Multivariable Control System | 3 | 9 |
| 2 | | EEA 703 | Dynamic Modeling system | 3 | 2 | | EEA 703 | Dynamic Modeling system | 3 | 9 |
| 3 | | EEA 749 | Fuzzy Logic and Intelligent Control Systems | 3 | 3 | | EEA 749 | Fuzzy Logic and Intelligent Control Systems | 3 | 9 |
| 4 | | EEA 509 | Nonlinear Control Systems | 3 | 4 | | EEA 750 | Nonlinear System Analysis & Control | 3 | 9 |
| 5 | | EEA 704 | Adaptive Control Systems | 3 | 5 | | EEA 704 | Adaptive Control Systems | 3 | 9 |
| 6 | | CEN 758 | Robotics and Intelligent Sensors | 3 | 6 | | CEN 758 | Robotics and Intelligent Sensors | 3 | 9 |
| 7 | | CEN 722 | Advanced Interfacing Techniques | 3 | 7 | | CEN 722 | Advanced Interfacing Techniques | 3 | 9 |
| 8 | | EEA 540 | Mechatronics | 3 | 8 | | EEA 751 | Advanced Mechatronics | 3 | 9 |
| 9 | | EEA 601 | Industrial Automation | 3 | 9 | | EEA 752 | Advanced Industrial | 3 | 9 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Technologies | | | | | Automation Technologies | | |
| 10 | | EEA 715 | Industrial Project Management | 3 | 10 | | EEA 715 | Industrial Project Management | 3 | 9 |
| 11 | | EEA 716 | Control Instrumentation and Robotics | 3 | 11 | | EEA 716 | Control Instrumentation and Robotics | 3 | 3,9 |
| 12 | | EEA 717 | Process Control Commissioning and Production Management | 3 | 12 | | EEA 717 | Process Control Commissioning and Production Management | 3 | 9 |
| 13 | | | | | 13 | | EEA 753 | Robotics Essentials | 3 | 9 |
| | | | | | 14 | | EEA 754 | Robot Motion Planning | 3 | 3, 9 |
| | | | | | 15 | | CEN 758 | Robotics & Intelligent Sensors | 3 | 3, 9, 11 |
| | | | | | 16 | | CEN 745 | Advanced Digital Image Processing | 3 | 3, 9 |
| | | | | | 17 | | EEN 725 | Advanced Digital Signal Processing | 3 | 9 |
| | | | | | 18 | | EEP 712 | Advanced Power Electronics | 3 | 9 |
| | | | | | 19 | | CSC 711 | Advanced Artificial Intelligence | 3 | 9 |
| | | | | | 20 | | CEN 752 | Advanced VLSI System Design | 3 | 9 |
| | | | | | 21 | | EEA 702 | Advance Topics in Control Systems | 3 | 9 |

**MS EE (Power Systems)**

**Core Courses**

| **Sr. No.** | **Existing Road Map** | | | | **Sr. No.** | **Proposed Road map aligned with HEC new PG Policy** | | | | **SDG's** |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Pre requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | | **Pre requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | |
| 1 | | ESC 501 | Research Methodology | 3 | 1 | | ESC 701 | Research Methodology | 3 | 9 |
| 2 | | EEN 510 | Stochastic Process | 3 | 2 | | EEN 710 | Stochastic Process for Engineers | 3 | 9 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | | EEP 558 | Power Transmission and Distribution | 3 | 3 | | EEP 710 | Advanced Power Transmission & Distribution | 3 | 7 |
| 4 | | EEP 559 | Power Generation and Plant Operation | 3 | 4 | | EEP 711 | Advanced Power Generation and Plant Operation | 3 | 7 |
| 5 | | EET 724 | Optimization Techniques in Electrical Engineering | 3 | 5 | | EET 724 | Optimization Techniques in Electrical Engineering | 3 | 9 |
| Total Credit Hours | | | | 15 | Total Credit Hours | | | | 15 | |

**List of Electives Courses**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | SDG's |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Pre requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | | **Pre requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | |
| 1 | | EEP 716 | Advanced Power System Analysis | 3 | 1 | | EEP 716 | Advanced Power System Analysis | 3 | 7 |
| 2 | | EEP 717 | Advanced Power System Planning | 3 | 2 | | EEP 717 | Advanced Power System Planning | 3 | 7 |
| 3 | | EEP 718 | Advanced Power System Protection | 3 | 3 | | EEP 718 | Advanced Power System Protection | 3 | 7 |
| 4 | | EEP 561 | High Voltage Engineering Design | 3 | 4 | | EEP 713 | Advanced High Voltage Engineering Design | 3 | 7 |
| 5 | | EEP 754 | Smart Grid System Operation | 3 | 5 | | EEP 754 | Smart Grid System Operation | 3 | 7 |
| 6 | | EEP 564 | Hydel Power Generation | 3 | 6 | | EEP 715 | Advanced Hydel Power Generation | 3 | 7 |
| 7 | | EEP 566 | Power System Reliability | 3 | 7 | | EEP 722 | Advanced Power System Reliability | 3 | 7 |
| 8 | | EEP 719 | Advanced Topics in Power Systems Engineering | 3 | 8 | | EEP 719 | Advanced Topics in Power Systems Engineering | 3 | 9 |
| 9 | | EEP 514 | Renewable Energy | 3 | 9 | | EEP 724 | Advanced Renewable Energy | 3 | 7 |
| 10 | | EEP 757 | Non Conventional Energy Systems | 3 | 10 | | EEP 757 | Non Conventional Energy Systems | 3 | 7 |
| 11 | | EEP 516 | Solar Power Generation | 3 | 11 | | EEP 725 | Advanced Solar Power Generation | 3 | 7 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 12 | | EEP 517 | Wind Power Generation | 3 | 12 | | EEP 726 | Advanced Wind Power Generation | 3 | 7 |
| 13 | | EEP 519 | Hybrid Power Systems | 3 | 13 | | EEP 727 | Advanced Hybrid Power Generation | 3 | 7 |
| 14 | | EEP 723 | Thermal and Nuclear Power Generation | 3 | 14 | | EEP 723 | Thermal and Nuclear Power Generation | 3 | 7 |
| 15 | | EEP 720 | Computer Methods in Power Systems | 3 | 15 | | EEP 720 | Computer Methods in Power Systems | 3 | 9 |
| 16 | | EEP 721 | Insulation Co ordination in Power Systems | 3 | 16 | | EEP 721 | Insulation Co ordination in Power Systems | 3 | 7 |
| 17 | | EEP 712 | Advanced Power Electronics | 3 | 17 | | EEP 712 | Advanced Power Electronics | 3 | 9 |
| 18 | | EEP 502 | Advanced Power System Operation and Control | 3 | 18 | | EEP 728 | Special Topics in Power System Operation and Control | 3 | 7 |
| 20 | | EEP 780 | EMS & SCADA | 3 | 19 | | EEP 780 | EMS & SCADA | 3 | 9 |
| 21 | | EEA 713 | Robust Multivariable Control System | 3 | 20 | | EEA 713 | Robust Multivariable Control System | 3 | 9 |
| 22 | | EEA 749 | Fuzzy Logic and Intelligent Control Systems | 3 | 21 | | EEA 749 | Fuzzy Logic and Intelligent Control Systems | 3 | 9 |
| 23 | | EEA 509 | Nonlinear Control Systems | 3 | 22 | | EEA 750 | Nonlinear System Analysis & Control | 3 | 9 |
| 24 | | EEP 565 | Integration of Distributed Generation | 3 | 23 | | EEP 729 | Integration of Distributed Generation in Power Systems` | 3 | 7 |
| | | | | | 24 | | EEP 775 | HVDC and Flexible AC Transmission | 3 | 7 |
| | | | | | 26 | | EEP 771 | Low Power System Design | 3 | 9 |
| | | | | | 27 | | CEN 752 | Advanced VLSI System Design | 3 | 9 |
| | | | | | 28 | | CSC 711 | Advanced Artificial Intelligence | 3 | 9 |
| | | | | | 29 | | EEP 773 | Power System Stability and Dynamics | 3 | 7, 9 |

**List of New Added Courses:**

| S. NO | Course Code | Course Title | Credit Hours |
|---|---|---|---|
| 1 | EEN 710 | Stochastic Process for Engineers | 3 |
| 2 | EET 770 | Advanced Information Theory and Coding | 3 |

| | | | |
|---|---|---|---|
| 3 | EET 771 | IoE & Digital Ecosystems | 3 |
| 4 | EET 772 | Data Networks & Security Technologies | 3 |
| 5 | EEA 712 | AI Enhanced Control Systems | 3 |
| 6 | EEA 750 | Nonlinear System Analysis & Control | 3 |
| 7 | EEA 751 | Advanced Mechatronics | 3 |
| 8 | EEA 752 | Advanced Industrial Automation Technologies | 3 |
| 9 | EEA 753 | Robotics Essentials | 3 |
| 10 | EEA 754 | Robot Motion Planning | 3 |
| 11 | EEP 710 | Advanced Power Transmission & Distribution | 3 |
| 12 | EEP 711 | Advanced Power Generation and Plant Operation | 3 |
| 13 | EEP 713 | Advanced High Voltage Engineering Design | 3 |
| 14 | EEP 715 | Advanced Hydel Power Generation | 3 |
| 15 | EEP 722 | Advanced Power System Reliability | 3 |
| 16 | EEP 724 | Advanced Renewable Energy | 3 |
| 17 | EEP 725 | Advanced Solar Power Generation | 3 |
| 18 | EEP 726 | Advanced Wind Power Generation | 3 |
| 19 | EEP 727 | Advanced Hybrid Power Generation | 3 |
| 20 | EEP 728 | Special Topics in Power System Operation and Control | 3 |
| 21 | EEP 729 | Integration of Distributed Generation in Power Systems` | 3 |

**List of Courses to be Removed**

| S. NO | Course Code | Course Title | Credit Hours |
|---|---|---|---|
| 1 | ESC 501 | Research Methodology | 3 |
| 2 | EEN 510 | Stochastic Process | 3 |
| 3 | EET 603 | Communication Technologies & Platforms for IoT | 3 |
| 4 | EET 560 | Telecommunication Network Management | 3 |
| 5 | EET 555 | Wireless & Mobile Communications | 3 |
| 6 | EET 552 | Multimedia Networking | 3 |
| 7 | EET 553 | Information Theory and Coding | 3 |
| 8 | EET 546 | Radio & Microwave Engineering | 3 |
| 9 | EET 558 | 5G And Internet of Things | 3 |
| 10 | EET 559 | Programming of Internet of Things | 3 |
| 11 | EET 601 | Narrow Band IoT Systems | 3 |
| 12 | EET 603 | SDN for Internet of Things | 3 |
| 13 | EET 602 | Ultra Low Power Radios for IoT | 3 |
| 14 | EEA 600 | Artificial Intelligence for Control Systems | 3 |

| | | | |
|---|---|---|---|
| 15 | EEA 509 | Nonlinear Control Systems | 3 |
| 16 | EEA 540 | Mechatronics | 3 |
| 17 | EEN 435 | Advanced Solid State Devices | 3 |
| 18 | EEA 601 | Industrial Automation Technologies | 3 |
| 19 | EEA 602 | System Integration | 3 |
| 20 | EEP 558 | Power Transmission and Distribution | 3 |
| 21 | EEP 559 | Power Generation and Plant Operation | 3 |
| 22 | EEP 561 | High Voltage Engineering Design | 3 |
| 23 | EEP 564 | Hydel Power Generation | 3 |
| 24 | EEP 566 | Power System Reliability | 3 |
| 25 | EEP 514 | Renewable Energy | 3 |
| 26 | EEP 516 | Solar Power Generation | 3 |
| 27 | EEP 517 | Wind Power Generation | 3 |
| 28 | EEP 519 | Hybrid Power Systems | 3 |
| 29 | EE P 714 | Advanced Topics in Renewable Energy | 3 |
| 30 | EEP 502 | Advanced Power System Operation and Control | 3 |
| 31 | EEP 521 | Design of Electrical Machines | 3 |
| 32 | EEP 565 | Integration of Distributed Generation | 3 |

**Course Outlines**

Course Name: **Stochastic Process for Engineers**

Course Code: EEN 710

Credit Hours: 3

Pre requisite: N/A

**Course Objectives**

This course provides an in depth study of stochastic processes with a focus on applications in engineering. Topics include measure theoretic foundations, various types of stochastic processes, stochastic calculus, and their applications in fields such as communications, signal processing, and financial engineering.

**Course Learning Outcomes**

After completing this course, students will be able to:

Understand the fundamental concepts in the Probability and Stochastic process

Apply the techniques and constructions of discrete and continuous time Markov chains to solve problems involving n step transition probabilities, and stationary distributions.

Develop and use stochastic models, such as renewal processes, queuing theory, and stochastic differential equations, to address practical issues in diverse fields like finance, physics, and engineering.

**Course Contents**

Introduction to Stochastic Processes, Definition and examples of stochastic processes, Classification of stochastic processes (discrete vs. continuous time, discrete vs. continuous state space), Applications of stochastic processes in various fields, Review of Probability Theory, Random variables and distributions,

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| Expectation, variance, and higher moments, Conditional probability and conditional expectation, Independence and correlation, Markov Chains, Definition and properties of Markov chains, Transition matrices, Classification of states (recurrent, transient, absorbing), Long term behavior and stationary distributions, Poisson Process, Definition and properties of the Poisson process, Inter arrival times, Thinning and superposition of Poisson processes, Applications of Poisson processes, Renewal Processes, Definition and examples of renewal processes, Renewal function and renewal equation, Limit theorems for renewal processes, Applications in queuing theory and reliability, Discrete time Markov chains (DTMCs), Chapman Kolmogorov equations, Classification of states, Long term behavior and stationary distributions, Continuous Time Markov Chains, Definition and properties of continuous time Markov chains (CTMC), Transition rate matrix, Kolmogorov forward and backward equations, Birth death processes, Brownian Motion, Definition and properties of Brownian motion, Sample path properties, Connection with the heat equation, Applications in finance and physics, Martingales, Definition and examples of martingales, Martingale convergence theorems, Stopping times, Applications in finance (e.g., option pricing), Introduction to Stochastic Calculus, Stochastic integrals, Ito's lemma, Stochastic differential equations (SDEs), Applications of SDEs, Queuing Theory, Basic queuing models (M/M/1, M/M/c, etc.), Little's Law, Queuing networks, Applications in telecommunications and operations research, Branching Processes, Definition and examples of branching processes, Generating functions, Extinction probabilities, Applications in engineering, Applications in reliability and inventory systems, Applications in Engineering, Communications and signal processing, Noise modeling and filtering, Markov and hidden Markov models |
| Resources |
| "Probability and Stochastic Processes," Yates & Goodman<br>"Probability, Random Variables and Stochastic Processes", A Papoulis & S U Pillai<br>"Stochastic Processes: Theory for Applications" by Robert G. Gallager<br>"Adventures in Stochastic Processes" by Sidney I. Resnick |

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| Course Name: **Advanced Information Theory and Coding** |
| Course Code: EEN 770 |
| Credit Hours: 3 |
| Pre requisite: N/A |
| **Course Objectives**<br><br>This course delves into the advanced principles and applications of information theory and coding. It explores the mathematical underpinnings of data transmission, compression, and error correction. The course aims to equip students with the theoretical and practical knowledge required to design and analyze efficient and reliable communication systems. |

| **Course Learning Outcomes** |
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| After completing this course, students will be able to:<br>Understand the fundamental concept of entropy, mutual information, channel capacity, and their applications in data transmission and compression.<br>Develop and evaluate various error correcting codes (e.g., linear block codes, convolutional codes, Turbo codes) and source coding algorithms for efficient and reliable communication.<br>Solve real world problems in telecommunications, data storage, and cryptography by applying advanced information theory and coding principles. |
| **Course Contents** |
| **Course Learning Outcomes**<br><br>Basic Information Theory Concepts, Entropy, Joint Entropy, Conditional Entropy, Mutual Information and Kullback Leibler Divergence, Review of Source Coding Theorems, Channel Capacity, Lossless Source Coding, Huffman Coding, Arithmetic Coding, Lempel Ziv Welch (LZW) Algorithm, Lossy Source Coding, Rate Distortion Theory, Scalar and Vector Quantization, Transform Coding (e.g., JPEG), Channel Capacity and Coding, Discrete Memoryless Channels, Channel Models and Capacity Calculation, Symmetric and Asymmetric Channels, Channel Coding Theorems, Shannon's Theorem, Noisy Channel Coding Theorem, Error Exponent, Error Correcting Codes, Linear Block Codes, Hamming Codes, BCH Codes, Reed Solomon Codes, Convolutional Codes, Encoding and Decoding Techniques, Viterbi Algorithm, Modern Coding Techniques, Turbo Codes, Low Density Parity Check (LDPC) Codes, Polar Codes, Advanced Topics in Coding Theory, Network Coding, Fundamentals and Benefits, Multicast Networks, Trellis and Graph Based Codes, Trellis Diagrams, Tanner Graphs, Belief Propagation, Multi User Information Theory, Multiple Access Channels (MAC), Capacity Region, Coding Strategies, Broadcast Channels, Degraded Broadcast Channels, Capacity Region, Interference Channels, Types and Capacity, Interference Management Techniques, Network Information Theory, Relay Channels, Decode and Forward, Compress and Forward, Cooperative Communication, Cooperative Diversity, Distributed Space Time Coding, Network Coding, Basics and Algorithms, Applications in Communication Networks, Quantum Information Theory, Quantum Entropy and Information, Quantum Entropy, Von Neumann Entropy, Quantum Channels and Coding, Quantum Error Correction, Quantum Capacity, Entanglement and Information Transmission, Entanglement Assisted Communication, Quantum Key Distribution, Practical Applications and Case Studies, Telecommunication Systems, Mobile and Wireless Communication, Fiber Optic Communication, Data Storage Systems, RAID Systems, Error Correction in Storage Media, Cryptography and Security, Information Theoretic Security, Cryptographic Protocols, Emerging Trends and Research Directions, Recent Advances in Information Theory, Machine Learning Applications, Big Data and Information Theory, Future Research Directions, Advanced Coding Techniques, Quantum Computing and Communication |
| **Resources**<br><br>Elements of Information Theory, T. M. Cover & J. A. Thomas, Wiley Interscience.<br>Information Theory: Coding Theorems for Discrete Memoryless Systems, I. Csiszàr & J. Körner, Cambridge University Press.<br>The Theory of Error Correcting Codes, F. J. MacWilliams & N. J. A. Sloane, North Holland.<br>Algebraic Codes for Data Transmission, Richard E. Blahut, Cambridge University Press. |

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| Course Name: **Internet of Everything (IoE) & Digital Ecosystems** |
| Course Code: EEN 771 |
| Credit Hours: 3 |
| Pre requisite: N/A |
| Course Objectives |
| In the first part, this course will develop an understanding of the challenges the IoE technology, the technical components of the IoE, and the technologies that make up those components. In particular, the Smart Sensor Network, power management technology, low power operation and the different types of Wireless Networks will be analyzed from the perspective of real world application scenarios. In the second part of the course, the contents covers several perspectives on ecosystems and examines the technological foundations on the basis of which digital ecosystems are built, maintained and governed. |
| **Course Learning Outcomes** |
| After completing this course, students will be able to:<br>To explain the fundamental concepts, principles, and technologies underpinning the Internet of Everything (IoE) and digital ecosystems. They will understand the convergence of people, processes, data, and things in the IoE framework and how digital ecosystems facilitate interconnectedness and collaboration among various stakeholders.<br>Demonstrate the ability to design, implement, and evaluate IoE solutions using various technologies such as IoT, cloud computing, big data analytics, and artificial intelligence. They will be capable of integrating these technologies to create efficient, scalable, and secure digital ecosystems tailored to specific industry needs.<br>Develop critical thinking and problem-solving skills to assess and address challenges in the deployment and management of IoE systems and digital ecosystems. They will be able to analyze real world case studies, identify potential risks, and propose innovative solutions to optimize the performance and sustainability of digital ecosystems. |
| **Course Contents**<br>Networking protocols<br>Sensor technology<br>Power management techniques and technology<br>Data processing<br>Techno economic implications of the IoE<br>Internet of mobile things<br>Internet of medical things<br>Internet of autonomous vehicles<br>Connectivity as a Service<br>IoE Platforms and Ecosystems<br>Architecture of Ecosystems: Modularity<br>Ecosystem Modelling<br>Ecosystems: Enabling Technologies<br>Ecosystems: Industrial Platform<br>Digital Health |

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| Connected Car<br>Smart Energy<br>Smart Cities |
| **Resources** |
| 1. IoT and IoE Driven Smart Cities, Springer International Publishing, 2021.<br>2. The internet of everything: Advances, challenges and applications, Springer International Publishing, 2019.<br>3. Digitalization: Approaches, Case Studies, and Tools for Strategy, Transformation and Implementation. Springer International Publishing, 2021. |

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| Course Name: **Data Networks & Security Technologies** |
| Course Code: EEN 772 |
| Credit Hours: 3 |
| Pre requisite: N/A |
| **Course Objectives** |
| This course is an introduction to the theory and practice of network and security and will cover the vulnerabilities and defenses in network and communication systems. It will introduce state of the art network and web security attacks along with hand on activities to provide better understanding of the security vulnerabilities. The objective of this course is to enable students to understand the main challenges in designing security mechanisms and protocols for thwarting attacks on existing and emerging data networks. Moreover, this course also covers the design and analysis of blockchain systems and distributed ledgers. |
| **Course Learning Outcomes** |
| After completing this course, students will be able to:<br>and protocols to protect network integrity and data privacy.<br>Develop practical skills in configuring, managing, and troubleshooting data networks. Through hands on lab exercises and projects, they will learn to set up network devices, configure network services, monitor network performance, and diagnose and resolve network issues. They will be able to apply these skills in real world scenarios to ensure reliable and secure network operations. |
| **Course Contents**<br>System security in data network<br>Introduction to network security: Vulnerabilities<br>Communication network background and attacks<br>Data link layer security (Ethernet, ARP, WiFi)<br>Network layer security (IP, IPSec)<br>Transport layer security (SSL/TLS)<br>Designing Network Security Policies |

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| Cross layer network security mechanisms (firewalls, Intrusion Detection Systems)<br>Application layer firewalls and IDS<br>Introduction to Digital Ledgers: Blockchain<br>Security and privacy of distributed ledgers<br>Blockchain security and privacy<br>Consensus algorithms (Proof of work, Proof of stake, Byzantine fault tolerance)<br>Traceability in blockchain (tracing transactions in the blockchain)<br>Smart contract development in Ethereum/Hyperledger<br>Blockchain and virtual machines<br>Blockchain ecosystem |
| **Resources**<br><br>1. Blockchain and distributed ledgers: Mathematics, technology, and economics by Lipton, Alexander, and Adrien Treccani. World Scientific, 2021.<br>2. Advances in Malware and Data Driven Network Security, BB Gupta, IGI Global, 2021. |

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| Course Name: **AI Enhanced Control Systems** |
| Course Code: EEA 712 |
| Credit Hours: 3 |
| Pre requisite: NIL |
| Course Objectives |
| The course aims to provide a comprehensive understanding of integrating artificial intelligence (AI) techniques into traditional control systems. Students will explore fundamental control system concepts, AI basics, machine learning, neural networks, fuzzy logic, expert systems, and optimization techniques. The course emphasizes practical applications, including the design, simulation, and validation of AI based controllers across various industries such as robotics and automotive. Ethical considerations and societal impacts of AI in control systems will also be addressed. By the end of the course, students will be equipped to enhance control system performance using AI, tackle complex control problems, and understand the future trends and challenges in the field. |
| Course Learning Outcomes |
| After completing this course, students will be able to:<br>Apply machine learning and artificial intelligence methods, such as neural networks and reinforcement learning, to design and optimize control systems.<br>Develop and implement data driven control strategies, leveraging AI algorithms to improve system performance and adaptability in dynamic environments.<br>Demonstrate the ability to integrate AI based control solutions into real world applications, validating their effectiveness through simulation and experimental setups. |
| Course Contents |

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| Introduction to AI , Problem solving as state space search , Heuristic Search , Introduction to Machine learning , Learning Decision Trees , Linear Regression , Support vector Machines , Unsupervised Learning , Reinforcement Learning , Supervised Learning , Learning in Neural Network , Introduction to NeuroFuzzy and soft computing , Fuzzy sets, Fuzzy Rules , Fuzzy Inference Systems , LSM Method for system Identification , Adaptive Neural Network , Neuro Fuzzy Modeling , Neuro Fuzzy Control. |
| Resources |
| Patrick Henry Winston, Artificial Intelligence, Third Edition, Addison Wesley Publishing Company, 2004.<br>Nils J Nilsson, Principles of Artificial Intelligence, Illustrated Reprint Edition, Springer Heidelberg, 2014<br>Neuro Fuzzy & Soft Computing— A computational approach to learning and machine intelligence Jyh Shing Roger Jang, Chuen Tsi Sun & Eiji Miztani (ISBN 0 13 261066 3 |

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| Course Name: **Nonlinear System Analysis and Control** |
| Course Code: EEA 750 |
| Credit Hours: 3 |
| Pre requisite: Linear control systems |

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| Course Objectives<br>This course aims to introduce the analysis of nonlinear system, and the common nonlinear control schemes. The course is divided into two parts, namely analysis and synthesis. In the analysis part, the state space description of nonlinear system is introduced, and the phase portrait analysis of the second order system is elaborated. Stability analysis of the nonlinear system, based on linearization method, and direct method of Lyapunov is explained. While the stability analysis is completed with Lasalle's theorem, absolute stability notion, Popov, and circle criteria, and the stability analysis of time varying nonlinear systems. Finally, the analysis of limit cycles is thoroughly elaborated using describing functions. In the synthesis part, after introducing of Lie Algebra, and required mathematics, Feedback linearization methods for input state, and input output cases are described, and backstopping method and sliding mode control is introduced. |
| Course Learning Outcomes |
| After completing this course, students will be able to:<br>Analyze and model nonlinear dynamical systems, identifying and characterizing various nonlinear behaviors such as bifurcations and chaos.<br>Design and implement controllers for nonlinear systems using techniques like Lyapunov stability and feedback linearization, assessing their stability and performance.<br>Apply nonlinear control theories to practical engineering problems, using simulation tools and real time control systems to validate control strategies. |
| Course Contents |
| Dynamics and modeling of nonlinear systems , Feedback linearization, Lie algebra ,<br>Sliding Mode Controllers , Vector Field Methods , Fuzzy State Space Models , Stability of non Linear Systems , Quadratic Indices , Lyapunov's Indirect Method, Lyapunov Like Analysis , Optimal Control , Calculus of Variations , Euler–Lagrange Equation , Linear Quadratic Regulator , Pontryagin's Minimum Principle , Optimal Control with Constraints on Inputs , Passivity Based Control , Sliding Mode control. |

| Resources |
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| Systems and Control by Stanislaw H. Zak<br>Nonlinear Systems by Hasan Khalil. |

| Course Name: **Advanced Mechatronics** |
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| Course Code: EEA 751 |
| Credit Hours: 3 |
| Pre requisite: N/A |

| **Course Objectives** |
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| This course provides an in depth study of mechatronics, focusing on the integration of mechanical, electronic, control, and computing systems. Students will learn advanced concepts and techniques used in the design and implementation of intelligent systems and automation. The course focuses on introducing the new field of mechatronics and demonstrating how it is used in numerous sectors, including manufacturing, Automobile, chemical, and pharmaceutical. The course includes theoretical lectures, practical laboratory sessions, and project based learning. |
| Course Learning Outcomes |
| On successful completion of this course students will be able to:<br>Understand the architecture of mechatronic systems<br>Design measurement systems using different sensors<br>Design various control systems using different actuators<br>Demonstrate PLCs application in mechatronics<br>Understand the CNC machine architecture and its programming fundamentals |
| Course Contents |
| The course focuses on introducing the new field of mechatronics and demonstrating how it is used in numerous sectors, including manufacturing, Automobile, chemical, and pharmaceutical. Introduction to Integrated Mechanical Electronics, Mechatronics system, Smart materials, Application of mechatronics system in industry. Elements of mechatronics system, Mechatronic and smart materials, Data conversion devices, Micro transducers, Examples of real life systems integrated mechanical electronics design. Controllers in Mechatronics, Drives and CNC mechanisms in Mechatronics, Pneumatic Systems, Hydraulic Systems. Digital control systems and discrete time controllers, Microcontroller architecture and programming, Industrial automation and robotic applications, Automation technologies and PLCs, Drives and CNC mechanisms in Mechatronics, Machine learning and artificial intelligence in mechatronics, Smart sensors and the Internet of Things (IoT), Emerging trends and future directions in mechatronics. •Signal con |
| Resources |
| Mechatronics 2013 Recent Technological and Scientific Advances (4th Edition, Springer).<br>Manufacturing automation: metal cutting mechanics, machine tool vibrations, and CNC design (2nd Edition, Cambridge University Press).<br>Mechatronics A Foundation Course (1st Edition, Taylor & Francis CRC Press).<br>Programmable Logic Controllers: Industrial Control (1st Edition, McGraw Hill Professional Publishing). |

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| Course Name: **Advanced Industrial Automation Technologies** |
| Course Code: EEA 752 |
| Credit Hours: 3 |
| Pre requisite: N/A |
| Course Objectives |
| This course equips students with a solid foundation in automation, covering key topics like sensor calibration, signal conditioning, and the impact of the industrial revolution. It includes practical training on pneumatic actuators, conveyor belt systems, and the use of PLCs, DCS, and SCADA in industry automation. Students will also learn to interpret Piping and Instrumentation Diagrams (P&ID) and explore automation in assembly lines and process industries, preparing them to lead and innovate in the evolving field of industrial automation. |
| **Course Learning Outcomes** |
| On successful completion of this course students will be able to:<br>Design and integrate advanced automation systems, including PLCs, SCADA, DCS, and robotics, into industrial processes<br>Apply advanced control strategies, such as model predictive control and adaptive control, to optimize and manage complex industrial systems<br>Effectively apply Industrial Internet of Things (IIoT) concepts to enhance system connectivity, enable real time data analytics, and support predictive maintenance strategies<br>Conduct and present research that advances knowledge in industrial automation technologies, addressing real world industrial challenges |
| **Course Contents**<br><br>This course provides a thorough overview of Industrial Automation and Technologies, beginning with the basics of automation systems and their components, and examining the impact of the industrial revolution. It covers sensor characteristics, signal conditioning, and calibration, along with the use of pyrometers for temperature measurement. The course includes practical training on conveyor belt systems, pneumatic and hydraulic activation systems, and the installation of pneumatic actuators. Students will learn to interpret Piping and Instrumentation Diagrams (P&IDs), understand PLC architecture and ladder logic, and explore PLC based automation, DCS, and SCADA systems. The course also addresses automation in assembly lines and the process industry, concluding with presentations and discussions on selected advanced topics. Students will also delve into the Industrial Internet of Things (IIoT) and Distributed Control Systems (DCS), gaining insights into cutting edge process control methods such as Advanced Process Control (APC). The course includes a focus on additive manufacturing, advanced production techniques, and the application of artificial intelligence and machine learning in automation. Additionally, students will engage in research methods and innovations in automation. |
| **Resources**<br>Automation, Production Systems, and CIM, Groover, M. P (5th Edition, Pearson).<br>Industrial Internet of Things: Cyber manufacturing Systems, Sabina Jeschke, Christian Brecher, and H. K. H. L., (1st Edition, Springer)<br>Industrial Automation and Robotics: A Hands On Approach, N. S. J. R. B. (1st Edition, CRC Press).<br>Manufacturing automation: metal cutting mechanics, machine tool vibrations, and CNC design (2nd Edition, Cambridge University Press).<br>Industrial Robotics: Theory, Modelling and Control, Bruno Siciliano and Lorenzo Sciavicco (1st Edition, |

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| Springer) |

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| Course Name: **Robotics Essentials** |
| Course Code: EEA 753 |
| Credit Hours: 3 |
| Pre requisite: Nil |
| Course Objectives |
| By the end of the course, students should be able to demonstrate fundamental understanding of the core concepts and principles of robotics, including the key components, mechanisms, and technologies involved in the field. They will study mathematical foundations of robot motion, including kinematics and dynamics, understand how robots move and interact with their environments. Explore the various sensors used in robotics, including vision systems, LiDAR, and ultrasonic sensors. Gain knowledge of algorithms and techniques used in planning robot paths and navigating robots through complex environments. Learn about the principles of robot manipulation, including kinematic chains, end effectors, and grasping techniques. Explore ongoing research and emerging trends in robotics, encouraging a forward thinking approach to the field. |
| Course Learning Outcomes |
| After completing this course, students will be able to:<br>Analyze and model the kinematics and dynamics of robotic systems, understanding the mathematical foundations and physical principles governing robot motion.<br>Design and implement control algorithms and path planning strategies for robotic systems, ensuring precise and efficient task execution in various environments.<br>Apply robotic principles and technologies to real world problems, demonstrating the ability to integrate sensors, actuators, and control systems to achieve desired functionalities in practical applications. |
| **Course Contents**<br>Introduction to Robotics, Kinematic Coordinate Transformation , Homogenous Transformation, Industrial Robot Kinematic Structure , Robot Architecture , DH Parameters, DH Algorithm , Arm Matrix (Apha II Robot) , 4,5 & 6 Axis Robot Forward Kinematics , Inverse Kinematics , Robot Work cell , Differential Relations, Jacobian , Design DOF Planer Robot using MATLAB/ Simscape , Drive Robot using Robotic system tool box/ Inverse Kinematics , Generating Trajectory using MATLAB, Build RRR robot and Drive in 3D using Forward Kinematics , Drive robot through Dynamics, PD and PID control of Robot Manipulator , Control Scheme, Sensors , Robot Vision , Robot Motion Planning, Robust Force Control of a Two Finger Exoskeleton during Grasping , Neural Control of an Index Finger Exoskeleton |
| **Resources** |
| Robert J Schilling, Fundamentals of Robotics, Prentice Hall India<br>John J Craig, Introduction to Robotics, Prentice Hall International, 2005<br>Reference Books:<br>M.W. Spong and S. Hutchinson Robot Modeling and Control. John Wiley & Sons,2005 |

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| Course Name: **Robot Motion Planning** |
| Course Code: EEA 754 |
| Credit Hours: 3 |
| Pre requisite: Nil |
| Course Objectives |
| Robot motion planning deals with the design of algorithms that can find collision free paths (if they exist) to take a robot from an initial point to a goal point. Due to recent interests in developing autonomous robotic systems, the subject has become extremely broad and covers not only the traditional areas of finding collision free paths, but automatic assembly, warehouse automation, multi robot cooperation, robotic surgery, etc. The course would cover the fundamental concepts and mathematics required to understand, analyze, and design algorithms required for motion planning of serial robotic arms and mobile robots. After taking this course, students could then take more advanced courses/topics in focused areas like, AI in Motion Planning, unmanned vehicles, probabilistic motion planning, etc. |

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| Course Learning Outcomes |
| After completing this course, students will be able to:<br>apply fundamental algorithms and mathematical concepts used in robot motion planning, such as configuration space, graph based methods, and optimization techniques.<br>Design, implement, and evaluate various motion planning algorithms, including probabilistic roadmaps (PRM), rapidly exploring random trees (RRT), and potential field methods for diverse robotic applications.<br>Apply motion planning algorithms to real world scenarios, using simulation tools to validate and optimize robot paths in complex environments, ensuring collision avoidance and efficiency. |
| Course Contents |
| Introduction to Robot Motion Planning, Basics of Serial robotic arms and Mobile robots , Joints and Degrees of Freedom, Work Volume and Rotation Transformation , Transformations, Kinematics , Earliest Bug Algorithms , Configuration Space, Manifold, Topology of Configuration Space , C Space Obstacles, C Space for mobile robots , C Space for Serial robotic arms, Road Map methods, , Cell decomposition methods, sampling based methods , Potential field based methods, wave front planners. , Navigation Function and Potential Field in 3D, Basic Search Algorithms , Motion Planning with Kinematic Constraints , Controllability Non holonomic systems and planning with kinematic constraints , Kinematic Constraints and Multifinger Robot , Multifinger Robot Hands , Motion planning for Multi robotic systems, motion planning in 3D. Optimization in Motin Planning. |
| Resources:<br>Latombe, Jean Claude. Robot motion planning. Vol. 124. Springer Science & Business Media,.<br>Reference Books:<br>. Articles & Research Papers<br>Tools:<br>• MATLAB/ Simulink/ Simscape<br>• Copeliasim |

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| Course Name**: Advanced Power Transmission and Distribution** |
| Course Code: EEP 710 |
| Credit Hours: 3 |
| Pre requisite: N/A |
| Course Objectives |
| The objective of this courses is to introduce the principle of power transmission and distribution, and cover topics related to the transmission and distribution network, network structure, substations, protection of transmission and distribution network, and power transformers. It introduces students to fundamental issues in the design and operation of electricity transmission and distribution networks. |
| Course Learning Outcomes |
| After completing this course, students will be able to:<br>Explain the fundamental principles, components, and operations of power transmission and distribution systems. They will understand how electrical power is generated, transmitted, and distributed to end users, including the various configurations and infrastructure involved in these processes.<br>Demonstrate the ability to design, analyze, and optimize power transmission and distribution networks. They will learn to use relevant software tools and methodologies to assess system performance, reliability, and efficiency, and to address issues related to load flow, voltage regulation, and fault management.<br>Develop a thorough understanding of safety standards, regulatory frameworks, and industry best practices related to power transmission and distribution. They will be able to apply this knowledge to ensure compliance, enhance system security, and mitigate risks associated with the operation and maintenance of transmission and distribution systems. |

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| Course Content:<br>Introduction to Power systems, main parts of Power system, Description, Discussion of each part, Design aspects of Power systems and Production of Loads.<br>Load Forecasting, Types of Loads in the Power System, Load factor, Demand Factor and Numerical examples.<br>Transmission of Power, Types of Transmission.<br>DC and AC Transmission, Advantages and Disadvantages<br>Various Systems of Transmission of Power<br>Economics of Transmission System<br>Annual cost of Energy wasted<br>Requirement of satisfactory Power Supply<br>Resistance of Transmission line<br>Inductance of Transmission line<br>Showing of Midterm papers<br>Mathematical derivation of equations<br>Derivation of equation of log<br>According to service<br>Discussion of Bus Bars<br>Types of Insulators<br>Specification of equipment, including through the use of power flow modelling tools such as MATLAB or PSSE.<br>Advanced system voltage regulation, system protection and system reliability.<br>Markov processes for state transmission models.<br>Introduction of various high voltage equipment used in substations, latest technology in High Voltage DC transmission, and future distributed power systems, such as smart grid technology and renewable energy systems. |
| Resources |
| Principles of Power System: Including Generation VK Mehta & Rohit Mehta · 2005.<br>Electrical Power Generation, Transmission And Distribution By Leonard L.Griggs.<br>Lecture Slides |

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| Course Name**: Advanced Power Generation and Plant Operation** |
| Course Code: EEP 711 |
| Credit Hours: 3 |
| Pre requisite: N/A |

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| Course Objectives |

The objective of this courses is to introduce students to the features, operations, advantages and limitations of common power plants, drivers for improvement, and features of advanced power plants. It introduces students to analysis of thermal performance and principles of plant design and operation, including fuel operation, optimization of combustion, performance improvement, and statutory inspection, General topics include the feature, operations, advantages and limitations of common power plants, Thermal performance and principles of power plant design and maintenance problems, and economics of plant operation.

| Course Learning Outcomes |
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| After completing this course, students will be able to:<br><br>Describe and explain the various methods of power generation, including fossil fuel, nuclear, renewable energy sources (solar, wind, hydro, geothermal), and emerging technologies. They will understand the principles, advantages, and limitations of each method, as well as the environmental and economic impacts associated with them.<br>Demonstrate the ability to operate and maintain different types of power plants efficiently and safely. This includes understanding the key components and systems within a power plant, such as boilers, turbines, generators, and control systems. Students will also learn to apply best practices for routine maintenance, troubleshooting, and ensuring operational reliability.<br>Develop a thorough knowledge of safety protocols, regulatory standards, and industry best practices relevant to power generation and plant operation. They will be capable of conducting risk assessments, implementing safety measures, and ensuring compliance with environmental and regulatory requirements to promote safe and sustainable power generation practices. |

| Course Contents |
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| Introduction, Types of power Station, Choice of type of Generator, Cost of Electrical Energy<br>Hydro Electric Stations: Introduction, Types of Hydro Electric Power Stations, Principle of working of a Hydro Electric Plant, Power Station Structure and Layout, Types of Turbine and their characteristics, Arrangements and location of Hydro Electric Stations, Types of Hydro Electric Plants and Dam, Characteristics of Generators, Costs of Hydro Electric Stations,<br>Steam Power Plants: Introduction, Main Parts and working of a steam Station, Plant Layout, Rankin Cycle and its types, Types of Boiler and their characteristics, characteristics of steam turbines, Design of a steam Power Station, Steam station auxiliaries, Cost of Steam Station.<br>Gas Turbines: Introduction, Main Parts of Gas turbine plant, Plant Layout, Principle of Operation, Characteristics of Gas Turbine plants, Gas Turbine Power Plant operation and Control, Combined Cycles Cost of Gas Turbine Stations.<br>Diesel Electric Station: Introduction of Diesel Engine, Principle of working, characteristics of diesel engines, sizes and dimensions of generator sets, Coordination of Engine and Generator Characteristics, Use of Diesel Sets as Alternative Power Plant, cost of diesel Plants.<br>Nuclear Power Stations: Introduction, Nuclear Reaction, Main Parts of Nuclear Power Stations, Plant Layouts, Principle of Nuclear Energy, Nuclear reactor and reactor control, Types of Power Reactor, Comparison of various types of reactor, Economics of Nuclear Power Stations.<br>MHD Generators: Gaseous conductors, analysis and design of MHD generator, Problems associated with MHD generation, possible configuration. |

| Introduction to renewable energy generation and Renewable energy resources |
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| Resource: |
| Elements of Electrical Power Station Design by Deshpande<br>Lecture Slide |

| Course Name: **Advanced High Voltage Engineering Design** |
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| Course Code: EEP 713 |
| Credit Hours: 3 |
| Pre requisite: N/A |

| Course Objectives |
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| The objective of this courses is to introduce students to the major items of high voltage equipment and components, including materials used and dielectric properties; field analysis and its use in determining the electrical insulation design; thermal ratings of equipment; the design of both static and dynamic contact systems for equipment; the design and operation of specific items of equipment including transformers (power and instrument) |

| Course Learning Outcomes |
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| After completing this course, students will be able to:<br>Explain the fundamental principles and theories of high voltage engineering, including electric field distribution, insulation coordination, and breakdown mechanisms in gases, liquids, and solids. They will understand the importance of these principles in the design and operation of high voltage systems.<br>Demonstrate the ability to conduct high voltage tests and measurements using standard testing methods and equipment. They will be able to evaluate the performance and reliability of high voltage components and systems, ensuring compliance with industry standards and safety regulations.<br>Develop the skills to design and implement high voltage systems, including power transmission lines, substations, and electrical equipment. They will be able to perform detailed design calculations, select appropriate materials and components, and apply advanced simulation tools to optimize the design for efficiency, reliability, and safety. |

| Course Contents |
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| Dielectric and Breakdown strength of Solid, Liquid and Gases<br>Methods of Generation of High Voltages<br>Methods of Measurement of High Voltages<br>Leakage Current in Low and High Voltage Systems<br>Source and types of Over Voltages and their remedies<br>Types of Insulation Materials<br>Lightening Phenomena and its effects on High Voltage Power Systems<br>Importance of Grounding in High Voltage Systems<br>Calculation of Switching Surges<br>HVDC and its future<br>Design and testing of High Voltage Systems and Insulation Systems<br>Application of High Voltages in vital daily life and research in various areas of Science<br>Switchgear, cables, overhead lines, surge arresters. |

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| Techniques to generate and measure high voltages.<br>Condition monitoring and high voltage diagnostic testing methods. |

| Resources |
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| E. Kuffel, W.S. Zaengl, and J. Kuffel, High Voltage Engineering: Fundamentals, 2nd edition, Butterworth Heinemann, 2000.<br>High Voltage Engineering by M.S. Naidu, V. Kamaraju, 4th ed.<br>High Voltage Engineering By J.R. Lucas.<br>Lecture Slides |

| Course Name: **Advanced Hydel Power Generation** |
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| Course Code: EEP 715 |
| Credit Hours: 3 |
| Pre requisite: N/A |
| Course Objectives |
| This course provides a detailed knowledge of intakes, tunnel system, power plants, optimization, state estimation and maintenance of electrical equipment, hydroelectric generators, constructive structure and design of hydropower generators. |
| Course Learning Outcomes |
| After completing this course, students will be able to:<br>Gain a thorough understanding of the principles, concepts, and technologies involved in hydel power generation. They will learn about the different types of hydropower plants, the process of converting hydraulic energy into electrical energy, and the environmental and economic implications of hydropower projects.<br>Develop the skills to design, operate, and maintain hydropower plants. They will be able to apply engineering principles to create efficient hydropower systems, perform feasibility studies, and understand the mechanical, electrical, and civil engineering aspects involved in hydel power generation.<br>Critically evaluate the environmental impact of hydropower projects and understand the importance of sustainable practices. They will learn to balance the benefits of hydropower with its ecological footprint, and explore strategies for minimizing negative environmental effects, ensuring the long term viability and sustainability of hydropower resources. |
| Course Contents |
| Water Resources, Dams, Canals and Reservoirs & Hydel Potentials<br>Hydro Power Development & Technology Status<br>Clarification of Hydel Power Plants<br>Planning, Design and Development of Hydro Electric Power Plants<br>Computer Aided design<br>AC generators & generation voltage<br>Protection system as applied to power house and its grid<br>Power System operation & maintenance<br>Power Management & Cost of Electricity generation<br>Meteorology and hydrology.<br>Design of the Dams, spillways and waterways |

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| Hydraulic losses, torque on a runner blade<br>Turbine and draft tube<br>Hydraulic transients. Regulation and dynamics.<br>Environment and laws. Marine current power.<br>Pumped storage hydropower.<br>Design of electrical systems in hyrdo power plant.<br>Dynamic sizing and control stability for power plants.<br>Operation and maintenance of turbine and efficiency measurements in the field. |
| Resources |
| Introduction to Hydro Energy Systems Basics, Technology and Operation By Hermann Josef Wagner, Jyotirmay Mathur · 2011<br>Hydropower engineering handbook by John S. Gulliver, Roger E. A. Arndt, Publisher: McGraw Hill, 1991.<br>Lecture Slides |

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| Course Name: **Advanced Power System Reliability** |
| Course Code: EEP 722 |
| Credit Hours: 3 |
| Pre requisite: N/A |
| Course Objectives |
| The course gives an introduction to the main principles and objectives of power system reliability analysis: Basic terms and definitions, applications, overview of methodologies for contingency analysis and reliability analysis, reliability models, input data (from fault statistics), reliability indicators, and state of the art. |
| Course Learning Outcomes |
| After completing this course, students will be able to:<br>To explain the fundamental concepts and metrics of power system reliability and their application in evaluating the performance of power systems.<br>Develop the skills to perform reliability analysis and assessment of power systems. They will learn various methodologies to evaluate the reliability of generation, transmission, and distribution systems. They will be capable of identifying and mitigating reliability issues in power systems.<br>Design and implement strategies to enhance the reliability of power systems. This includes the ability to plan and manage maintenance schedules, integrate renewable energy sources, and utilize smart grid technologies. They will also learn how to balance reliability with cost considerations and regulatory requirements to ensure optimal operation of power systems. |
| Course Contents |
| General reliability modeling and evaluation:<br>Introduction to probability and stochastic processes;<br>System modeling for reliability;<br>Methods of reliability assessment: State space, cut set and tie set analysis<br>Decomposition |

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| Monte Carlo simulation: non sequential and sequential; synchronous and asynchronous timing.<br>Reliability modeling and analysis of electric power systems:<br>Bulk power systems, distribution systems, and industrial systems.<br>Component modeling: generator modeling, transmission line modeling<br>Load modeling; capacity outage table;<br>Probability and frequency distributions; unit addition algorithm; load modeling algorithm.<br>Generation adequacy assessment using discrete convolution: discrete convolution of generation and load models; generation reserve model; determination of LOLP, LOLF, EUE.<br>Reliability of multi node systems: methods for multi area and composite system analysis; contingency enumeration/ranking; equivalent assistance;<br>Stochastic/ probabilistic load flow; state space decomposition;.<br>Monte Carlo simulation, sequential and non sequential<br>Analysis of risk in power systems; understanding of causes and remedial measures.<br>Contingency analysis and reliability analysis of generation, transmission and distribution systems. |
| Resources |
| Assessment of Power System Reliability: Methods and Applications Marko Čepin · 2011.<br>R. Ramakumar, Engineering Reliability: Fundamentals and Applications. Prentice Hall.<br>J. Endrenyi, Reliability Modeling in Electric Power Systems. Wiley.<br>IEEE Recommended Practice for Design of Reliable Industrial and Commercial Power Systems. IEEE.<br>Lecture Slides |

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| Course Name: **Advanced Renewable Energy** |
| Course Code: EEP 724 |
| Credit Hours: 3 |
| Pre requisite: N/A |
| Course Objectives |
| This course offers a comprehensive exploration of advanced renewable energy technologies and their integration into modern power systems. The course objectives are to equip students with in depth knowledge of solar, wind, biomass, geothermal, and hydroelectric power systems, along with cutting edge developments in energy storage and smart grid technologies. Students will develop expertise in designing, optimizing, and integrating renewable energy systems, with a strong focus on power electronics and grid stability. The course aims to enhance critical analysis skills in evaluating the technical, economic, and environmental aspects of renewable energy projects. By the end of the course, students will be proficient in using advanced modeling and simulation tools, and will have a thorough understanding of renewable energy economics and policies. This multifaceted approach prepares students to address complex challenges in sustainable energy systems and to take on leadership roles in renewable energy research, development, and implementation. |

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| Course Learning Outcomes:<br>After completing this course, students will be able to:<br>Analyze and optimize the performance of advanced solar, wind, geothermal, and biomass energy systems using sophisticated engineering principles and tools.<br>Design and analyze power electronic converters and inverters for renewable energy applications, including |

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| maximum power point tracking and grid integration solutions.<br>Assess and mitigate power quality issues arising from the integration of renewable energy sources into the grid. |
| Course Contents |
| Introduction to Renewable Energy Systems, Global energy landscape, Climate change and energy transition, Overview of renewable energy technologies, Advanced Solar Energy Technologies, Photovoltaic cell physics and materials, Concentrated solar power systems, Solar thermal applications, Wind Energy Engineering, Aerodynamics and fluid mechanics, Wind turbine design and optimization, Offshore wind energy systems, Bioenergy and Biomass Conversion, Biomass feedstocks and characterization, Thermochemical and biochemical conversion processes, Biofuels and biorefinery concepts, Geothermal Energy Systems, Geothermal resource assessment<br>Enhanced geothermal systems, Power plant design and optimization, Hydroelectric and Ocean Energy, Advanced hydropower systems, Wave and tidal energy conversion, Ocean thermal energy conversion, Energy Storage Technologies, Electrochemical storage systems, Mechanical and thermal storage, Hydrogen production and fuel cells, Smart Grids and Energy Systems Integration, Grid modernization and stability, Demand response and load management, Hybrid renewable energy systems, Advanced Power Electronics for Renewable Energy, Inverter and converter technologies, Maximum power point tracking, Grid integration challenges, Renewable Energy Economics and Policy, Energy markets and pricing mechanisms, Policy frameworks and incentives, Project finance and risk assessment, Environmental Impact and Life Cycle Assessment, Environmental impact of renewable technologies, Life cycle assessment methodologies, Sustainability metrics and indicators, Research Methods and Data Analysis, Experimental design for renewable energy research, Advanced data analysis and modeling techniques, Machine learning applications in renewable energy, Emerging Technologies in Renewable Energy, Perovskite solar cells, Airborne wind energy systems, Advanced nuclear technologies (fusion, small modular reactors), Hybrid Renewable Energy Systems, Optimal sizing and configuration of hybrid systems, Control strategies for hybrid systems, Energy management systems for microgrids, Integration of electric vehicles in smart grids, Power quality issues and mitigation strategies, Grid Integration Challenges, Low Voltage Ride Through (LVRT) and High Voltage Ride Through (HVRT), Active and reactive power control strategies, Harmonic mitigation techniques, Synchronization methods for grid connected systems, Fault current limiters and protection schemes, |
| Resources<br>Renewable Energy Resources" by John Twidell and Tony Weir<br>"Renewable and Efficient Electric Power Systems" by Gilbert M. Masters<br>Power Electronics in Renewable Energy Systems and Smart Grid: Technology and Applications" by Bhim Singh, Ambrish Chandra, and Kamal Al Haddad |

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|---|---|
| Course Name: **Advanced Solar Power Generation** | |
| Course Code: EEP 725 | |
| Credit Hours: 3 | |
| Pre requisite: N/A | |

| Course Objectives |
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| This course provides a detailed presents the resource and the mechanisms of solar propagation through the atmosphere up to the point of conversion. It then discusses the various conversion processes (solar heating/cooling, concentrated thermal power generation and the photovoltaic phenomenon). The state of the art of each of these technologies is then discussed, including their market and economic aspects. It familiarizes students with theory and principles of operation, application, modeling and control of solar thermal systems and direct solar electricity converters. |
| Course Learning Outcomes |
| After completing this course, students will be able to:<br>Gain a thorough understanding of the principles of solar energy, including photovoltaic (PV) and solar thermal systems. They will learn about the science behind solar power generation, the components of solar power systems, and the various types of solar technologies available.<br>Develop the skills to design, size, and implement solar power systems for different applications. This includes performing site assessments, selecting appropriate solar technologies, and calculating energy production and system efficiency. They will also learn about grid connected and off grid systems, and the integration of solar power with other renewable energy sources.<br>To critically evaluate the performance of solar power systems, identifying factors that impact efficiency and reliability. They will learn to apply tools and techniques for monitoring, maintaining, and optimizing solar installations. Additionally, they will understand the economic, environmental, and regulatory aspects of solar power generation, enabling them to make informed decisions for sustainable energy solutions. |

| Course Contents |
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| Introduction: Reckoning of Time, Solar Angles, Incident Angle for Moving Surfaces, Sun Path Diagrams, Solar Radiation, Thermal Radiation, Transparent Plates, Radiation Exchange between Surfaces,<br>Extraterrestrial Solar Radiation, Atmospheric Attenuation, Terrestrial Irradiation, Total Radiation on Tilted Surfaces, Solar Radiation Measuring Equipments.<br>Solar Energy Collectors Stationary Collectors, Sun Tracking Concentrating Collectors,<br>Thermal Analysis of Flat Plate Collectors,<br>Thermal Analysis of Air Collectors, Practical Considerations for Flat Plate Collectors, Concentrating Collectors.<br>Performance of Solar Collectors Collector Thermal efficiency, Effect of Flow Rate, Collectors in Series.<br>Solar Water Heating Systems Passive Systems, Active Systems, Heat Storage Systems, Module and Array Design,<br>Differential Temperature Controller, Solar Water Heater Performance Evaluation, Simple System Models, Practical Considerations.<br>Solar Space Heating and Cooling Solar Space Heating and Cooling, |

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| Solar Cooling, Solar Cooling with Absorption Refrigeration.<br>Industrial Applications of Solar Systems General Design Considerations, Solar Steam Generation Systems<br>Solar Chemistry Applications, Solar Dryers, Solar Hydrogen Generation.<br>Solar Desalination Systems Introduction, Desalination Process. Direct Collection Systems, Indirect Collection Systems<br>Photovoltaic Systems Semiconductors, Photovoltaic Panels, Related Equipment, Applications,<br>Design of PV Systems, Concentrating PV, Hybrid PV/T Systems.<br>Solar Thermal Power Systems Parabolic Trough Collector Systems, Power Tower Systems, Dish Systems, Thermal Analysis of Solar Power Plants, Solar Ponds.<br>Power electronics for photovoltaics.<br>Grid connected PV systems, Network integration aspects.<br>Isolated PV systems and Solar energy storage. |
| **Resources**<br>Soteris A. Kalogirou, "Solar Energy Engineering, Process and Systems", Academic Press, 2014.<br>John A. Duffie, William A. Beckman, "Solar Engineering of Thermal Process", John Wiley & Sons, 2006.<br>Krishnan Rajeshwar, "Solar Hydrogen Generation", Springer, 2008.<br>Eduardo F. Camacho, Manuel Berenguel, "Control of Solar Energy Systems, Springer, 2012.<br>Richard Petela, "Engineering Thermodynamics of Thermal Radiation", McGraw Hill, 2010.<br>Mukund R. Patel, "Wind and Solar Power Systems: Design, Analysis, and Operation", CRC Press, 2006.<br>Lecture Slides |

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| Course Name: **Advanced Wind Power Generation** |
| Course Code: EEP 726 |
| Credit Hours: 3 |
| Pre requisite: N/A |

| Course Objectives |
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| This course provi]des a detailed presents the resource and the mechanisms of solar propagation through the atmosphere up to the point of conversion. It then discusses the various conversion processes (solar heating/cooling, concentrated thermal power generation and the photovoltaic phenomenon). The state of the art of each of these technologies is then discussed, including their market and economic aspects. It familiarizes students with theory and principles of operation, application, modeling and control of solar thermal systems and direct solar electricity converters. |

| Course Learning Outcomes |
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| After completing this course, students will be able to<br>Describe the core principles of wind power generation, including the mechanics of wind turbines, aerodynamic principles, and the different types of wind turbines. They will understand the basic components and operation of wind energy systems, from wind resource assessment to energy conversion.<br>Demonstrate the ability to design and analyze wind turbines and their components. They will be able to apply engineering principles to optimize turbine performance, assess site specific conditions, and evaluate the efficiency and economic viability of wind power projects.<br>Evaluate the environmental and economic impacts of wind power generation. They will be able to assess factors such as noise, wildlife interactions, and land use, as well as conduct cost benefit analyses and financial modeling to determine the feasibility and sustainability of wind power projects. |
| Course Contents |
| Renewa]ble Energy Resources and Applications<br>Wind Turbine Systems Overview and Power Control<br>Model of the Mechanical Transmission System<br>General Structure of a Wind Turbine, Topology Overview<br>Squirrel Cage Induction Generator, Soft Starter Function<br>Reactive Power Consumption,<br>Topology overview, Induction generator, Generator Inverter Control<br>Grid Inverter Control, Doubly Fed Induction Generator<br>Rotor Impedance Control, Converter Control, Rotor Converter Control Scheme<br>Grid Inverter Control Scheme, Synchronous Generator<br>System Solutions: Wind Farm<br>Double Fed Induction Generation for Wind Power Generation<br>DFIG Control analysis<br>Wind Energy Meteorology<br>Wind Power System Design and Global Perspective<br>Benefits and Commercial Applications<br>Wind's Future<br>Power electronics for wind plants.<br>Grid connected Wind systems, Network integration aspects.<br>Isolated Wind systems and Wind energy storage. |
| Resources<br>Electricity Generation Using Wind Power (Second Edition) William Shepherd, Li Zhang · 2017<br>H. Bulent Ertan, "Modern Electrical Drives",<br>Eric Hau , "Wind Turbines, Fundamentals, Technologies, Application, Economics" 2nd Edition. 2005, Springer<br>Lecture Slides |

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|---|---|
| Course Name: **Advanced Hybrid Power Systems** |
| Course Code: EEP 727 |
| Credit Hours: 3 |
| Pre requisite: N/A |

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| Course Objectives<br>This course presents Electricity access and intro to Hybrid Renewable Energy Systems (HRES), Assessing and understanding loads for HRES, Dispatchable energy for HRES, RE resources for HRES, Project planning and Storage for HRES. |
| Course Learning Outcomes |
| After completing this course, students will be able to: |
| Course Contents<br><br>World energy system and remote consumers. Cost of electricity production, Operation of autonomous<br>Hybrid power generation systems.<br>Hybrid System with Controlled and Uncontrolled Energy Resources<br>Control of Different energy Resources<br>Problems of collaboration between thermal units and wind power. Advantages and disadvantages of interaction between thermal units and wind turbines. Sizing of hybrid power systems using wind power and thermal power generation<br>Main energy storage technologies. |
| Hybrid wind diesel systems. Hybrid PV diesel systems, with or without energy storage. Wind PV diesel systems.<br>Hybrid systems of space and water heating. Hybrid systems for the coverage of thermal loads (solar energy, biomass, geothermal).<br>Techno economic evaluation of hybrid energy systems.<br>Environmental social benefits of hybrid energy systems<br>New technologies for hybrid power systems.<br>Energy and cost savings with hybrid power systems.<br>Energy saving in the residential and the building sectors. Energy saving in the industrial, agricultural and transportation sectors. Legislation and finance schemes<br>Third party contracts for energy saving. Energy and cost savings in the industrial, agricultural and transportation sectors.<br>Co generations methods.<br>Control and optimisation of HRES.<br>Energy transmission and distribution & monitoring with HRES. |
| Resources |
| Hybrid Renewable Energy Systems By Umakanta Sahoo, 2021.<br>Papantonis D., 2001, "Small Hybdropower Plants", Ed. Symeon/9607888235.<br>Sayigh Ali, 2012, "Comprehensive Renewable Energy", Elsevier B.V., ISBN 978 008 087 872 0<br>Kaldellis J.K., 2010, "Stand alone and hybrid wind energy systems. Technology, energy storage and applications", |

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| Woodhead Publishing, ISBN 978 1 84569 527 9<br>Lecture Slides |

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| Course Name: **Special Topics in Power System Operation and Control** |
| Course Code: EEP 728 |
| Credit Hours: 3 |
| Pre requisite: N/A |
| Course Objectives |
| This course aims to provide students with an understanding of the advanced topics in power system stability, control and optimal operation. This course aims to develop an understanding of the fundamental principles of power system, power system operation and control. Characteristics of the generating units, different formats for the representation of the characteristics of the generating units, different types of the heat rate for fuel cost curves. Optimization problem, objective function and constraints in an optimization problem, maxima and minima, necessary and sufficient conditions, non convexity issues. |
| Course Learning Outcomes |
| After completing this course, students will be able to: |
| Course Contents |
| Introduction of the subject, power system, power system operation and control.<br>Characteristics of the generating units, different formats for the representation of the characteristics of the generating units, different types of the heat rate for fuel cost curves.<br>Optimization problem, objective function and constraints in an optimization problem, maxima and minima, necessary and sufficient conditions, non convexity issues.<br>Economic dispatch problem, mathematical modelling of economic dispatch problem, constraints, handling of constraints.<br>Lagrange method of solving economic dispatch problem, lagrange multiplier, Kuhn tuker multiplier, equal incremental cost criteria for solving economic dispatch problem.<br>Gradient method for solving economic dispatch problem.<br>Newton method for solving economic dispatch problem, lambda Iteration method for solving economic dispatch problem.<br>Dynamic programming Method for solving economic dispatch problem.<br>Unit commitment, mathematical modelling of unit commitment.<br>Shut down role for unit commitment, constraints in unit commitment problem.<br>Solution methods for unit commitment, brute force technique, and priority list schemes.<br>Dynamic programming method for solving unit commitment problem.<br>Dynamic programming method for solving unit commitment problem continued.<br>Hydrothermal coordination/scheduling ,different types of hydro models ,different types of hydrothermal scheduling problems<br>Different methods for solving Hydrothermal scheduling problem, constraints involved in hydrothermal |

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| scheduling program.<br>Production Cost Models<br>Automatic generation control, Optimal power flow, Power system protection and reliability of protection system.<br>Power system stability and protection for stability enhancement, Interchange of power and energy.<br>Power system security, Power quality, harmonic generation, monitoring and elimination. |
| Resources |
| Power system operation and control by Alan J Wood<br>Lecture Slides |

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| Course Name: **Integration of Distributed Generation in Power Systems** |
| Course Code: EEP 729 |
| Credit Hours: 3 |
| Pre requisite: N/A |

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| Course Objectives<br>Distributed energy generation is developing into a significant market in the generation, distribution and utilisation of electrical energy. It includes local fossil fuel derived energy sources, for example, co generation from LNG, renewable energy sources, such as wind, solar and hydro, and low carbon hybrid energy systems that combine energy sources from more than one energy source, whether renewable or fossil fuelled. |
| Course Learning Outcomes<br>After completing this course, students will be able to:<br>Equip with the fundamental technical and economic processes and drivers at play in the electrical power generation industry.<br>Comprehend the basics of distribution network modelling, the different types of distributed energy sources utilised (Co generation/CHP, wind, hydro and photovoltaic) and where they are integrated onto the electrical grid.<br>Learn the integration of such sources on the fundamental operation of the distribution and transmission networks, and how distributed generation is impacting on the development and operation of market frameworks. |

| Course Contents |
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| History and Introduction of embedded generation, Reason , extent and issues of embedded generation CIGRE and CIRED reports studies, Concept of hosting capacity, Increasing the Hosting Capacity, Technical and economic Impacts of distributed generation, Wind Power as DG & Wind turbine types and components, Betz Criteria and Space vector modeling of Wind turbine generators, Mathematical modeling of IG in WEGS, Power electronic interfacing with the grid, Concept of Hosting capacity and Overloading of Radial Distribution Networks Redundancy and Meshed Operation, Impact of DG on power quality, Impact of DGs on overloading and power losses, Power flow, Fault and Stability studies in the presence of DG, Overcurrent Protection, Upstream and down stream faults, Upstream and downstream Fault currents calculation; Islanding protection, Seasonal Variations in Production Capacity, Fast Variations with Time, Voltage Quality and Design of Distributed Generation, Probabilistic Methods for Design of Distribution Feeders, Transmission System Operation, Frequency Control, Balancing, and Reserves, Prediction of Production and Consumption, Frequency Stability, Angular Stability, HVDC and Facts, Increasing the Hosting Capacity, Alternative Scheduling of Reserves. |
| Resources<br>Janaka Ekanayake, "SMART GRID TECHNOLOGY AND APPLICATIONS".<br>Ali Kehhani, "DESIGN OF SMART POWER GRID RENEWABLE ENERGY SYSTEMS" |

**Program Title:** **MS Software Engineering**

**Duration:** **2 to 3 Years**

**Total Credit Hours:** **30**

**Summary of Credit Hours**

| Sr. No. | Courses as per HEC new GE Policy 2023 (All courses at MS level must be 700 level) | Credit Hours/Contact Hours | |
|---|---|---|---|
| | | Existing Road Map | Proposed New Road Map |
| 1. | Core Courses | 12 | 12 |
| 2. | Electives Courses | 12 | 12 |
| 3. | Interdisciplinary courses | - | - |
| 3. | Thesis/Elective | 6 | 6 |
| 4. | Deficiency course in case of candidate from another domain or interdisciplinary domain | | |
| | Total | 30 | 30 |

*Subject to allocation of deficiency courses by admission committee.

# Semester wise Road map

## Semester 1

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours |
| 1 | | | Core I | 3 | 1 | | | Core I | 3 |
| 2 | | | Core II | 3 | 2 | | | Core II | 3 |
| 3 | | | Core III | 3 | 3 | | | Core III | 3 |
| Total Credit Hours in Semester 1 | | | | 9 | Total Credit Hours in Semester 1 | | | | 9 |

## Semester 2

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours |
| 1 | | | Core IV | 3 | 1 | | | Core IV | 3 |
| 2 | | | Elective I | 3 | 2 | | | Elective I | 3 |
| 3 | | | Elective II | 3 | 3 | | | Elective II | 3 |
| Total Credit Hours in Semester 2 | | | | 9 | Total Credit Hours in Semester 2 | | | | 9 |

## Semester 3

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours |
| 1 | | | Elective III | 3 | 1 | | | Elective III | 3 |
| 2 | | | Elective IV | 3 | 2 | | | Elective IV | 3 |
| 3 | | ESC 600 | Thesis I / (Elective V) | 3 | | | THS 799 | Thesis I / (Elective V) | 3 |
| Total Credit Hours in Semester 3 | | | | 9 | Total Credit Hours in Semester 3 | | | | 9 |

**Semester 4**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours |
| **1** | | ESC 600 | Thesis II / (Elective VI) | 3 | 1 | | THS 799 | Thesis II / (Elective VI) | 3 |
| | Total Credit Hours in Semester 4 | | | 3 | 2 | Total Credit Hours in Semester 4 | | | 3 |
| **Total Program Credit Hours** | | | | 30 | Total Program Credit Hours | | | | 30 |

## MS SE (Master of Science in Software Engineering)

## Core Courses

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | SDGs |
| **1** | | ~~SEN 522~~ | ~~Advanced Software System Architecture~~ | 3 | 1 | | SEN 721 | Advanced Software System Architecture | 3 | 9, 12 |
| **2** | | SEN 547 | Software Testing and Quality Assurance | 3 | 2 | | SEN 706 | Advanced Software Testing and Quality Assurance | 3 | 9, 12 |
| **3** | | ~~SEN 558~~ | ~~Advanced Requirement Engineering~~ | 3 | 3 | | SEN 701 | Advanced Requirements Engineering | 3 | 9 |
| **4** | | ESC 701 | Research Methodology | 3 | 4 | | ESC 701 | Research Methodology | 3 | 4, 9 |
| **Total Credit Hours** | | | | 12 | Total Credit Hours | | | | 12 | |

## List of Electives Courses

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | SDGs |
| 1 | | SEN 523 | Automated Software Engineering | 3 | 1 | | SEN 724 | Advanced Automated Software Engineering | 3 | 9 |
| 2 | | SEN 546 | Software Metrics | 3 | 2 | | SEN 746 | Advanced Software Metrics | 3 | 9 |
| 3 | | ~~SEN 601~~ | ~~Advanced Software Project Management~~ | 3 | 3 | | SEN 747 | Advanced Software Project Management | 3 | 8, 9 |
| 4 | | SEN 602 | Agile Software Development Methods | 3 | 4 | | SEN 702 | Advanced Agile Software Development Methods | 3 | 8 |
| 5 | | SEN 720 | Advanced Human Computer Interaction | 3 | 5 | | SEN 720 | Advanced Human Computer Interaction | 3 | 9 |
| 6 | | SEN 723 | Formal Methods and Specifications | 3 | 6 | | SEN 723 | Formal Methods and Specifications | 3 | 9 |
| 7 | | SEN 754 | Advanced Web Computing System and Application | 3 | 7 | | SEN 754 | Advanced Web Computing System and Application | 3 | 9, 12 |
| 8 | | SEN 755 | Service Oriented Computing | 3 | 8 | | SEN 755 | Service Oriented Computing | 3 | 9, 12 |
| 9 | | SEN 756 | Advanced Usability Engineering | 3 | 9 | | SEN 756 | Advanced Usability Engineering | 3 | 8 |
| 10 | | SEN 758 | Component based Software Engineering | 3 | 10 | | SEN 758 | Component based Software Engineering | 3 | 9 |
| 11 | | SEN 759 | Software Re-Engineering | 3 | 11 | | SEN 759 | Software Re-Engineering | 3 | 9 |
| 12 | | SEN 760 | Complex Adaptive Systems | 3 | 12 | | SEN 760 | Complex Adaptive Systems | 3 | 8,9 |
| 13 | | SEN 762 | Advanced Big Data Analytics | 3 | 13 | | SEN 762 | Advanced Big Data Analytics | 3 | 9, 3 |
| 14 | | SEN | Advanced | 3 | 14 | | SEN | Advanced | 3 | 9 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 763 | Software Engineering | | | | 763 | Software Engineering | | |
| 15 | | SEN 764 | Ontology Engineering | 3 | 15 | | SEN 764 | Ontology Engineering | 3 | 9, 4 |
| 16 | | SEN 774 | IoTs Architecture, Protocols & Applications | 3 | 16 | | SEN 774 | IoTs Architecture, Protocols & Applications | 3 | 9, 11 |
| | | | | | 17 | | SEN 729 | Advanced DevOps | 3 | 9 |
| | | | | | 18 | | SEN 705 | Advanced Interaction Design | 3 | 9, 11 |

**Note: (Minimum 2 of the above courses)**

## GENERAL ELECTIVE COURSES

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | SDGs |
| **1** | | CSC 504 | Ubiquitous Computing | 3 | 1 | | CSC 706 | Advanced Ubiquitous Computing | 3 | 9, 11 |
| **2** | | ~~CSC 521~~ | ~~Advanced Design and Analysis of Algorithm~~ | 3 | 2 | | CSC 721 | Advanced Design and Analysis of Algorithms | 3 | |
| **3** | | CSC 704 | Advanced Cryptography | 3 | 3 | | CSC 704 | Advanced Cryptography | 3 | 16 |
| **4** | | CSC 708 | Advanced Simulation and Modeling | 3 | 4 | | CSC 708 | Advanced Simulation and Modeling | 3 | 9, 13 |
| **5** | | CSC 711 | Advanced Artificial Intelligence | 3 | 5 | | CSC 711 | Advanced Artificial Intelligence | 3 | 9, 3 |
| **6** | | CSC 719 | Machine Learning | 3 | 6 | | CSC 719 | Machine Learning | 3 | 9, 3 |
| **7** | | CSC 720 | Advanced Operating Systems | 3 | 7 | | CSC 720 | Advanced Operating Systems | 3 | 9, 12 |
| **8** | | CSC 741 | Advanced Natural Language Processing | 3 | 8 | | CSC 741 | Advanced Natural Language Processing | 3 | 4, 16 |
| **9** | | CSC 744 | Advanced Computer Graphics | 3 | 9 | | CSC 744 | Advanced Computer Graphics | 3 | 9, 11 |

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|---|---|---|---|---|---|---|---|---|---|---|
| **10** | | CSC 746 | Advanced Data Mining | 3 | 10 | | CSC 746 | Advanced Data Mining | 3 | 9, 3 |
| **11** | | CSC 761 | Advanced Neural Networks | 3 | 11 | | CSC 761 | Advanced Neural Networks | 3 | 9, 3 |
| **12** | | CSC 751 | Pattern Recognition | 3 | 12 | | CSC 751 | Pattern Recognition | 3 | 9, 3 |
| **13** | | CSC 753 | Distributed Databases | 3 | 13 | | CSC 753 | Distributed Databases | 3 | 9, 12 |
| **14** | | CSC 759 | Agent based Modeling | 3 | 14 | | CSC 759 | Agent based Modeling | 3 | 9, 13 |
| **15** | | CSC 760 | Advanced Data Warehousing | 3 | 15 | | CSC 760 | Advanced Data Warehousing | 3 | 9, 12 |
| **16** | | CSC 764 | Computer Vision | 3 | 16 | | CSC 764 | Computer Vision | 3 | 9, 3 |
| **17** | | CSC 765 | Bio Medical Image Analysis | 3 | 17 | | CSC 765 | Bio Medical Image Analysis | 3 | 3, 9 |
| **18** | | CSC 781 | Cloud Computing | 3 | 18 | | CSC 781 | Cloud Computing | 3 | 9, 12 |
| **19** | | SEN 604 | Blockchain Technologies | 3 | 19 | | ISC 748 | Blockchain Essentials | 3 | 9, 16 |
| **20** | | DSC 707 | Deep Learning | 3 | 20 | | DSC 707 | Deep Learning | 3 | 9, 3 |
| **21** | | CEN 707 | Advanced Distributed Systems | 3 | 21 | | CEN 707 | Advanced Distributed Systems | 3 | 9, 11 |
| **22** | | CEN 720 | Advanced Computer Architecture | 3 | 22 | | CEN 720 | Advanced Computer Architecture | 3 | 9 |
| **23** | | CEN 745 | Advanced Digital Image Processing | 3 | 23 | | CEN 745 | Advanced Digital Image Processing | 3 | 9, 3 |
| **24** | | GSC 700 | Advanced Engineering Mathematics | 3 | 24 | | GSC 700 | Advanced Engineering Mathematics | 3 | 9, 4 |
| **25** | | EET 702 | Advanced Network Security | 3 | 25 | | EET 702 | Advanced Network Security | 3 | 9, 16 |
| | | | | | 26 | | DSC 703 | Data Visualization | 3 | 9, 11 |
| | | | | | 27 | | ISC 732 | Advance Computer Security | 3 | 16 |
| | | | | | 28 | | ISC 747 | Advanced Cryptanalysis | 3 | 16 |

**Course Title: Advanced Automated Software Engineering**

**Course Code: SEN 724**
**Credit Hours: 3**

**Course Description:**
This advanced course delves into the concepts and applications of automation within software engineering. It begins with an exploration of automation principles, including the benefits, limitations, and critical decision points for when to automate processes. The curriculum covers various automated aspects of software engineering, such as project management, communication management, software quality management, and quality audits. It includes in depth discussions on automated requirement management, requirement traceability, quality assurance, and testing, with a focus on automated test case generation. The course also addresses automated configuration and change management. Practical examples of CASE tools are provided, encompassing Software Project Management (SPM), Software Quality Management (SQM), Software Quality Assurance (SQA), Requirement Management (REM), and Configuration and Change Management (CCM).

**Recommended Books:**

1. Bobbio, A., & Bonaccorsi, A. (2018). Automated Software Engineering: A Deep Dive. Springer.
2. Mahmood, Z. (2019). Software Project Management for Distributed Computing: Lifecycle, Practices, and Tools. Springer.
3. Ali, A., & Shah, S. M. A. (2020). Advanced Software Quality Assurance: Tools and Techniques. Wiley.


**Course Title: Advanced Software System Architecture**
**Course Code: SEN 721**
**Credit Hours: 3**

**Course Description:**

The course teaches how large, complex software systems are designed at architectural level and detailed design level using modern system and software design techniques. Topics include: Software Architecture, Architectural and design patterns, architecture & design representations through Modelling; architectural assessment & Evaluation; Software product lines; Software Quality Attributes, Architectural Design Tactics & Strategies for Achieving Software Quality, Web Architectures, Service Oriented Architectures & Microservices, Web 3.0, Object Oriented Design, Clean Architecture, Clean Code with SOLID principles, Enterprise System Architectures, Refactoring, Agile Design, Containerization Architecture in System Design, Contemporary issues in Software Architecture & Design (Selected papers from Software Engineering/Software Design & Modelling journals).

**Recommended Books:**

1. Bass, L, Clements, P., & Kazman, R. (2021). Software Architecture in Practice. 4th Ed. Pearson Education Inc.
2. Oliver Goldman (2024), Effective Software Architecture: Building Better Software Faster,

Addison Wesley Professional.
3. Humberto Cervantes, Rick Kazman (2024), Designing Software Architectures: A Practical Approach (SEI Series in Software Engineering) 2nd Ed, Addison Wesley Professional.
4. Duggan, D. (2012). Enterprise Software Architecture & Design: Entities, Services & Resources. John Wiley & Sons Publishers.
5. Fairbanks, G.H. (2010). Just Enough Software Architecture: A Risk Driven Approach. Marshall & Brainerd Publishers.

**Course Title: Advanced Requirements Engineering**
**Course Code: SEN 701**
**Credit Hours: 3**

**Course Description:**

This course exposes students to the problem of Requirements engineering in the Software System development which is one of the key phases in Software Development lifecycle. This course exposes students to the issues and challenges related to the elicitation, specification and management of requirements for various types of software systems. Most specifically the following topics are covered in the course; Requirements Engineering fundamentals, Scenario & Use Case approaches to requirements elicitation, requirements elicitation techniques, , Non functional requirements & their presentation, Specifying System & Software quality, Requirements Specification & Documentation, IEEE/ISO standards for Software & Systems Requirements, Requirements Prioritization, Traditional requirement practices vs Agile projects (Requirements specification in Agile Development through User stories, User Story estimation & Prioritization), Requirements Verification & Validation techniques, Principles for writing good requirements, Prototyping, Requirements Management, Requirements traceability & Change Management, Presentation of business processes through BPMN, Goal based requirements engineering, Contemporary issues in Requirements engineering (selected research articles from Software/Systems Engineering journals)

**Recommended Books:**

1. Phillip A. Laplante, Mohamad Kassab (2022), "Requirements Engineering for Software and Systems", 4th Edition, Auerbach Publications; 4th Ed.
2. Jeremy Dick, Elizabeth Hull, Ken Jackson (2017), "Requirements Engineering", 4th Ed., Springer.
3. George Koelsch (2016), "Requirements Writing for System Engineering”, 1st Ed, Apress.
4. Dean Leffingwell (2010), "Agile Software Requirements: Lean Requirements Practices for Teams, Programs, and the Enterprise", 1st Ed, Addison Wesley Professional.

**Course Title: Advanced Interaction Design**
**Course Code: SEN 705**
**Credit Hours: 3**

**Course Description:**

The aim of this course is to provide extensive guidelines to the students for the design of computer technology, and how computer technology can be made more usable by people. It takes a research oriented approach to providing students with specialized human computer interaction (HCI) knowledge as they grapple with designing, prototyping and testing a device or software application to solve a problem. The main topics cover human factors, interaction design, cognitive aspects, Usability and User Experience Goals, social and emotion interaction, interfaces, prototyping and construction, data gathering, design & Conduct of UI/UX experiments & evaluations, evaluation studies, Modern Interaction techniques, Interaction design for mobile and wearable devices, Accessibility and Inclusiveness, Usability Evaluation techniques for Mobile & Web applications, Contemporary issues/challenges in Usability Engineering, HCI and Interaction design (Selected papers from journals of software engineering & HCI).

**Recommended Books:**

1. Jennifer Preece, Yvonne Rogers, Helen Sharp, "Interaction Design: Beyond Human Computer Interaction", 6th Edition, Wiley, 2023
2. Mackenzie, S. (2013). Human Computer Interaction: An Empirical Research Perspective. Elsevier Ltd.
3. Cipolla Ficarra, F. V. (2014). Advanced Research and Trends in New Technologies, Software, Human Computer Interaction, and Communicability. IGI Global.
4. Kurosu, M. (2013). Human Computer Interaction: Human Centered Design Approaches. Springer.
5. Purchase, H. C. (2013). Experimental Human Computer Interaction. A Practical Guide with Visual Examples.

**Course Title: Advanced Software Project Management**
**Course Code: SEN 747**
**Credit Hours: 3**

**Course Description:**

This course deals with managing information technology and software development projects. It is not restricted to project managers but encompasses the art and science of using teamwork to meet project goals. The team includes the project manager, lead developers, software engineers, supporting functions, business experts and other stakeholders. Therefore, this course is directed to students across a wide range of backgrounds and interests. The student will learn how to conceptualize, initiate, plan and execute a successful project. Students will participate in a competitive team effort to propose a major design project.

Students will be able to:

- recognize the principles of general management theory which transfer to project management
- apply techniques for successfully managing a project throughout its life cycle
- interpret the processes and knowledge areas in the Project Management Institute's Project Management Body of Knowledge
- formulate the determination of success as a measurable organizational value
- consider the human side of projects including participation in a team project
- understand the propositions of software design by the legendary Fred Brooks
- understand Agile fundamentals, Agile frameworks and methodologies
- perform Agile planning and estimation
- apply advanced Agile practices utilizing Agile project management tools
- understand Agile metrics and reporting
- Agile Leadership and Team Dynamics

**Recommended Books:**

1. Project Management Institute. 2017. A Guide to the Project Management Body of Knowledge (PMBOK® Guide) – Sixth Edition. Newtown Square
2. Marchewka, J. (2012). Information Technology Project Management, 4th Edition. John Wiley & Sons.
3. Brooks, F. (2010). The Design of Design: Essays from a Computer Scientist, Pearson Education.
4. Fairley, R. E. (2011). Managing and Leading Software Projects. John Wiley & Sons.
5. "Agile Project Management", Second Edition, Jim Highsmith, Addison Wesley
6. Project Management Institute. 2013. Managing Change in Organizations: A Practice Guide. Newtown Square.

**Course Title: Advanced Software Testing and Quality Assurance**
**Course Code: SEN 706**
**Credit Hours: 3**

**Course Description:**

This course takes off by providing an overview of fundamental notions of software testing and quality assurance techniques used to build and check quality in software systems. A particular emphasis is placed on quantitative assessment of software quality and quality control using software testing techniques. The students would not only be introduced to the theoretical background of these concepts, but they would also be given hands on experience of applying these concepts. Once a sound background is updated, students are focused on advanced concepts such as slicing, test suite reduction techniques, test case prioritization, TMMI, etc. The students are given a sound understanding of ISO 9001:2008 and CMMI where they are able to practically implant these in their respective organizations. This course introduces the student fundamental notions of software quality, and the techniques used to build and check quality in software systems.

A particular emphasis is placed on quantitative assessment of software quality and quality control using software testing techniques. The students would not only be introduced to the theoretical background of these concepts, but they would also be given hands on experience of applying these concepts. The assignments would be planned carefully to enhance students' learning of applying the learned concepts from a practical standpoint. The assignments are planned carefully to enhance students' learning of applying the learned concepts from a practical standpoint.

The quality assurance part of the course stresses the need of early identification and prevention of product defects. Among its key activities are setting quality standards and procedures, creating guidelines to follow across the development process, conducting measurements, and reviewing and changing workflows to enhance them. The students also learn, in addition to ISO 9015 and CMMI, Lean Six Sigma that seeks to improve employee and company performance by eliminating the waste of resources and process/product defects. The students learn how to combine the process improvement methods of Six Sigma and Lean enterprise.

**Recommended Books:**

1. Myers, G. J., Sanders, C., & Badgett, T. (2015). The Art of Software Testing, 3rd Edition, John & Willey Inc.
2. Laporte, C. Y., & April, A. (2018). Software Quality Assurance, Wiley.
3. The Six Sigma Way: How to Maximize the Impact of Your Change and Improvement Efforts
4. Peter Pande, Robert Neuman, Roland Cavanagh, Level: Introductory
5. "CMMI® for Development: Guidelines for Process Integration and Product Improvement" by Mary Beth Chrissis, Mike Konrad, and Sandy Shrum

**Course Title: Advanced DevOps**
**Course Code: SEN 729**
**Credit Hours: 3**

**Course Description:**

This course is designed to provide students with an in depth understanding of DevOps concepts and practices. Through hands on learning and real world case studies, students will develop the skills and knowledge necessary to design, implement, and manage complex DevOps initiatives at scale. Topics covered in this course may include automation and orchestration, continuous integration and delivery (CI/CD), containerization, infrastructure as code (IaC), microservices, monitoring and logging, security and compliance, cloud computing, and emerging trends in DevOps. Students will also explore the challenges and solutions associated with implementing DevOps in large organizations.

**Recommended Books:**

1. Effective DevOps: Building a Culture of Collaboration, Affini ty, and Tooling at Scale 1st Edition.
2. The DevOps Handbook: How to Create World Class Agility, Reliability, and Security in Technology Organizations
3. Accelerate: The Science of Lean Software and DevOps: Building and Scaling High Performing Technology Organizations

**Course name: Advanced Software Metrics**
**Course Code: SEN 746**
**Credit Hours: 3**

**Course Description:**
This course offers state of the art knowledge of software measurements and best practices with emphasis on the value of software measurement as a set of pragmatic methodologies and tools for both software engineers and software project management. After completing this course student will have a good understanding of nature and problems associated with software measurement and experimentation, software measurement planning and implementation (incl. data collection and analysis), software size measurement (Function Point counting, etc.), software cost estimation (COCOMO II model and tool, etc.), software resource, process, and product (i.e., product structure, complexity, quality, and reliability) measurement.

**Reference Books:**

- Fenton, N., & Bieman, J. (2014). *Software Metrics: A rigorous and practical approach*, 3rd Edition, CRC Press.
- Nicolette, D. (2015). *Software Development Metrics*. Manning Publications.

**Course name: Advanced Agile Software Development Methods**
**Course Code: SEN 702**
**Credit Hours: 3**

**Course Description:**
In software problem areas that require exploratory development efforts, those with complex requirements and high levels of change, agile software development practices are highly effective when deployed in a collaborative, people centered organizational culture. This course examines agile methods, including Extreme Programming (XP), Scrum, Lean, Crystal, Dynamic Systems Development Method and Feature Driven Development to understand how rapid realization of software occurs most effectively. The ability of agile development teams to rapidly develop high quality, customer valued software is examined and contrasted with teams following more traditional methodologies that emphasize planning and documentation. Students will learn agile development principles and techniques covering the entire software development process from problem conception through development, testing, and deployment, and will be able to effectively participate in and manage agile software developments as a result of their successfully completing this course. Case studies and software development projects are used throughout.

**Reference Books:**

- Maximini (2015). *The Scrum Culture: Introducing Agile Methods in Organization.* Springer.
- Ashmore & Runyan (2014). *Introduction to Agile Methods*. Pearson Education Inc.

Program Title: **MS (Computer Science)**
Duration: **2 to 3 Years**
Total Credit Hours: **30**

**Program Mission**
The mission of the MSCS program is to produce Computer Science graduates who are able to apply their theoretical knowledge and analytical skills to create effective and novel solutions to practical and research oriented computing problems.

## Education Objectives

*The key objectives of the MSCS program include the following.*

1. To provide an in depth understanding of the theory and concepts of the core Computer Science areas.
2. To prepare students for graduate level training in specialized areas of Computer Science.
3. To enable learning of the latest Computing tools and technologies.
4. To enable students to apply their knowledge and analytical skills to create effective and novel solutions to various computing problems.
5. To develop effective oral and written communication skills for working independently and in groups.

**Program Learning Outcomes**
Students graduating from the MS (CS) program are expected to:

1. Ability to apply Mathematical foundations, computational theory and algorithmic principles to solve practical as well as research-oriented computing problems.
2. Ability to turn complex programming specifications into well designed and well tested computer programs.
3. Acquaintance with the latest computing tools and technologies.
4. To develop effective oral and written communication skills.
5. Ability to pursue continuous professional development.
6. Ability to work on practical and research-based problems collaboratively as well as independently.

**Summary of Credit Hours**

| Sr. No. | Courses as per HEC new GE Policy 2023 (All courses at MS level must be 700 level) | Credit Hours/Contact Hours | |
|---|---|---|---|
| | | **Existing Road Map** | **Proposed New Road Map** |
| **1.** | Core/University Requirement | 15 | 15 |
| **2.** | Electives Courses | 9 | 9 |
| **3.** | Interdisciplinary courses | - | - |
| **3.** | Thesis | 6 | 6 |
| **4.** | Deficiency course in case of candidate from other relevant domains | 3 to 15 | 3 to 9 |
| **Total** | | **30** | **30** |

**Semester wise Road map**

**Semester 1**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Pre requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | | **Pre requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | **17 UN SDGs alignment (please mention relevant SDG No.** |
| **1** | | ~~CSC 503~~ | ~~Advanced Theory of Computation~~ | 3 | 1 | | CSC 703 | Advanced Theory of Computation | 3 | 4,11 |
| **2** | | ~~CSC 521~~ | ~~Advanced Design and Analysis of Algorithms~~ | 3 | 2 | | CSC 721 | Advanced Design and Analysis of Algorithms | 3 | 4,11 |
| **3** | | ESC 701 | Research Methodology (University Requirement) | 3 | 3 | | ESC 701 | Research Methodology (University Requirement) | 3 | 4 |
| **Total Credit Hours** | | | | 9 | Total Credit Hours | | | | 9 | |

***The SDGs are based on the elective course mentioned in the list of electives.**

**Semester 2**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment (please mention relevant SDG No. |
| **1** | | CSC 720 | Advanced Operating Systems | 3 | 1 | | CSC 720 | Advanced Operating Systems | 3 | 4,9,11 |
| **2** | | CEN 720 | Advanced Computer Architecture | 3 | 2 | | CEN 720 | Advanced Computer Architecture | 3 | 9 |
| **3** | | | Elective I | 3 | 3 | | | Elective I | 3 | |
| **Total Credit Hours** | | | | **9** | **Total Credit Hours** | | | | **9** | |

**Semester 3**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment |
| **1** | | | Elective II | 3 | 1 | | | Elective II | 3 | |
| **2** | | | Elective III | 3 | 2 | | | Elective III | 3 | |
| **3** | | ESC 500 | Thesis I / Elective IV | 3 | 3 | | | Thesis I/ Elective IV | 3 | 4,8,9 |
| **Total Credit Hours** | | | | **9** | **Total Credit Hours** | | | | **9** | |

****The SDGs are based on the objectives and application scenario of the proposed MS thesis.**

**Semester 4**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment |
| 1 | | ESC 500 | Thesis II / Elective V | 3 | 1 | | THS 799 | Thesis II / Elective V | 3 | 4,8,9 |
| **Total Credit Hours** | | | | **3** | **Total Credit Hours** | | | | **3** | |

**List of Electives Courses**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment (please mention relevant SDG No. |
| 1 | | CSC 504 | Ubiquitous Computing | 3 | | | CSC 706 | Advanced Ubiquitous Computing | 3 | 4,9 |
| 2 | | ~~CSC 505~~ | ~~Intelligent User Interface Design and Evaluation~~ | 3 | | | CSC 705 | Intelligent User Interface Design and Evaluation | 3 | 4,11 |
| 3 | | CSC 515 | Virtual Reality | 3 | | | CSC 717 | Virtual Reality Technologies | 3 | 4,11 |
| 4 | | ~~CSC 516~~ | ~~Game Theory~~ | 3 | | | CSC 716 | Game Theory | 3 | 4,9,11 |
| 5 | | CSC 701 | Computer Supported Cooperative Work | 3 | | | CSC 701 | Computer Supported Cooperative Work | 3 | 4,9 |
| 6 | | SEN 720 | Advanced Human Computer Interaction | 3 | | | SEN 720 | Advanced Human Computer Interaction | 3 | 4,9,11 |
| 7 | | SEN | Advanced | 3 | | | SEN | Advanced | 3 | 4,8,9 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 756 | Usability Engineering | | | | 756 | Usability Engineering | | |
| 8 | | ~~CSC 518~~ | ~~Decision Support Systems~~ | 3 | | | CSC 728 | Decision Support Systems | 3 | 4,8 |
| 9 | | CSC 715 | Intelligent Agents | 3 | | | CSC 715 | Intelligent Agents | 3 | 4,8 |
| 10 | | CSC 719 | Machine Learning | 3 | | | CSC 719 | Machine Learning | 3 | 3,4,7,9 |
| 11 | | DSC 707 | Deep Learning | 3 | | | DSC 707 | Deep Learning | 3 | 3,4,7,9 |
| 12 | | CSC 741 | Advanced Natural Language Processing | 3 | | | CSC 741 | Advanced Natural Language Processing | 3 | 3,4,11 |
| 13 | | CEN 745 | Advanced Digital Image Processing | 3 | | | CEN 745 | Advanced Digital Image Processing | 3 | 3,4,11 |
| 14 | | CSC 749 | Advanced Neural Networks and Fuzzy Logic | 3 | | | CSC 749 | Advanced Neural Networks and Fuzzy Logic | 3 | 3,4,7,9 |
| 15 | | CSC 751 | Pattern Recognition | 3 | | | CSC 751 | Pattern Recognition | 3 | 3,4,7,9 |
| 16 | | CSC 764 | Computer Vision | 3 | | | CSC 764 | Computer Vision | 3 | 3,4,7,9 |
| 17 | | CSC 750 | Intelligent Tutoring Systems | 3 | | | CSC 750 | Intelligent Tutoring Systems | 3 | 4 |
| 18 | | ~~EET 519~~ | ~~Distributed Networking~~ | 3 | | | ESC 719 | Distributed Networking | 3 | 4,9,11 |
| 19 | | ~~EET 520~~ | ~~Network Administration and Management~~ | 3 | | | ESC 722 | Network Administration and Management | 3 | 4,11 |
| 20 | | EET 556 | ~~Mobile Communications and Networking~~ | 3 | | | ESC 756 | Mobile Communications and Networking | 3 | 4,9,11 |
| 21 | | EET 702 | Advanced Network | 3 | | | EET 702 | Advanced Network | 3 | 4,11 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Security | | | | | Security | | |
| 22 | | EET 713 | Advanced Network Design | 3 | | | EET 713 | Advanced Network Design | 3 | 4,9,11 |
| 23 | | EET 716 | Advanced Topics in Wireless Networking and Communications | 3 | | | EET 716 | Advanced Topics in Wireless Networking and Communications | 3 | 4,9,11 |
| 24 | | EET 718 | Network Performance Evaluation | 3 | | | EET 718 | Network Performance Evaluation | 3 | 4,11 |
| 25 | | EET 761 | Network Protocols and Standards | 3 | | | EET 761 | Network Protocols and Standards | 3 | 4,11 |
| 26 | | CSC 781 | Cloud Computing | 3 | | | CSC 781 | Cloud Computing | 3 | 3,4,9,11 |
| 27 | | ~~CSC 553~~ | ~~Advanced Information Theory~~ | 3 | | | CSC 733 | Advanced Information Theory | 3 | 4,9 |
| 28 | | CSC 746 | Advanced Data Mining | 3 | | | CSC 746 | Advanced Data Mining | 3 | 3,4,7,9 |
| 29 | | CSC 747 | Text Mining | 3 | | | CSC 747 | Text Mining | 3 | 3,4,9 |
| 30 | | CSC 752 | Advanced DBMS | 3 | | | CSC 752 | Advanced DBMS | 3 | 4,8 |
| 31 | | CSC 753 | Distributed Databases | 3 | | | CSC 753 | Distributed Databases | 3 | 3,4,11 |
| 32 | | CSC 754 | Object Oriented Databases | 3 | | | CSC 754 | Object Oriented Databases | 3 | 4,8 |
| 33 | | CSC 755 | Web based DBMS | 3 | | | CSC 755 | Web based DBMS | 3 | 3,4,11 |
| 34 | | CSC 756 | Multimedia Databases | 3 | | | CSC 756 | Multimedia Databases | 3 | 4,11 |
| 35 | | CSC 760 | Advanced Data Warehousing | 3 | | | CSC 760 | Advanced Data Warehousing | 3 | 3,4,7,9 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 36 | | CSC 514 | Information Retrieval Techniques | 3 | | | CSC 714 | Advanced Information Retrieval Techniques | 3 | 3,4,11 |
| 37 | | SEN 764 | Ontology Engineering | 3 | | | SEN 764 | Ontology Engineering | 3 | 3,4,7,9 |
| 38 | | SEN 761 | Semantic Web | 3 | | | SEN 761 | Semantic Web | 3 | 4,11 |
| 39 | | SEN 761 | Semantic Web | 3 | | | SEN 761 | Semantic Web | 3 | 4,11 |
| 40 | | SEN 761 | Semantic Web | 3 | | | SEN 761 | Semantic Web | 3 | 4,11 |
| 41 | | - | - | - | | | CEN 759 | Generative AI | 3 | 4, 9 |

| Advanced Theory of Computation | |
|---|---|
| **Course Code:** | **CSC 703** |
| **Credit Hours:** | 3+0 |
| **Prerequisites:** | Theory of Automata<br>It is assumed that students have had decent exposure to computability topics in an undergraduate level course. |
| **Objectives:** | This course covers the theoretical computer science areas of formal languages and automata, computability and complexity. It is concerned with the theoretical limits of computability. Several mathematical models of computation have been formulated independently and under any such computational model, the existence of well defined but unsolvable problems can be formally shown. These topics form part of the core of the mathematical foundations of computer science that will provide students and researchers with a sound theoretical view of the most fundamental concepts of computation.<br>At successful completion of the course, students should be able to:<br>• Demonstrate advanced knowledge of formal computation and its relationship to languages<br>• Classify different computing languages and their types<br>• Use these formalisms to explore the inherent limitations of computations<br>• Recognise and comprehend formal reasoning about languages<br>• Show an understanding of the basic concepts of complexity theory<br>• Describe some major current approaches for investigating feasible computation. |
| **Course outline:** | **Finite Automata and Regular Languages:** determinism and non determinism, checking vs. computing, Closure properties of regular languages, regular expressions, the pumping lemma for proving non regular languages, relationship between finite automata and regular expressions<br>**Context Free languges**: Context free grammars, Chomsky's normal form, relationship between CFG and CNF<br>**Universal models of computations**: issues of computability, the Turing machine, translation between models, model independence<br>**Computability theory:** primitive and partial recursive functions, encoding a Turing machine, Variations of Turing machine, recursive and R.E. languages, Rice's theorem and the Recursion theorem, Unsolvability , Decidable problems in RL and CFL, Undecidability of Turing machine<br>**Complexity theory:** reducibility among problems, reduction and complexity classes, hierarchy theorems, model independent complexity classes, NP completeness, space completeness, provably intractable problems<br>**Proving problems hard:** NP complete problems, P completeness proofs, Turing reductions and search problems, the polynomial hierarchy and enumeration problems<br>**Complexity theory in practice:** restriction of hard problems, strong NP completeness, the complexity of approximation, the power of randomization, complexity and constructive mathematics |
| **Resources:** | 1. Michael Sipser. *Introduction to the Theory of Computation, Third Edition*, 2013 Cengage Learning.<br>2. Introduction to Automata Theory, Languages, and Computation, 3/e by John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Pearson Ed., 2009.<br>3. Mathematics and Computation, by Avi Wigderson, Princeton Press, 2018. |

| **Advanced Design and Analysis of Algorithm** | |
|---|---|
| **Course Code:** | **CSC 721** |
| **Credit Hours:** | 3+0 |
| **Prerequisites:** | Design and Analysis of Algorithms, Data Structures and Algorithms |
| **Objectives:** | Algorithm design and analysis is fundamental and important course of computer science. This course introduces students to advanced techniques for the design and analysis of algorithms and explores a variety of application areas. Upon completion of the course, students should be able to explain the mathematical concepts used in describing the complexity of an algorithm, and design and apply algorithms appropriate to a particular situation |
| **Course outline:** | **Advanced Algorithm Analysis**: Asymptotic analysis, Average case of analysis, probabilistic analysis, amortized analysis<br>**Fundamental algorithm strategies**: Brute force, greedy, divide and conquer, backtracking, branch and bound.<br>**Advanced algorithm design:** NP Completeness, Heuristic and approximation algorithms, randomized algorithms, geometric algorithms<br>**Parallel Algorithms**: The PRAM model, design techniques for parallel algorithms, optimally and efficiency issues of PRAM algorithms<br>**Distributed Algorithms**: The computational model, distributed algorithms for broadcasting, leader election, message routing, event ordering and resource allocation problems, complexity issues<br>**Graph theory in problem solving**. Employing graphs to model science and engineering problems, and to reason about when it is appropriate to use it optimally.<br>**Genetic Algorithms:** Major elements of genetic algorithms, genetic solutions of computationally hard problems, Parallel Genetic Algorithms<br>**Advanced topics** such as computational geometry, operations research, cryptography, Metaheuristic Algorithms etc. |
| **Resources:** | 1. Mitzenmacher, M., & Upfal, E. (2017). Probability and computing: Randomization and probabilistic techniques in algorithms and data analysis. Cambridge university press.<br>2. Vazirani, V. V. (2001). Approximation algorithms (Vol. 1). Berlin: springer.<br>3. Borodin, A., & El Yaniv, R. (2005). Online computation and competitive analysis. Cambridge university press.<br>4. Fuschi, P., Pisano, A. A., & Weichert, D. (2015). Direct methods for limit and shakedown analysis of structures. Berlin: Springer.<br>5. Sedgewick, R. (2013). An introduction to the analysis of algorithms. Pearson Education India.<br>6. Ali Kaveh (2022). Advances in Metaheuristic Algorithms for Optimal Design of Structures. 3rd edition Springer<br>7. Steven S. Skiena (2021). The Algorithm Design Manual 3rd editionSpringer<br>8. Michael T. Goodrich & Roberto Tamassia (2015) Algorithm Design and Applications. 1st edition Wilay. |

**Advanced Ubiquitous Computing**

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| **Course Code:** | **CSC 706** |
| **Credit Hours:** | 3+0 |
| **Prerequisites:** | Human Computer Interaction |
| **Objectives:** | Ubiquitous computing integrates computation into the environment, rather than having computers as distinct objects. Embedding computation into the environment enables people to move around and interact with computers more naturally than they currently do. Therefore, the objective of this course is to help students gain a general understanding of ubiquitous computing, including its systems, privacy concerns, field studies, and interfaces. Additionally, students will explore advanced topics such as the wearable computing, pervasive healthcare and future trends in ubiquitous computing. |
| **Course outline:** | Introduction to ubiquitous computing, ubiquitous computing systems, privacy in ubiquitous computing, ubiquitous computing field studies, Ethnography in ubiquitous computing, interfaces for ubiquitous computing, location in ubiquitous computing, context aware computing and processing sequential sensor data, Internet of Things (IoT), wearable computing, smart environments, human computer interaction in ubiquitous computing, security in ubiquitous computing, ethical and social implications, ambient intelligence, pervasive healthcare, future trends in ubiquitous computing. |
| **Resources:** | 1. Ubiquitous Computing Fundamentals by John Krumm<br>2. Ubiquitous Computing by Eduard Babkin ISBN 978 953 307 409 2, Publisher: InTech, Published: February 10, 2011<br>3. Everyware, The Dawning Age of Ubiquitous Computing By Adam Greenfield |

| Intelligent User Interfaces Design and Evaluation | |
|---|---|
| **Course Code:** | CSC 705 |
| **Credit Hours:** | 3+0 |
| **Prerequisites:** | Human Computer Interaction |
| **Objectives:** | The third wave of Human Computer Interaction (HCI) has seamlessly integrated computing systems into the fabric of everyday human life. Initially, HCI research was predominantly focused on cognitive aspects; however, contemporary human centered computing has broadened the scope by enhancing traditional software processes, including requirements engineering and evaluation methodologies. This course aims to provide students with a comprehensive understanding of advanced user interface design and evaluation techniques. By the end of the course, students will be proficient in applying these methodologies to create intuitive, effective, and user friendly interfaces that meet modern usability standards and improve user experience. |
| **Course outline:** | Scenarios and Personas, Mental Models and Affordances, Tangible User Interfaces, Design as Applied Perception, Information Processing and Skilled Behavior, Cognitive Dimensions of Notational Frameworks, User Mental Modeling, Activity Theory, Distributed Cognition, Interaction Design, Evaluation Studies (Controlled v/s Natural settings), Inspections, Analytics and Models, Field Evaluation Methods, Field Evaluation Methods<br>Adaptive and Personalized Interfaces, Artificial Intelligence and Machine Learning in UI Design, Usability Testing Techniques, User Experience (UX) Metrics and Analysis, Multimodal Interfaces, Cross Platform Interface Design |
| **Resources:** | 1. Dourish P. (2001) Where the Action Is: The Foundations of Embodied Interaction. MIT Press<br>2. Readings in Intelligent User Interfaces, Mark T. Maybury, Wolfgang Wahlster, Morgan Kaufman Publishers, 1998<br>3. Markus, M.L. & Keil, M. (1994) If we build it, they will come: Designing information systems people want to use. Sloan Management Review<br>4. Dunne, A.; Raby, F. (2001): Design Noir: The Secret Life of Electronic Objects, Birkhäuser<br>5. Ehn, P. (1988): Work Oriented Design of Computer Artifacts. Stockholm, Arbetslivscentrum.<br>6. Gaver, B., Beaver, J.; Benford, S. (2003) Ambiguity as a resource for design. Proc. of CHI03. ACM Press, S. 233 240.<br>7. Multimedia Interaction and Intelligent User Interfaces: Principles, Methods |

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| | and Applications, by Ling Shao, Caifeng Shan, Jiebo Luo – 2010 |

| **Decision Support Systems** | |
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| **Course Code:** | CSC 728 |
| **Credit Hours:** | 3+0 |
| **Prerequisites:** | None |
| **Objectives:** | The primary focus of this course is developing intellectual capabilities related to design and development of decision support systems and also explore the role of DSS in supporting organization goals and the impact of information systems on organizations. To review and clarify the fundamental terms, concepts and theories associated with Decision Support Systems, computerized decision aids, expert systems, group support systems and executive information systems. To examine examples and case studies documenting computer support for organizational decision making, and various planning, analysis and control tasks. To discuss and develop skills in the analysis, design and implementation of computerized Decision Support Systems. Case Base Reasoning Based Decision Support Systems. This course should enable a student to understand managerial decisions, to participate in the decision making process, and to be able to develop models and systems to support the decision making. This course focuses on the use and application of information systems to support the decision making process. Different types of systems are discussed as a basis for designing and developing highly effective decision support systems. Data models, interactive processes, knowledge based approaches and integration with database systems are also described. Theoretical concepts would be applied to real world applications. |
| **Course outline:** | Decision support systems overview, Decision Making, Systems, Modeling, and Support, business intelligence, Data Management, Modeling and Analysis, Decision Support System Development, Fundamentals of Expert Systems and Intelligent Systems, Collaborative Computing Technologies, Knowledge Management. This course will examine the design, development and implementation of information technology based systems that support managerial and professional work, including Communications Driven and Group Decision Support Systems (GDSS), Data Driven DSS, Model Driven DSS, Document Driven DSS, and Knowledge Driven DSS. The broadest definition states that Decision Support Systems are interactive computer based systems and subsystems that help decision makers utilize data, models and/or communications to solve problems and make decisions. Data Driven DSS emphasize using data and include Executive Information Systems (EIS); Model Driven DSS emphasize using models to support decision making. A Communications Driven or Group decision support system (GDSS) is an interactive computer based system intended to facilitate the solution of problems by decision makers working together as a group and includes |

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| | groupware. Knowledge Driven DSS attempt to capture the knowledge of a human expert in a computer system. This computer system can then be used by less expert users. Document Driven DSS access and display text and multimedia information to support decision making. Case Base Reasoning Based Decision Support Systems. |
| **Resources:** | 1. Efraim Turban and Jay E. Aronson, Decision Support Systems and Intelligent Systems, Seventh Edition, Prentice Hall Pub. M 2004.<br>2. Decision Support Systems and Business Intelligence Systems. 9e. by E. Turban & J. Aronson, 2010.<br>3. Jao, Chiang, ed. Decision support systems. BoD–Books on Demand, 2010.<br>4. Jao, Chiang, ed. Efficient decision support systems: Practice and challenges from current to future. BoD–Books on Demand, 2011.<br>5. Yu, Xinghuo, ed. Applied decision support with soft computing. Vol. 124. Springer, 2012.<br>6. Bandyopadhyay, Susmita. Decision Support System: Tools and Techniques. CRC Press, 2023. |

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| | **Distributed Networking** |
| **Course Code:** | ESC 719 |
| **Credit Hours:** | 3+0 |
| **Prerequisites:** | Advanced Computer Networking |
| **Objectives:** | This course is design to teach how distributed networks are designed and implemented in real systems and provides detail on basic topics like communication, replication, fault systems,tolerance, and security. Students will be given real life examples of Distributed Networks such as Ad hoc, sensor and delay tolerant networks . |
| **Course outline:** | Communication, Processes, Synchronization, Consistency and replication, Scalability, Caching and replication, Fault tolerance and security, Naming in Distributed environments, Distributed file systems and coordination based systems, Middleware models, Distributed networks: Ad Hoc Networks,<br><br>Sensor Networks, Delay Tolerant Networks, Peer to Peer Networks.Grid Computing and Application, virtualization and cloud computing,network operating systems,(Distributed) denial of service attacks. |

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| **Resources:** | 1. Andrew S. Tanenbaum, Maarten Van Steen, Distributed Systems: Principles and Paradigms, Pearson Education. 2007<br>2. Kenneth P. Birman, Reliable Distributed Systems: Technologies, Web Services, and Applications.<br>3. David Culler, Anoop Gupta, J.P. Singh, Parallel Computer Architecture: A Hardware/ Software Approach, Morgan Kaufmann.<br>4. George Coulouris, Jean Dollimore, Tim Kindberg, Distributed System Concepts and Design, Addison Wesley, 2001.<br>5. Coulouris, Dollimore and Kindberg. *Distributed Systems Concepts and Design*. Addison Wesley 2011.<br>6. Alasdair Allan, Kipp Bradford, Distributed Network Data,O'Reilly, 2013. |

| **Advanced Information Theory** | |
|---|---|
| **Course Code:** | CSC 733 |
| **Credit Hours:** | 3+0 |
| **Prerequisites:** | |
| **Objectives:** | This course presents the fundamentals of Information Theory, that stays at the basis of modern digital communications, data compression, lossy source coding and multiuser networks.<br>Develop a deep understanding of the fundamental and advanced concepts of Information Theory. Explore the latest research and methodologies in data compression, coding theorems, and network information theory. Apply theoretical principles to complex problems in digital communication systems and networks. |
| **Course outline:** | Asymptotic Equipartition Theorem, types, and typical sequences, Information measures and their properties: entropy, Kullback Leibler divergence, mutual information, source coding theorem, channel coding theorem, rate distortion theory, quantization, maximum entropy principle Typical sequences and typical sets, error exponents in: hypothesis testing, source coding, and channel coding, information theory and estimation, rudiments of network information theory.<br><br>The course "Advanced Information Theory" (CSC 700) covers a wide range of topics fundamental to modern digital communications and data compression. An in depth exploration of advanced entropy and information measures, examining joint, conditional, and relative entropy, as well as mutual information and its properties, the Asymptotic Equipartition Property (AEP) and typical sequences, highlighting their applications in data compression and hypothesis testing. A revisits of Shannon’s first theorem and explores advanced source coding techniques like Arithmetic and Lempel Ziv coding. A deep dive into Shannon’s noisy channel coding theorem, with a focus on capacity calculations for various channels, including MIMO and fading |

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| | channels, and error correction codes such as LDPC and Turbo codes.<br><br>A focus on rate distortion theory and advanced quantization techniques, crucial for multimedia compression. It explores error exponents in hypothesis testing, including Chernoff bounds and large deviations theory, and applies information theoretic approaches to estimation problems, covering Fisher information and Bayesian estimation. The course introduces network information theory, including multi terminal source coding, multiple access channels, broadcast channels, relay channels, and network coding. The intersection of information theory and cryptography is then analyzed, focusing on entropy, information leakage, and modern cryptographic protocols. Advanced topics such as the maximum entropy principle and recent research advancements are covered, followed by emerging trends like machine learning, quantum information theory, and biological systems. The course concludes with a capstone project, where students apply their knowledge to a novel problem or research scenario, followed by group presentations, peer reviews, a comprehensive course review, and final exam preparation. This comprehensive structure ensures that students gain a deep and broad understanding of advanced information theory, preparing them for research and professional excellence in the field. |
| **Resources:** | 1. T.M. Cover and J.A. Thomas, Elements of Information Theory, 2nd ed., Wiley, 2006;<br>2. I. Csisz`ar and J. K¨orner, Information theory: coding theorems for discrete memoryless systems, 2nd ed., Cambridge University Press, 2011.<br>3. Codes: an introduction to information communication and cryptography by Norman Biggs, 2008<br>**New resources:**<br>1. Kakihara, Y., 2016. *Abstract methods in information theory* (Vol. 10). World Scientific.<br>2. Ash, Robert B. *Information theory*. Courier Corporation, 2012.<br>3. Norman Biggs, *Codes: An Introduction to Information Communication and Cryptography*, 2008.<br>4. Additional research papers and articles from contemporary journals and conferences. |

| Advanced Information Retrieval Techniques | |
|---|---|
| **Course Code:** | CSC 714 |
| **Credit Hours:** | 3+0 |
| **Prerequisites:** | Database Management System |
| **Objectives:** | This course provides an in-depth understanding of Information Retrieval (IR) techniques, focusing on the underlying algorithms, models, and systems used to retrieve information from large datasets. The course covers the theory behind IR, and recent advancements, particularly in the context of web search engines and data driven IR systems. |
| **Course outline:** | Introduction to Information Retrieval.<br>Retrieval Models: Boolean retrieval models, vector space model, probabilistic models and comparison of these models.<br>Query optimization. The nature of unstructured and semistructured text.<br>The term vocabulary and postings list.<br>Text Preprocessing and Indexing: tokenization, stemming, lemmatization, stop words, phrases. Inverted index and its construction TF IDF Weighing and Efficient storage and retrieval of large datasets.<br>Optimizing indices with skip lists. Proximity and phrase queries. Positional indices.<br>Index construction. Postings size estimation, sort based indexing, dynamic indexing, positional indexes, n gram indexes, distributed indexing, realworld issues.<br>Index compression: lexicon compression and postings lists compression. Gap encoding, gamma codes, Zipf's Law, variable byte encoding. Blocking. Extreme compression.<br>Dictionaries and tolerant retrieval. Dictionary data structures. Wild card queries, permuterm indices, n gram indices.<br>Spelling correction and synonyms: edit distance, soundex, language detection.<br>Results summaries: static and dynamic.<br>Evaluating search engines. User happiness, precision, recall, F measure. Mean average Precision (MAP), User centric evaluation metrics, Receiver operating characteristics (ROC) Creating test collections: kappa measure, inter judge agreement. Relevance, approximate vector retrieval.<br>Web Search and IR Systems: Web crawling and indexing, search engine architecture, PageRank and Link analysis, Adversarial information retrieval (Span Detection)<br>Advanced Topics: Neural IR models, cross language information retrieval, Deep learning for IR, social media and user generated content in IR |

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| **Resources:** | 1. Introduction to information retrieval, Manning, Christopher D., Prabhakar Raghavan and Hinrich Schutze, Cambridge University Press, 2008<br>2. Search Engines: Information Retrieval in Practice by Bruce Croft, Donald Metzler, and Trevor Strohman<br>3. Modern information retrieval, R. Baeza Yates and B. Ribeiro Neto, ACM Press, 2009<br>4. Information Retrieval Techniques for Pattern Matching: Managing and Searching Textual and XML Information in 21st Century Applications, by Riccardo Martoglia, LAP Lambert Acad. Publ., 2010 |

| **Virtual Reality Technologies** | |
|---|---|
| **Course Code:** | CSC 717 |
| **Credit Hours:** | 3+0 |
| **Prerequisites:** | • Computer Graphics<br>• C/C++ Programming |
| **Objectives:** | The objective of this course is to familiar students to Virtual Reality (VR). In this course, we will discuss the concepts and detail of rapidly growing field of VR. At the end of the course, students should be able use virtual reality in its own domain of application and should have a clear understanding of the various possibilities of this far reaching technology. |
| **Course outline:** | Understanding the basic principles of virtual reality, virtual reality hardware and software, applications for current virtual reality hardware and software, designing and constructing a simple virtual environment, social, philosophical, and psychological factors and implications of virtual reality, Graphics pipeline and virtual world appearance, Collision detection and physics of the virtual world, Tracking and Navigation |
| **Resources:** | 1. Introduction to Virtual Reality by John Vince, Springer 2004<br>2. Virtual Reality Technology by Burdea, Grigore and Coiffet, Philippe, second edition. New York: John Wiley & Sons, 2003<br>3. Virtual Reality Technology, John Wiley & Sons, Burdea G. and P. Coiffet, 1994.<br>4. Virtual Reality Photography: Creating Panoramic and Object Images, by Scott Highton,2010.<br>5. Virtual Reality by Steven M. Lavalle, Cambridge University Press,2023 |

Program Title: **MS (Data Science)**
Duration: **2 to 3 Years**
Total Credit Hours: **30**
Endorsement References: Recommendations of DBOS dated **16.08.2024** (recorded in the minutes of DBOS meeting)

**Program Mission**

Big data and analytics drive strategic decision making and innovation whether it is in relation to engineering, finance, healthcare or other professional areas. There is a growing demand for data scientists who can apply powerful tools and advanced statistical modeling techniques to make discoveries about business problems, processes and platforms.

**Program Education Objectives**

*The key objectives of the MS Data Science program include the following.*

1. To provide an in depth understanding of the theory and concepts of data analytics and modeling.
2. To prepare students for graduate level training in the core areas of data analysis and business analytics.
3. To enable learning of cutting edge technologies and tools.
4. To enable students to apply their knowledge and analytical skills to create effective and novel solutions to various computing problems.
5. To develop effective oral and written communication skills.
6. To foster leadership and collaboration skills to lead data driven projects within cross functional teams and bridge the gap between technical and business oriented roles

**Program Learning Outcomes**

Students graduating from the MS (Data Science) program are expected to:

7. To apply advanced statistical techniques, data mining, and predictive modeling to extract actionable insights from data.
8. Equip students with cutting edge skills in data science technologies, such as machine learning, artificial intelligence, and big data processing frameworks.
9. Acquaintance with the latest computing tools and technologies.
10. Enable students to align data science solutions with business strategy, understanding how to use data to solve real world business problems.
11. Ability to pursue continuous professional development.
12. Ability to work on practical and research-based problems collaboratively as well as independently.

**Summary of Credit Hours**

| Sr. No. | Courses as per HEC new GE Policy 2023 (All courses at MS level must be 700 level) | Credit Hours/Contact Hours | |
|---|---|---|---|
| | | Existing Road Map | Proposed New Road Map |
| **1.** | Core/University Requirement | 18 | 18 |
| **2.** | Electives Courses | 6 | 6 |
| **3.** | Interdisciplinary courses | | |
| **3.** | Thesis | 6 | 6 |

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| **4.** | Deficiency course/courses for candidates from other relevant domains | 3 to 9 | 3 to 9 |
| **Total** | | **30** | **30** |

## Semester wise Road map

## Semester 1

| **Sr. No.** | **Existing Road Map** | | | | **Sr. No.** | **Proposed Road map aligned with HEC new PG Policy** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Pre requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | | **Pre requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | **17 UN SDGs alignment** |
| **1** | | ~~DSC 500~~ | ~~Tools and Techniques in Data Science~~ | 3 | 1 | | DSC 777 | Tools and Techniques in Data Science | 3 | 4,8 |
| **2** | | ~~DSC 501~~ | ~~Statistical and Mathematical Methods for Data Analysis~~ | 3 | 2 | | DSC 711 | Statistical and Mathematical Methods for Data Analysis | 3 | 4,8 |
| **3** | | ESC 701 | Research Methodology | 3 | 3 | | ESC 701 | Research Methodology | 3 | 4 |
| **Total Credit Hours** | | | | **9** | **Total Credit Hours** | | | | **9** | |

## Semester 2

| **Sr. No.** | **Existing Road Map** | | | | **Sr. No.** | **Proposed Road map aligned with HEC new PG Policy** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Pre requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | | **Pre requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | **17 UN SDGs** |
| **1** | | DSC 700 | Big Data Analytics | 3 | 1 | | DSC 700 | Big Data Analytics | 3 | 4,8 |
| **2** | | CSC 719 | Machine Learning | 3 | 2 | | CSC 719 | Machine Learning | 3 | 3,4,7,9 |
| **3** | | | Elective I | 3 | 3 | | | Elective I | 3 | |
| **Total Credit Hours** | | | | **9** | **Total Credit Hours** | | | | **9** | |

**Semester 3**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment |
| 1 | | DSC 707 | Deep Learning | 3 | 1 | | DSC 707 | Deep Learning | 3 | 3,4,7,9 |
| 2 | | | Elective II | 3 | 2 | | | Elective II | 3 | |
| 3 | | ESC 500 | Thesis I / Elective – III | 3 | | | | MS Thesis I / Elective – III | 3 | 4,8,9 |
| Total Credit Hours | | | | 9 | Total Credit Hours | | | | 9 | |

****The SDGs are based on the objectives and application scenario of the proposed MS thesis.**

**Semester 4**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment |
| 1 | | ESC 500 | Thesis II / Elective – IV | 3 | 1 | | | MS Thesis II / Elective – IV | 3 | 4,8,9 |
| Total Credit Hours | | | | 3 | Total Credit Hours | | | | 3 | |

**List of Electives Courses**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite | Course Code | Course Title | Credit Hours | | Pre requisite | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment |
| 1 | | DSC 702 | Data Visualization | 3 | | | DSC 703 | Data Visualization | 3 | 4,8,11 |
| 2 | | DSC 703 | Distributed Data Engineering | 3 | | | DSC 704 | Distributed Data Engineering | 3 | 4,8,11 |
| 3 | | DSC 705 | Unstructured Data Processing | 3 | | | DSC 706 | Unstructured Data Processing | 3 | 4,8 |
| 4 | | ~~CSC 518~~ | ~~Decision Support Systems~~ | 3 | | | CSC 728 | Decision Support Systems | 3 | 4,8 |

**Tools and Techniques in Data Science**

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| **5** | | CSC 715 | Intelligent Agents | 3 | | | CSC 715 | Intelligent Agents | 3 | 4,8 |
| **6** | | CSC 741 | Advanced Natural Language Processing | 3 | | | CSC 741 | Advanced Natural Language Processing | 3 | 3,4,11 |
| **7** | | CEN 745 | Advanced Digital Image Processing | 3 | | | CEN 745 | Advanced Digital Image Processing | 3 | 3,4,11 |
| **8** | | CSC 749 | Advanced Neural Networks and Fuzzy Logic | 3 | | | CSC 749 | Advanced Neural Networks and Fuzzy Logic | 3 | 3,4,7,9 |
| **9** | | CSC 751 | Pattern Recognition | 3 | | | CSC 751 | Pattern Recognition | 3 | 3,4,7,9 |
| **10** | | CSC 764 | Computer Vision | 3 | | | CSC 764 | Computer Vision | 3 | 3,4,7,9 |
| **11** | | CSC 781 | Cloud Computing | 3 | | | CSC 781 | Cloud Computing | 3 | 3,4,9,11 |
| **12** | | ~~CSC 554~~ | ~~Advanced Information Theory~~ | 3 | | | CSC 733 | Advanced Information Theory | 3 | 4,9 |
| **13** | | CSC 747 | Text Mining | 3 | | | CSC 747 | Text Mining | 3 | 3,4,9 |
| **14** | | CSC 752 | Advanced DBMS | 3 | | | CSC 752 | Advanced DBMS | 3 | 4,8 |
| **15** | | CSC 760 | Advanced Data Warehousing | 3 | | | CSC 760 | Advanced Data Warehousing | 3 | 4,8 |
| **16** | | SEN 764 | Ontology Engineering | 3 | | | SEN 764 | Ontology Engineering | 3 | 3,4,7,9 |
| **17** | | | | | | | CEN 759 | Generative AI | 3 | 4, 9 |
| **18** | | ~~ESC 500~~ | ~~Thesis~~ | 6 | | | THS 799 | Thesis | 6 | |
| **Total Credit Hours** | | | | | **Total Credit Hours** | | | | | |

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| **Course Code:** | DSC 777 |
| **Credit Hours:** | 3+0 |
| **Prerequisites:** | |
| **Objectives:** | This course aims to introduce students to the foundational principles of data science with hands on exercises using the latest data science tools. Students will gain proficiency in data manipulation, exploratory data analysis, machine learning algorithms, and data visualization, preparing them for real world applications in various domains. Students will also explore latest tools currently used in industry for creating data science pipelines. |
| **Course outline:** | Introduction to Data Science: Definition and scope of data science, Evolution and importance in modern applications. Overview of emerging trends in data science applications. Data Science Life Cycle & Process Asking the Right Questions in Data Science, Understanding Data through exploratory data analysis (EDA, Building Predictive Models using supervised and unsupervised learning techniques, Generating Visualizations for data driven insights. Integrating ethics and fairness into the data science life cycle Introduction to Data,Types of Data (structured, unstructured, semi structured)<br>Introduction to Python Data Science Stack Python programming fundamentals. Numpy for numerical computations, Pandas for data manipulation, Matplotlib, seaborn for data visualization. Introduction to Scikit Learn Overview of Scikit Learn library for machine learning in Python .<br>Relational Algebra & SQL. Introduction to NoSQL databases and their applications<br>Data Quality Measurement of data quality metrics. Data Pre processing Stages Aggregation, Sampling techniques, Dimensionality Reduction methods, Feature Subset Selection and Creation for model building. Techniques in data cleaning and preprocessing for different data types, for example, text, image , structured data and spatio temporal data. Algebraic & Probabilistic View of Data. Probability theory and its role in data analysis . Datasets: Sources and characteristics in contemporary data science. Obtaining Data from various sources (APIs, databases, web scraping). Scraping & Data Wrangling Assessing data sources Structuring, Cleaning & Munging of data for analysis. Using APIs for data extraction and integration<br>Basic Descriptive & Exploratory Data Analysis, Techniques for summarizing and visualizing data distributions, Exploring relationships and patterns in data. Interactive data visualization tools and libraries, Introducing Tableau.<br>Introduction to Text Analysis Text Preprocessing: Stemming, Lemmatization, Bag of Words, TF IDF for feature extraction from text data. Introduction to Prediction and Inference Algorithms Supervised Learning: Regression, Classification;Unsupervised Learning: Clustering, Dimensionality Reduction. Sentiment analysis and topic modeling. Recommender Systems, covering algorithms such as collaborative filtering, content based filtering, and hybrid methods for personalized recommendations in various domains.<br>Bias Variance Tradeoff ,Understanding the balance between model bias and variance, Techniques to mitigate bias and variance in predictive models. |

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| | Model Evaluation & Performance Metrics Accuracy, Confusion Matrix, Precision Recall, F 1 Score, Lift, etc. Selecting appropriate metrics based on application requirements.<br>Explainable AI Techniques for interpreting and explaining machine learning models. Importance of transparency and interpretability in AI. Case studies on real world applications of Explainable AI<br>Data Science Tools: Introduction to tools such as RapidMiner, Power BI, Tableau, QlikView, etc. Hands on exercises in creating interactive dashboards and visual analytics. Integration of data storytelling principles into visualization techniques. |
| **Resources:** | **Text Books:**<br>1. Python Data Science Essentials: A practitioner's guide covering essential data science principles, tools, and techniques, 3rd Edition by Alberto Boschetti (Author), Luca Massaron (Author) , 2018<br>2. Data Science from Scratch, 1st Edition, Joel Grus, 2015<br>**Reference Books:**<br>1. An Introduction to Statistical Learning with Applications in R, 1st Edition, G. James, D. Witten, T. Hastie and R. Tibshirani, 2013<br>2. Computational and Inferential Thinking: The Foundations of Data Science, 1st Edition, A. Adhikari and J. DeNero, 2017<br>3. Hands On Explainable AI (XAI) with Python: Interpret, visualize, explain, and integrate reliable AI for fair, secure, and trustworthy AI apps Title. Denis Rothman Packt Publishing, 2020<br>4. Introduction to Data Science. A Python Approach to Concepts, Techniques and Applications, 1st Edition, Laura Igual, 2017 |

| Decision Support Systems | |
|---|---|
| **Course Code:** | CSC 728 |
| **Credit Hours:** | 3+0 |
| **Prerequisites:** | None |
| **Objectives:** | The primary focus of this course is developing intellectual capabilities related to design and development of decision support systems and also explore the role of DSS in supporting organization goals and the impact of information systems on organizations. To review and clarify the fundamental terms, concepts and theories associated with Decision Support Systems, computerized decision aids, expert systems, group support systems and executive information systems. To examine examples and case studies documenting computer support for organizational decision making, and various planning, analysis and control tasks. To discuss and develop skills in the analysis, design and implementation of computerized Decision Support Systems. Case Base Reasoning Based Decision Support Systems. This course should enable a student to understand managerial decisions, to participate in the decision making process, and to be able to develop models and systems to support the decision making. This course focuses on the use and application of information systems to support the decision making process. Different types of systems are discussed as a basis for designing and developing highly effective decision support systems. Data models, interactive processes, knowledge based approaches and integration with database systems are also described. Theoretical concepts would be applied to real world applications. |
| **Course outline:** | Decision support systems overview, Decision Making, Systems, Modeling, and Support, business intelligence, Data Management, Modeling and Analysis, Decision Support System Development, Fundamentals of Expert Systems and Intelligent Systems, Collaborative Computing Technologies, Knowledge Management. This course will examine the design, development and implementation of information technology based systems that support managerial and professional work, including Communications Driven and Group Decision Support Systems (GDSS), Data Driven DSS, Model Driven DSS, Document Driven DSS, and Knowledge Driven DSS. The broadest definition states that Decision Support Systems are interactive computer based systems and subsystems that help decision makers utilize data, models and/or communications to solve problems and make decisions. Data Driven DSS emphasize using data and include Executive Information Systems (EIS); Model Driven DSS emphasize using models to support decision making. A Communications Driven or Group decision support system (GDSS) is an interactive computer based system intended to facilitate the solution of problems by decision makers working together as a group and includes groupware. Knowledge Driven DSS attempt to capture the knowledge of a human expert in a computer system. This computer system can then be used by less expert users. Document Driven DSS access and display text and multimedia information to support decision making. Case Base Reasoning Based Decision |

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|---|---|
| | Support Systems. |
| **Resources:** | 7. Efraim Turban and Jay E. Aronson, Decision Support Systems and Intelligent Systems, Seventh Edition, Prentice Hall Pub. M 2004.<br>8. Decision Support Systems and Business Intelligence Systems. 9e. by E. Turban & J. Aronson, 2010.<br>9. Jao, Chiang, ed. Decision support systems. BoD–Books on Demand, 2010.<br>10. Jao, Chiang, ed. Efficient decision support systems: Practice and challenges from current to future. BoD–Books on Demand, 2011.<br>11. Yu, Xinghuo, ed. Applied decision support with soft computing. Vol. 124. Springer, 2012.<br>12. Bandyopadhyay, Susmita. Decision Support System: Tools and Techniques. CRC Press, 2023. |

| **Advanced Information Theory** | |
|---|---|
| **Course Code:** | CSC 733 |
| **Credit Hours:** | 3+0 |
| **Prerequisites:** | |
| **Objectives:** | This course presents the fundamentals of Information Theory, that stays at the basis of modern digital communications, data compression, lossy source coding and multiuser networks.<br>Develop a deep understanding of the fundamental and advanced concepts of Information Theory. Explore the latest research and methodologies in data compression, coding theorems, and network information theory. Apply theoretical principles to complex problems in digital communication systems and networks. |
| **Course outline:** | Asymptotic Equipartition Theorem, types, and typical sequences, Information measures and their properties: entropy, Kullback Leibler divergence, mutual information, source coding theorem, channel coding theorem, rate distortion theory, quantization, maximum entropy principle Typical sequences and typical sets, error exponents in: hypothesis testing, source coding, and channel coding, information theory and estimation, rudiments of network information theory.<br><br>The course "Advanced Information Theory" (CSC 700) covers a wide range of topics fundamental to modern digital communications and data compression. An in depth exploration of advanced entropy and information measures, examining joint, conditional, and relative entropy, as well as mutual information and its properties, the Asymptotic Equipartition Property (AEP) and typical sequences, highlighting their applications in data compression and hypothesis testing. A revisits of Shannon's first theorem and explores advanced source |

| | |
|---|---|
| | coding techniques like Arithmetic and Lempel Ziv coding. A deep dive into Shannon's noisy channel coding theorem, with a focus on capacity calculations for various channels, including MIMO and fading channels, and error correction codes such as LDPC and Turbo codes.<br><br>A focus on rate distortion theory and advanced quantization techniques, crucial for multimedia compression. It explores error exponents in hypothesis testing, including Chernoff bounds and large deviations theory, and applies information theoretic approaches to estimation problems, covering Fisher information and Bayesian estimation. The course introduces network information theory, including multi terminal source coding, multiple access channels, broadcast channels, relay channels, and network coding. The intersection of information theory and cryptography is then analyzed, focusing on entropy, information leakage, and modern cryptographic protocols. Advanced topics such as the maximum entropy principle and recent research advancements are covered, followed by emerging trends like machine learning, quantum information theory, and biological systems. The course concludes with a capstone project, where students apply their knowledge to a novel problem or research scenario, followed by group presentations, peer reviews, a comprehensive course review, and final exam preparation. This comprehensive structure ensures that students gain a deep and broad understanding of advanced information theory, preparing them for research and professional excellence in the field. |
| **Resources:** | 4. T.M. Cover and J.A. Thomas, Elements of Information Theory, 2nd ed., Wiley, 2006;<br>5. I. Csisz`ar and J. K¨orner, Information theory: coding theorems for discrete memoryless systems, 2nd ed., Cambridge University Press, 2011.<br>6. Codes: an introduction to information communication and cryptography by Norman Biggs, 2008<br>**New resources:**<br>5. Kakihara, Y., 2016. *Abstract methods in information theory* (Vol. 10). World Scientific.<br>6. Ash, Robert B. *Information theory*. Courier Corporation, 2012.<br>7. Norman Biggs, *Codes: An Introduction to Information Communication and Cryptography*, 2008.<br>8. Additional research papers and articles from contemporary journals and conferences. |

Program Title: **MS (Information Security)**
Duration: **2 to 3 Years**
Total Credit Hours: **30**
Endorsement References: A: Recommendations of DBOS dated **16.08.2024** (recorded in the minutes of DBOS meeting)

**Program Mission**

The mission of the MSIS program is to produce knowledgeable, highly skilled, and competitive Information Security graduates who can play an effective role in the efforts to make cyberspace reliable and secure for National and International communities.

**Program Education Objectives**

*The key objectives of the MSIS program include the following.*

1. To provide exposure to the knowledge and skills required to protect information assets.
2. To enable understanding of current threats and vulnerabilities and finding ways of developing effective countermeasures.
3. To contribute to the growing need of information security professionals to protect and secure information assets.
4. To enable students to design and implement effective security mechanisms for organizations using the latest tools and technologies.
5. To develop effective oral and written communication skills.
6. To prepare students to work independently as well as in groups.

**Program Learning Outcome**

Students graduating from the MSIS program are expected to gain.

1. Understanding of the information security challenges in networks and software systems.
2. Ability to perform risk assessment of an organization's information assets.
3. Ability to apply the knowledge and skills acquired during the program to design and implement secure networked software and distributed systems.
4. Acquaintance with the latest information security tools and technologies.
5. To develop effective oral and written communication skills.
6. Ability to pursue continuous professional development.
7. Ability to work on practical and research-based problems collaboratively as well as indepe ndently.

**Summary of Credit Hours**

| Sr. No. | Courses as per HEC new GE Policy 2023 (All courses at Ph.D. level must be 800 level) | Credit Hours/Contact Hours | |
|---|---|---|---|
| | | Existing Road Map | Proposed New Road Map |
| 1. | Core/University Requirement | 15 | 15 |
| 2. | Electives Courses | 9 | 9 |
| 3. | Interdisciplinary courses | | |
| 3. | Thesis | 6 | 6 |
| 4. | Deficiency course in case of candidates from other relevant domains | | |
| **Total** | | 30 | 30 |

## Semester wise Road map

## Semester 1

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Pre requisite** | **Course Code** | **Course Title** | **Credit Hours** | | **Pre requisite** | **Course Code** | **Course Title** | **Credit Hours** | **17 UN SDGs alignment** |
| **1** | | ~~ISC 511~~ | ~~Number Theory~~ | 3 | 1 | | ISC 711 | Number Theory | 3 | 4 |
| **2** | | ~~CSC 521~~ | ~~Advanced Design and Analysis of Algorithms~~ | 3 | 2 | | CSC 721 | Advanced Design and Analysis of Algorithms | 3 | 4,11 |
| **3** | | ~~ISC 512~~ | ~~Computer and Network Security~~ | 3 | 3 | | ISC 712 | Computer and Network Security | 3 | 4,9,11 |
| **Total Credit Hours** | | | | **9** | **Total Credit Hours** | | | | **9** | |

***The SDGs are based on the elective course mentioned in the list of electives.**

**Semester 2**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Pre requisite** | **Course Code** | **Course Title** | **Credit Hours** | | **Pre requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | **17 UN SDGs alignment (please mention relevant SDG No.** |
| **1** | | Elective I | Elective I | 3 | 1 | | Elective I | Elective I | 3 | |
| **2** | | ISC 721 | Advanced Cryptography and Cryptanalysis | 3 | 2 | | ISC 721 | Advanced Cryptography and Cryptanalysis | 3 | 4,11 |
| **3** | | ESC 701 | Research Methodology | 3 | 3 | | ESC 701 | Research Methodology | 3 | 4 |
| **Total Credit Hours** | | | | **9** | **Total Credit Hours** | | | | **9** | |

**Semester 3**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Pre requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | | **Pre requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | **17 UN SDGs alignment** |
| **1** | | | Elective II | 3 | 1 | | | Elective II | 3 | |
| **2** | | ESC 500 | Thesis I / Elective III | 3 | 2 | | | Thesis I / Elective III | 3 | 4,8,9 |
| **3** | | | Elective IV | 3 | | | | Elective IV | 3 | |
| **Total Credit Hours** | | | | **9** | **Total Credit Hours** | | | | **9** | |

**Semester 4**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment (please mention relevant SDG No. |
| **1** | | ESC 500 | Thesis II / Elective V | 3 | 1 | | | Thesis II / Elective V | 3 | 4,8,9 |
| **Total Credit Hours** | | | | **3** | **Total Credit Hours** | | | | **3** | |

**List of Electives Courses**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requi site | Course Code | Course Title | Credit Hours | | Pre requ isite | Cours e Code | Course Title | Credit Hours | 17 UN SDGs alignment |
| **1** | | ~~EET 519~~ | ~~Distributed Networking~~ | 3 | | | ESC 719 | Distributed Networking | 3 | 4,9,11 |
| **2** | | ~~EET 520~~ | ~~Network Administration and Management~~ | 3 | | | ESC 722 | Network Administration and Management | 3 | 4,11 |
| **3** | | EET 553 | Information theory and coding | 3 | | | CSC 733 | Advance Information theory | 3 | 4,9 |
| **4** | | ~~EET 556~~ | ~~Mobile Communication and Networking~~ | 3 | | | ESC 756 | Mobile Communication and Networking | 3 | 4,9,11 |
| **5** | | ISC 732 | Advance Computer Security | 3 | | | ISC 732 | Advance Computer Security | 3 | 4,11 |
| **6** | | ISC 733 | Information Hiding | 3 | | | ISC 733 | Information Hiding | 3 | 4,9,11 |

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|---|---|---|---|---|---|---|---|---|---|---|
| **7** | | ISC 734 | Wireless Network Security | 3 | | | ISC 734 | Wireless Network Security | 3 | 4,11 |
| **8** | | ISC 735 | Cloud Computing Security | 3 | | | ISC 735 | Cloud Computing Security | 3 | 3,4,9,11 |
| **9** | | ISC 736 | Cyber Warfare | 3 | | | ISC 736 | Cyber Warfare | 3 | 9,11 |
| **10** | | ISC 737 | Computer and Network Forensics | 3 | | | ISC 737 | Computer and Network Forensics | 3 | 9,11 |
| **11** | | ISC 738 | Ethical Hacking | 3 | | | ISC 738 | Ethical Hacking | 3 | 4,11 |
| **12** | | ISC 739 | Cyber Crimes and Laws | 3 | | | ISC 739 | Cyber Crimes and Laws | 3 | 4,16 |
| **13** | | ISC 740 | Quantum Cryptograph y | 3 | | | ISC 740 | Quantum Cryptograph y | 3 | 9,11 |
| **14** | | ISC 741 | Algebraic Cryptanalysi s | 3 | | | ISC 741 | Algebraic Cryptanalysis | 3 | 4,11 |
| **15** | | ISC 742 | Intrusion Detection and Prevention | 3 | | | ISC 742 | Intrusion Detection and Prevention | 3 | 4,9,11 |
| **16** | | | | | | | CSC 719 | Machine Learning | 3 | 3,4,7,9 |
| **17** | | | | | | | DSC 707 | Deep Learning | 3 | 3,4,7,9 |
| **18** | | ISC 743 | Penetration Testing and Vulnerability Analysis | 3 | | | ISC 743 | Penetration Testing and Vulnerability Analysis | 3 | 9,11 |
| **19** | | EET 710 | Advanced Computer Networks | 3 | | | EET 710 | Advanced Computer Networks | 3 | 4,9,11 |
| **20** | | CSC 720 | Advanced Operating Systems | 3 | | | CSC 720 | Advanced Operating Systems | 3 | 4,9,11 |
| **21** | | ISC 731 | Information Security Managemen | 3 | | | ISC 731 | Information Security Managemen | 3 | 9,11 |

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| | | | t | | | | | t | | |
| **22** | | | | | | | ISC 748 | Blockchain Essentials | 3 | 4,9,11 |
| | | | | | | **Total Credit Hours** | | | | |

**List of Updated Courses**

| **Sr. No.** | **Existing Road Map** | | | | **Sr. No.** | **Proposed Road map aligned with HEC new UG Policy** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Pre requisite** | **Course Code** | **Course Title** | **Credit Hours** | | **Pre requisite** | **Course Code** | **Course Title** | **Credit Hours** | **17 UN SDGs alignment** |
| **1** | | ISC 511 | Number Theory | 3 | | | ISC 711 | Number Theory | 3 | 4 |
| **2** | | CSC 521 | Advanced Design and Analysis of Algorithms | 3 | | | CSC 721 | Advanced Design and Analysis of Algorithms | 3 | 4,11 |
| **3** | | ISC 512 | Computer and Network Security | 3 | | | ISC 712 | Computer and Network Security | 3 | 4,9,11 |
| **4** | | EET 519 | Distributed Networking | 3 | | | ESC 719 | Distributed Networking | 3 | 4,9,11 |
| **5** | | EET 520 | Network Administration and Management | 3 | | | ESC 722 | Network Administration and Management | 3 | 4,11 |
| **6** | | EET 553 | Information theory and coding | 3 | | | CSC 733 | Advance Information theory | 3 | 4,9 |
| **7** | | EET 556 | Mobile Communication and Networking | 3 | | | ESC 756 | Mobile Communication and Networking | 3 | 4,9,11 |
| **Total Credit Hours** | | | | | **Total Credit Hours** | | | | | |

| Number Theory | |
|---|---|
| **Course Code:** | ISC 711 |
| **Credit Hours:** | 3+0 |

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|---|---|
| **Prerequisites:** | None |
| **Objectives:** | The objective of this course is to introduce number theory that is an ongoing rich area of mathematical exploration and is noted for its theoretical depth, with connections and applications relating to physics and cryptography. The course will give in depth knowledge of number primes, congruence's, and Diophantine equations and their usage in real world problems. Also, the course will provide mathematical foundation for computer system design and advance cryptographic techniques using elliptic curves. |
| **Course outline:** | Time estimates for doing arithmetic, Divisibility and the Euclidean algorithm, Chinese remainder theorem, Theory of Congruences, order and primitive roots, applications to factoring, Finite Fields and Quadratic Residues, Finite fields, Quadratic residues and reciprocity, cryptography: Some simple cryptosystems, Enciphering matrices, Public Key: The idea of public key cryptography, RSA, Discrete log, Knapsack, Zero knowledge protocols<br><br>and oblivious transfer. Primality and Factoring: Pseudo primes, The rho method, Fermat factorization and factor bases, The continued fraction method, The quadratic sieve method. Elliptic Curves, Database Security, Secret Sharing Quantum Number Theoretic Algorithms, Computer Systems Design (Representing Numbers in Residue Number Systems, Fast Computations in Residue Number Systems, Residue Computers, Complementary Arithmetic, Hash Functions, Error Detection and Correction Methods, Random Number Generation) |
| **Resources:** | 1. Number Theory for Computing<br>2. An Introduction to Number Theory with Cryptography (second edition) James S. Kraft Lawrence C. Washington<br>3. Elementary Number Theory by David Burton, 2016, ISBN 13: 978 0073383149 |

| Advanced Design and Analysis of Algorithm | |
|---|---|
| **Course Code:** | **CSC 721** |
| **Credit Hours:** | 3+0 |
| **Prerequisites:** | Design and Analysis of Algorithms, Data Structures and Algorithms |
| **Objectives:** | Algorithm design and analysis is fundamental and important course of computer science. This course introduces students to advanced techniques for the design and analysis of algorithms and explores a variety of application areas. Upon completion of the course, students should be able to explain the mathematical concepts used in describing the complexity of an algorithm, and design and apply algorithms appropriate to a particular situation |
| **Course outline:** | **Advanced Algorithm Analysis**: Asymptotic analysis, Average case of analysis, probabilistic analysis, amortized analysis<br>**Fundamental algorithm strategies**: Brute force, greedy, divide and conquer, backtracking, branch and bound.<br>**Advanced algorithm design:** NP Completeness, Heuristic and approximation algorithms, randomized algorithms, geometric algorithms<br>**Parallel Algorithms**: The PRAM model, design techniques for parallel algorithms, optimally and efficiency issues of PRAM algorithms<br>**Distributed Algorithms**: The computational model, distributed algorithms for broadcasting, leader election, message routing, event ordering and resource allocation problems, complexity issues<br>**Graph theory in problem solving**. Employing graphs to model science and engineering problems, and to reason about when it is appropriate to use it optimally.<br>**Genetic Algorithms:** Major elements of genetic algorithms, genetic solutions of computationally hard problems, Parallel Genetic Algorithms<br>**Advanced topics** such as computational geometry, operations research, cryptography, Metaheuristic Algorithms etc. |
| **Resources:** | 9. Mitzenmacher, M., & Upfal, E. (2017). Probability and computing: Randomization and probabilistic techniques in algorithms and data analysis. Cambridge university press.<br>10. Vazirani, V. V. (2001). Approximation algorithms (Vol. 1). Berlin: springer.<br>11. Borodin, A., & El Yaniv, R. (2005). Online computation and competitive analysis. Cambridge university press.<br>12. Fuschi, P., Pisano, A. A., & Weichert, D. (2015). Direct methods for limit and shakedown analysis of structures. Berlin: Springer.<br>13. Sedgewick, R. (2013). An introduction to the analysis of algorithms. Pearson Education India.<br>14. Ali Kaveh (2022). Advances in Metaheuristic Algorithms for Optimal Design of Structures. 3rd edition Springer<br>15. Steven S. Skiena (2021). The Algorithm Design Manual 3rd editionSpringer<br>16. Michael T. Goodrich & Roberto Tamassia (2015) Algorithm Design and Applications. 1st edition Wilay. |

| Advanced Information Theory | |
|---|---|
| **Course Code:** | CSC 733 |
| **Credit Hours:** | 3+0 |

| | |
|---|---|
| **Prerequisites:** | |
| **Objectives:** | This course presents the fundamentals of Information Theory, that stays at the basis of modern digital communications, data compression, lossy source coding and multiuser networks.<br>Develop a deep understanding of the fundamental and advanced concepts of Information Theory. Explore the latest research and methodologies in data compression, coding theorems, and network information theory. Apply theoretical principles to complex problems in digital communication systems and networks. |
| **Course outline:** | Asymptotic Equipartition Theorem, types, and typical sequences, Information measures and their properties: entropy, Kullback Leibler divergence, mutual information, source coding theorem, channel coding theorem, rate distortion theory, quantization, maximum entropy principle Typical sequences and typical sets, error exponents in: hypothesis testing, source coding, and channel coding, information theory and estimation, rudiments of network information theory.<br><br>The course "Advanced Information Theory" (CSC 700) covers a wide range of topics fundamental to modern digital communications and data compression. An in depth exploration of advanced entropy and information measures, examining joint, conditional, and relative entropy, as well as mutual information and its properties, the Asymptotic Equipartition Property (AEP) and typical sequences, highlighting their applications in data compression and hypothesis testing. A revisits of Shannon's first theorem and explores advanced source coding techniques like Arithmetic and Lempel Ziv coding. A deep dive into Shannon's noisy channel coding theorem, with a focus on capacity calculations for various channels, including MIMO and fading channels, and error correction codes such as LDPC and Turbo codes.<br><br>A focus on rate distortion theory and advanced quantization techniques, crucial for multimedia compression. It explores error exponents in hypothesis testing, including Chernoff bounds and large deviations theory, and applies information theoretic approaches to estimation problems, covering Fisher information and Bayesian estimation. The course introduces network information theory, including multi terminal source coding, multiple access channels, broadcast channels, relay channels, and network coding. The intersection of information theory and cryptography is then analyzed, focusing on entropy, information leakage, and modern cryptographic protocols. Advanced topics such as the maximum entropy principle and recent research advancements are covered, followed by emerging trends like machine learning, quantum information theory, and |

| | |
|---|---|
| | biological systems. The course concludes with a capstone project, where students apply their knowledge to a novel problem or research scenario, followed by group presentations, peer reviews, a comprehensive course review, and final exam preparation. This comprehensive structure ensures that students gain a deep and broad understanding of advanced information theory, preparing them for research and professional excellence in the field. |
| **Resources:** | 7. T.M. Cover and J.A. Thomas, Elements of Information Theory, 2nd ed., Wiley, 2006;<br>8. I. Csisz`ar and J. K¨orner, Information theory: coding theorems for discrete memoryless systems, 2nd ed., Cambridge University Press, 2011.<br>9. Codes: an introduction to information communication and cryptography by Norman Biggs, 2008<br>**New resources:**<br>9. Kakihara, Y., 2016. *Abstract methods in information theory* (Vol. 10). World Scientific.<br>10. Ash, Robert B. *Information theory*. Courier Corporation, 2012.<br>11. Norman Biggs, *Codes: An Introduction to Information Communication and Cryptography*, 2008.<br>12. Additional research papers and articles from contemporary journals and conferences. |

rogram Title: **MS (Mathematics)**
Duration: **2 to 3 years**
Total Credit Hours: **30**
Endorsement References:

Recommendations of DBoS dated **16.08.2024** (recorded in the minutes of DBOS meeting)

**Program Educational Objectives**

1. To provide a deep understanding of both pure and applied mathematics
2. To prepare students for graduate level training in specialized areas of mathematics.
3. To enable students to apply their knowledge and analytical skills to create novel solutions to mathematical problems.
4. To develop effective oral and written communication skills for working independently and in groups.

**Program Learning Objectives**

1. Enhance students' ability to apply mathematical techniques to solve complex problems in various fields, such as science, engineering, finance, and technology.

2. Equip students with the skills to explore novel aspects in mathematics, enabling them to contribute new knowledge to the field through thesis work or research projects.
3. Acquaintance with the latest mathematical tools and technologies.
4. Ability to pursue continuous professional development.

**Summary of Credit Hours**

| Sr. No. | Courses as per HEC new GE Policy 2023 (All courses at MS level must be 700 level) | Credit Hours/Contact Hours | |
|---|---|---|---|
| | | Existing Road Map | Proposed New Road Map |
| 1. | Major/Disciplinary | 12 | 12 |
| 2. | Electives Courses | 12 | 12 |
| 3. | Interdisciplinary courses | | |
| 3. | Thesis | 06 | 06 |
| 4. | Deficiency course/courses for candidates from other relevant domains | | |
| | Total | 30 | 30 |

**<u>Semester wise Road map</u>**

**<u>Semester 1</u>**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment |
| **1** | | | Core I | 03 | 1 | | | Core I | 03 | 4 |
| **2** | | | Core II | 03 | 2 | | | Core II | 03 | 4 |
| **3** | | | Core III | 03 | 3 | | | Core III | 03 | 4 |
| | | | **Total Credit Hours** | 09 | | | | Total Credit Hours | 09 | |

**<u>Semester 2</u>**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment |
| **1** | | ESC 501 | Research Methodology | 03 | 1 | | ESC 701 | Research Methodology | 03 | 4 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **2** | | | Core IV | 03 | 2 | | | Core IV | 03 | 4 |
| **3** | | | Elective I | 03 | 3 | | | Elective I | 03 | 4 |
| | | | **Total Credit Hours** | 09 | | | | Total Credit Hours | 09 | |

**Semester 3**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment |
| **1** | | MAT 700 | Supervised Research (MS Thesis) | 03 | 1 | | THS 799 | MS Thesis | 03 | |
| **2** | | | Elective II | 03 | 2 | | | Elective II | 03 | 4 |
| | | | **Total Credit Hours** | 06 | | | | Total Credit Hours | 06 | |

**Semester 4**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment |
| **1** | | MAT 700 | Supervised Research (MS Thesis) | 03 | 1 | | THS 799 | MS Thesis | 03 | |
| **2** | | | Elective III | 03 | 2 | | | Elective III | 03 | 4 |
| | | | **Total Credit Hours** | 06 | | | | Total Credit Hours | 06 | |

**List of Core Courses**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite | Course Code | Course Title | Credit Hours | | Pre requisite | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **1** | | MAT 710 | Advanced Partial Differential Equations | 03 | 1 | | MAT 710 | Advanced Partial Differential Equations | 03 | 4 |
| **2** | | MAT 711 | Advanced Functional Analysis | 03 | 2 | | MAT 711 | Advanced Functional Analysis | 03 | 4 |
| **3** | | MAT 713 | Advanced Group Theory | 03 | 3 | | MAT 713 | Advanced Group Theory | 03 | 4 |
| **4** | | ~~MAT 610~~ | ~~Mathematical Techniques for Boundary Value Problems~~ | 03 | 4 | | MAT 739 | Mathematical Techniques for Boundary Value Problems | 03 | 4 |
| **5** | | MAT 511 | Integral Equations and Applications | 03 | 5 | | MAT 726 | Advanced Integral Equations and Applications | 03 | 4 |
| **6** | | MAT 727 | Riemannian Geometry | 03 | 6 | | MAT 727 | Riemannian Geometry | 03 | 4 |
| **7** | | MAT 728 | ODEs and Computational Linear Algebra | 03 | 7 | | MAT 728 | ODEs and Computational Linear Algebra | 03 | 4 |
| **8** | | MAT 729 | Advanced Mathematical Physics | 03 | 8 | | MAT 729 | Advanced Mathematical Physics | 03 | 4 |
| **Total Credit Hours** | | | | | Total Credit Hours | | | | | |

**Note: Every student will have to study four core courses.**

**<u>University Requirement Course</u>**

| **Sr. No.** | **Existing Road Map** | | | | **Sr. No.** | **Proposed Road map aligned with HEC new PG Policy** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **1** | | ESC 501 | Research Methodology | 03 | 1 | | ESC 701 | Research Methodology | 03 | 4 |

**List of Electives Courses**

| **Sr. No.** | **Existing Road Map** | | | | **Sr. No.** | **Proposed Road map aligned with HEC new PG Policy** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite | Course Code | Course Title | Credit Hours | | Pre requisite | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment |
| **1** | | MAT 510 | Fluids Dynamics I | 03 | 1 | | MAT 737 | Fluid Dynamics | 03 | 4, 9 |
| | | MAT 737 | Fluid Dynamics II | | | | | | | |
| **2** | | MAT 512 | Fixed Point Theory | 03 | 2 | | | | | |
| **3** | | MAT 513 | Number Theory | 03 | 3 | | ISC 711 | Number Theory | 03 | |
| **4** | | MAT 514 | Spectral Theory in Hilbert Spaces | 03 | 4 | | | | | |
| **5** | | MAT 611 | Topological Vector Spaces | 03 | 5 | | | | | |
| **6** | | MAT 712 | Numerical Solution of Partial differential Equations | 03 | 6 | | MAT 712 | Numerical Solution of Partial differential Equations | 03 | 4 |
| **7** | | MAT 714 | Non Newtonian Fluid | 03 | 7 | | MAT 714 | Non Newtonian Fluid | 03 | 4, 9 |
| **8** | | MAT 715 | Perturbation Methods | 03 | 8 | | MAT 715 | Perturbation Methods | 03 | 4 |
| **9** | | MAT 716 | Finite Element Method | 03 | 9 | | MAT 716 | Finite Element Method | 03 | 4 |
| **10** | | MAT 717 | Near Rings | 03 | 10 | | MAT 717 | Near Rings | 03 | 4 |

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|---|---|---|---|---|---|---|---|---|---|---|
| **11** | | MAT 718 | Fuzzy Logic/Fuzzy Algebra | 03 | 11 | | MAT 718 | Fuzzy Logic/Fuzzy Algebra | 03 | 4 |
| **12** | | MAT 719 | Advanced Ring Theory | 03 | 12 | | MAT 719 | Advanced Ring Theory | 03 | 4 |
| **13** | | MAT 720 | Topological Algebras | 03 | 13 | | MAT 720 | Topological Algebras | 03 | 4 |
| **14** | | MAT 721 | Commutative Semigroup Rings | 03 | 14 | | MAT 721 | Commutative Semigroup Rings | 03 | 4 |
| **15** | | MAT 722 | General Relativity | 03 | 15 | | MAT 722 | General Relativity | 03 | 4 |
| **16** | | MAT 723 | Advanced Analytical Dynamics | 03 | 16 | | MAT 723 | Advanced Analytical Dynamics | 03 | 4 |
| **17** | | MAT 724 | Heat and Mass Transfer | 03 | 17 | | MAT 724 | Heat and Mass Transfer | 03 | 4, 9 |
| **18** | | MAT 730 | Numerical Optimization | 03 | 18 | | MAT 730 | Numerical Optimization | 03 | 4, 11 |
| **19** | | MAT 731 | Advanced Cryptography | 03 | 19 | | ISC 721 | Advanced Cryptography and Cryptanalysis | 03 | 4, 9, 11 |
| **20** | | MAT 732 | Probability Models and Applications | 03 | 20 | | MAT 732 | Probability Models and Applications | 03 | 4, 11 |
| **21** | | MAT 733 | Advanced Modern Algebra with Applications | 03 | 21 | | MAT 733 | Advanced Modern Algebra with Applications | 03 | 4 |
| **22** | | MAT 734 | Spectral Methods in Fluid Dynamics | 03 | 22 | | MAT 734 | Spectral Methods in Fluid Dynamics | 03 | 4 |
| **23** | | MAT 735 | Simple Linear Regression Models | 03 | 23 | | MAT 735 | Simple Linear Regression | 03 | 4, 11 |

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|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Models | | |
| **24** | | MAT 736 | Lattice Boltzmann Method | 03 | 24 | | MAT 736 | Lattice Boltzmann Method | 03 | 4 |
| **25** | | Math 738 | Lie Group Methods for Differential Equations | 03 | 25 | | MAT 738 | Lie Group Methods for Differential Equations | 03 | 4 |
| **Total Credit Hours** | | | | | Total Credit Hours | | | | | |

| Fluid Dynamics | |
|---|---|
| **Course Code:** | **MAT 737** |
| **Credit Hours:** | 3+0 |
| **Prerequisites:** | None |
| **Objectives:** | This course focuses on methods used to solve mathematical models in the form of Boundary value problem obtained from the phenomena that arise in engineering fields. The course will cover introduction to boundary value problems, linear and nonlinear models. |
| **Course outline:** | Some examples of viscous flow phenomena, properties of fluids, types of flow, boundary conditions, equation of continuity, Euler's equation of motion, the Navier Stokes equations, the energy equation, boundary condition, and the stream functions. Couette flows, Poiseuille flows, unsteady duct flows, similarity solutions, Dynamical similarity and Reynold's number, Turbulent flow, Boundary layer concept and governing equations, Reynold's equations of turbulent motion, Unsteady duct flows; some exact analytic solutions of BVP, similarity solutions; two dimensional solutions; thermal boundary layer. Some exposure will also be given from the recent literature appearing in the journals. Thermal boundary layers without coupling of velocity field to the temperature field: Boundary layer equations for the temperature field; forced convection; Boundary layer with moderate wall heat transfer; natural convection effect of dissipation; indirect natural convection; mixed convection. Different kinds of boundary layer control; continuous suction and blowing; massive suction and blowing; similar solutions. |
| **Resources:** | 1. F.M.White, Viscous fluid flow, McGraw Hill inc., 1991.<br>2. H.Schlichting and K.Gertsen, Boundary layer theory, Springer, 1991.<br>3. P.A.Davidson, An introduction to magnetohydrodynamics, Cambridge University Press, 2001.<br>4. Landau Lifshitz, Fluid Mechanics, Pergamon Press, 1959.<br>5. G.K. Batchelor, Fluid Dynamics, Cambridge University Press, 1967.<br>6. N.A. Krall and A.W. Trivelpiece, Principles of Plasma Physics, McGraw Hill Book Company, 1973. |

**Program Title:** **MS CE**
**Duration:** **2 to 3 Years**
**Total Credit Hours:** **30_____**
**Endorsement References:**
Recommendations of DBOS dated 15-08-2024 (recorded in the minutes of DBOS meeting)

**Summary of Credit Hours**

| Sr. No. | Courses as per HEC new GE Policy 2023 (All courses at MS level must be 700 level) | Credit Hours/Contact Hours | |
|---|---|---|---|
| | | Existing Road Map | Proposed New Road Map |
| 1. | Core Courses | 9 | 9 |
| 2. | Electives Courses | 12 | 12 |
| 3. | University Requirement | 3 | 3 |
| 3. | Thesis/ Elective Courses | 6 | 6 |
| 4. | Deficiency course in case of candidate from other domain or interdisciplinary domain | Up to 12 CH | Up to 9 CH |
| | Total | 30 | 30 |

**PROGRAM MISSION**

The mission of the Master of Science in Computer Engineering program is to educate graduates by enhancing their knowledge of computer engineering with theory, practice and research to cater technological advances for the betterment of society.

**PROGRAM EDUCATIONAL OBJECTIVES**

1. Ability to apply theoretical and practical knowledge to solve challenging problems in their professions.
2. Ability to engage in lifelong learning for personal and societal growth.
3. Ability to demonstrate effective interpersonal skills as an individual or in a team.

**PROGRAM LEARNING OUTCOMES**

1. To provide solutions of complex engineering problems using computer engineering knowledge, methodologies and principles.
2. To understand research aspects of computer engineering and its allied domains.
3. To articulate technical concepts clearly and concisely in both written and oral formats.
4. To recognize importance of technological developments and pursue lifelong learning.

**ELIGIBILITY CRITERIA**

HEC recognized 4 years Bachelor’s Degree or equivalent in a relevant computing/ engineering (BS/BSE/BEE/BET/CS/CE/IT/M.Sc Applied Physics/Electronics/equivalent) with a minimum CGPA of 2.0/4.0 or 50% marks where CGPA is not given. The following courses (or equivalent) are pre-requisite for the MS Computer Engineering program:

1. Digital Logic Design or equivalent
2. Computer Programming or equivalent
3. Calculus or equivalent

   Students shall be required to complete the deficiency courses (as mentioned above). Applicants must also provide HEC verification of all academic degrees and transcripts as per BU rules.

**Semester wise Road map**

**Semester 1**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC Graduate Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment |
| **1** | | | Core I | 3 | 1 | | | Core I | 3 | Mentioned in list of courses |
| **2** | | | Core II | 3 | 2 | | | Core II | 3 | Mentioned in list of courses |
| **3** | | ESC 701 | Research Methodology | 3 | 3 | | ESC 701 | Research Methodology | 3 | SDG 4 |
| | | | **Total Credit Hours** | 9 | | | | Total Credit Hours | 9 | |

**Semester 2**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC Graduate Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment |
| **1** | | | Core III | 3 | 1 | | | Core III | 3 | Mentioned in list of courses |
| **2** | | | Elective I | 3 | 2 | | | Elective I | 3 | Mentioned in list of courses |
| **3** | | | Elective II | 3 | 3 | | | Elective II | 3 | Mentioned in list of courses |
| | | | **Total Credit Hours** | 9 | | | | Total Credit Hours | 9 | |

**Semester 3**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC Graduate Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course | Course Code | Course Title | Credit Hours | | Pre requisite Course | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment |

| | Code | | | | | Code | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Elective III | 3 | | | | Elective III | 3 | Mentioned in list of courses |
| | | THS 799 | Thesis I / Elective IV | 3 | | | THS 799 | Thesis I / Elective IV | 3 | SDG 9, SDG* |
| | | | **Total Credit Hours** | 6 | | | | Total Credit Hours | 6 | |

**Semester 4**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC Graduate Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment |
| | | | Elective V | 3 | | | | Elective V | 3 | Mentioned in list of courses |
| | | THS 799 | Thesis II / Elective VI | 3 | | | THS 799 | Thesis II / Elective VI | 3 | SDG 9, SDG* |
| | | | **Total Credit Hours** | 6 | | | | Total Credit Hours | 6 | |

*Any additional SDG pertaining to the scholar's thesis area

**List of Core Courses**

| Sr. No. | Existing Road Map | | | | Sr. No. | Proposed Road map aligned with HEC Graduate Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisite Course Code | Course Code | Course Title | Credit Hours | | Pre requisite Course Code | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment |
| **1** | | ~~CEN 520~~ | ~~Advanced Computer System Architecture~~ | 3 | 1 | | CEN 720 | Advanced Computer Architecture | 3 | SDG 9 |
| **2** | | CSC 720 | Advanced Operating Systems | 3 | 2 | | CSC 711 | Advanced Artificial Intelligence | 3 | SDG 9 |
| **3** | | CEN 524 | Advanced Digital Design | 3 | 3 | | CEN 742 | Advanced Digital System Design | 3 | SDG 9 |

**List of Electives Courses**

| Sr. No. | Existing Road Map | | | | Sr. N | Proposed Road map aligned with HEC Graduate Policy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre requisit | Course Code | Course Title | Credit Hours | | Pre requ | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment |

| | e Course Code | | | | o. | isite Course Code | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **1** | | CSC 751 | Pattern Recognition | 3 | 1 | | CSC 751 | Pattern Recognition | 3 | SDG 9 |
| **2** | | CSC 764 | Computer Vision | 3 | 2 | | CSC 764 | Computer Vision | 3 | SDG 9 |
| **3** | | CSC 719 | Machine Learning | 3 | 3 | | CSC 719 | Machine Learning | 3 | SDG 9 |
| **4** | | CSC 711 | Advanced Artificial Intelligence | 3 | | | | | | |
| **5** | | CSC 765 | Bio Medical Image Analysis | 3 | 4 | | CSC 765 | Bio Medical Image Analysis | 3 | SDG 3, SDG 9 |
| **6** | | CEN 745 | Advanced Digital Image Processing | 3 | 5 | | CEN 745 | Advanced Digital Image Processing | 3 | SDG 9 |
| **7** | | CSC 518 | Decision Support Systems | 3 | | | | | | |
| **8** | | CEN 740 | Advanced Embedded Systems | 3 | 6 | | CEN 740 | Advanced Embedded Systems | 3 | SDG 9 |
| **9** | | CEN 525 | Digital Signal Processing & Applications | 3 | 7 | | EEN 725 | Advanced Digital Signal Processing | 3 | SDG 9 |
| **10** | | CEN 707 | Advanced Distributed Systems | 3 | 8 | | CEN 707 | Advanced Distributed Systems | 3 | SDG 9 |
| **11** | | CEN 553 | Real Time Computer Systems | 3 | | | | | | |
| **12** | | CSC 758 | Parallel Processing | 3 | 9 | | CSC 758 | Parallel Processing | 3 | SDG 9 |
| **13** | | CEN 752 | Advanced VLSI System Design | 3 | 10 | | CEN 752 | Advanced VLSI System Design | 3 | SDG 9 |
| **14** | | CEN 541 | ASIC and FPGA Design | 3 | | | | | | |
| **15** | | CEN 721 | Advanced Microprocessor Systems | 3 | 11 | | CEN 721 | Advanced Microprocessor Systems | 3 | SDG 9 |
| **16** | | CEN 753 | Design of Real Time Embedded Systems | | 12 | | CEN 753 | Design of Real Time Embedded Systems | 3 | SDG 9 |
| **17** | | CSC 502 | Information Systems | 3 | | | | | | |
| **18** | | EET 710 | Advanced Computer Networks | 3 | 13 | | EET 710 | Advanced Computer Networks | 3 | SDG 9 |
| **19** | | EET 511 | Digital | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Communication Systems | | | | | | | |
| **20** | | EET 556 | Mobile Communication & Networking | 3 | | | | | | |
| **21** | | EET 548 | Mobile Cellular Systems and Standards | | | | | | | |
| **22** | | EET 554 | Wireless Networks | | | | | | | |
| **23** | | EET 755 | Wireless Communication Techniques | 3 | 14 | | EET 755 | Wireless Communication Techniques | 3 | SDG 9 |
| **24** | | EET 555 | Wireless and Mobile Communications | 3 | | | | | | |
| **25** | | EET 702 | Advanced Network Security | 3 | 15 | | EET 702 | Advanced Network Security | 3 | SDG 9 |
| **26** | | EET 553 | Information Theory and Coding | | | | | | | |
| **27** | | EET 519 | Distributed Networking | | | | | | | |
| **28** | | EET 520 | Network Administration & Management | | | | | | | |
| **29** | | EET 706 | Advanced Optical Fiber Networks | 3 | | | | | | |
| **30** | | EET 711 | Advanced Digital Communications | 3 | 16 | | EET 711 | Advanced Digital Communications | 3 | SDG 9 |
| **31** | | EET 769 | Mobile/Vehicular Ad Hoc Networks | 3 | 17 | | EET 769 | Mobile/Vehicular Ad Hoc Networks | 3 | SDG 9 |
| **32** | | GSC 700 | Advanced Engineering Mathematics | 3 | 18 | | GSC 700 | Advanced Engineering Mathematics | 3 | SDG 4, SDG 9 |
| **33** | | EEN 510 | Stochastic Processes | 3 | | | | | | |
| **34** | | CSC 704 | Advanced Cryptography | 3 | 19 | | CSC 704 | Advanced Cryptography | 3 | SDG 9 |
| **35** | | SEN 762 | Advanced Big Data Analytics | 3 | 20 | | SEN 762 | Advanced Big Data Analytics | 3 | SDG 9 |
| **36** | | DSC 707 | Deep Learning | 3 | 21 | | DSC 707 | Deep Learning | 3 | SDG 9 |
| **37** | | CSC 781 | Cloud Computing | 3 | 22 | | CSC 781 | Cloud Computing | 3 | SDG 9 |
| **38** | | ISC 737 | Computer and Network Forensics | 3 | 23 | | ISC 737 | Computer and Network Forensics | 3 | SDG 9, SDG 16 |
| **39** | | SEN 774 | IoTs Architecture, Protocols & Applications | 3 | 24 | | SEN 774 | IoTs Architecture, Protocols & Applications | 3 | SDG 9 |

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|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 25 | | CSC 720 | Advanced Operating Systems | 3 | SDG 9 |
| | | | | | 26 | | CEN 758 | Robotics and Intelligent Sensors | 3 | SDG 9 |
| | | | | | 27 | | CEN 710 | Digital Integrated Circuits | 3 | SDG 9 |
| | | | | | 28 | | CEN 711 | Digital and Analog IC Design | 3 | SDG 9 |
| | | | | | 29 | | CEN 759 | Generative AI | 3 | SDG 9 |
| | | | | | 30 | | CSC 708 | Advanced Simulation and Modeling | 3 | SDG 9 |
| | | | | | 31 | | CSC 741 | Advanced Natural Language Processing | 3 | SDG 9 |
| | | | | | 32 | | CSC 746 | Advanced Data Mining | 3 | SDG 9 |
| | | | | | 33 | | CSC 759 | Agent Based Modeling | 3 | SDG 9 |
| | | | | | 34 | | EET 730 | AI for Internet of Things | 3 | SDG 9 |
| | | | | | 35 | | CSC 744 | Advanced Computer Graphics | 3 | SDG 9 |
| | | | | | 36 | | CSC 753 | Distributed Databases | 3 | SDG 9 |
| | | | | | 37 | | CSC 760 | Advanced Data Warehousing | 3 | SDG 9 |
| | | | | | 38 | | SEN 720 | Advanced Human Computer Interaction | 3 | SDG 9 |
| | | | | | 39 | | SEN 723 | Formal Methods and Specifications | 3 | SDG 9 |
| | | | | | 40 | | SEN 760 | Complex Adaptive Systems | 3 | SDG 9 |
| | | | | | 41 | | EET 713 | Advanced Network Design | 3 | SDG 9 |
| | | | | | 42 | | ISC 712 | Computer and Network Security | 3 | SDG 9 |
| | | | | | 43 | | ISC 748 | Blockchain Essentials | 3 | SDG 9 |
| | | | | | 44 | | ISC 721 | Advance Cryptography and Cryptanalysis | 3 | SDG 9, SDG 16 |
| | | | **Total Credit Hours** | | | | | Total Credit Hours | | |

**Course Outlines**

| **Advanced Computer Architecture** | |
|---|---|
| **Course Code:** | CEN 720 |
| **Credit Hours:** | 3+0 |
| **Prerequisites:** | |
| **Objectives:** | This course covers the advanced concepts in computer architecture including computer organization instruction set design principles and MIPS architecture, principles of scalable performance, pipelining, instruction level parallelism, compilers, code optimization, caches, main and virtual memory. Students will also be introduced to parallel computers and storage devices. |
| **Course outline:** | Computer Organization review, Instruction Set Design principles and MIPS architecture, Principles of Scalable Performance, Speedup Performance laws, Scalability analysis and approaches, Pipelining: Basic pipelining, Data and control Hazards, Exceptions, Branch Prediction, Speculation, Performance Evaluation, Instruction level Parallelism, Score Board Architecture, Dynamic Scheduling, Multiple instruction issue using superscalar approach,VLIW – software based ILP, Compilers and code optimization, Caches, Cache basics, Techniques to reduce miss rate, Techniques to reduce miss penalty, Programming for memory performance, Main memory organization, Virtual Memory and paging, Storage devices, Parallel Computers, Multiprocessors, Parallel Architectures and applications, Synchronization Mechanisms. |
| **Resources:** | 1. John L. Hennessy and David A. Patterson, "Computer Architecture: A quantitative approach", 4th edition 2006<br>2. D. Sima, T. Fountain, P. Kacsuk, "Advanced Computer Architecture",Addison Wesley, 1997<br>3. H.S. Stone, "High performance Computer Architecture", 3rd edition,Addison Wesley, 1993<br>4. Patterson, D. A. and Hennessy, J. L., "Computer Organization and Design:The Hardware/ Software Interface", Morgan Kaufmann, 1998<br>5. Kai Hwang, "Advanced Computer Architecture", McGraw Hill, 2008<br>6. William Stallings, "Computer Organization and Architecture", 5th Edition, Prentice Hall International Inc., 2000<br>7. Computer Architecture, Fifth Edition: A Quantitative Approach (The Morgan Kaufmann Series in Computer Architecture and Design) 5thEdition, by David A. Patterson, 2011. |

| Advanced Digital System Design | |
|---|---|
| **Course Code:** | CEN 742 |
| **Credit Hours:** | 3+0 |
| **Prerequisites:** | |
| **Objectives:** | This course explores advanced topics in digital system design, focusing on the design and implementation of complex digital systems. |
| **Course outline:** | Digital design concepts, Complexity in Digital System Design, Trade offs in Digital System Design, Advanced Design Methodologies, Digital System Design Challenges, Review of basic digital logic design principles , Introduction to HDLs (Hardware Description Languages), VHDL (VHSIC Hardware Description Language), Verilog HDL, Writing Efficient and Scalable HDL Code, Digital Design Tools, Development Environments for Digital Design, Simulation and Testing Tools, Hardware Synthesis Tools, Multiplexers and Demultiplexers, Arithmetic Logic Units (ALUs), Advanced Combinational Logic Circuits, Designing with Multiplexers and Decoders, Advanced Sequential Logic Design, Synchronous and Asynchronous Sequential Circuits, State Machines, Designing with Registers and Counters, FPGA Programming and Implementation. |
| **Resources:** | 1. "Digital Design and Computer Architecture" by David Money Harris and Sarah L. Harris<br>2. Online tutorials for digital design tools and FPGA development environments and research articles<br>3. W. Wolf, FPGA based System Design", latest edition, Prentice Hall |

| vanced Embedded Systems | |
|---|---|
| **Course Code:** | CEN 740 |
| **Credit Hours:** | 3+0 |
| **Prerequisites:** | None |
| **Objectives:** | Embedded systems are pervasive in all areas of society, and as such, knowledge of how to design them is a vital skill for all electrical engineers. The objective of this course is to equip students with the knowledge and skills that enable them to design basic embedded systems, where a microprocessor/microcontroller is the central element. The first half of the course will focus on ARM processor architecture, instruction sets, assembly language fundamentals and techniques. Input and output, floating point representation, interrupts, and exceptions will be covered in the second half of the course. |

| **Advanced Microprocessor Systems** | |
|---|---|
| **Course Code:** | CEN 721 |
| **Credit Hours:** | 3+0 |
| **Prerequisites:** | NA |
| **Objectives:** | The main objective of this course is that students focus on advanced techniques for optimizing and customizing microprocessor systems. |
| **Course outline:** | Study of application specific instruction set extensions (ASIPs) and domain specific accelerators (DSAs), Techniques for customizing memory hierarchies, I/O interfaces, and architectural features. Hardware software co design, Principles and methodologies for co designing hardware and software to achieve optimal system performance.<br><br>Optimization strategies for different application domains: embedded systems, IoT, AI/ML, networking, etc. Customization and optimization of microprocessor systems for real time, low power, and high performance applications. Performance Tuning and profiling,Analysis Tools for Microprocessor Systems, Microprocessor System Reliability and Fault Tolerance, Microprocessor Systems in Automotive and Autonomous Systems. |
| **Resources:** | 1. "Microprocessor Architecture, Programming, and Systems featuring RISC V" by Yu Cheng Liu and Glenn A. Gibson<br>2. "Domain Specific Processors: Systems, Architectures, Modeling, and Simulation" by Wayne Wolf<br>3. "Advanced Compiler Design and Implementation" by Steven Muchnick |

| | |
|---|---|
| **Course outline:** | . RTOS: Real time Operating Systems Pre emptive and Non preemptive Scheduling, Introduction to Real time operating system (RTX environment). Real time Scheduling, Rate Monotonic and Earliest Deadline First Scheduling. Priority Inversion Problem and its Solutions. Hardware Software Co design and Embedded SoPC (System on |

| | |
|---|---|
| | Programmable, Chips). |
| **Resources:** | 1. Daniel W. Lewis, Fundamentals of Embedded Software with the ARM Cortex M3, 2nd Edition Pearson 2013, ISBN 978 0 13 291654 7<br>2. Steve Furber: ARM System on chip Architecture, (Addison Wesley)<br>3. Raj Hamal: Embedded Systems Architecture, Programming and Design, (McGraw Hill) |

| **Advanced VLSI System Design** | |
|---|---|
| **Course Code:** | CEN 752 |
| **Credit Hours:** | 3+0 |
| **Prerequisites:** | None |
| **Objectives:** | This course explores advanced topics in Very Large Scale Integration (VLSI) system design flow and methodologies focusing on cutting edge techniques and methodologies. Students will gain an in depth understanding of advanced digital design, low power design, and emerging trends in VLSI technology. |
| **Course outline:** | Review of digital design fundamentals, Advanced digital design techniques, Timing analysis and optimization, CMOS VLSI Design, Low Power VLSI Design, VLSI testing methodologies, Built in self test (BIST), Formal verification techniques, Emerging VLSI technologies, Non volatile memories (e.g., NAND, NOR, MRAM), Hardware security considerations.<br>System Level Optimization: Discusses techniques to optimize at the system level, considering power consumption, performance, area, and reliability. |
| **Resources:** | 1. "CMOS VLSI Design: A Circuits and Systems Perspective" by Neil H. E. Weste and David Harris<br>2. Academic papers, research articles, and online tutorials related to advanced VLSI design concepts |

| **Design of Real Time Embedded System Design** | |
|---|---|
| **Course Code:** | CEN 753 |
| **Credit Hours:** | 3+0 |
| **Prerequisites:** | None |
| **Objectives:** | This course explores advanced topics in Very Large Scale Integration (VLSI) system design flow and methodologies focusing on cutting edge techniques and methodologies. Students will gain an in depth understanding of advanced digital design, low power design, and emerging trends in VLSI technology. |

| | |
|---|---|
| **Course outline:** | Introduction to Real Time Systems, Designing and Modelling Real Time Systems, Requirements analysis, System modelling techniques, Design principles and methodologies, Hardware and software considerations, Trade offs in design choices, Overview of real time operating systems (RTOS), Testing & Reliability, Synchronization & Communication. |
| **Resources:** | 1. Burns and Wellings, "Real Time Systems and Programming Languages: Ada, Real Time Java and C/Real Time POSIX," 4th edition, Addison Wesley, 2009<br>2. Laplante and Ovasaka, "Real Time Systems Design and Analysis: Tools for the Practitioner" (4th Edition)<br>3. Posix Threads (Pthreads) Application Programming Interface Appendix B, Linux for Embedded and Real time Applications, Chapter Appendix B, pp.275 286 (available in the Barr Smith Library)<br>4. Kernighan and Ritchie, "The C Programming Language," 2nd edition, Prentice Hall, 1988 |

| **Advanced Digital Image Processing** | |
|---|---|
| **Course Code:** | CEN 745 |
| **Credit Hours:** | 3+0 |
| **Prerequisites:** | None |
| **Objectives:** | This course will provide mathematical foundations and practical techniques for digital manipulation of images, image acquisition, preprocessing, segmentation. The course will expose the students to the basic theory and algorithms widely used in digital image processing. After the completion of this course the students will be able to understand the basic concepts behind the processing of digital images as well as various techniques of filtering/processing images in spatial as well as in frequency domain. The course will serve as the basis for more advance topics in Computer Vision. |
| **Course outline:** | Introduction to Digital Image Processing Computer Vision and Pattern Recognition, Fundamentals Element of visual Perception, Image Sensing and Acquisition Image Sampling and Quantization. Pixel operations, linear & Non linear operations, Image Enhancement in spatial Domain: Background, Grey level Transformations, Filtering in spatial domain.<br>Image Enhancing in Frequency Domain: Frequency domain, Fourier Transform, Filtering in frequency domain, Color Image Processing, Fundamentals of Image Compression, Lossless and lossy compression, Image Compression standards, Image Segmentation: Detection of Discontinuities, Edge and Boundary detection, Thresholding, Region Based segmentation, Morphological image processing, Representation schemes:Boundary and region descriptors. |

| | |
|---|---|
| **Resources:** | 1. *Digital Image Processing,* R. C. Gonzalez and R. E. Woods, Addison Wesley, 3rd Edn., 2007.<br>2. *Fundamentals of Digital Image Processing: A Practical Approach with Examples in Matlab,* Chris Solomon and Toby Breckon, 2011. |

| **Digital and Analog IC Design** | |
|---|---|
| **Course Code:** | CEN 711 |
| **Credit Hours:** | 3+0 |
| **Prerequisites:** | None |
| **Objectives:** | High performance digital and analog integrated circuit (IC) design is a key to the success of high data rate broadband networks. This course provides information about fundamentals of wireless communication systems and transceiver circuit designs. It introduces both digital and analog IC designs with emphasis on the front end IC design skills. Students will learn Verilog Hardware Description Language for digital ASIC designs and will gain hands on experience in analog IC designs using Cadence Analog IC Design Tools. |
| **Course outline:** | • Introduction to Wireless Communications<br>• Analog IC Design Using Cadence Analog IC Design Tools<br>• Bipolar and MOS Transistors – dc sim<br>• Bandgap Reference and Current Mirrors – dc sim<br>• Switching and Logic Circuits – tran sim<br>• Linear Amplifiers – ac sim<br>• Low Noise Amplifiers – s parameter sim<br>• Oscillators – pss pnoise sim<br>• Digital IC Design Using Verilog HDL<br>• Delta sigma Modulators<br>• Digital Phase Locked Loops |
| **Resources:** | 1. RF Microelectronics by Behzad Razavi, 2nd edition, 2012.<br>2. Analysis and Design of Analog Integrated Circuits, Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, 5th Edition, 2009.<br>3. The Verilog Hardware Description Language by Philip R. Moorby, Donald E. Thomas.<br>4. Integrated Circuit Design for High Speed Frequency Synthesis by J. Rogers, C. Plett, and F. Dai |

| Digital Integrated Circuits | |
|---|---|
| **Course Outline** | |
| **Course Description** | CMOS devices and deep sub micron manufacturing technology. CMOS inverters and complex gates. Modeling of interconnect wires. Optimization of designs with respect to a number of metrics: cost, reliability, performance, and power dissipation. Sequential circuits, timing considerations, and clocking approaches. Design of large system blocks, including arithmetic, interconnect, memories, and programmable logic arrays. Introduction to design methodologies. |
| **Learning Objectives** | 1. Gain understanding of CMOS IC manufacturing and digital IC design metrics<br>2. Gain understanding of combinational logic design<br>3. Gain understanding of digital design with wires and interconnects<br>4. Gain understanding of sequential logic design<br>5. Gain understanding of timing in digital IC design<br>6. Gain understanding of clocking and clock distribution<br>7. Gain understanding of large arithmetic blocks (adders, multipliers, etc)<br>8. Gain understanding of memory design (SRAM, DRAM)<br>9. Master the EDA tools (HSPICE, Cadence layout tools, etc) |
| Refrence Book | Digital Integrated Circuit Design, Ken Martin |

| **Generative AI** | |
|---|---|
| **Course Code:** | CEN 759 |
| **Credit Hours:** | 3+0 |
| **Prerequisites:** | |
| **Objectives:** | This course provides a comprehensive overview of generative AI, focusing on its theoretical underpinnings, practical applications, and emerging trends. Students will gain a deep understanding of various generative models, their architectures, and training methodologies. The course will emphasize hands on experience through projects and assignments, enabling students to develop practical skills in building and deploying generative AI systems. |

| | |
|---|---|
| **Course outline:** | Introduction to Generative AI, Foundations of Generative Models, Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), VAE architecture and latent space, Training VAEs with variational inference, Applications of VAEs (e.g., image generation, anomaly detection), Diffusion process and its connection to generative modeling, Noise scheduling and denoising diffusion probabilistic models (DDPMs), Applications of diffusion models (e.g., text to image generation), Advanced Topics in Generative AI, Generative models for different data modalities (text, audio, video), Model evaluation and metrics, Transfer learning and fine tuning, Emerging trends and future directions |
| **Resources:** | **1.** Ian Goodfellow, Yoshua Bengio, Aaron Courville Deep Learning, MIT Press, 2016.<br>**2.** David Foster Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play, O'Reilly Media, 2019.<br>**3.** Chris Manning, Hinrich Schütze Foundations of Statistical Natural Language Processing, MIT Press, 1999.<br>**4.** Jürgen Schmidhuber Deep Learning in Neural Networks: An Overview, Neural Networks, 2015. |

Program Title: **MS Geology**
Duration: **2 to 3Years**
Total Credit Hours: **30**
Endorsement References: A: Recommendations of DBOS dated **12th August** 2024 (Minutes of DBOS meeting)

**Summary of Credit Hours**

| **Sr. No.** | **Category of course** | **Credit Hours/Contact Hours** | |
|---|---|---|---|
| | | **Existing Road Map** | **Proposed New Road Map** |
| 1. | Compulsory Courses | 12 | 12 |
| 2. | Elective courses | 12 | 12 |
| 3. | Thesis | 6 | 6 |
| | **Total** | **30** | **30** |

**Program Educational Objectives**

1. Attain employment in geological field, or engage in entrepreneurship. (PEO1)
2. Advance careers by demonstrating leadership and interpersonal skills including teamwork and communication skills. (PEO2)

3. Pursue their professional development through self learning or pursue advanced degrees. (PEO3)

**Program Learning Objectives**

PLO1. Appraise geological problems and recognize processes responsible for the geologic outcomes.

PLO 2. Apply practical and theoretical knowledge to solve geological problems.

PLO 3. Develop and execute geological research in an original and creative manner using common and specialized research techniques.

PLO 4. Demonstrate responsibility in independent learning.

PLO 5 Prepare high quality technical reports and research publications in peer reviewed ISI journals; and, deliver geological research to other professionals and the wider community.

| Sr No. | Pre requisite | Course Code | Course Title | Credit Hours | Sr No. | Pre requisite Course Code | Course Code | Course Title | Credit Hours | HEC Category | **17 UN SDGs alignment** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | N/A | GEO 503 | Advanced Petroleum Geology | 3 | 1 | N/A | GEO 703 | Advanced Petroleum System Analysis | 3 | Core | 7 & 9 |
| 2. | N/A | GEO 501 | Global Tectonics | 3 | 2 | N/A | GEO 701 | Global Tectonics | 3 | Core | 11 |
| 3. | N/A | GEO 512 | Mineral Prospecting and Exploration | 3 | 3 | N/A | GEO 712 | Mineral Prospecting and Exploration | 3 | Core | 9 & 11 |
| 4. | N/A | ESC 701 | Research Methodology | 3 | 4 | N/A | ESC 701 | Research Methodology | 3 | Core | 4 |
| 5. | N/A | GEO 541 | Applications of GIS in Geosciences | 3 | **4** | N/A | GEO 741 | Applications of GIS in Geoscience | 3 | Elective | 9 & 11 |
| 6. | N/A | GEO 548 | Advanced Seismic Stratigraphy | 3 | **5** | N/A | GEO 748 | Advanced Seismic Stratigraphy | 3 | Elective | 7 |
| 7. | N/A | GEO 505 | Advanced Sedimentology | 3 | **6** | N/A | GEO 705 | Sedimentary Petrology | 3 | Elective | 7 |
| 8. | N/A | GEO 506 | Hydrocarbon Geochemistry | 3 | **7** | N/A | GEO 706 | Petroleum Geochemistry | 3 | Elective | 7 |
| 9. | N/A | GEO 507 | Basin Analysis | 3 | **9** | N/A | GEO 707 | Basin Analysis | 3 | Elective | 7, 9 & 11 |
| 10 | N/A | GEO 508 | Stratigraphy and Petroleum Prospects of Pakistan | 3 | **10** | N/A | GEO 708 | Stratigraphic Analysis and Petroleum Prospects | 3 | Elective | 7, 9 & 11 |
| 11 | N/A | GEO 545 | Petrophysical Analysis | 3 | **11** | N/A | GEO 745 | Petrophysical Analysis | 3 | Elective | 7, 9 & 11 |
| 12 | N/A | GEO 547 | Drilling Operations and Well Site Geology | 3 | **12** | N/A | GEO 747 | Drilling Operations and Well Site Geology | 3 | Elective | 7, 9 & 11 |
| 13 | N/A | GEO 510 | Development of Groundwater Resources | 3 | **13** | N/A | GEO 710 | Groundwater Development and Management | 3 | Elective | 3, 6, 13 & 15 |
| 14 | N/A | GEO 531 | Advanced Structural Geology | 3 | **14** | N/A | GEO 731 | Techniques in Structural Geology | 3 | Elective | 9 & 11 |
| 15 | N/A | GEO 520 | Rock Mechanics | 3 | **15** | N/A | GEO 765 | Rock Mechanics | 3 | Elective | 9 & 11 |
| 16 | N/A | GEO 521 | Soil Mechanics | 3 | **16** | N/A | GEO 721 | Soil Mechanics | 3 | Elective | 9, 11 & 15 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | N/A | GEO 522 | Geochemical Exploration | 3 | **17** | N/A | GEO 722 | Geochemical Exploration | 3 | Elective | 7 & 9 |
| 18 | N/A | GEO 523 | Isotope Geochemistry | 3 | **18** | N/A | GEO 723 | Isotope Geochemistry | 3 | Elective | 7 & 9 |
| 19 | N/A | GEO 524 | Clastic Sedimentology | 3 | **19** | N/A | GEO 724 | Clastic Sedimentology | 3 | Elective | 9 |
| 20 | N/A | GEO 525 | Carbonate Sedimentology | 3 | **20** | N/A | GEO 725 | Non Clastic Sedimentology | 3 | Elective | 9 |
| 21 | N/A | GEO 526 | Clay Mineralogy | 3 | **21** | N/A | GEO 726 | Clay Mineralogy | 3 | Elective | 11 |
| 22 | N/A | GEO 527 | Hydrochemistry & Groundwater Pollution | 3 | **22** | N/A | GEO 727 | Hydrochemistry & Groundwater Pollution | 3 | Elective | 3&6 |
| 23 | N/A | GEO 528 | Groundwater Modeling | 3 | **23** | N/A | GEO 728 | Groundwater Modeling | 3 | Elective | 3&6 |
| 24 | N/A | GEO 529 | Industrial Mineralogy | 3 | **24** | N/A | GEO 729 | Industrial Mineralogy | 3 | Elective | 7&9 |
| 25 | N/A | GEO 530 | Advanced Marine Geology | 3 | **25** | N/A | GEO 730 | Advanced Marine Geology | 3 | Elective | 7&9 |
| 26 | N/A | GEO 534 | Reservoir Geology | 3 | **26** | N/A | GEO 734 | Reservoir Geology | 3 | Elective | 7&9 |
| 27 | N/A | GEO 535 | Applied Mineralogy | 3 | **27** | N/A | GEO 735 | Applied Mineralogy | 3 | Elective | 7&9 |
| 28 | N/A | GEO 530 | Fundamentals of Gemology | 3 | **28** | N/A | GEO 787 | Fundamentals of Gemology | 3 | Elective | 7&9 |
| 29 | N/A | GEO 537 | Advanced Engineering Geology | 3 | **29** | N/A | GEO 737 | Advanced Engineering Geology | 3 | Elective | 11 |
| 30 | N/A | ENV 537 | Environmental Engineering | 3 | **30** | N/A | ENV 737 | Recent Trends in Environmental Engineering | 3 | Elective | 3, 6, 13 & 15 |
| 31 | N/A | ENV 513 | Health Safety and Environment | 3 | **31** | N/A | ENV 713 | Health, Safety and Environment | 3 | Elective | 3, 6, 13 & 15 |
| 32 | N/A | GEO 536 | Advanced Igneous Petrology | 3 | **32** | N/A | GEO 736 | Advanced Igneous Petrology | 3 | Elective | 7 |
| 33 | N/A | GEO 538 | Advanced Metamorphic Petrology | 3 | **33** | N/A | GEO 738 | Advanced Metamorphic Petrology | 3 | Elective | 7 |
| 34 | N/A | GEO 539 | Ore Geology | 3 | **34** | N/A | GEO 739 | Ore Deposits Geology | 3 | Elective | 7, 8 & 9 |
| 35 | N/A | GEO 546 | Advanced Biostratigraphy | 3 | **35** | N/A | GEO 746 | Advanced Biostratigraphy | 3 | Elective | 7 & 9 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 36 | N/A | GEO 502 | Geophysical Exploration Methods | 3 | **36** | N/A | GEO 702 | Geophysical Exploration Techniques | 3 | Elective | 7 &9 |
| 37 | N/A | GEO 519 | Coal Geology | 3 | **37** | N/A | GEO 719 | Coal Geology | 3 | Elective | 7, 8 & 9 |
| 38 | N/A | ENV 540 | Climate Change Adaption and Mitigation | 3 | **38** | N/A | ENV 740 | Climate Crisis Adaption and Mitigation | 3 | Elective | 13 |
| 39 | N/A | ENV 522 | Disaster Management | 3 | **39** | N/A | ENV 722 | Disaster Mitigation and Emergency Management | 3 | Elective | 11 |
| 40 | N/A | ENV 504 | Environmental Impact Assessment | 3 | **40** | N/A | ENV 704 | Environmental Impact Assessment | 3 | Elective | 13 & 15 |
| 41 | N/A | GEO 516 | Applied Environmental Geophysics | 3 | **41** | N/A | GEO 716 | Environmental Geophysics | 3 | Elective | 3, 6, 13 & 15 |
| 42 | N/A | GEO 603 | Engineering Geophysics | 3 | **42** | N/A | GEO 771 | Engineering Geophysics | 3 | Elective | 11 |
| 43 | N/A | GEO 604 | Machine Learning for Geosciences | 3 | **43** | N/A | MAT 769 | Machine Learning in Geoscience | 3 | Elective | 4, 8 & 9 |
| 44 | N/A | GEO 605 | Applications of Geostatistics in Geosciences | 3 | **44** | N/A | GEO 770 | Applications of Geostatistics in Geosciences | 3 | Elective | 4, 8 & 9 |
| 45 | N/A | GEO 606 | Reservoir Geomechanics | 3 | **45** | N/A | GEO 786 | Reservoir Geomechanics | 3 | Elective | 7 & 9 |
| 46 | N/A | GEO 607 | Unconventional Hydrocarbon Resources | 3 | **46** | N/A | GEO 750 | Unconventional Energy Resources | 3 | Elective | 7 & 9 |
| 47 | N/A | GEO 608 | Practical Applications of Geosciences Softwares | 3 | **47** | N/A | GEO 760 | Practical Technology Use in the Geoscience | 3 | Elective | 4 & 9 |
| 48 | N/A | THS 701 | MS Thesis | 3 | **48** | N/A | THS 799 | MS Thesis | 6 | Core | |

## Course Outlines MS Geology

**Course Title** **Advanced Petroleum System Analysis**

**Course Outline:**

Hydrocarbons in a global context; the philosophy and structure of the oil industry; energy trends, petroleum environment: source rocks, reservoirs, traps, seals and the timing of generation relative to trap formation, basic stratigraphic principles as they relate to correlation, the importance of establishing markers and datum lines, the use of macro and micro fossils in chronostratigraphy, correlation of well logs, production of structural maps, construction of net and gross reservoir maps, cross sections and reserve calculations, mapping faults, pinch outs and sub crops, play and Field examples from around the world, reserves and risk, use of modern seismic and new technology, petroleum System and play fairway analysis, prospect evaluation, petroleum basins of Pakistan, case history.

Course Outcomes:

On completion of the course, students are expected to get a good knowledge of key concepts regarding,

1. Hydrocarbon habitat and exploration approaches
2. Petroleum Play and its components; Organic matter deposition, Hydrocarbon generation, migration, distribution and preservation in a petroleum basin. Reservoir types and their properties
3. Types, usage and display of subsurface geological data and the limits on the reliability of such data
4. Description and evaluation of relatively simple subsurface datasets from wells and evaluate these data to conduct a geological evaluation of a field and undertake a reserves calculation

Reference Books/Materials:

1. Petroleum Geology by F.K. North
2. Petroleum Geology Manual by Baker Hughes INTEQ
3. Petroleum Geology by R.E. Chapman
4. Petroleum Geology of Pakistan by Iqbal B. Qadri
5. Petroleum Geosciences by Knut Bjorlykke
6. Startigraphy of Pakistan by Syed Ibrahim Shah.

**Course Title** **Global Tectonics**

**Course Outline:**

Overview of plate tectonics, geological techniques in tectonics, principal tectonic features of the earth, divergent margins and rifting, transform faults, strike slip faults and related fracture zones, convergent margins, tectonics and geology of selected triple junctions, collision orogenesis, anatomy of orogenic belts, the external thrust complex, foreland fold and thrust belts, the crystalline core zone, underplating, uplift and exhumation, nappe formation, back folding/thrusting and rotation, tectonics and metamorphism, neotectonics, case studies of orogenic belts.

Course Aims and Objectives

The course presents a broader global view of plate tectonics processes, including plate kinematics, the nature of plate boundaries, the forces responsible for those processes and the implications of plate tectonics. It will develop a concept of current global geography in the context of global tectonic processes.

**Course Outcomes:**

1. To acquire Knowledge about plate tectonics that control large scale structures of the Earth.
2. To understand the causes and impact of natural calamities such as earthquakes, tsunamis, land sliding and climate change and their mitigation
3. To understand geotectonic framework of Pakistan

**Reference Books/Materials**:

1. Global Tectonics 3rd Edition by Philip Kearey, Keith A. Klepeis, Frederick J. Vine (2009), Wiley Blackwell publisher
2. Geology and tectonics of Pakistan by Kazmi and Jan (1997)
3. Plate Tectonics: How it works by A. Cox and R.B. Hart (1991), Wiley Blackwell publisher
4. Regional Geology and Tectonics by Nicola Scarselli, Jurgen Adam et al (2020), Elsevier Science publisher
5. Research papers related to global tectonics
6. Tectonics by Moores, E.M. and Twiss, R.J., 1995. Freeman and Company, New York.
7. Structural geology of rocks and regions by Davis, G.H. and Reynolds, S.J., 1996. 2nd Edition, John Wiley and Sons, Inc, New York.
8. Structural geology by Twiss, R.J. and Moores, E.M., 2007. 2nd Edition, Freeman and Company, New York.
9. Global Tectonics by Keary, P. and Wine, F., 1990. Blackwell Scientific Publications, London.

**Course Title Petrophysical Analysis (3 CH)**

**Course Outline**:
Introduction to well logs and Petrophysics; Basic Wireline logging methods (electrical, radioactive, nuclear, acoustic and mechanical logs) and logging procedures; Application and use of open hole and cased hole logs for evaluating/estimating the Petrophysical properties of reservoir; Qualitative and Quantitative interpretation of well logs (lithology identification, shale content, porosities measurement fluid saturation, permeability, identification of pay intervals, well correlation based on the log characters/signatures and determination of lateral variations of Petrophysical parameters using well correlation etc.); Identification of Facies and evaluation of Depositional environments using wireline logs; Application of image logs and their analysis; Application of conventional logs in evaluation of unconventional reservoirs (Tight & Self Contained/shale reservoirs); Application of core analysis and its integration in Petrophysical analysis; Software based quick look Petrophysical interpretation in Geographix/Tecklog/Vizdom solutions VGS.

**Course Aims and Objectives**:

The aim of this course is to convey conceptual understanding of wireline logging techniques, logging procedures under certain well bore conditions/environments. This course will also communicate practical evaluation of these mentioned logs for the measurement/estimation of petrophysical evaluation of reservoir rocks for further testing and completion.

Course Outcomes:
1. Familiarize with key concepts of the wireline logging techniques and their applications.
2. Identify the factors affecting the log quality and their remedial measures.
3. Able to describe the behavior of different curves on different wireline logs regarding rock characteristics
4. Use of key concepts about the interpretation of different wireline logs to evaluate the lithology, depositional environments and hydrocarbon availability & its quantification.

Reference Books/Materials:

1. The Geological Interpretation of well logs by Malcolm Rider, edition II, 2002
2. Basic Well Log analysis for Geologist by George Asquith & Charls Gibson
3. Log Interpretation Principles/Applications by Schlumberger 1991

**Course Title Applications of GIS in Geoscience (3 CH)**

**Course Outline:**

Introduction to the GIS; Data exploration and preparation for GIS studies; Uses of GIS in hydrocarbon exploration, and in geological studies; Spatial Interpolation; GIS in flood management; Terrain Processing; GIS for watershed delineation; Geospatial Analysis, field development and planning; Analyzing Surfaces, spatial analysis for creating contours, hillshades and calculating viewshed; Map Algebra, working with NoData values, doing conditional processing, and merging multiple Rasters together.

Course Aims and Objectives:

The main focus of this course is to develop understanding of advanced concepts and techniques used in modeling geographic reality and analysis of geo data. Educate students to explore issues, problem solve, and evaluate situations in a spatial context. It is focused to develop students' GIS and spatial analysis skills, allowing them to become independent learners able to solve complex spatial problems

Course Outcomes:

Students will acquire the advanced knowledge of GIS and will use GIS to:

1. Explore mapped data and Relate GIS with remote sensing technologies
2. Analyze spatial data and perform spatial analysis, using GIS analysis tools and develop and manage geodatabases
3. Create maps, images and apps to communicate spatial data in a meaningful way to others

Reference Books/Materials:

1. Introduction to GIS and Remote sensing by Kang tsung Chang , 9th edition
2. Campbell, J. B., & Wynne, R. H. (2011). Introduction to Remote Sensing. Guilford Press.
3. Geographic Information Systems and Science, Longley, P., Goodchild et al, 2005, Wiley.

**Course Title Advanced Seismic Stratigraphy**

**Course Outline:**

Introduction to sequence and seismic stratigraphy; Philosophy and history of sequence stratigraphy; Fault mechanical stratigraphy; Vail and Galloway sequence theory; Hierarchy and application; Sequence models; Basin development; sediment deposition and accommodation concepts; Geophysical fundamentals; Examples of operational sequences; Basin related depositional systems; Chronostratigraphy construction and interpretation; Sea level curves; Orders of cyclicity; Carbonate and Siliciclastic sequences; System Tracts; Stratigraphic surfaces; Seismic facies; Paleo environmental analysis; Geohistory reconstruction; Biostratigraphic signature; Sequences in Deep marine, Shallow marine, Shelfal, Deltaic and Neritic Environment; Hydrocarbon traps related geometries; Seismic truncations; Data Integration at seismic, log, core and outcrop scale; Demarcation of stratigraphic surfaces on integrated data sets; Static and dynamic models; Optimizing exploration.

Course Aims and Objectives:

Students will be able to:

1. Understand the use of sequence stratigraphy as a tool in basin exploration, and describe related workflow structure, ensure accurate stratigraphic breakdown of well data, manipulate and use a full dataset in an integrated project: well log, outcrop
2. Development of sedimentary basins, and their sedimentary infill, with emphasis on depositional processes/environments and resultant stratigraphic architecture.
3. Understand the sequence and sedimentology in a temporal and spatial perspective.

Course Outcomes:

After taking this course you will know:

1. General principles of sequence stratigraphy and their applications in depositional environments and basin types with main processes and products in a range of depositional environments.
2. Spatial and temporal development in sedimentary basins, with a predictive perspective on determining facies distribution.
3. Seismic expression of various strata and their sequence stratigraphic expression.

Reference Books/Materials:

1. Siliciclastic Sequence Stratigraphy   Concepts and Applications" by H.W. Posamentier and G.P.
2. Allen, 2000; SEPM Concepts in Sedimentology and Paleontology Series 7, Society for Sedimentary Geology, 204 pages.
3. Seismic and Sequence Stratigraphy and Integrated Stratigraphy: New Insights and contributions by Gemma Aiello edition I.2017
4. The Sedimentary Record of Sea Level Change by Angela L.Coe, cmabridge uni press 2nd edition,2003
5. Sequence Stratigraphy and Facies Associations (Special Publication 18 of the IAS) Henry W. Posamentier,haq and Allen,
6. Seismic Stratigraphy and Depositional Facies Models by P.C.H Veeken, 1st edition
7. Seismic Stratigraphy, Basin Analysis and Reservoir Characterisation by P.C.H Veeken, volume 37

**Course Title Sedimentary Petrology (3 CH)**

Course Outline:

Classification of sedimentary rocks on the basis of textures, classification criteria, texture and fabric, petrography of common clastic rocks, grains classification, matrix textural maturity, recognition of cements and its types, sedimentary rock forming minerals, their fabric and modal analysis, compositional and textural classification systems of chemically precipitated rocks, petrography of carbonate rocks, chert, phosphatic and glauconitic rocks, ironstone, evaporites, organic rocks: coal and lignite, volcaniclastic and zeolitic sedimentary rocks, soils & mudrocks.

**Course Aims and Objectives:**

The course will help in enhancing the concept of facies and the connection between tectonics and deposition. The students will be able to discuss the processes acting, and the resulting facies and facies associations in modern depositional environments. Further, they will learn how facies and facies associations can be used in the interpretation of ancient deposits from all continental and marine environments will be examined.

**Course Outcomes**:

1. Describe and interpret sediments from all sedimentary environments.

2. Locate, synthesize and interpret data, information and observations on marine sedimentary successions at an advanced level.

3. Apply knowledge and appropriate techniques, including those associated with fieldwork, to interpret the geological importance of marine and terrestrial sedimentary populations at an advanced level.

**Reference Books/Materials:**

1. Lindholm, R. (2012). A practical approach to sedimentology. Springer Science & Business Media.

2. Potter, P. E., Maynard, J. B., & Pryor, W. A. (2012). Sedimentology of shale: study guide and reference source. Springer Science & Business Media.

3. Perry, C., & Taylor, K. (Eds.). (2009). Environmental sedimentology. John Wiley & Sons.
4. Nichols, G. (2009). Sedimentology and stratigraphy. John Wiley & Sons.

**Course Title** **Petroleum Geochemistry**

Course Outline:

Concepts in petroleum geochemistry, the family of fossil hydrocarbons, origins, host rock geochemistry, classification, composition and chemical properties, physical properties, the heavy hydrocarbons; molecular structure , preparation, processing, conversion, analytical techniques, characteristics of kerogen and petroleum, conversion of kerogen to hydrocarbons, generating geochemical data, interpreting geochemical data, maturity modeling, sampling procedure from a well, environmental aspects.

Course Aims and Objectives:

To have a basic understanding of the hydrocarbon system, hydrocarbon as a resource, and the value chain. Have a basic understanding of a broad array of tools used in the search for and production of hydrocarbon reserves. Understand how geologists conduct the search for hydrocarbon resources through the value chain or the life cycle of a hydrocarbon resource. This will include the processes involved and actual examples.

Course Outcomes:

On completing the programme students should learn:

1. An advanced knowledge and understanding of the origin of hydrocarbon source rocks and
2. of the processes of oil and gas generation in sedimentary basins
3. Understanding of the processes influencing hydrocarbon migration and trapping
4. Understanding of the geochemistry of hydrocarbon reservoirs
5. An understanding of the geochemistry of molecular marker compounds in sediments and crude oils their uses and limitations
6. An understanding of the principles, applications and limitations of the main analytical techniques used in hydrocarbon geochemistry, and an advanced understanding of some of these techniques.

Reference Books/Materials:

1. Hydrocarbon Geochemistry and Geology by John Hunt.
2. The Biomarker Guide: Volume 1, Biomarkers and Isotopes in the Environment and Human History 2nd Edition, Kindle Edition by K. E. Peters (Author), C. C. Walters (Author), J. M. Moldowan (Author).
3. The Biomarker Guide, Volume 2: Biomarkers and Isotopes in the Hydrocarbon Exploration and Earth History (The Biomarker Guide 2 Volume Hardback Set) 2nd Edition by K. E. Peters (Author), C. C. Walters (Author), J. M. Moldowan (Author).

4. Hydrocarbon Formation and Occurrence: A New Approach to Oil and Gas Exploration Book by Bernard P. Tissot and Dietrich H. Welte.

**Course Title Stratigraphic Analysis and Petroleum Prospects**

Course Outline:

Introduction to Stratigraphy and Facies analysis; Lithostratigraphy; Biostratigraphy; Controls of sedimentary environments on the development of hydrocarbon and coal resources; Sedimentary basins; Potential source rocks, Potential reservoir rocks; Trapping mechanism in different sedimentary basins of Pakistan; Unconventional hydrocarbon prospects; Review of case histories for Conventional and Unconventional hydrocarbon prospects of Pakistan; Brief review of Stratigraphy of Pakistan

Course Aims and Objectives:

To provide theoretical knowledge to the student and practical application of the subject in the industry. Main focus of the course is on the development of hydrocarbon resources in different depositional environments. Introduce the students with the Petroleum Prospects of Pakistan including Conventional and Unconventional.

Course Outcomes:

1. Be able to apply this understanding to the description of sedimentary rocks in order to deduce depositional processes and environments.
2. To produce better useful petroleum stratigrapher working hand in the field and able to work in the industry.
3. Apply this understanding for the analysis of the petroleum prospects in the subsurface using geophysical data.

Reference Books/Materials:

1. Stratigraphy of Pakistan, By Shah, S. M. I., 2009. Geological Survey of Pakistan. Memoir, Vol. 22.
2. Stratigraphy and Historical Geology of Pakistan by Kazmi, A. H. and Abbasi, I. A., 2008, Graphic Publishers, Karachi, Pakistan.

**Course Title Basin Analysis**

Course Outline:

The foundation of sedimentary basins: basin in their plate tectonic environment, lithospheric mechanics, the mechanics of sedimentary basin formation: basin due to lithospheric stretching, basin due to flexure, basin associated with strike slip deformation, the sedimentary basin fill, control on basin stratigraphy: depositional style, evolution of the basin fill: subsidence history, thermal history, application to petroleum play assessment: the petroleum play, quatification of undiscovered potential.

Course Aims and Objectives:

This course will deal with the concrete theoretical foundation building regarding basin studies along with Practical approach to learn about different basins and their formation processes, depositional patterns and filling of basin with sediments.

Course Outcomes:

After studying the course students will be able to

1. To fully understand and get equipped with regional petroleum play assessment of basins along with its theoretical background.
2. To give a quantitative as well as qualitative fundament for analyzing sedimentary basins, particularly from seismic data
3. To integrate the data set to develop static and dynamic basin models

Reference Books/Materials:

1. Basin Analysis: Principles and Application to Petroleum Play Assessment, 3rd Edition by Philip A. Allen, John R. Allen, 2013
2. Physical Principles of Sedimentary Basin Analysis, by Magnus Wangen, 2010
3. AAPG memoir 60: The petroleum system from source to trap by Leslie b. Morgan and Wallace G Dow
4. Seismic stratigraphy, basin analysis and reservoir characterizations by p. C. Veeken

**Course Title Drilling Operations and Well Site Geology**

Course Outline:

Well Planning and its pre requisites; Drilling of a well (Vertical & Directional); Drilling Rig Types; Components of a drilling Rig and their Operation (Derrick/Mast, Sub structure, Hoisting, Rotary, Circulatory, Well Control, Bits etc.); Introduction to Drilling Fluids, Their Types & Selection; Casing, Casing Design and casing /cementing operation; Coring, its requirement, Types & Operation; Fishing; Mud Logging and its benefits; Lag Time Calculation; Drill Return (Cuttings) collection/ Sampling; Master Log and recorded parameters with their interpretation; Visual and microscopic analysis of cuttings at well site for lithological identification, porosity measurement, fluorescence/oil shows and formation tops; Chromatographic Analysis and interpretation of Gas Shows; Wireline logging Operations and their quality control; Measurement while drilling and its utilization; Well Testing (DST, MDT etc.); Perforation & Completion of a successfully tested well.

Course Aims and Objectives:

This course describes the complete package of well site operations required for a well site geologist to interpret/evaluate drilling as well as mud logging parameters with a very effective & practical approach.

**Course Outcomes:**

On completion of the course, students are expected to:

1. Familiarize with key concepts of Well Planning and its drilling according to the analysed, estimated and prognosed parameters.
2. Have basic knowledge about drilling fluid, its system and selection as per prognosed drilling as well as formation / reservoir pressure parameters.
3. Monitoring & Quality control of all well site operations, their outcomes, issues with them and their possible solutions.

**Reference Books/Materials:**

1. The Wellsite Guide (An Introduction to Wellsite Geological Operations) by Bernhard W. Seubert
2. Wellsite Geology (Reference Guide) by Baker Hughes INTEQ
3. The Online Mud Logging Handbook by Alun Whittaker
4. Properties of Petroleum Fluids (2nd Edition) by W.D. McCain
5. Field Methods for Petroleum Geologists by Fakhry A. Assaad
6. Introduction To Oil Well Drilling (International Edition) by Natraj Vaddadi
7. Oilwell Drilling Engineering: Principles and Practice by H.Rabia
8. Working Guide to Drilling Equipment and Operations by William Lyons

**Course Title Groundwater Development and Management (3 CH)**

Course Outline:

Introduction of ground water resources: Global perspectives Occurrence of ground water Geological factors governing the occurrence of ground water Hydraulics of ground water Aquifers and their types and important terms related to ground water Governing equation of ground water flow in aquifers Geophysical methods in ground water exploration Open wells or dug wells Tubewells Yield of wells and tubewells by Thiem's and Dupuit's equilibrium formula Hydraulics of wells Quality and quantity of ground water and its usefulness in Saline water intrusion Relationship between fresh and saline water Structure of fresh salt water interface Control of saline water intrusion. An introduction to geophysical and geochemical methods of exploration for planning, and design of regional water resources investigations; Groundwater Exploration, reconnaissance survey, surface investigation methods, subsurface investigations including test drilling, drilling methods, resistivity logging, radiation logging, temperature logging, velocity measurement and other methods; Groundwater Management, groundwater monitoring, observation network, water table fluctuation, selection of sites for the observation network. Contaminant transport in groundwater and management Concepts of basin management Equations of hydrologic equilibrium Groundwater basin investigation . Case histories in the sustainable management of ground water resources.

**Course Aims and Objectives**:

The course should enable students to:

The aim of this course is to impart knowledge about the importance and physical distribution of groundwater resources at the global scale with a special emphasis on Pakistan under drivers or climate change. Methods for the groundwater quantitative and qualitative assessment and for evaluation of the interactions between groundwater discharge and ecosystems. Substantiable Groundwater Management.

Course Outcomes:

1. The students will be able to impart knowledge about the importance and physical distribution of groundwater resources at the global scale with a special emphasis on Pakistan under drivers or climate change.
2. The students will be able to understands the exploration methods for the groundwater quantitative and qualitative assessment and for evaluation of the interactions between groundwater discharge and ecosystems.
3. The students will be able to develop Substantiable Groundwater Management plan.

Reference Books/Materials:

1. Anderson, M and Woessner, William: Applied Groundwater Modelling, Simulation of Flow and
2. Advective Transport, 381 pages, Academic Press; 1st edition (1991) ISBN 10: 0120594854, ISBN

3. 13: 978 0120594856

4. Freeze, R .A. and J.A. Cherry (1979): Groundwater. Prentice Hall, Englewood Cliffs

5. Fetter,C.W.(2001): Applied Hydrogeology. Prentice Hall, Englewood Cliffs

6. Fetter, C.W. (1993): Contaminant Hydrogeology. Macmillan Publishing Company, New York; S.

**Course Title Techniques in Structural Geology (3 CH)**

Course Outline:

Geological mapping and cross sections, stereographic projections, fold morphology, fold orientations: projection techniques, fold classification, fold sections and profiles, fold mechanism (single and multilayers), strain and small scale structures in folds, superposed folding, fault geometry and morphology, faults and the construction of balanced cross sections, mechanical analysis of fractures, fracture analysis and plotting techniques, ductile and brittle shear zones, joints, structural analysis of an area that has experienced a single episode of deformation, multiple deformations, examples and labs..

Course Aims and Objectives:

The course includes a quantitative approach of stress and strain in various tectonic setting, advanced aspects of rock deformation and rheology in the light of brittle, ductile and plastic deformation processes, an appraisal of the spectrum of complex deformation geometries, approaches of balancing and restoring deformation, as well as aspects of climate tectonic interaction.

**Course Outcomes:**

The student will be able to

1. Recognize moderately complex structures and can relate these to specific deformation regimes as well as quantitatively describe stress and strain

2. Know that tectonic styles can result from a combination of endogenous and exogenous processes

3. Discuss aspects in structural geology and tectonics with respect to the regional geology of Pakistan

Reference Books/Materials:

1. Bond, C.E., Lunn, R.J., Shipton, Z.K., and Lunn, A.D., 2012, What makes an expert effective at interpreting seismic images? Geology, v. 40, p. 75 78, doi:10.1130/G32375.1

2. Bond, C.E., Gibbs, A.D., Shipton, Z.K., and Jones, S., 2007, What do you think this is? "Conceptual uncertainty" in geosciences interpretation: GSA Today, v. 17, no. 11, p. 4 10.

3. Pilkey, O.H. and Pilkey Jarvis, L., 2007, Useless arithmetic: why environmental scientists can't predict the future: New York, Columbia University Press, 230 p.

**Course Title Rock Mechanics (3CH)**

Course Outline:

Introduction to Rocks: Nature of rock ; Classification and Index properties of Rocks: Geological classification of rocks, Index properties of rock systems (Porosity, Density, Hydraulic permeability and conductivity, Strength, Slaking and durability, Sonic velocity), Classification of rock masses for engineering purposes ; Rock Strength and Failure Criterion: Modes of rock failure, Common laboratory strength tests, stress strain behavior in compression, Rock strengths, Stress Strain curve, Mohr Coulomb failure criterion, Anisotropic rocks ; Planes of Weaknesses in Rocks ; Rock Support and Reinforcement.

Course Aims and Objectives:

Aims and objectives of the course are as follows:

1. To develop the understanding of rock varieties and their response against varieties of stresses.
2. To develop the skills for proper data collection, interpretation and classification.
3. To develop the better understanding of excavation and support designs.

**Course Outcomes:**

On successful completion of course student will be able to

1. Identify the rock variety on the basis of its geomechanical behavior and its response against variety of forces.

2. Identify the objectives of geotechnical data collection and rock mass classification methods and can easily collect the data for geotechnical dataset.

3. Identify the principles of rock mechanics and excavation designs to develop excavation proposals for geologic environments i.e. stratified, massive, blocky or faulted lithology.

Reference Books/Materials:

1. Introduction to rock mechanics 2nd edition by Richard E. Goodman

**Course Title Soil Mechanics (3CH)**

Course Outline:

Introduction, geotechnical index properties of soil, classification systems for soil, atterberg limits and their laboratory determination, compaction and factors affecting compaction, laboratory and field determination, hydraulic properties of the soil and their determination, darcy's law, laplace equation, flow nets properties and application, pressure bulbs, shear strength of soil and it's determination, stability analysis for soil slopes, lateral earth pressure theories, ground water consideration in the soil engineering.

Course Aims and Objectives:

Aims and objectives of the course are as follows:

1. To develop the understanding of soil index properties.
2. To develop the skills for proper data collection, interpretation and classification.

3. To develop the better understanding of soil investigation techniques both used in filed and laboratory.

Course Outcomes:

On successful completion of course student will be able to

1. Identify the soil variety on the basis of its index properties.
2. Identify the data collection and rock mass classification methods and can easily collect the data for geotechnical dataset.
3. Identify the principles of soil mechanics and can identify the locations with the potential of slope failure problems.

Reference Books/Materials:

1. Principles of geotechnical engineering, 5th edition by Braja, M. D., 2001, Brooks / Cole.

2. Soil Mechanics: Concepts and applications, 2nd edition, by Powrie, W., 2004, Taylor & Francis.
3. Geotechnical Engineering: Principles and practices of soil mechanics

**Course Title Geochemical Exploration (3CH)**

**Current Course Outline:**

Basic principles for geochemical exploration. Geochemical dispersion, geochemical mobility and association of elements. Classification of mineral deposits. Types of geochemical anomalies in bed rock residual and overburden, drainage sediments, and natural waters. Orientation surveys. Role of path finder elements in mineral exploration. Decay pattern in stream sediments. Statistical interpretation of geochemical data. Geochemical methods and selection of sediments in mineral exploration with emphasis on litho stream sediments and soil survey. Geochemical evaluation and appraisal of ore deposits.

Lab. Preparation of histogram, frequency diagram sand geochemical maps.

Course Aims and Objectives

Aim:

To enable students to acquire technical knowhow for geochemical exploration and to analyze, explain and apply the geochemical processes controlling the geochemical anomalies

**Objectives:**

1. To enable students to understand applied geochemistry to target ore deposits
2. To enable students to know different field and laboratory techniques to analyze minerals and rocks
3. To interpret field and lab data for targeting possible geochemical anomalous zones

**Course Outcomes:**

The course is designed to impart practical knowledge to the students to understand the basics of geochemistry and its applications. Geochemical exploration is an integrated study combined with mineral prospecting and exploration. After acquiring knowledge in geochemical exploration, the students will be able to use different geochemical techniques required for specific ore deposits. The ores are mineralized in rocks and/or deposited as placer deposits. The ultimate goal is to target mineralized zones as resources for societal needs.

**Reference Books/Materials:**

1. Rock Geochemistry in Mineral Exploration by G.J.S Govett (1983)
2. Geochemistry in Mineral Exploration: Harper's Geoscience Series by Herbert Edwin

3. Hawkes (Author), John Stuart Webb (Author), Carey Croneis (Editor) (2012), Literary Licensing, LC publisher
4. Geochemical Exploration, Volume 17 by G.R. Parslow (1984), Elsevier Science publisher

5. Practical problems in exploration geochemistry by A.A. Levinson et al (1987), Thomson Applied Publication

**Course Title Isotope Geochemistry (3CH)**

Course Outline:

Principles of stable isotopes geochemistry; stable isotopes in the atmosphere and hydrosphere; stable isotope variations in various types of rocks and weathering and diagenetic processes; carbon and sulphur isotope studies of organic matter; fossil fuels and related materials, applications in burial and tectonic evolution. On the other hand radioactive decay introduction, decay mechanisms (beta, positron, electron capture, alpha), fission, rates of radioactive decay, half life, decay series and secular equilibrium, applications of natural radioactivity and units of radioactivity; an introduction to isotopic dating methods and radiogenic isotope as tracers of geological processes: introduction, K Ar, Ar40 Ar39, Rb Sr, Sm Nd, U Th Pb (concordia, discordia, zircons, isochrons), extinct radio nuclides, fission tracks, cosmogenic nuclides and C14 dating, heterogeneity of the earth's mantle, Nd and Sr isotope compositions of the ocean. Laser probe isotope geochemistry and dating techniques. Data oriented exercises; Discrimination diagrams and interpretation; mass spectrometry of stable isotopes and radioactive nuclides.

Course Aims and Objectives:

To impart the basic understanding of the stable and radiogenic isotope geochemistry to the students. Radiogenic isotopes have very useful contribution in dating techniques. Stable isotopes can reveal the genesis of various types of rocks and minerals.

**Course Outcomes:**

The students would learn about the isotopes in general and stable and radioactive isotopes in particular, used in earth sciences. This subject would also enable the students to understand the geological process and related minerals deposits, their origin and emplacement in particular geological environment.

**Reference Books/Materials:**

1. Attendorn H. G. and Bowen R. N. C. (1987) Radioactive and Stable Isotope Geology. Chapman and Hall, London. QE501.4. N9 B69.

2. Barrie A. and Prosser S. J., (1996) Automated analysis of light element stable isotopes by isotope ratio mass spectrometry. In: Mass Spectrometry of Soils (eds: T. W. Boutton and S. Yamasaki). Marcel Dekker Inc. New York, p 1 46. S593.M4415.

3. Boutton T. W. and Yamasaki S. editors (1996) Mass Spectrometry of Soils. Marcel Dekker Inc, New York. S593.M4415.

4. Coleman D. C. and Fry B. editors (1991) Carbon Isotope Techniques. Academic Press Inc. San Diego. QH 324.3.C37.

5. Faure G., (1986) Principles of Isotope Geology. John Wiley and Sons, New York.

6. Hoefs J., (1997) Stable Isotope Geochemistry. Springer, Berlin. QE515.H67

7. Knowles R. and Blackburn T. H. editors (1993) Nitrogen Isotope Techniques. Academic Press, Inc. San Diego. QH324.35.N1 N57.

8. Lajtha K. and Michener R. H. editors (1994) Stable Isotopes in Ecology and Environmental Science. Blackwell Scientific Publishing. QH541.15.S68 L35.

9. Longstaffe F. J., (1987) Stable isotope studies of diagenetic processes. In: Stable Isotope Geochemistry of Low Temperature Fluids (ed. T. K. Kyser) Mineralogical Association of Canada, Saskatoon, May 1987. Volume 13, p 187 257. QE501.4.N9 S725.

10. Longstaffe F. J. (1989), Stable isotopes as tracers in clastic diagenesis. In: Short Course in Burial Diagenesis (ed. I. E. Hutcheon) Mineralogical Association of Canada, Montreal, May 1989. volume 15, p 201 277.

11. Sharp Z. (2007) Principles of Stable Isotope Geochemistry. Pearson Prentice Hall, New York. Valley J. W. and Cole D. R. editors (2001) Stable Isotope Geochemistry. Mineralogical Society of America, Reviews in Mineralogy and Geochemistry, volume 43. QE501.4.N9 S724.

**Course Title Clastic Sedimentology (3CH)**

**Course Outline:**

classification of sediments and sedimentary rocks (sedimentary rock types), sediment movement by fluid flow and sediment transport processes including transport, – basic concepts of fluid mechanics, , textures of terrigenous clastic sedimentary rocks (properties of sedimentary particles),Terrigenous clastic sediments, Sediment Types, Sediment texture, Sedimentary structures, Detrital components, Classification schemes and detailed description of terrigenous clastic sediments, Sandstone digenesis, Facies analysis and Depositional environments, Porosity and permeability. Lab. Petrographic study of elastic rocks. Heavy mineral analysis. Recording, plotting and analysis of Paleocurrent data. Field techniques for study of elastic sedimentary rocks.

**Course Aims and Objectives:**

This objective of this course is to acquire knowledge about texture and classification of sedimentary rocks, Sedimentary environments and facies analysis, Paleocurrent analysis and Diagenesis and provenance analysis of clastic rocks

**Course Outcomes:**

After studying clastic sedimentology students will be able to

1. Understand about various clastic rocks and their diagenesis
2. Understand the classification and depositional system of clastic rocks

3. Know about the sediments play in global climate system as well as how energy and other resources come from clastic rock.

Reference Books/Materials:

1. Sedimentary Environments and Facies by Reading, H. G., 1986, Blackwell Scientific Publications.
2. Ancient Sedimentary Environments by Selley, R. C., 1978, Chapman and Hall.
3. Origin of Sedimentary Rocks by Blatt. H., Middleton, G and Murrey, R., latest Ed., Prentice Hall.
4. Depositional Sedimentary Environments by Renieck, H. E. and Singh, I. B., 1980, Springer Verlag.
5. Sand and Sandstones by Pettijohn by F.J., Potter, P. E. and Sever, R., latest Edition., Springer Verlag.
6. Principles of Sedimentology by Friedman, G. M. and Sanders, J. E., 1978, John Wiley and Sons.
7. Petrology of Sedimentary Rocks by Boggs Jr. S., 1992, Merril Publishing Co.

**Course Title Non Clastic Sedimentology (3CH)**

Current Course Outline:

Mineralogy of non clastic rocks, classification of carbonate rocks, carbonate depositional environments, carbonate diagnosis, dolomite and dolomitization, model nature & origin of evaporites, nature and origin of phosphatic rocks, ironstones, economic significance of non clastic rocks. • fracturing in carbonate and evaporitic reservoirs • Fracture terminology and classification • Fractures in different data types • Evolution of carbonate porosity systems

Lab. Identification of carbonate sediments in hand specimen and thin sections. Microfacies interpretations Staining and XRD techniques.

Course Aims and Objectives:

This objective of this course is to study carbonate rocks and the processes associated to it. Study the different depositional systems of carbonate rocks and diagenesis

Course Outcomes:

After studying clastic sedimentology students will be able to

1. To know about carbonate mineralogy and chemistry
2. Understand classification, and depositional models,
3. Understand microfacies, cyclicity in carbonates, carbonate depositional systems.

**Reference Books/Materials**:

1. Carbonate Sediments and their Diagenesis by Bathurst, R. G., latest Edition., Elsevier.
2. Marine Carbonate by Milliman, J. D., 1974, Springer Verlag.
3. Carbonate Depositional Environment by Scholle, P. A. Bebout, D. G. and Moore, C. H., AAPG Mem.
4. Carbonate Sedimentology by Tucker, M. E. and Wright, V. P., 1990, Blackwell Scientific Publications.
5. Carbonate Depositional Environments by Scholle, P. A.,, Bebout, D. G. and Moore, C. H., 1993, Mem. Am. Assoc. Petrol. Geol.

**Course Title Clay Mineralogy (3CH)**

Course Outline:

Introduction, structure and classification of clay minerals; introduction to analytical methods for clay separation and their identification; origin and diagenesis; clay minerals during diagenesis and low grade metamorphism; paleothermometery; geological significance in petroleum industry; depositional environments; clay minerals and sedimentation; significance of clay minerals in soils, drilling fluids and reservoirs; industrial applications. Economic clay deposits of Pakistan Identification of clay minerals by XRD and XRF techniques; data oriented exercises.

Course Aims and Objectives:

Clay minerals make an important resource in making medicines, pottery, drilling fluids etc. The main objective of this course is to get the students know the importance of clay minerals and their uses in various industries.

Course Outcomes:

The students would learn about different clays minerals and their parent rocks, mineralogical and chemical composition and distribution in Pakistan.

Reference Books/Materials:

1. Clay minerals by Grim R. E., 1986, McGraw Hill, New York.
2. X RayIdentification and crystal structure of clay minerals by Brown G., latest edition, Min. Soc. London.
3. Crystal Structure of Clay Minerals and their X Ray Identification by Brindley and Brown, 1980, Min Soc. London.
4. X Ray Diffraction and the Identification and Analysis of Clay Minerals by Moore and Renolds, 1989.

**Course Title Hydrochemistry and Groundwater Pollution (3CH)**

Course Outline:

Introduction and basic concepts: The water molecule: structure and properties; water as a solvent.

Ways of expressing the concentrations of substances dissolved in water, Composition and analysis of waters, Types of natural waters. Composition of continental waters: types of constituents and their relative importance. Chemical analysis of groundwater: Types and characteristics. The balance error: concept and utility. TSD and Dry Residue: concept and determination; electrical conductivity as an expression of the total salinity of water. Preliminary interpretation of hydrochemical data: graphical methods (diagrams). Concept of hydrochemical facies. Water chemistry . Chemical equilibria: The Law of Mass Action; activities. Complexes. Water dissociation: pH concept. Dissolved gases: cases of O2 and CO2. Equilibria of the CO2 H2O system; Alkalinities. Dissolution of minerals:

solubilities; effects of ionic strength and common ion. Deviations from equilibrium: saturation states. Dissolution of carbonate rocks. Hardness. Oxidation Reduction Processes: concepts of pe and Eh. Oxygen consumption: concepts of BOD and COD. Surface processes: sorption and cation exchange. Hydrogeochemistry . Precipitation water. Water on the ground. Underground flow: regional evolution; modifying processes. Infiltration water in irrigated areas. Origin and hydrogeochemical characteristics of the main dissolved constituents of groundwater. Estimation of hydrological variables from hydrogeochemical data: water mixtures; chloride balance. Water quality and pollution .Concepts. Quality for supply: commentary on Spanish regulations. Quality for agricultural uses. Quality for industrial uses. Modes of groundwater contamination. Main polluting agents. Main potential sources of groundwater contamination. Some examples: Urban waste (liquid and solid); Agricultural pollution; Pollution from industrial activities. Reaction of aquifers to pollution. Behaviour of the main polluting agents on the ground. Research into aquifer contamination. Remediation of aquifer contamination. Protection of groundwater from contamination. Solute transport processes .

Diffusion, Advection and Dispersion: concepts and numerical expressions. Non aqueous phase liquids. Column experiments. Macroscopic aspects of dispersion. Species retardation. Transport models.

Lab Work: Ground water sampling for chemical analysis.

Course Aims and Objectives:

1. Natural groundwater quality and principles of contaminant transport and common remediation techniques.
2. Ground water sampling for chemical analysis and interpretation methods.
3. The student with an integrated understanding of groundwater chemistry and contaminant hydrogeology as preparation for a career as a geohydrologist or geohydrochemisty

Course Outcomes:

1. Students will understand about Natural groundwater quality and principles of contaminant transport and common remediation techniques.
2. Students will understand Ground water sampling for chemical analysis and interpretation methods.
3. Students will also be prepared to provide expert hydrochemical input to the industry.

Reference Books/Materials:

1. Appelo, C.A.J. and Postma, D., 2004. Geochemistry, groundwater and pollution. CRC press
2. Emmanuel Olutayo, Martins Olorunfemi. 2018. Geophysical and Hydrochemical Investigations of Groundwater Pollution. LAP LAMBERT Academic Publishing

**Course Title Groundwater Modeling (3 CH)**

Course Outline:

Concept of groundwater components and aquifers, Purpose of groundwater modelling; Conceptual model, estimation of aquifer parameters, conceptualization of grid and boundary conditions, Steady and transient simulations, conceptualization of aquifer aquitard systems; Three dimensional anisotropy, Specification of boundary conditions; Construction of a steady state model, visualization of groundwater level, regional model, Hydrological stresses; Design of numerical model, finite difference solutions of flow problems; Steady versus unsteady model; One layer versus multi layer model; Lay out of grids; Stress period/time steps; Model inputs, initial conditions; boundary conditions; Hydrogeological parameters, model calibration procedures and validation, selection of model code; Model prediction, purpose of prediction; Simulation of scenarios; Determination of capture zones; Introduction to MODFLOW; Exercises and case study.

Course Aims and Objectives:

Upon completion, the participant should be able to: Describe process and procedures of applied groundwater modelling. Construct numerical groundwater models using popular modelling tools with hands on exercises. Use groundwater models to simulate groundwater flow, contaminant transport, and saltwater intrusion with hypothetical examples. Apply groundwater models for groundwater resources management and protection in real world case studies.

**Course Outcomes:**

At the conclusion of this course, the student will:

1. Have a better understanding of basic components of a groundwater modeling;
2. Be familiar with most common solution methods used in groundwater modeling; and
3. Be able to define boundary conditions and to perform calibration for the computer models.

Reference Books/Materials:

1. Applied Hydrogeology, Author: C.W. Fetter Jr.
2. Fundamentals Of Groundwater Modelling, Authors: Husam Baalousha

3. Applied Groundwater Modeling: Simulation of Flow and Advective Transport: Authors: Mary P. Anderson, William W. Woessner

**Course Title Industrial Mineralogy (3CH)**

Course Outline:

Economic importance and industrial utilization of industrial mineral resources, role of industrial minerals in our daily life, significance of distinct physical properties and chemical composition of minerals for industrial applications, characterization of minerals and rocks with the help of optical, chemical and physical/engineering studies (density, porosity, water absorption, grain size distribution, fineness, soundness, brightness, surface area, decrepitating, liquid limit, plastic limit, compression and abrasion strengths), assessment of suitability of materials based on international standards like ASTM and British Standards, case studies on resources with examples from Pakistan and worldwide, field identification and textural and mineralogical description of industrial rocks/minerals in the laboratory, description of industrial mineral occurrences in Pakistan and various mineral based industries, mineral economics and marketing trends.

Course Aims and Objectives:

The use of industrial rocks/minerals has increased manifold in recent years. This course is designed to introduce students to common rocks/minerals being utilized in the industries.

**Course Outcomes:**

The outcomes of this course are to understand physical and chemical properties of industrial rocks and minerals, kinematics of the mineral formation, beneficiation processes of various industrial minerals and rocks.

**Reference Books/Materials:**

1. Applied Mineralogy by Jones, M. P., 1987, Graham and Trotman.
2. X ray diffraction and the identification and analysis of clay mineral by MOORE, D. M. and Reynolds, Jr., R. C., 1989, Oxford University Press.
. Minerals and rocks for industry by Ahmad, Z. and Siddiqi, R. A., 1992, Geological survey of Pakistan, Quetta.
4. Geology of the Industrial Rocks and Minerals by BATES, R. L., 1960. Dover
5. Mineral Resources and Their Management by Lunden, J. B.,1985,
6. Refractories for Iron and Steel making by Chesters, J. H., 1974, the Metals Society.
7. Industrial Geology by Knill, J. L., 1978, Oxford University Press.
8. Mineral Processing Technology by Wills, B. A., 1988, Pergamon Press.

**Course Title Advanced Marine Geology (3 CH)**

Course Outline:

Introduction to marine environment and geological processes and shapes of world's modern oceans. Evolution of ocean basin; Types of marine/ocean basins; Concept of Oceanography; Modern and ancient deep marine processes; Key processes over timescales and past climate changes due to ocean volume change, Deposits and environments; Physical and Biological processes in shallow and deep marine environments; Sediments and facies, beds, their sedimentary characteristics and interpreted depositional processes; Deep water ichnology, Mineral resources of sea; Time space integration including sedimentary marine deposition; Statistical properties of sediment; Gravity flow deposits; mass transport Deposits; Bed thickness distributions; Sea bed morphology; Sediment drifts and abyssal sediment waves, Contourites; Submarine fans and related depositional systems; Interpretations of offshore and sub environments using multiple data sets;

Course Aims and Objectives:

Students will have a clear overview of how ocean basins form and change in time also they will understand the dynamics of the earth's crust and its importance for geomorphology and evolution. Types of sediments and rocks, the reason for the existence of oceans and continents and the spatio temporal dynamics of marine sedimentary and igneous processes. Climatic variations over the period of time. Numerous case studies demonstrated in the class will illustrate concepts such a plate tectonics via island formation, and sedimentology via discussion of attractive sedimentary systems, such as coral reefs. Students will have a broad understanding of geological ocean dynamics

**Course Outcomes:**

1. A solid grounding in marine geology and the driving forces behind, consequences, and importance of sea level changes in the geological record.
2. Be able to describe sediments found in different water depths and settings, and understand the sedimentary processes leading to their deposition.

3. Be able to describe the main geological and geophysical techniques for observing the seabed and sub seabed. Impacts of climate change and global warming

Reference Books/Materials:

1. Kevin T. Pickering & Richard N. Hiscott (Deep Marine Systems, to be published by Wiley Blackwell in late 2014)
2. Haq, B. U., & Milliman, J. D. (1985). Marine geology and oceanography of Arabian Sea and coastal Pakistan.
3. Wright, D. J., & Barlett, D. J. (Eds.). (1999). Marine and coastal geographical information systems. CRC press.
4. BUL The Sea Floor An Introduction to Marine Geology By E. Seibold W. H. Berger. 3rd Ed 1996

**Course Title Reservoir Geology (3CH)**

Course Outline:

Introduction to reservoir characterization, Reservoir characterization and modeling objectives; Reservoir characterization and modeling workflows; Data and related uncertainty; Data integration; Reservoir heterogeneities. Petrophysics based reservoir properties from cores & logs evaluation; Coring; Porosity: definition and measurements (effective and total porosity); pore size, Reservoir properties; effects of Depositional and digenetic controls on reservoir properties; Fluid properties and their saturation; Hydrocarbon distribution and fluid contacts; Reservoir zonation and thickness mapping; Reservoir pore spaces configuration; Mapping reservoir heterogeneity; Field observations to understand reservoir; Migration of hydrocarbons from source rock to reservoir; Estimation and calculation of reservoir volumetrics; Material balance and production decline curve methods; Appraisal and development of reservoir basic concepts.

**Course Aims and Objectives**:

Students will know about different type of reservoir rocks, fluid properties and its impact on reservoir rocks. Reservoir heterogeneity and reserves estimation.

**Course Outcomes:**

Students will be able to understand

1. Different types of reservoir rocks, their properties, different depositional environments,
2. Fluid properties and their saturations, reserve estimation methods.
3. Reservoir heterogeneity appraisal and development of reservoir basic concepts.

Reference Books/Materials:

1. Elements of Petroleum Geology by Richard C. Selley, Stephen A. Sonnenberg
2. Sandstone Petroleum Reservoirs by John H. Barwis, John G. McPherson, Joseph
3. Basin Analysis Principles and Application to Petroleum Play Assessment by Philip A. Allen

**Course Title Applied Mineralogy (3CH)**

Course Outline:

Introduction to applied mineralogy. Physical properties chemistry and paragenesis of principal rock forming minerals: olivine group, aluminosilicates, garnet group, epidotes, pyroxene and amphibole groups, micas and other sheet silicates, feldspar group, silica group, oxides and carbonates, native elements, sulfides, sulfosalts, halides, nitrates, borates, sulfates and chromates, tungstates and molybdates, phosphates, arsenates, vanadates and other industrial minerals, kinematics of mineral formation, mechanism of mineral nucleation and crystal growth, measurement of mineral triple junction angles and grain boundaries in context of texture development, calculations of mineralogical parameters and mineral formulas. Mineralogical applications in mineral exploration, mineral processing, beneficiation, tailings, acid rock drainage.

Course Aims and Objectives:

The main aim and objective of this course is to impart knowledge of the applied mineralogy in terms of identification of minerals using different techniques in the best interest of the society.

Course Outcomes:

After completion of the course, the students will develop skills to identify minerals and their use in mineral industry.

Reference Books/Materials:


1. Applied Mineralogy, A Quantitative Approach by Jones, M. P., 1987, Graham and Trotman.
2. X ray diffraction and the identification and analysis of clay mineral by MOORE, D. M. and Reynolds, Jr., R. C., 1989, Oxford University Press.
3. Minerals and rocks for industry by Ahmad, Z. and Siddiqi, R. A., 1992, Geological survey of Pakistan, Quetta.
4. Geology of the Industrial Rocks and Minerals by BATES, R. L., 1960
5. Applied Mineralogy, Application in Industry and Environment by Mukerjee, Swapna., 2011. Springer
6. Applied Mineralogy in Mining Industry by William Petruk., 2000. Elsevier Science


**Course Title Fundamentals of Gemology (3CH)**

Course Outline

Gems, Crystallography, coloring metals in gemstones, the origin and environment of gems occurrences, physical and chemical characteristics of gemstones, inclusion in gemstones, luminescence, evaluation techniques of important gemstones (i.e., diamond, ruby, sapphire, emerald, aquamarine, topaz, tourmaline, peridote, garnet, spodumenc, quartz, turquoise and lapis lazuli) and their genesis, gemstones occurrences in Pakistan: structure associated gemstones, pegmatite associated gemstones, gemstones in hydrothermal veins and miscellaneous gemstones.

Course Aims and Objectives

Aims:

This aim of Fundamental of Gemology course is to impart knowledge to students to enable them to apply this knowledge in their professional career.

Objectives:

1. To teach and train students in the field of Gemology,
2. To impart hands on training in the identification of natural, synthetic and treated gemstones
3. To familiarize the students to know the occurrence and origin of the gemstone deposits of Pakistan

**Course Outcomes:**

Mineral deposits are classified as metallic minerals, industrial minerals, mineral fuels and gemstones. The students who acquire knowledge in the course of Fundamental of Gemology will be able to identify real, synthetic and treated gemstones. They will also acquire knowledge about the mode of occurrence of gemstones and their origin and also the guidelines for exploring various gemstones. They can be professionals to contribute to the economy of the country.

**Reference Books/Materials:**

1. Gems and Gemmology of Pakistan by Tahseenullah Khan and Allah Bakhsh Kausar (2010), Geological Survey of Pakistan Special Publication

2. Gem Testing. Rev. by E. A. Jobbins. 10th Edition Anderson, Basil W. (1990), Butterworth, London.

3. The Spectroscope and Gemmology by Anderson, Basil W and James Payne (1998), Gemstone Press, Woodstock, VT.

4. Diamonds. 2nd Edition by Bruton, Eric. (1978), Chilton Book Co., Radnor, PA

5. Gems and Gemology in Review: Treated Diamonds (2008), Gemological Institute of America, Carlsbad, CA.

6. Gems: Their Sources, Description and Identification. (2006) 6th ed. Ed. by Michael O'Donoghue. Butterworth Heinemann, Boston.

7. Photoatlas of Inclusions in Gemstones by Gübelin, Eduard J. and John I. Koivula (2004), [Volume 1]. 4th Ed., Opinio Publishers, Basel.

8. Gemstones by Hall, Cally (2000), Dorling Kindersley, London; New York.

9. Identification of gemstones by O'Donoghue, Michael and Louise Joyner. (2003),Butterworth Heinemann, Oxford.

**Course Title Applied Engineering Geology (3CH)**

Course Outline:

Engineering properties of rocks, Rock mechanics, Soil mechanics, Engineering geology and earth processes, especially Earthquake, volcanic and landslide processes; Site investigation, Water resources, reservoirs and dams, the foundation of dam bridges and roads, Geological factors in engineering work, Geological investigations, Tunnels and underground excavations, Underground mining methods, Open pit mining techniques.

**Course Aims and Objectives:**

The main aim and objectives of the course are as follows:

1. To develop better understanding of geological materials i.e. rocks and soils and their interaction with the engineering structures.
2. To develop the ability to identify the areas with the potential of geo hazards and to minimize the impact of those geo hazards on engineering structures.
3. To develop a better understanding of engineering structures i.e. dams, tunnels and bridges

**Course Outcomes:**

After successful completion of course, student will be able to:

1. Identify rocks and soils and their interaction with the engineering structures.
2. Identify the areas with the potential of geo hazards and can suggest remedial or preventive measures to minimize the loss of life and property.
3. Identify the geological parameters of an area and suggest proper site selection for critical structures i.e. dams, bridges and tunnels.

**Reference Books/Materials:**

1. Attewell, P. B. and Farmer, I. W., 1976. Principles of Engineering Geology. John Willey & sons; New York.

2. Beavis, F.C., 1985. Engineering Geology. Blackwell Scientific Publications, Melbourne.
3. Legget, R. F., 1962. Geology and Engineering. McGraw Hill; New York.

**Course Title Advances in Environmental Engineering (3CH)**

Course Outline:

Principles of Environmental Engineering: population, economic growth, industrialization, energy use. Physical and transport properties of mixtures, contaminant partitioning and transport in air, water and solids. Application of environmental principles, life cycle analysis, principles of environmental quality, standards and guidelines. Water and wastewater: characteristics and parameters, standard methods of analysis, treatment plants and systems. Industrial wastewater characteristics, treatment, treatment levels and available technologies. Sanitation, Water distribution Components, Methods of analysis, Water conservation, Sustainable solutions. Sources and classification of atmospheric pollutants and particulates, health and ecological impacts. Gaussian diffusion model, lapse rate and stability conditions. Control of particulates: collection, mechanisms and efficiencies. Control of gases and vapors, adsorption, absorption, incineration, odor and gaseous pollutant control. Solid waste characterization and classification. 3R techniques Solid Waste Management, Soil and its quality, Contaminated site remediation.

**Course Aims and Objectives:**

1. To equip students with the understanding of basic principles of environmental engineering.
2. To familiarize with the study of environmental hazards, risks prevention, field monitoring, data collection and interpretation of risk management, engineering principles, Technologies and solutions to environmental problems.
3. To give the understanding of principles of environmental quality, standards and guidelines for various environmental parameters.

**Course Outcomes:**

1. On completion of this course, students are expected to be able to know about basic applications of environmental engineering, environmental remediation and treatment technologies and solution to the hazards.

**Reference Books/Materials**:

1. Environmental technologies (Engineering & Principles)
2. Environmental Engineering (Wiley)

**Course Title Health Safety and Environment**

Course Outline:

Health, safety and environment: Hazards; Physical, mechanical, biological, chemical and psychological hazards and stress. Health and environment, Environmental safety, Hazards identification and risk assessment and management process. Work place environment: Occupational safety and health issues in industries, construction, agriculture and service sectors, Accidents, injuries and workplace fatalities statistics, Occupational safety and health management systems (international and national). Safety Management: Regulations of health, safety and environment. Industrial hygiene, Internal control and management philosophy, Duties and rights, strategies and goals, Roles and responsibilities of occupational health and safety professionals. Key principles of management and HSE, Measures and models for HSE, Organizational environment, HSE statutes and regulations, Establishing HSE plans, Challenges of health within working environment, external environment and safety, Different tools and instruments. 85 Culture, Behavior, Interactions, participation and communication, health surveillance, injury reporting, Emergency response procedures; fires, spills, leaks etc., Preparedness and monitoring of adverse events and follow ups, Case studies. Work place safety and health: Assessing current practices and promoting change in the profession, Personnel Protective Equipment, Formulation of Standard operating procedures, Human Factors and Ergonomic, Planning, decision making and problem solving.

**Course Aims and Objectives:**

The objective of this course to provide orientation to the students on importance of occupational safety, health and environment. Regulations and guidelines concerning HSE work, Reporting of HSE problems and discrepancies, Reporting of HSE problems and discrepancies

**Course Outcomes:**

Students will have the necessary knowledge about HSE to ensure their own and other people's safety at working environment. This includes knowledge of the HSE concept, objectives for the HSE work and
how to behave safely in laboratories and during field work. The theoretical and practical basic training in first aid and fire protection shall provide the students with a basis for correct handling of a fire or accident situation.

**Reference Books/Materials:**

1. Hand book of Environmental Health & Safety, principles and Practices By Herman Koren and Mechael Bisesi, Vol.1 , Lewis publishers.
2. English, P. F. 2012. Safety Performance in a Lean Environment: A Guide to Building Safety into a Process (Occupational Safety & Health Guide Series), CRC press. Taylor and Francis group. USA.
3. Salvendy, G. 2012. Handbook of Human Factors and Ergonomics. 4 th ed., John Willey Inc. New Jersey, USA.
4. OHSAS BS 18001 Standard

**Course Title Advanced Igneous Petrology (3 CH)**

**Course Outline:**

Classification of igneous rocks, fractionation in igneous processes, compositional variation in magmas in terms of variation diagram and inter element correlation, magmatism and global tectonic processes, geochemical characteristics of igneous rocks as petrogenetic indicators, partial melting processes in the earth’s upper mantle, magmatism at constructive and destructive plate margins, continental rift zone magmatism, basalts their classification petrography, basaltic associations of ocean basins, continental mafic magmas from deep sources, andesites and associated volcanic rocks of island arcs and continental margins, rocks of continental plutonic provinces (granitic complex), petrology and origin of potash rich basic volcanic rocks, case studies and exercises.

Course Aims and Objectives:

This course aims at the process involved in the formation of igneous rocks, and the environments where they form. Study sources of magma and its associated processes

**Course Outcomes:**

At the end of the course students will be able to

1. Define Mantle magma systems and source of magma.
2. Evaluate petrogenic provinces.
3. Define the ophiolite.

**Reference Books/Materials:**


1. Igneous Petrology by Hill, A., 1987. Longman Scientific and Technical.
2. Petrology: Igneous, Sedimentary and Metamorphic by Ehlers, E.G. and Blatt, H.W.H., 1982, W. H. Freeman and Co.
3. Petrology: Igneous and Metamorphic Rocks by Hyndman, D.W., 1972, McGraw Hill.
4. Igneous and Metamorphic petrology by Best, M.G., 1982, W.H., 1982, W. H. Freeman and Co.
5. Igneous and Metamorphic Petrology by Turner, F.J. and Verhoogen, J. 1960, McGraw Hill.
6. Igneous Petrogenesis by Wilson, M., 1989, Unwing Hyman. 39
7. Igneous Petrogenesis by Carmichael, I.S.E., Turner, F.J. and Verhoogen, J., 1974, McGraw Hill.
8. Igneous Petrology by McBirney, A.R., 1984, Freeman Cooper and Co.
9. Introduction to Igneous and Metamorphic Petrology by Winter, J.D., 2001, Prentice Hall.


**Course Title Advanced Metamorphic Petrology (3CH)**

Course Outline:

Characteristics of metamorphic reactions, metamorphic facies and the concept of metamorphic rocks as systems in stable equilibrium, facies series of contact metamorphism, regional facies series in tectonic and nontectonite domains, diagrammatic representation of mineral paragenesis, progressive metamorphism of mafic, ultramafic and pelitic rocks, metamorphic rocks of the ocean floor, metamorphic rocks of upper mantle, tectonics of regional metamorphic belts, eclogites and eclogite facies, and case studies and exercises.

**Course Aims and Objectives:**

This course is about the detailed study of metamorphic rocks. The pressure and temperature at which these rocks are formed are evaluated. Study metamorphic facies.

**Course Outcomes**:

At the end of the course students will be able to

1. Define characteristics of metamorphic reactions and role of liquids and differentiate different types of metamorphic facies series.
2. Evaluate tectonics of regional metamorphic belts; paired metamorphic belts.
3. Define different types of metamorphic structures of continental crust.

**Reference Books/Materials**:


1. Petrology: Igneous, Sedimentary and Metamorphic by Ehlers, E. G. and Blatt, H. W. H., 1982, W. H. Freeman and Co.
2. Igneous and Metamorphic Petrology by Hyndman, D. W., 1972, McGraw Hill.
3. Igneous and Metamorphic Petrology by Best M. G.,1982, W. H. Freeman and Co.
4. Metamorphic petrology by Turner, F. J., 1981, McGraw Hill.

5. Metamorphism and Plate Tectonics Regimes by Ernst, W. G. 1975, Dowden, Hutchisnson and Ross, Inc.
6. Petrology of the Metamorphic Rocks by Mason, R., 1981, George Allen and Unwin/Thomas Murby.
7. Introduction to Igneous and Metamorphic Petrology by Winter, J. D., 2001, Prentice Hall.

**Course Title Ore Deposits Geology (3CH)**

**Current Course Outline**:

Introductory definitions and discussions, classification of ore deposits, magmatic deposits, magmatic hydrothermal deposits, hydrothermal vein deposits, sedimentary hosted massive sulphide deposits, skarn type ore deposits, volcanogenic massive sulphide deposits, and ores formed by metamorphism.

Lab. Identification of ores in hand specimens. Ore microscopy Case studies of ore deposits of Pakistan.

**Course Aims and Objectives**

**Aims:**

The course is designed to impart knowledge to students regarding the geology of ore minerals, their origin, occurrence and identification for exploitation

**Objectives:**

1. To know geology and origin of the ore minerals
2. To know their occurrences and economic viability
3. To know lab techniques for the identification of ore minerals both metallic and non metallic

**Course Outcomes:**

The student will be able to identify geological, mineralogical, textural and ore minerals of the ore deposits. Students will also acquire basic knowledge on economic geology and the utilization of ore minerals for the betterment of the society.

**Reference Books/Materials:**

1. Ore Deposit Geology and its influence on mineral exploration by Richard Edwards and Keith Atkinson (1986), Chapman and Hall publisher
2. Ore Deposit Geology by John Ridley 7th Ed (2019), Cambridge University Press publisher
3. Ore Deposits: Origin, Exploration, and Exploitation by Sophie Decrée and Laurence Robb (2019), American Geophysical Union
4. Journal of Ore Geology Reviews
5. Journal of economic Geology

**Course Title Advanced Biostratigraphy (3 CH)**

**Course Outline:**

Index fossils, biozone and, index fossils of Pakistan, animal and plant fossils, stratigraphic distribution, age determination, correlation, sequence boundaries and their correlative conformities, application in establishing paleoecology and paleoenvironments, collection and extraction.

**Practical Work**

Characterization of physical parameters, material and methods, sampling techniques, section measurement, labelling and storing, cataloging and shelving, faunal preservation techniques, thin section preparation, treatments of planktons, microfossils extraction.

**Course Aims and Objectives:**

The course is aimed to provide students with a better understanding of one of the most valuable tools in stratigraphic and paleoenvironmental analyses. The course will introduce the major marine and non marine taxonomic groups used in biostratigraphic and paleoenvironmental studies and what we know about them – their stratigraphic range, modes of life, and environmental preferences. Case studies will be used to illustrate the application of microfossils to biostratigraphic and paleoenvironmental problems in preparation for research in biostratigraphy.

**Course Outcomes:**

At the end of this course, the students will be able to make a micro paleontological sampling in the field, to identify the major strata's containing microfossil groups and criteria for their recognition, and to understand their applications in paleobiology, paleoecology, paleogeography, paleoclimatology and paleo oceanography.

**Reference Books/Materials:**

1. Introduction to Marine Micropaleontology (Bilal U. Haq, Anne Boersma)
2. Biostratigraphy: microfossils and geological time by McGrowan, B., 2005, Cambridge University press, London.
3. Non marine Permian biostratigraphy and biochronology by Lucas, S.G., Cassinis, G. and Schneider, J.W., 2006, Geological Society of London, London.
4. Applied micropaleontology by Jenkins, D.J., 1993. Kluwer Academic publishers, Netherlands.
5. Recent developments in applied biostratigraphy by Powell, A. J. And Ridding, J. B., 2005. Geological Society of London and British Micropaleontological society, London.
6. Paleozoic vertebrate biostratigraphy and biogeography by Long, J.A., 1994. John JHopkins University Press, MD, USA.
7. Discover the mysterious world of fossils in close up their origin, formation and extraordinary variety by Taylor, P.D., 2000. D.K. Eyewitness Books.
8. Plankton stratigraphy by Bolli, H.M., Saunders, J.B. and Perch Neilsen, K., 1985. Cambridge University Press.

**Course Title** **Mineral Prospecting & Exploration (3 CH)**

**Course Outline:**

Mineral prospects and economic deposits, its types, Mineral exploration through to underground and open pit extraction and the processing and marketing of mining products. The environmental impact of mining and sustainable mining techniques are introduced, as well as monitoring and remediation techniques, target selection, deposit modeling, exploration technology, international exploration, environmental issues, program planning, proposal development. Geochemical prospecting methods, Development of primary and secondary haloes around ore deposits. Distribution of detrital material and solutions by streams, glaciers, etc. Dispersion of trace metals from mineral deposits and their discovery. Principles and application of primary dispersion to the search for metallic mineral deposits. Secondary dispersion processes (mechanical and chemical) applied to the search for metalliferous mineral deposits. Field methods of analysis for trace amount of metals. Labs consists of analysis and statistical interpretation of data from soils, stream sediments, vegetation, and rock in connection with field problems. Individual special investigations of a laboratory or field problem in exploration geochemistry. The mineralogy of economic deposits. Mineral deposit geology and models. Mineral exploration data and evaluation techniques.

**Course Aims and Objectives**

**Aims:**

The course aim is to train students to discover and exploit economically viable mineral deposits that can benefit the country.

**Objectives:**

1. To impart knowledge about economic geology in terms of prospecting and exploration of minerals and familiarize them with the geological processes responsible for mineralization.
2. To impart knowledge for understanding different field and laboratory techniques required for mapping, prospecting and analysis.
3. To train the students for the identification of metallic and industrial minerals and to prepare projects.

**Course Outcomes:**

The course is designed to impart practical knowledge to the students to understand the basics of economic geology in terms of acquiring knowledge in the fields of ore and industrial minerals. They will know how to explore economically viable ore resources and how to prepare development projects. They will also study some case studies related to important mega mines. Their ultimate aim will be to discover and exploit economically viable mineral deposits to the benefit of society.

**Reference Books/Materials:**

1. Introduction to mineral exploration Edited by Charles J. Moon, Michael E.G. Whateley and Anthony M. Evans (2012), Blackwell publisher
2. Mineral Exploration, 2nd Edition Principles and Applications by Swapan Haldar (2018), Elsevier publisher
3. Mineral Deposit Evaluation A Practical Approach by Alwyn E. Annels (1991), Chapman & Hall Publisher.
4. An introduction to economic geology and its environmental impact by Anthony M. Evans (1997), Wiley Blackwell publisher
5. Gems and Gemology in Pakistan by Tahseenullah Khan and Allah Bakhsh Kausar (2010), Geological Survey of Pakistan
6. Journal of Economic Geology
7. Research papers on economic geology

**Course Title** **Engineering Geophysics (3 CH)**

**Course Outline:**

Introduction to Geophysical and engineering tools used for underground analysis, Relevant physical properties of rocks and soil; Seismic reflection, Optimum window and optimum offset techniques; Identifying environmental and engineering problems as well as geophysical technique; Field procedure, techniques, and instrumentation; Data correction and interpretation; Seismic refraction, Interpretation techniques such as GRM and others; Electrical Images, 2D Resistivity Modelling; Finite difference method; 2D electrical imaging exploration and multi electrodes, Electromagnetic methods (Slingram, VLF, TEM), Georadar, Radiometry and well logging, Data collection and interpretation; Introduction to 3D electrical imaging; Relevant topics such as GPR and others; Field examples for environmental, engineering and hydrogeology; Latest research articles related the subject will be discussed in class.

**Course Aims and Objectives:**

The students should understand to expose you to the geophysical methods that geologists and geophysicist use to examine several different geological and environmental problems. Furthermore, it is expected to perform field examples processing and interpretation for environmental, engineering and hydrogeology. The students should understand the relevant physical properties of rocks and soil. The students should able to perform simple geophysical computations and data interpretation. Furthermore, it is expected that they should know how to do geological interpretations based on geophysical data.

**Course Outcomes**:

1. The students will be able to understand how geophysics data is used to map the near surface geological conditions and fields examples interpretations.
2. The students will be able to understand the main relevant physical properties of rocks and soil.
3. The students will be able to perform simple geophysical computations and data interpretation. Furthermore, it is expected that they should know how to do geological interpretations based on geophysical data.

**Reference Books/Materials:**

1. Philip Kearey, Michael Brooks, Ian Hill: An Introduction to Geophysical Exploration, Wiley Blackwell, 2002.
2. Dorbin, M. B. and Savit, C. H.: Introduction to Geophysical Prospecting (4th edition), McGraw Hill, 1998.
3. Telford, W. M., Geldart, L. P. and Sheriff, R. E.: Applied Geophysics (2nd edition), Cambridge University Press, 1990.
4. Reynolds, J. M.: An Introduction to Applied and Environmental Geophysics, Wiley, 1998.

**Course Title** **Machine Learning in Geoscience (3 CH)**

**Course Outline:**

Introduction and Inference in Geosciences (In verse Method, Geostatistics, NN), Introduction to python, Big Data Analytics and ML Overview, Python libraries, Optimization methods and Sampling Introduction to Machine Learning; Types, Supervised, Unsupervised; Model Representation; Cost Function; Supervised learning, Generative/discriminative learning, parametric/nonparametric learning, neural networks, and support vector machines; Gradient Descent; Gradient descent for Linear Regressions; Clustering, dimensionality reduction, kernel methods; Machine learning for seismic interpretation, fault extraction, horizon mapping, surface generation, facies analysis through supervised and unsupervised methods.

**Course Aims and Objectives:**

Machine Learning has made a huge impact on helping operating companies improve operational efficiency, eliminate unplanned downtime, improve safety, and overall reduce costs. Based on fundamental knowledge of computer science principles and skills, probability and statistics theory, and the theory and application of linear algebra. This course provides a broad introduction to machine learning and statistical pattern recognition.

**Course Outcomes:**

1. Students will have an understanding about applications of machine learning, such as to robotic control, data mining
2. How machine learning will help in understanding complex geophysical processes.
3. How to extract geophysical properties through machine learning

**Reference Books/Materials:**

1. Moseley, B., and Krischer, L., 2020, Machine Learning and Artificial Intelligence in Geosciences, Elsevier Science.
2. Langer, H., Falsaperla, S., and Hammer, C., 2019, Advantages and Pitfalls of Pattern Recognition: Selected Cases in Geophysics, Elsevier Science.
3. Misra, S., Li, H., and He, J., 2019, Machine Learning for Subsurface Characterization, Elsevier Science.
4. Alexej Gvishiani, Jacques O. Dubois., 2013, Artificial Intelligence and Dynamic Systems for Geophysical Applications, Springer Science & Business Media,

**Course Title Applications of Geostatistics in Geoscience (3 CH)**

**Course Outline:**

fundamental concepts and algorithms for geostatistical modelling and demonstration of application in the geosciences and spatial distribution, Geostatistical simulation and simple interpolation difference, Introduction to Geostatistics; Computer application in geo statistics; Collection and editing of data, primary data and secondary data; Measures of central tendency or averages, types of averages, arithmetic mean, median, mode, empirical relation between mean, median and mode; Relative merits and demerits of various averages; Measures of dispersion range, semi interquartile range or quartile deviation, mean deviation, standard deviation, skewness; Correlation and simple regression, coefficient of correlation, scatter diagram, rank correlation, regression; Geo statistical analysis, variogram calculation, interpretation, linking variogram behaviour with physical causes (geology, sampling); Extension variances and estimation variances/simple calculations in one and two dimensions; Global reserve/resource estimation; Optimal estimation and introduction to kriging.

**Course Aims and Objectives:**

This unit is designed to provide students with an introduction to the geostatistical techniques used in estimation from spatial data. Applications will be mainly in the areas of mining, petroleum, soil science and environmental management.

**Course Outcomes:**

On successful completion of this course, students will be:

1. Apply the concepts of spatial variability to geological, geomechanical and/or environmental variables,
2. Calculate variograms for simple one and two dimensional data sets
3. Assemble models to experimental variograms and interpret model parameters and Evaluate simple calculations of estimation variances
4. Formulate and solve kriging equations

**Reference Books/Materials:**

1. Hohn, M. (2013). Geostatistics and petroleum geology. Springer Science & Business Media.
2. Wackernagel, H. (2013). Multivariate geostatistics: an introduction with applications. Springer Science & Business Media.
3. Chilès, J. P., & Delfiner, P. (2012). Geostatistics: Modeling Spatial Uncertainty. Wiley Publishing.
4. Armstrong, M. (2012). Basic Linear Geostatistics. Springer Science & Business Media.

**Course Title Reservoir Geomechanics (3 CH)**

**Course Outline:**

Basic stress and strain analysis; pore pressure and in situ stress estimation and measurement; deformation mechanisms in rock; rock fracture description and analysis; wellbore stresses and failure; wellbore stability analysis; fault classification and stability analysis; depletion induced reservoir deformation; and hydraulic fracturing. Emphasis on applications to petroleum engineering. Structural Geology,Stress and strain analysis; Tectonic stress, Review of Earth Stresses; Stresses in various types of basins; Determining initial stress conditions in typical reservoir cases; Mechanical Behavior of Reservoir Rocks, Diagenetic processes in reservoir rocks; Transport Properties of Reservoir Rocks; Thermal conductivity and expansion properties of rocks and minerals; Effect of high temperatures on clay minerals and hydrous minerals; Permeability vs. effective stresses in porous media; Fractured media. Pore Pressure Prediction.

**Course Aims and Objectives:**

This course is interdisciplinary and encompasses the different geological and geophysical disciplines including fields of rock mechanics and structural geology. Also deals with the geomechanical problems that arise during the exploitation of oil and gas reservoirs. This course will also cover Pore pressure, estimation of hydrocarbon column heights, determination of optimally stable well trajectories, casing set points and mud weights, changes in reservoir performance during depletion, and production induced faulting and subsidence.

**Course Outcomes:**

1. Relevancy of Geomechanics throughout the reservoir life cycle

2. Applications of the principles of geomechanics to solve real world problems and reduce risk
3. How to be proactive instead of reactive towards geomechanical issues.

**Reference Books/Materials:**

1. Zoback, M.D., 2010. Reservoir geomechanics. Cambridge University Press.

2. Zoback, M.D. and Kohli, A.H., 2019. Unconventional reservoir geomechanics. Cambridge University Press.
3. Zhang, J.J., 2019. Applied Petroleum Geomechanics. Gulf Professional Publishing.
4. Nauroy, J.F., 2011. Geomechanics applied to the petroleum industry. Editions Technip.

**Course Title Unconventional Energy Resources (3 CH)**

**Course Outline:**

energy resources (solar, wind, thermal, water, conventional and unconventional hydrocarbon) and their role in modern society, with both national and global perspectives in multiple fields of applied sciences. The present and future impacts of nuclear and fossil fuels on the environment will be explored. Energy technologies and use of solar, wind, hydro, biomass and fossil fuel energy resources will be introduced, and the relationship between public policy and resource usage will be discussed.

**Course Aims and Objectives:**

The course is designed to expose attendees to the understanding and application of the latest approaches, techniques and requirements being applied to reserves evaluation within unconventional resources. Focus is given to actions and methodologies that are necessary to enhance the reserve categorization. The course is designed to expose attendees to the understanding improvements in techniques such as horizontal drilling and hydraulic fracturing have increased access to unconventional hydrocarbon resources, ushering in the “shale boom” alternate energy resources and disrupting the energy sector.

**Course Outcomes:**

1. At the end of the course, the student should be able to recall the relative energy content per mass of various fuels, and the relative energy efficiency of the most common heat engines.
2. After completion of this course, the student should be able to:
3. Describe the most important energy sources in use today in Norway and worldwide, including the sources, extraction, transport and use of these resources.
4. Calculate the energy content of various energy resources and compare the values available from different sources.
5. Explain the relationship between absorption, emission and the greenhouse effect.
6. Explain and employ the computer models used for characterizing population growth and resource usage.

7.The students should know and understand the methods for production of viscous oil and the methods for recovery of gas from rocks with very low permeability.

**Reference Books/Materials:**

1. Arthur, M.A. and Cole, D.R., 2014. Unconventional hydrocarbon resources: prospects and problems. Elements, 10(4), pp.257 264.

2. Reza Barati, Mustafa M. Alhubail. 2020. Unconventional Hydrocarbon Resources: Techniques
3. Reservoir Engineering Analysis ISBN: 978 1 119 42032 3 American Geophysical Union

**Course Title** **Practical Technology Use in Geoscience**

**Course Outline:**

Introduction to software used in different industry. How to create and manage a project including establishing project boundaries, choosing an X/Y projection. the use of authors, CRS and its types. Culture (geographic layer) input: creating and entering culture data on the base map including formatted and unformatted data entry and the importing of ESRI shape files. Well data input: using file sources such as HIS Energy and ascii formatted data; loading of well locations, deviation surveys, formation tops, log curves, and local and shared Time Depth information. Using the SEG Y Viewer to examine 2D and 3D trace header data. 2D and 3D data loading from files and the use of Share/Copy feature for seismic data. Introduction Review basic concepts: Waves; Wavelet; Seismic sections 2D vs. 3D; Seismic display, slice, 2D and 3D view, Volume concept, Slicing the data volume, Dynamic range and data loading, Polarity and colour Character and zero phase, Colour principles, Interpretative value of colour, Interpretation procedure/workflow, Synesthetic seismogram, Structural interpretation, Fault recognition and mapping, Horizon mapping and procedures, Visualization and auto tracking. Direct contouring and the importance of the strike perspective, Maps and its types. Depth conversion and procedures. Composite displays. Advantage and disadvantages of different displays, Subtle structural features. Stratigraphic interpretation. Seismic facies analysis. Geological softwares like move, basin mod for basin inversion analysis, corel draw, autocad
Small project based on available data.

**Course Aims and Objectives:**

1. Course will help the students to use different software.
2. This course provides a broad introduction and application of datasets used for G and G industry.

3. Course will help to give awareness t the student to get familiar with state of the art technology used by different industries in the world.

**Course Outcomes:**

The following outcomes will achieve from the course.

1. Students get awareness about different applications of softwares used for seismic and well data interpretation.
2. Students will understand about usage of different software.
3. Students learn about different data formats used to create projects.
4. Graduate can work more scientific way to perform their research.

**Reference Books/Materials:**

1. Bacon, M., Simm, R., and Redshaw, T., 2007, 3 D Seismic Interpretation, Cambridge University Press.
2. Herron, D. A., and Latimer, R. B., 2011, First Steps in Seismic Interpretation, Society of Exploration Geophysicists.

3. Brown, A. R., Geologists, A. A. P., and Geophysicists, S. E., 2011, Interpretation of Three Dimensional Seismic Data, Seventh Edition: AAPG Memoir 42, 7th Edition/SEG Investigation in Geophysics, No. 9, Published jointly by American Association of Petroleum Geologists and the Society of Exploration Geophysicists.

**Course Title Coal Geology**

**Course Outline:**

Introduction, Coalification, Coal types, Tectonic Setting of Coal Basins, Coal bearing Cycles & paleoenvironments, Geology of coal, Coal field exploration, Coal in relation to Delta type, Fluvial Coals, Environmental impact of coal mining, Coal resource estimates, General coal Depositional Model.

Lab: Petrography of coal and associated rocks. Preparation a coal pellets. Petrographic methods of coal analysis. Specified assignments/projects.

**Course Aims and Objectives:**

The course begins with a review of the global coal and coal seam gas industry, and the likely future directions based on the current project pipeline and demand scenarios. The details of coal geology, how it's formed, stratigraphy, the chemistry of coal, understanding reservoirs, groundwater and the different types of coal beds around world. How to assess a coal basin play and then evaluate one and the difference between mining and gas plays. Variability in the subsurface and the relationships between groundwater, Finally, underground coal gasification, sequestration and storage, along with issues with overlapping tenures and other techniques.

**Course Outcomes:**

The expected outcomes of course are to explain how coal is formed, to explain how coal is found and extracted by either surface or underground mines, to discuss how geological problems and environmental issues surrounding extraction affect mining and to explain the reasons for the decline in the coal industry.

**Reference Books/Materials:**

1) Hydrocarbons from Coal (AAPG Studies in Geology)" by B E Law
2) "Coal and Coal bearing Strata: Recent Advances" by Scott A C
3) "Coal Geology" by Thomas and Larry
4) "Coal Geology" by WARD

**Course Title Climate Crisis Adaption and Mitigation**

Course Outline:

Climate science, Natural and Anthropogenic causes of climate crisis, Role of atmospheric and ocean circulation in climate regulation, Present rapid warming, Projection of future climate change, Uncertainty in climate change projections Climate Change Policy, Impacts of Climate Change in Pakistan, Green Economy, Carbon Footprint, Carbon capture and storage, Technological Development and Changing climate, Climate Change matters, , Climate change mitigation in developing countries, climate and human rights, societal systems, Social attitudes to climate change: Adaptation, Mitigation options: increased energy efficiency, fuel substitution, nuclear power, hydropower, solar energy, wind power, biomass energy, tidal, wave and geothermal energy, hydrogen economy, changes in infrastructure and behavior.

Course Aims and Objectives:

The objective of this course is to provide a wide ranging understanding on the impacts of climate change on society, understanding of adaptation and mitigation options in relation to climate change.

Course Outcomes:

Students will be able to learn the various mitigation and adaptation measures for climate change problem.

Reference Books/Materials:

1) William James Burroughs (2017) Climate change: A Multidisciplinary Approach, Cambridge University Press, Cambridge, UK.

2) Sharon L. Spray, Karen Leah McGlothlin, (2012) Global climate change, Rowman& Littlefield, Maryland, USA

3) Horace M. Karling, (2010) Global climate change, Nova Publishers, New York, USA

**Course Title Disaster Management**

Course Outline:

Natural hazards and disasters: The need for hazard and disaster studies, Historical background on Hazard and Disaster research; Disaster types: Natural vs anthropogenic; Flooding, Earthquake Landslide; Natural cycles and their role, Prediction; Hazards, Risk and Vulnerability: Definitions and characterization, Different approaches and Indicators; Factors of vulnerability: Demographic factors, Mapping of disaster prone areas, Socio economic factors, Cultural factors, Political factors, Physical factors; The impact of natural disasters: Direct and short term impact of disasters, Indirect and long term consequences of catastrophes, Disaster as an opportunity for development; Disaster Management: Components of management, International phenomenon; Hazard and vulnerability reduction and Mitigation: hard and soft measures; Earthquake Management, Flood Management: Organizational Role; Role of Government and Non Governmental Organizations (NGOs); International phenomenon, Role of Media in Disaster Management; Techniques and methods to assess hazard, vulnerability and risk: Qualitative and Quantitative approaches

**Course Aims and Objectives:**

This course will provide know how in dealing with natural calamities and their management by encompassing the field of hazard and disaster studies. It discusses a wide range of aspects, i.e., assessment of factors which put societies in vulnerable situations to the disaster management continuum. To underline the importance of disasters in socio economic development, this course also aims to make an assessment of the consequences of ‘natural’ catastrophic at both short and long terms. It finally tends to provide the students with basic knowledge on hazard reduction and vulnerability mitigation.

Course Outcomes:

Students will be able to learn the assessment of the consequences of ‘natural’ catastrophic at both short and long terms and in depth knowledge on hazard reduction and vulnerability mitigation.

Reference Books/Materials:

1. Natural Disasters Alexander, D., Chapman & Hall, New York.

2. Rising from the Ashes: Development Strategies in Time of Disaster Anderson, M.B., and Woodrow, P.J, Westview Press, Boulder, UNESCO, Paris.

3. The Environment as Hazard Burton I., Kates, R.W., and White G.F., 2nd Edition, The Guilford Press, New York.

4. Disaster Management: A Disaster Manager's Handbook Carter N.W., ADB, Manila.

**Course Title Environmental Impact Assessment**

Course Outline:

Introduction: principles, concepts and purposes of IEE and EIA and its significance for the society. Cost and benefits of EIA. Main stages in EIA process. Public consultation and participation in EIA process. Methods and techniques for impact prediction and evaluation. Life cycle assessment, Periodic evaluation. EIA review and post project analysis. EIA process management. Role of quality assurance and quality control in environmental analysis. EIA Regulations and guidelines in Pakistan.

**Course Aims and Objectives**:

The aim of this course is to enable the participants to build their capacity to integrate environmental concerns in project proposals.

Course Outcomes:

Students will be able to learn the principles, skills, procedures and practices of integrating environment in development through EIA; become aware of the legal and regulatory obligations of integrating environment in development projects; will familiarize with the techniques of getting public participation and integrate socio economic aspects in development projects.

Reference Books/Materials:

1) Environmental Impact Assessment Handbook for Pakistan, Fischer, T.S. (ed.), 2014, Liverpool University Press, UK

2) Introduction to Environmental Impact Assessment, Glasson, J., Therivel, R., and Chadwick, A., Routledge, London, 2005.

3) EIA Manual: Training Resource Manual, Sadler, B., & McCabe, M., (ed.),2nd Edition, United Nations Environment Programme, 2002.

4) Environmental Impact Assessment in Practice, Harrop, D.O. & Nixon, .A., National Book Foundation, Islamabad, 2000.

**Course Title Geophysical Exploration Techniques**

**Course Outline:**

An introduction to the physics of the earth. Theory and application of basic geophysical field techniques including, gravity, magnetic, electrical, electromagnetic, GPS, seismic studies, and satellite remote sensing. The present internal structure and dynamics of the earth and constraints from the gravitational and magnetic fields, seismology, mineral phases and wave propagation in earth materials. The earthquake source in terms of seismic and geodetic signals. Contributions of heat flow, gravity, paleomagnetic, and earthquake mechanism data to plate tectonics, the driving mechanism of plate tectonics, and the energy sources of mantle convection.

Application of the basic principles of physics to the earth sciences, including mechanics of rotating bodies, the two body problem, tidal theory, oscillations and normal modes, diffusion and heat transfer, wave propagation, electro and magneto statics.

**Course Aims and Objectives:**

This course will introduce a series of geological and geophysical techniques that can be applied to determine the physical characteristics of the Earth's lithosphere, with direct application to the detection and mapping of mineral and energy resources in three dimensions. The course will be divided into modules covering geophysical exploration techniques commonly used in minerals and energy exploration, (gravity, magnetic, electrical, electro magnetic and seismic surveys). Theoretical basis of each technique will be studied, the methods of data collection, presentation and analysis, and appropriate, geologically constrained, interpretation of the data. Students will explore an industry style data base and softwares with the aim of developing an exploration and targeting model for hydrocarbon resources.

**Course Outcomes:**

The anticipated knowledge, skills and/or attitude to be developed by the student are: Demonstrated proficiency in common practical skills in resource exploration, The scientific basis of mineral, energy and natural resource exploration, he generic characteristics of economic mineral and energy resources – geological, geophysical and geochemical anomalism, The geophysical techniques (seismic, gravity, magnetic, electrical and electro magnetics), The geochemical techniques (sampling media, sampling strategies, analytical techniques), Field based data collection – sampling strategies, Demonstrated understanding of the importance of data quality – collection, analysis, processes techniques

**Reference Books/Materials:**

1) Geophysical Exploration Technology by Ming li
2) Developments in Geophysical Exploration Methods by Fitch
3) An Introduction to Geophysical Exploration by Robert H. Tatham

**Course Title Environmental Geophysics**

Course Outline:

Importance of geophysics in environmental studies, geological and geophysical characteristics of some environmental problems; Landslides, cavities and sinkholes, groundwater pollution, dam problems, different geophysical techniques and field applications. Fixed and mobile hazards. Applications in contaminant plumes, conduits, fractures, voids, aquifers. buried containers, waste pits, ordnance, landfill delineation. Use of seismic methods, ground penetration radar, electromagnetic methods, tomography and other geophysical methods to environmental problems.

**Course Aims and Objectives:**

Geophysical exploration methods are fundamental tools in the search for mineral resources but are also used widely in engineering, archaeology and in earth and environmental sciences to explore and image the shallow subsurface (< 200 m depth). A wide range of geophysical methods are now used routinely in the search for buried archaeological sites, characterization of groundwater resources, geological imaging of subsurface structures and stratigraphic studies.

**Course Outcomes:**

Introduces geophysical exploration methods with emphasis on techniques used to investigate the near surface (< 200 m depth). These methods include seismic reflection/refraction, ground penetrating radar, electromagnetic, resistivity, gravity and magnetic methods. For each method, we will examine the underlying physical principles, the practical aspects of field data acquisition and signal processing and interpretation

**Reference Books/Materials:**


1) Mussett, A.E. and Khan, M.A., Looking into the Earth: An Introduction to Geological Geophysics, Cambridge University Press, 2000.
2) Kearey, P., Brooks, M., Hill I., An Introduction to Geophysical Exploration, Blackwell, 2002.
3) Reynolds, J.M., An Introduction to Applied and Environmental Geophysics, Wiley, 2011.
4) Lay, T. and Wallance, T.C., Modern Global Seismology, Academic Press, 1995.
5) Sheriff R., and Geldart L., Exploration Seismology, Cambridge University Press, 1995.
6) Sheehan, H.R., Jones, A.F., and Burger C.H., Introduction to Applied Geophysics: Exploring the Shallow Subsurface, W. W. Norton & Company, 2006.


**Course Title** **Advanced Petroleum System Analysis**

Course Outline:

Hydrocarbons in a global context; the philosophy and structure of the oil industry; energy trends, petroleum environment: source rocks, reservoirs, traps, seals and the timing of generation relative to trap formation, basic stratigraphic principles as they relate to correlation, the importance of establishing markers and datum lines, the use of macro and micro fossils in chronostratigraphy, correlation of well logs, production of structural maps, construction of net and gross reservoir maps, cross sections and reserve calculations, mapping faults, pinch outs and sub crops, play and Field examples from around the world, reserves and risk, use of modern seismic and new technology, petroleum System and play fairway analysis, prospect evaluation, petroleum basins of Pakistan, case history.

**Course Outcomes:**

- On completion of the course, students are expected to get a good knowledge of key concepts regarding,
- Hydrocarbon habitat and exploration approaches
- Petroleum Play and its components; Organic matter deposition, Hydrocarbon generation, migration, distribution and preservation in a petroleum basin. Reservoir types and their properties
- Types, usage and display of subsurface geological data and the limits on the reliability of such data
- Description and evaluation of relatively simple subsurface datasets from wells and evaluate these data to conduct a geological evaluation of a field and undertake a reserves calculation

**Reference Books/Materials:**


1) Petroleum Geology by F.K. North
2) Petroleum Geology Manual by Baker Hughes INTEQ
3) Petroleum Geology by R.E. Chapman
4) Petroleum Geology of Pakistan by Iqbal B. Qadri
5) Petroleum Geosciences by Knut Bjorlykke

6) Startigraphy of Pakistan by Syed Ibrahim Shah.

**Course Title** **Global Tectonics (3 CH)**

**Course Outline:**

Overview of plate tectonics, geological techniques in tectonics, principal tectonic features of the earth, divergent margins and rifting, transform faults, strike slip faults and related fracture zones, convergent margins, tectonics and geology of selected triple junctions, collision orogenesis, anatomy of orogenic belts, the external thrust complex, foreland fold and thrust belts, the crystalline core zone, underplating, uplift and exhumation, nappe formation, back folding/thrusting and rotation, tectonics and metamorphism, neotectonics, case studies of orogenic belts.

**Course Aims and Objectives**

The course presents a broader global view of plate tectonics processes, including plate kinematics, the nature of plate boundaries, the forces responsible for those processes and the implications of plate tectonics. It will develop a concept of current global geography in the context of global tectonic processes.

**Course Outcomes:**

- To acquire Knowledge about plate tectonics that control large scale structures of the Earth.
- To understand the causes and impact of natural calamities such as earthquakes, tsunamis, land sliding and climate change and their mitigation
- To understand geotectonic framework of Pakistan

**Reference Books/Materials:**

1) Global Tectonics 3rd Edition by Philip Kearey, Keith A. Klepeis, Frederick J. Vine (2009), Wiley Blackwell publisher
2) Geology and tectonics of Pakistan by Kazmi and Jan (1997)
3) Plate Tectonics: How it works by A. Cox and R.B. Hart (1991), Wiley Blackwell publisher
4) Regional Geology and Tectonics by Nicola Scarselli, Jurgen Adam et al (2020), Elsevier Science publisher
5) Research papers related to global tectonics
6) Tectonics by Moores, E.M. and Twiss, R.J., 1995. Freeman and Company, New York.
7) Structural geology of rocks and regions by Davis, G.H. and Reynolds, S.J., 1996. 2nd Edition, John Wiley and Sons, Inc, New York.
8) Structural geology by Twiss, R.J. and Moores, E.M., 2007. 2nd Edition, Freeman and Company, New York.
9) Global Tectonics by Keary, P. and Wine, F., 1990. Blackwell Scientific Publications, London

**Course Title** **Petrophysical Analysis (3 CH)**

**Course Outline:**

Introduction to well logs and Petrophysics; Basic Wireline logging methods (electrical, radioactive, nuclear, acoustic and mechanical logs) and logging procedures; Application and use of open hole and cased hole logs for evaluating/estimating the Petrophysical properties of reservoir; Qualitative and Quantitative interpretation of well logs (lithology identification, shale content, porosities measurement fluid saturation, permeability, identification of pay intervals, well correlation based on the log characters/signatures and determination of lateral variations of Petrophysical parameters using well correlation etc.); Identification of Facies and evaluation of Depositional environments using wireline logs; Application of image logs and their analysis; Application of conventional logs in evaluation of unconventional reservoirs (Tight & Self Contained/shale reservoirs); Application of core analysis and its integration in Petrophysical analysis; Software based quick look Petrophysical interpretation in Geographix/Tecklog/Vizdom solutions VGS.

**Course Aims and Objectives**:

The aim of this course is to convey conceptual understanding of wireline logging techniques, logging procedures under certain well bore conditions/environments. This course will also communicate practical evaluation of these mentioned logs for the measurement/estimation of petrophysical evaluation of reservoir rocks for further testing and completion.

**Course Outcomes**:

- Familiarize with key concepts of the wireline logging techniques and their applications.
- Identify the factors affecting the log quality and their remedial measures.
- Able to describe the behavior of different curves on different wireline logs regarding rock characteristics
- Use of key concepts about the interpretation of different wireline logs to evaluate the lithology, depositional environments and hydrocarbon availability & its quantification.

Reference Books/Materials:

1) The Geological Interpretation of well logs by Malcolm Rider, edition II, 2002
2) Basic Well Log analysis for Geologist by George Asquith & Charls Gibson
3) Log Interpretation Principles/Applications by Schlumberger 1991

**Course Title Applications of GIS in Geosciences (3 CH)**

Course Outline:

Introduction to the GIS; Data exploration and preparation for GIS studies; Uses of GIS in hydrocarbon exploration, and in geological studies; Spatial Interpolation; GIS in flood management; Terrain Processing; GIS for watershed delineation; Geospatial Analysis, field development and planning; Analyzing Surfaces, spatial analysis for creating contours, hillshades and calculating viewshed; Map Algebra, working with NoData values, doing conditional processing, and merging multiple Rasters together.

Course Aims and Objectives:

The main focus of this course is to develop understanding of advanced concepts and techniques used in modeling geographic reality and analysis of geo data. Educate students to explore issues, problem solve, and evaluate situations in a spatial context. It is focused to develop students' GIS and spatial analysis skills, allowing them to become independent learners able to solve complex spatial problems

**Course Outcomes:**

Students will acquire the advanced knowledge of GIS and will use GIS to:

- Explore mapped data and Relate GIS with remote sensing technologies
- Analyze spatial data and perform spatial analysis, using GIS analysis tools and develop and manage geodatabases
- Create maps, images and apps to communicate spatial data in a meaningful way to others
- Reference Books/Materials:

1. Introduction to GIS and Remote sensing by Kang tsung Chang , 9th edition
2. Campbell, J. B., & Wynne, R. H. (2011). Introduction to Remote Sensing. Guilford Press.
3. Geographic Information Systems and Science, Longley, P., Goodchild et al, 2005, Wiley.

**Course Title Sedimentary Petrology (3 CH)**

Course Outline:

Classification of sedimentary rocks on the basis of textures, classification criteria, texture and fabric, petrography of common clastic rocks, grains classification, matrix textural maturity, recognition of cements and its types, sedimentary rock forming minerals, their fabric and modal analysis, compositional and textural classification systems of chemically precipitated rocks, petrography of carbonate rocks, chert, phosphatic and glauconitic rocks, ironstone, evaporites, organic rocks: coal and lignite, volcaniclastic and zeolitic sedimentary rocks, soils & mudrocks.

**Course Aims and Objectives:**

The course will help in enhancing the concept of facies and the connection between tectonics and deposition. The students will be able to discuss the processes acting, and the resulting facies and facies associations in modern depositional environments. Further, they will learn how facies and facies associations can be used in the interpretation of ancient deposits from all continental and marine environments will be examined.

**Course Outcomes:**

- Describe and interpret sediments from all sedimentary environments.
- Locate, synthesize and interpret data, information and observations on marine sedimentary successions at an advanced level.
- Apply knowledge and appropriate techniques, including those associated with fieldwork, to interpret the geological importance of marine and terrestrial sedimentary populations at an advanced level.

**Reference Books/Materials:**

1) Lindholm, R. (2012). A practical approach to sedimentology. Springer Science & Business Media.

2) Potter, P. E., Maynard, J. B., & Pryor, W. A. (2012). Sedimentology of shale: study guide and reference source. Springer Science & Business Media.

3) Perry, C., & Taylor, K. (Eds.). (2009). Environmental sedimentology. John Wiley & Sons.

4) Nichols, G. (2009). Sedimentology and stratigraphy. John Wiley & Sons

**Course Title** **Stratigraphic Analysis and Petroleum Prospects (3 CH)**

**Course Outline:**

Introduction to Stratigraphy and Facies analysis; Lithostratigraphy; Biostratigraphy; Controls of sedimentary environments on the development of hydrocarbon and coal resources; Sedimentary basins; Potential source rocks, Potential reservoir rocks; Trapping mechanism in different sedimentary basins of Pakistan; Unconventional hydrocarbon prospects; Review of case histories for Conventional and Unconventional hydrocarbon prospects of Pakistan; Brief review of Stratigraphy of Pakistan

**Course Aims and Objectives:**

To provide theoretical knowledge to the student and practical application of the subject in the industry. Main focus of the course is on the development of hydrocarbon resources in different depositional environments. Introduce the students with the Petroleum Prospects of Pakistan including Conventional and Unconventional.

**Course Outcomes:**

- Be able to apply this understanding to the description of sedimentary rocks in order to deduce depositional processes and environments.
- To produce better useful petroleum stratigrapher working hand in the field and able to work in the industry.
- Apply this understanding for the analysis of the petroleum prospects in the subsurface using geophysical **data.**

**Reference Books/Materials:**

1) Stratigraphy of Pakistan, By Shah, S. M. I., 2009. Geological Survey of Pakistan. Memoir, Vol. 22.
2) Stratigraphy and Historical Geology of Pakistan by Kazmi, A. H. and Abbasi, I. A., 2008, Graphic Publishers, Karachi, Pakistan.

**Course Title** **Basin Analysis (3CH)**

**Course Outline:**

The foundation of sedimentary basins: basin in their plate tectonic environment, lithospheric mechanics, the mechanics of sedimentary basin formation: basin due to lithospheric stretching, basin due to flexure, basin associated with strike slip deformation, the sedimentary basin fill, control on basin stratigraphy: depositional style, evolution of the basin fill: subsidence history, thermal history, application to petroleum play assessment: the petroleum play, quatification of undiscovered potential.

**Course Aims and Objectives:**

This course will deal with the concrete theoretical foundation building regarding basin studies along with Practical approach to learn about different basins and their formation processes, depositional patterns and filling of basin with sediments.

**Course Outcomes:**

After studying the course students will be able to

- To fully understand and get equipped with regional petroleum play assessment of basins along with its theoretical background.
- To give a quantitative as well as qualitative fundament for analyzing sedimentary basins, particularly from seismic data
- To integrate the data set to develop static and dynamic basin models

**Reference Books/Materials:**

1) Basin Analysis: Principles and Application to Petroleum Play Assessment, 3rd Edition by Philip A. Allen, John R. Allen, 2013
2) Physical Principles of Sedimentary Basin Analysis, by Magnus Wangen, 2010
3) AAPG memoir 60: The petroleum system from source to trap by Leslie b. Morgan and Wallace G Dow
4) Seismic stratigraphy, basin analysis and reservoir characterizations by p. C. Veeken

**Course Title** **Drilling Operations and Well Site Geology (3 CH)**

**Course Outline:**

Well Planning and its pre requisites; Drilling of a well (Vertical & Directional); Drilling Rig Types; Components of a drilling Rig and their Operation (Derrick/Mast, Sub structure, Hoisting, Rotary, Circulatory, Well Control, Bits etc.); Introduction to Drilling Fluids, Their Types & Selection; Casing, Casing Design and casing /cementing operation; Coring, its requirement, Types & Operation; Fishing; Mud Logging and its benefits; Lag Time Calculation; Drill Return (Cuttings) collection/ Sampling; Master Log and recorded parameters with their interpretation; Visual and microscopic analysis of cuttings at well site for lithological identification, porosity measurement, fluorescence/oil shows and formation tops; Chromatographic Analysis and interpretation of Gas Shows; Wireline logging Operations and their quality control; Measurement while drilling and its utilization; Well Testing (DST, MDT etc.); Perforation & Completion of a successfully tested well.

**Course Aims and Objectives:**

This course describes the complete package of well site operations required for a well site geologist to interpret/evaluate drilling as well as mud logging parameters with a very effective & practical approach.

**Course Outcomes:**

On completion of the course, students are expected to:

- Familiarize with key concepts of Well Planning and its drilling according to the analysed, estimated and prognosed parameters.
- Have basic knowledge about drilling fluid, its system and selection as per prognosed drilling as well as formation / reservoir pressure parameters.
- Monitoring & Quality control of all well site operations, their outcomes, issues with them and their possible solutions.
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**Reference Books/Materials:**

1) The Wellsite Guide (An Introduction to Wellsite Geological Operations) by Bernhard W. Seubert

2) Wellsite Geology (Reference Guide) by Baker Hughes INTEQ
3) The Online Mud Logging Handbook by Alun Whittaker
4) Properties of Petroleum Fluids (2nd Edition) by W.D. McCain
5) Field Methods for Petroleum Geologists by Fakhry A. Assaad
6) Introduction To Oil Well Drilling (International Edition) by Natraj Vaddadi
7) Oilwell Drilling Engineering: Principles and Practice by H.Rabia
8) Working Guide to Drilling Equipment and Operations by William Lyons

**Course Title Groundwater development and management (3 CH)**

**Course Outline:**

Introduction of ground water resources: Global perspectives Occurrence of ground water Geological factors governing the occurrence of ground water Hydraulics of ground water Aquifers and their types and important terms related to ground water Governing equation of ground water flow in aquifers Geophysical methods in ground water exploration Open wells or dug wells Tubewells Yield of wells and tubewells by Thiem's and Dupuit's equilibrium formula Hydraulics of wells Quality and quantity of ground water and its usefulness in Saline water intrusion Relationship between fresh and saline water Structure of fresh salt water interface Control of saline water intrusion. An introduction to geophysical and geochemical methods of exploration for planning, and design of regional water resources investigations; Groundwater Exploration, reconnaissance survey, surface investigation methods, subsurface investigations including test drilling, drilling methods, resistivity logging, radiation logging, temperature logging, velocity measurement and other methods; Groundwater Management, groundwater monitoring, observation network, water table fluctuation, selection of sites for the observation network. Contaminant transport in groundwater and management Concepts of basin management Equations of hydrologic equilibrium Groundwater basin investigation . Case histories in the sustainable management of ground water resources.

**Course Aims and Objectives:**

The course should enable students to:

The aim of this course is to impart knowledge about the importance and physical distribution of groundwater resources at the global scale with a special emphasis on Pakistan under drivers or climate change. Methods for the groundwater quantitative and qualitative assessment and for evaluation of the interactions between groundwater discharge and ecosystems. Substantiable Groundwater Management.

**Course Outcomes:**

- The students will be able to impart knowledge about the importance and physical distribution of groundwater resources at the global scale with a special emphasis on Pakistan under drivers or climate change.
- The students will be able to understands the exploration methods for the groundwater quantitative and qualitative assessment and for evaluation of the interactions between groundwater discharge and ecosystems.
- The students will be able to develop Substantiable Groundwater Management plan.

**Reference Books/Materials:**


1) Anderson, M and Woessner, William: Applied Groundwater Modelling, Simulation of Flow and
2) Advective Transport, 381 pages, Academic Press; 1st edition (1991) ISBN 10: 0120594854, ISBN 13: 978 0120594856
3) Freeze, R .A. and J.A. Cherry (1979): Groundwater. Prentice Hall, Englewood Cliffs
4) Fetter,C.W.(2001): Applied Hydrogeology. Prentice Hall, Englewood Cliffs
   Fetter, C.W. (1993): Contaminant Hydrogeology. Macmillan Publishing Company, New York; S.


**Course Title** **Techniques in Structural Geology (3 CH)**

**Course Outline:**

Geological mapping and cross sections, stereographic projections, fold morphology, fold orientations: projection techniques, fold classification, fold sections and profiles, fold mechanism (single and multilayers), strain and small scale structures in folds, superposed folding, fault geometry and morphology, faults and the construction of balanced cross sections, mechanical analysis of fractures, fracture analysis and plotting techniques, ductile and brittle shear zones, joints, structural analysis of an area that has experienced a single episode of deformation, multiple deformations, examples and labs..

**Course Aims and Objectives:**

The course includes a quantitative approach of stress and strain in various tectonic setting, advanced aspects of rock deformation and rheology in the light of brittle, ductile and plastic deformation processes, an appraisal of the spectrum of complex deformation geometries, approaches of balancing and restoring deformation, as well as aspects of climate tectonic interaction.

**Course Outcomes:**

The student will be able to

- Recognize moderately complex structures and can relate these to specific deformation regimes as well as quantitatively describe stress and strain
- Know that tectonic styles can result from a combination of endogenous and exogenous processes
- Discuss aspects in structural geology and tectonics with respect to the regional geology of Pakistan

Reference Books/Materials:


1) Bond, C.E., Lunn, R.J., Shipton, Z.K., and Lunn, A.D., 2012, What makes an expert effective at interpreting seismic images? Geology, v. 40, p. 75 78, doi:10.1130/G32375.1
2) Bond, C.E., Gibbs, A.D., Shipton, Z.K., and Jones, S., 2007, What do you think this is? "Conceptual uncertainty" in geosciences interpretation: GSA Today, v. 17, no. 11, p. 4 10.
3) Pilkey, O.H. and Pilkey Jarvis, L., 2007, Useless arithmetic: why environmental scientists can't
4) predict the future: New York, Columbia University Press, 230

**Course Title** **Clastic Sedimentology (3CH)**

**Course Outline:**

classification of sediments and sedimentary rocks (sedimentary rock types), sediment movement by fluid flow and sediment transport processes including transport, – basic concepts of fluid mechanics, , textures of terrigenous clastic sedimentary rocks (properties of sedimentary particles),Terrigenous clastic sediments, Sediment Types, Sediment texture, Sedimentary structures, Detrital components, Classification schemes and detailed description of terrigenous clastic sediments, Sandstone digenesis, Facies analysis and Depositional environments, Porosity and permeability. Lab. Petrographic study of elastic rocks. Heavy mineral analysis. Recording, plotting and analysis of Paleocurrent data. Field techniques for study of elastic sedimentary rocks.

**Course Aims and Objectives**:

This objective of this course is to acquire knowledge about texture and classification of sedimentary rocks, Sedimentary environments and facies analysis, Paleocurrent analysis and Diagenesis and provenance analysis of clastic rocks

**Course Outcomes:**

After studying clastic sedimentology students will be able to

- Understand about various clastic rocks and their diagenesis
- Understand the classification and depositional system of clastic rocks
- Know about the sediments play in global climate system as well as how energy and other resources come from clastic rock.

**Reference Books/Materials:**

1) Sedimentary Environments and Facies by Reading, H. G., 1986, Blackwell Scientific Publications.
2) Ancient Sedimentary Environments by Selley, R. C., 1978, Chapman and Hall.
3) Origin of Sedimentary Rocks by Blatt. H., Middleton, G and Murrey, R., latest Ed., Prentice Hall.
4) Depositional Sedimentary Environments by Renieck, H. E. and Singh, I. B., 1980, Springer Verlag.
5) Sand and Sandstones by Pettijohn by F.J., Potter, P. E. and Sever, R., latest Edition., Springer Verlag.
6) Principles of Sedimentology by Friedman, G. M. and Sanders, J. E., 1978, John Wiley and Sons.
7) Petrology of Sedimentary Rocks by Boggs Jr. S., 1992, Merril Publishing Co.
8) Sedimentary Rocks by Pettijohn, F. J., latest Ed., Harper and Row.
9) Depositional Systems, A Genetic Approach to Sedimentary Geology by Davis, R. A. Jr., 1983. Prentice Hall.
10) Sedimentary Petrology, An Introduction by Tucker, M. E., 1981, Black Well Scientific Publications Osney Mead.
11) Terrigenous Clastic Depositional Systems, Application to Petroleum, Coal and Uranium Exploration by Galloway, W. E. and Hobday, D. K., 1983, Springer Verlag, New York, Inc.
12) A Practical Guide to the Study of Glacial Sediments by David J. Evans, 2004, Oxford University Press.
13) Microfacies of carbonate rocks. Analysis, interpretation and application by Flugel, E., 2004, Springer

**Course Title** **Non Clastic Sedimentology (3CH)**

**Current Course Outline:**

Mineralogy of non clastic rocks, classification of carbonate rocks, carbonate depositional environments, carbonate diagnosis, dolomite and dolomitization, model nature & origin of evaporites, nature and origin of phosphatic rocks, ironstones, economic significance of non clastic rocks. • fracturing in carbonate and evaporitic reservoirs • Fracture terminology and classification • Fractures in different data types • Evolution of carbonate porosity systems
Lab. Identification of carbonate sediments in hand specimen and thin sections. Microfacies interpretations Staining and XRD techniques.

**Course Aims and Objectives:**

This objective of this course is to study carbonate rocks and the processes associated to it. Study the different depositional systems of carbonate rocks and diagenesis

**Course Outcomes:**

After studying clastic sedimentology students will be able to

- To know about carbonate mineralogy and chemistry
- Understand classification, and depositional models,
- Understand microfacies, cyclicity in carbonates, carbonate depositional systems.

**Reference Books/Materials:**

1) Carbonate Sediments and their Diagenesis by Bathurst, R. G., latest Edition., Elsevier.
2) Marine Carbonate by Milliman, J. D., 1974, Springer Verlag.
3) Carbonate Depositional Environment by Scholle, P. A. Bebout, D. G. and Moore, C. H., AAPG Mem.
4) Carbonate Sedimentology by Tucker, M. E. and Wright, V. P., 1990, Blackwell Scientific Publications.
5) Carbonate Depositional Environments by Scholle, P. A.,, Bebout, D. G. and Moore, C. H., 1993, Mem. Am. Assoc. Petrol. Geol.

**Course Title** **Groundwater Modeling (3 CH)**

**Course Outline:**

Concept of groundwater components and aquifers, Purpose of groundwater modelling; Conceptual model, estimation of aquifer parameters, conceptualization of grid and boundary conditions, Steady and transient simulations, conceptualization of aquifer aquitard systems; Three dimensional anisotropy, Specification of boundary conditions; Construction of a steady state model, visualization of groundwater level, regional model, Hydrological stresses; Design of numerical model, finite difference solutions of flow problems; Steady versus unsteady model; One layer versus multi layer model; Lay out of grids; Stress period/time steps; Model inputs, initial conditions; boundary conditions; Hydrogeological parameters, model calibration procedures and validation, selection of model code; Model prediction, purpose of prediction; Simulation of scenarios; Determination of capture zones; Introduction to MODFLOW; Exercises and case study.

**Course Aims and Objectives:**

Upon completion, the participant should be able to: Describe process and procedures of applied groundwater modelling. Construct numerical groundwater models using popular modelling tools with hands on exercises. Use groundwater models to simulate groundwater flow, contaminant transport, and saltwater intrusion with hypothetical examples. Apply groundwater models for groundwater resources management and protection in real world case studies.

**Course Outcomes:**

At the conclusion of this course, the student will:

- Have a better understanding of basic components of a groundwater modeling;
- Be familiar with most common solution methods used in groundwater modeling; and
- Be able to define boundary conditions and to perform calibration for the computer models.

**Reference Books/Materials:**

1) Applied Hydrogeology, Author: C.W. Fetter Jr.
2) Fundamentals Of Groundwater Modelling, Authors: Husam Baalousha
3) Applied Groundwater Modeling: Simulation of Flow and Advective Transport: Authors: Mary P. Anderson, William W. Woessner

**Course Title Advanced Marine Geology (3 CH)**

**Course Outline:**

Introduction to marine environment and geological processes and shapes of world's modern oceans. Evolution of ocean basin; Types of marine/ocean basins; Concept of Oceanography; Modern and ancient deep marine processes; Key processes over timescales and past climate changes due to ocean volume change, Deposits and environments; Physical and Biological processes in shallow and deep marine environments; Sediments and facies, beds, their sedimentary characteristics and interpreted depositional processes; Deep water ichnology, Mineral resources of sea; Time space integration including sedimentary marine deposition; Statistical properties of sediment; Gravity flow deposits; mass transport Deposits; Bed thickness distributions; Sea bed morphology; Sediment drifts and abyssal sediment waves, Contourites; Submarine fans and related depositional systems; Interpretations of offshore and sub environments using multiple data sets;

**Course Aims and Objectives**:

Students will have a clear overview of how ocean basins form and change in time also they will understand the dynamics of the earth's crust and its importance for geomorphology and evolution. Types of sediments and rocks, the reason for the existence of oceans and continents and the spatio temporal dynamics of marine sedimentary and igneous processes. Climatic variations over the period of time. Numerous case studies demonstrated in the class will illustrate concepts such a plate tectonics via island formation, and sedimentology via discussion of attractive sedimentary systems, such as coral reefs. Students will have a broad understanding of geological ocean dynamics

**Course Outcomes:**

- A solid grounding in marine geology and the driving forces behind, consequences, and importance of sea level changes in the geological record.
- Be able to describe sediments found in different water depths and settings, and understand the sedimentary processes leading to their deposition.
- Be able to describe the main geological and geophysical techniques for observing the seabed and sub seabed. Impacts of climate change and global warming

**Reference Books/Materials:**

1) Kevin T. Pickering & Richard N. Hiscott (Deep Marine Systems, to be published by Wiley Blackwell in late 2014)
2) Haq, B. U., & Milliman, J. D. (1985). Marine geology and oceanography of Arabian Sea and coastal Pakistan.
3) Wright, D. J., & Barlett, D. J. (Eds.). (1999). Marine and coastal geographical information systems. CRC press.
4) BUL The Sea Floor An Introduction to Marine Geology By E. Seibold W. H. Berger. 3rd Ed 1996

**Course Title Reservoir Geology (3CH)**

**Course Outline:**

Introduction to reservoir characterization, Reservoir characterization and modeling objectives; Reservoir characterization and modeling workflows; Data and related uncertainty; Data integration; Reservoir heterogeneities. Petrophysics based reservoir properties from cores & logs evaluation; Coring; Porosity: definition and measurements (effective and total porosity); pore size, Reservoir properties; effects of Depositional and digenetic controls on reservoir properties; Fluid properties and their saturation; Hydrocarbon distribution and fluid contacts; Reservoir zonation and thickness mapping; Reservoir pore spaces configuration; Mapping reservoir heterogeneity; Field observations to understand reservoir; Migration of hydrocarbons from source rock to reservoir; Estimation and calculation of reservoir volumetrics; Material balance and production decline curve methods; Appraisal and development of reservoir basic concepts.

Course Aims and Objectives:

Students will know about different type of reservoir rocks, fluid properties and its impact on reservoir rocks. Reservoir heterogeneity and reserves estimation.

**Course Outcomes:**

Students will be able to understand

- Different types of reservoir rocks, their properties, different depositional environments,
- Fluid properties and their saturations, reserve estimation methods.
- Reservoir heterogeneity appraisal and development of reservoir basic concepts.

**Reference Books/Materials:**

1) Elements of Petroleum Geology by Richard C. Selley, Stephen A. Sonnenberg
2) Sandstone Petroleum Reservoirs by John H. Barwis, John G. McPherson, Joseph
3) Basin Analysis Principles and Application to Petroleum Play Assessment by Philip A. Allen

**Course Title Mineral Prospecting & Exploration (3 CH)**

**Course Outline:**

Mineral prospects and economic deposits, its types, Mineral exploration through to underground and open pit extraction and the processing and marketing of mining products. The environmental impact of mining and sustainable mining techniques are introduced, as well as monitoring and remediation techniques, target selection, deposit modeling, exploration technology, international exploration, environmental issues, program planning, proposal development. Geochemical prospecting methods, Development of primary and secondary haloes around ore deposits. Distribution of detrital material and solutions by streams, glaciers, etc. Dispersion of trace metals from mineral deposits and their discovery. Principles and application of primary dispersion to the search for metallic mineral deposits. Secondary dispersion processes (mechanical and chemical) applied to the search for metalliferous mineral deposits. Field methods of analysis for trace amount of metals. Labs consists of analysis and statistical interpretation of data from soils, stream sediments, vegetation, and rock in connection with field problems. Individual special investigations of a laboratory or field problem in exploration geochemistry. The mineralogy of economic deposits. Mineral deposit geology and models. Mineral exploration data and evaluation techniques.

**Course Aims and Objectives**

Aims:

The course aim is to train students to discover and exploit economically viable mineral deposits that can benefit the country.

**Objectives:**

- To impart knowledge about economic geology in terms of prospecting and exploration of minerals and familiarize them with the geological processes responsible for mineralization.
- To impart knowledge for understanding different field and laboratory techniques required for mapping, prospecting and analysis.
- To train the students for the identification of metallic and industrial minerals and to prepare projects.

**Course Outcomes:**

The course is designed to impart practical knowledge to the students to understand the basics of economic geology in terms of acquiring knowledge in the fields of ore and industrial minerals. They will know how to explore economically viable ore resources and how to prepare development projects. They will also study some case studies related to important mega mines. Their ultimate aim will be to discover and exploit economically viable mineral deposits to the benefit of society

**Reference Books/Materials:**

1) Introduction to mineral exploration Edited by Charles J. Moon, Michael E.G. Whateley and Anthony M. Evans (2012), Blackwell publisher
2) Mineral Exploration, 2nd Edition Principles and Applications by Swapan Haldar (2018), Elsevier publisher
3) Mineral Deposit Evaluation  A Practical Approach by Alwyn E. Annels (1991), Chapman & Hall Publisher.
4) An introduction to economic geology and its environmental impact by Anthony M. Evans (1997), Wiley Blackwell publisher
5) Gems and Gemology in Pakistan by Tahseenullah Khan and Allah Bakhsh Kausar (2010), Geological Survey of Pakistan
6) Journal of Economic Geology
7) Research papers on economic geology

**Course Title Engineering Geophysics (3 CH)**

**Course Outline:**

Introduction to Geophysical and engineering tools used for underground analysis, Relevant physical properties of rocks and soil; Seismic reflection, Optimum window and optimum offset techniques; Identifying environmental and engineering problems as well as geophysical technique; Field procedure, techniques, and instrumentation; Data correction and interpretation; Seismic refraction, Interpretation techniques such as GRM and others; Electrical Images, 2D Resistivity Modelling; Finite difference method; 2D electrical imaging exploration and multi electrodes, Electromagnetic methods (Slingram, VLF, TEM), Georadar, Radiometry and well logging, Data collection and interpretation; Introduction to 3D electrical imaging; Relevant topics such as GPR and others; Field examples for environmental, engineering and hydrogeology; Latest research articles related the subject will be discussed in class.

**Course Aims and Objectives:**

The students should understand to expose you to the geophysical methods that geologists and geophysicist use to examine several different geological and environmental problems. Furthermore, it is expected to perform field examples processing and interpretation for environmental, engineering and hydrogeology. The students should understand the relevant physical properties of rocks and soil. The students should able to perform simple geophysical computations and data interpretation. Furthermore, it is expected that they should know how to do geological interpretations based on geophysical data.

**Course Outcomes:**

- The students will be able to understand how geophysics data is used to map the near surface geological conditions and fields examples interpretations.
- The students will be able to understand the main relevant physical properties of rocks and soil.
- The students will be able to perform simple geophysical computations and data interpretation. Furthermore, it is expected that they should know how to do geological interpretations based on geophysical data.

**Reference Books/Materials:**

1) Philip Kearey, Michael Brooks, Ian Hill: An Introduction to Geophysical Exploration, Wiley Blackwell, 2002.
2) Dorbin, M. B. and Savit, C. H.: Introduction to Geophysical Prospecting (4th edition), McGraw Hill, 1998.
3) Telford, W. M., Geldart, L. P. and Sheriff, R. E.: Applied Geophysics (2nd edition), Cambridge University Press, 1990.
4) Reynolds, J. M.: An Introduction to Applied and Environmental Geophysics, Wiley, 1998.

**Course Title** **Machine Learning in Geoscience (3 CH)**

**Course Outline**:

Introduction and Inference in Geosciences (In verse Method, Geostatistics, NN), Introduction to python, Big Data Analytics and ML Overview, Python libraries, Optimization methods and Sampling Introduction to Machine Learning; Types, Supervised, Unsupervised; Model Representation; Cost Function; Supervised learning, Generative/discriminative learning, parametric/nonparametric learning, neural networks, and support vector machines; Gradient Descent; Gradient descent for Linear Regressions; Clustering, dimensionality reduction, kernel methods; Machine learning for seismic interpretation, fault extraction, horizon mapping, surface generation, facies analysis through supervised and unsupervised methods.

**Course Aims and Objectives:**

Machine Learning has made a huge impact on helping operating companies improve operational efficiency, eliminate unplanned downtime, improve safety, and overall reduce costs. Based on fundamental knowledge of computer science principles and skills, probability and statistics theory, and the theory and application of linear algebra. This course provides a broad introduction to machine learning and statistical pattern recognition.

**Course Outcomes:**

- Students will have an understanding about applications of machine learning, such as to robotic control, data mining
- How machine learning will help in understanding complex geophysical processes.
- How to extract geophysical properties through machine learning

**Reference Books/Materials:**

1) Moseley, B., and Krischer, L., 2020, Machine Learning and Artificial Intelligence in Geosciences, Elsevier Science.
2) Langer, H., Falsaperla, S., and Hammer, C., 2019, Advantages and Pitfalls of Pattern Recognition: Selected Cases in Geophysics, Elsevier Science.
3) Misra, S., Li, H., and He, J., 2019, Machine Learning for Subsurface Characterization, Elsevier Science.
4) Alexej Gvishiani, Jacques O. Dubois., 2013, Artificial Intelligence and Dynamic Systems for Geophysical Applications, Springer Science & Business Media,

**Course Title** **Applications of Geostatistics in Geoscience (3 CH)**

Course Outline:

fundamental concepts and algorithms for geostatistical modelling and demonstration of application in the geosciences and spatial distribution, Geostatistical simulation and simple interpolation difference, Introduction to Geostatistics; Computer application in geo statistics; Collection and editing of data, primary data and secondary data; Measures of central tendency or averages, types of averages, arithmetic mean, median, mode, empirical relation between mean, median and mode; Relative merits and demerits of various averages; Measures of dispersion range, semi interquartile range or quartile deviation, mean deviation, standard deviation, skewness; Correlation and simple regression, coefficient of correlation, scatter diagram, rank correlation, regression; Geo statistical analysis, variogram calculation, interpretation, linking variogram behaviour with physical causes (geology, sampling); Extension variances and estimation variances/simple calculations in one and two dimensions; Global reserve/resource estimation; Optimal estimation and introduction to kriging.

**Course Aims and Objectives:**

This unit is designed to provide students with an introduction to the geostatistical techniques used in estimation from spatial data. Applications will be mainly in the areas of mining, petroleum, soil science and environmental management.

**Course Outcomes:**

On successful completion of this course, students will be:

- Apply the concepts of spatial variability to geological, geomechanical and/or environmental variables,
- Calculate variograms for simple one and two dimensional data sets
- Assemble models to experimental variograms and interpret model parameters and Evaluate simple calculations of estimation variances
- Formulate and solve kriging equations

**Reference Books/Materials:**

1) Hohn, M. (2013). Geostatistics and petroleum geology. Springer Science & Business Media.
2) Wackernagel, H. (2013). Multivariate geostatistics: an introduction with applications. Springer Science & Business Media.
3) Chilès, J. P., & Delfiner, P. (2012). Geostatistics: Modeling Spatial Uncertainty. Wiley Publishing.
4) Armstrong, M. (2012). Basic Linear Geostatistics. Springer Science & Business Media.

**Course Title Reservoir Geomechanics (3 CH)**

**Course Outline:**

Basic stress and strain analysis; pore pressure and in situ stress estimation and measurement; deformation mechanisms in rock; rock fracture description and analysis; wellbore stresses and failure; wellbore stability analysis; fault classification and stability analysis; depletion induced reservoir deformation; and hydraulic fracturing. Emphasis on applications to petroleum engineering. Structural Geology,Stress and strain analysis; Tectonic stress, Review of Earth Stresses; Stresses in various types of basins; Determining initial stress conditions in typical reservoir cases; Mechanical Behavior of Reservoir Rocks, Diagenetic processes in reservoir rocks; Transport Properties of Reservoir Rocks; Thermal conductivity and expansion properties of rocks and minerals; Effect of high temperatures on clay minerals and hydrous minerals; Permeability vs. effective stresses in porous media; Fractured media. Pore Pressure Prediction.

**Course Aims and Objectives:**

This course is interdisciplinary and encompasses the different geological and geophysical disciplines including fields of rock mechanics and structural geology. Also deals with the geomechanical problems that arise during the exploitation of oil and gas reservoirs. This course will also cover Pore pressure, estimation of hydrocarbon column heights, determination of optimally stable well trajectories, casing set points and mud weights, changes in reservoir performance during depletion, and production induced faulting and subsidence.

**Course Outcomes:**

- Relevancy of Geomechanics throughout the reservoir life cycle
- Applications of the principles of geomechanics to solve real world problems and reduce risk
- How to be proactive instead of reactive towards geomechanical issues.

**Reference Books/Materials:**

1) Zoback, M.D., 2010. Reservoir geomechanics. Cambridge University Press.

2) Zoback, M.D. and Kohli, A.H., 2019. Unconventional reservoir geomechanics. Cambridge University Press.
3) Zhang, J.J., 2019. Applied Petroleum Geomechanics. Gulf Professional Publishing.
4) Nauroy, J.F., 2011. Geomechanics applied to the petroleum industry. Editions Technip.


**Course Title Advanced Seismic Techniques**

**Course Outline:**

Introduction to seismic data processing. Processing sequences, Introduction to seismic data interpretation: Overview of Seismic Stratigraphy. Wavelet analysis for seismic stratigraphic interpretation. Overview of Seismic Stratigraphy. Study of seismic section and other geological aspects of prospecting, structural interpretation, construction of isochron and isopach maps, thin bed resolution and pitfalls, LRLC interpretation, AVO and attribute analysis, Prospect evaluation & Ranking, Basis of seismic interpretation in workstation environment using standard packages.

**Course Aims and Objectives**:

This course is focused to familiarize students with advance seismic techniques that are being used in Oil Industry and to develop understanding of modeling/Gridding, linear interpolation/extrapolation techniques. The course will familiarize students with Reservoir Characterization Techniques such as AVO/AVA, Inversion, Post Stack Attributes

**Course Outcomes:**

- Students would be able to transform seismic data in time domain to frequency domain
- Students would be able to carry out modeling on any given data set using triangulation gridding techniques
- Students would be able to harmonize sonic and checkshot data for modeling purposes
- Students would be able to utilize Seismic Attributes, AVO/AVA and Seismic Inversion techniques for Reservoir Characterization
- Students would be able to execute modeling and reservoir characterization related workflows on modern Softwares

**Reference Books/Materials:**


1. 3D Seismic Interpretation by M. Bacon Cambridge University Press
2. Interpreting Seismic Data by J. A. Coffeen
3. Chiburis, E, Leany, S, Skidmore, C, Franck, C, and McHugo, S. Hydrocarbon detection with AVO. Netherlands: N. p., 1993. Web.
4. Barclay, F. & Bruun, A. & Rasmussen, K.B. & Alfaro, J.C. & Cooke, A. & Cooke, D. & Salter, D. & Godfrey, R.
5. Lowden, D. & McHugo, S. & Özdemir, H. & Pickering, S. & Pineda, F.G. & Herwanger, Jorg & Volterrani, S.
6. Murineddu, A. & Rasmussen, A. & Roberts, R.. (2008). Seismic inversion: Reading between the lines. Oilfield Review. 20. 42 63.


**Course Title 3D Seismic Data Interpretation (3 CH)**

**Course Outline:**

Recapitulation of the fundamentals that are of direct relevance for interpretation, reflection coefficients, polarity convention etc. Exercises on seismic fundamentals. Brief summary on seismic acquisition and processing, focusing on aspects that have direct relevance for interpretation, such as minimum/maximum offset, multiplicity, type of imaging, phase issues etc. Seismic acquisition/processing related exercises. Generation of synthetic seismograms and well to seismic matching. Well to seismic Matching exercise. Summary of well geophysics. Interpretation fundamentals and introduction of 2D/3D seismic interpretation workflows. Marker recognition and transfer. Seismic (volume) attributes for seismic interpretation. Seismic illustration of structural styles: extension, compression, wrench and halokinesis. Exercise with examples from the different styles. Structural interpretation workflow in detail. Exercise with round correlation of shallow markers. Horizon tracking exercises. Mechanics of faulting and Fault interpretation. Exercise with hand interpretation of fault segments. Brief summary of stratigraphic interpretation. Exercise on stratigraphic interpretation. Interpretation pitfalls. Interpretation project QAQC. Overview of seismic velocities. Time to depth conversion. Exercise on seismic velocities, and time do depth conversion. Mapping and contouring. Contouring exercise. Volumetrics and uncertainties. Exercise on volumetrics. Seismic expression of DHI's.Introduction to rock and fluid prediction from seismic. Seismic inversion and AvO, exercises.

**Course Aims and Objectives:**

The students are introduced to methodologies and strategies for interpretation of 3D seismic data. Students will know how to do interpretation, what are the basics and practicality to start seismic interpretation, workflow and advance interpretation methods.

**Course Outcomes:**

1. They will develop skills in structural and stratigraphic interpretation.
2. Students will acquire knowledge about seismic amplitude reflections from lithological boundaries within the subsurface.
3. Students will understand basics and practical seismic data interpretation

**Reference Books/Materials:**

1. Seismic Amplitude by Rob Simm and Mike Bacon
2. Three Dimensional Seismic Interpretation by Alstair Borwn
3. 3D seismic Interpretation by Mike Bacon
4. Seismic Data Interpretation and Evaluation for hydrocarbon Exploration and Production by Nanda

**Course Title Seismic Data conditioning and Analysis (3 CH)**

**Course Outline**:

Basic Concepts of Seismic Surveying, What makes a seismic trace – Body & Surface waves Reflection and refraction Basics of seismic fold and image or stacked traces – Stacking Diagrams, Land Acquisition Systems and Operations, Sources – Sensors – Positioning Recording the Data – Arrays or Single Sensor Recording – Full Azimuth recording

Simultaneous Sources – Industry Trends Quality Assurance, Principles of wave propagation Physical basis of wave types – Huygens's principle Refractions and Diffractions Seismic Velocities and Reflection amplitude, Waves in time and space, Frequency and Wavenumber, Aliasing both spatial and temporal – FK transform Convolution Cross & Auto correlation. Properties of Seismic Waveforms and traces – Polarity Vertical Resolution – Lateral Resolution – Tuning Amplitude Effects, Types of Seismic Data Acquisition – Marine, Land, Transition, Borehole, Ocean Bottom, TimeLapse – Signal and Noise – Field Array Design – Alternatives to arrays – Common Reasons for Failure, Causes of Distortions – Seismic Datum – Long & short wavelength statics, Surface Consistency Methods of Correction – Identifying errors, Wavelets and Wavelet Shaping, Reasons why Wavelet Shaping is necessary – Types of wavelets – Zero & Minimum phase, Types of Deconvolution Decon.'s place in the sequence – Examples. Noise Attenuation Noise Types – Noise Removal Methodologies – Organised Noise, Seismic Interference Random Noise – Examples, Multiple Attenuation, What are multiples? – Types of multiple Classifications and examples of removal methods, Types of velocity – NMO stretch – Velocity Analysis Techniques – Potential pitfalls, Velocity Model Building, Importance of velocity Types of Model geometries – Tomography – Velocity model building techniques – Imaging, Differences between Time and Depth Imaging – Limitations of Post stack imaging Current Imaging Techniques Their strengths and weaknesses Examples – Likely future trends, Migration and effects of seismic migration

**Course Aims and Objectives:**
The course emphasizes for each process and various existing underlying geophysical models. This course is designed to provide basic background and training for the processing of digital seismic data, particularly used by the petroleum industry. The emphasis is placed on the principles and practicality of the major processing methods, statics, deconvolution, velocity analysis, stacking, and migration.

**Course Outcomes:**

- At the end of the course the participants will have obtained an understanding and appreciation of the many alternative processing approaches that are representative for the practice of current seismic data processing.
- This course provides the participants with a working knowledge of the different processing methods and enables them to assess the quality of a processing result.
- At the end of the course the participants will have obtained an understanding on the principles and practicality of the major processing methods, statics, deconvolution, velocity analysis, stacking, and migration.

**Reference Books/Materials:**
1. Zhou, H.W., 2014. Practical seismic data analysis. Cambridge University Press.
2. Yilmaz, Ö., 2001, Volume 1. Seismic data analysis: Processing, inversion, and interpretation of seismic data. Society of exploration geophysicists.
3. Yilmaz, Ö., 2001, Volume 2. Seismic data analysis: Processing, inversion, and interpretation of seismic data. Society of exploration geophysicists

**Course Title** **Advances in Exploration Geophysics (3CH)**

**Course Outline:**

Introduction to geophysical methods and their applications. The course will provide a comprehensive overview on seismic methods, an introduction to gravity, electric, magnetic, electromagnetic, and radar techniques, and a short overview on other methods. Applications include hydrocarbon exploration, mineral exploration, studies of the shallow sub surface and the deep Earth.

**Course Aims and Objectives:**

This course aims to introduce students to the techniques used to measure and map geologic, geophysical and geochemical characteristics of the lithosphere, with applications to mineral and energy exploration. It also aims to provide students with the theoretical background to each technique, the methods of data collection, analysis and interpretation and an appreciation of the exploration scenarios in which each technique may apply.

**Course Outcomes:**

1. This course will take a generic view, about different geophysical methods to understand economical natural resource
2. The course will be divided into modules covering geophysical exploration techniques commonly used in minerals and energy exploration, (gravity, magnetic, electrical, electro magnetic and seismic surveys).
3. Students will be able to analyze and interpret all the studied geophysical data sets.

**Reference Books/Materials:**

1. An Introduction to Geophysical Exploration by P. Keary, M. Brooks and I. Hill
2. Introduction to mineral exploration (Moon, Whateley and Evans), 2nd Ed, 2006, Blackwell Publishing
3. Geophysics for the Mineral Exploration Geoscientist (Dentith and Mudge), 2014, Cambridge University Press

**Course Title Borehole Geophysics (3CH)**

**Course Outline:**

Borehole geophysics as critical link Introduction, Fundamentals of rock physics, Borehole seismic methods – introduction, Borehole seismic methods – Data acquisition, Borehole seismic methods – Data processing principles, 3D VSP, Introduction to well logging

**Course Aims and Objectives:**

This course will enable the students to understand about the role of borehole geophysics in oil and gas industry by covering the fundamentals of petrophysics and its use in the analysis of cores and geophysical well logs for reservoir characterization and hydrocarbon assessment. The objective of this course is to enable students to learn about borehole geophysics builds that link between rock physics, well logging and surface seismic. The students are also required to apply some of these concepts analytically and numerically to familiarize their use in practical applications.

**Course Outcomes:**

On completion of the course, students are expected to be able to:

1. To understand the theoretical basis and practical limitations of logging tools. And evaluate reservoir intervals defined in clastic and shaly sandstone systems.

2. Integrate all other available data with wireline log data, including mud logs, sample descriptions, VSP, and core.
3. Illustrate the principle petrophysical differences between conventional reservoirs and unconventional shale reservoirs.

**Reference Books/Materials:**

1. Ellis, Darwin V, & Singer, Julian M. (2007). Well Logging for Earth Scientists (2 ed.). Dordrecht, The Netherlands: Springer
2. Labo, J. (1987). A Practical Introduction to Borehole Geophysics: An Overview of Wireline Well
3. Logging Principles for Geophysicists: Society of Exploration Geophysicists.
4. Sayers, Colin M. (2010). Geophysics under stress: Geomechanical applications of seismic and
5. borehole acoustic waves: Society of Exploration Geophysicists and European Association of Geoscientists & Engineers.Principles of Electric Methods in Surface and Borehole Geophysics, Volume 44 by Alex Kaufman B. Anderson

**Course Title Applied Seismology (3CH)**

Course Outline:

This course will provide the students with an advance understanding of Seismology, i.e., Investigating Earth's structures by seismic waves, Active seismic zones, ground motion and penetration, Tsunami and Earthquake parameters, Focus and epicentre, Magnitude and intensity, Natural Earthquakes, Man made energy movement causes, parameters, prediction, Earthquake mitigation, Earthquake and its relationship to plate boundaries

**Course Aims and Objectives:**

This course will enable the students to understand the applications of seismology for earthquake studies The objective of this course is to enable students to acquire the knowledge of earthquake seismology. The students are also required to apply some of these concepts to determine the potential risks due to earthquakes and microzonate those areas accordingly

**Course Outcomes**:

On completion of the course, students are expected to be able to:

1. Understand the methodologies adopted for seismic risk assessment with Peak ground acceleration (PGA) and its applications
2. Advanced methods used for evaluation of earthquake hazards with microzonation and macrozonation
3. Use of microtremors to reveal the subsurface structure

**Reference Books/Materials:**

1. Micro Earthquake Seismology and Seismotectonics of South Asia by J.R. Kayal
2. Surface Wave Methods for Near Surface Site Characterization by Foti et al.
3. Manual for zonation on seismic geotechnical hazards (Revised version), ISSMGE,1999

**Course Title Mining Geophysics (3 CH)**

**Course Outline:**

This course presents the most widely used methods of applied geophysics and their applications, with emphasis on mining projects. For each method and for specific combinations of methods, the advantages and limitations for prospecting various raw materials are discussed. Methods covered include seismic reflection and refraction, geoelectric, gravimetric, magnetic, and electromagnetic. In addition, the economic benefits of geophysical exploration are addressed.

**Course Aims and Objectives:**

The Mining Geophysics will focus on geology, mining methods, exploration technology, surveying, and computer applications for mining operations and mineral explorations. Students learn hands on science and mining skills

**Course Outcomes:**

Mining Geophysics concentrates how to apply the knowledge for example in exploration, mapping and management of natural resources, and in environmental and engineering studies. In the life cycle of a mine, geophysics plays an important role in all stages: before opening the mine in mineral exploration and resource assessment, during active mining operations in exploration for additional resources and environmental monitoring, and after the closure of the mine in environmental monitoring and mapping of potentially contaminated areas.

**Reference Books/Materials:**

1. Glazer, S. N., 2016, Mine Seismology: Data Analysis and Interpretation: Palabora Mine Caving Process as Revealed by Induced Seismicity, Springer International Publishing.

2 Kaufman, A. A., Alekseev, D., and Oristaglio, M., 2014, Principles of Electromagnetic Methods in Surface Geophysics, Elsevier Science.

3. Schön, J. H., 2015, Physical Properties of Rocks: Fundamentals and Principles of Petrophysics, Elsevier Science.

4. Dentith, M., and Mudge, S. T., 2014, Geophysics for the Mineral Exploration Geoscientist, Cambridge University Press.

**Course Title Geodesy (3 CH)**

Course Outline:

The course involves: the fundamentals and modern concerns of geodesy, recent developments and applications of global and satellite geodesy; the gravity field of the earth and how it affects observations; the geometry of the ellipsoid; determination of geographical and map projection coordinates from geodetic observations; and the concept of a geodetic datum and how to transform coordinates from one datum to another.

**Course Aims and Objectives:**

The fundamentals and modern concerns of geodesy, recent developments and applications of global and satellite geodesy; the geometry of the ellipsoid; The principles of various global/satellite geodetic techniques; Determination of geographical and map projection coordinates from geodetic observations; and the concept of a geodetic datum and how to transform coordinates from one datum to another.

**Course Outcomes:**

On successful completion of the course students will be able to:

1. Understand how the earth's gravity field affects surveying observations, and how these observations can be reduced from the earth's topography to the map. Locate and use web based resources for the latest developments in geodesy.
2. Demonstrate a basic understanding of the geometry of the ellipsoid and of map projections.
3. Demonstrate their understanding of the Geocentric Datum of Pakistan

**Reference Books/Materials:**

1. Torge, W., & Müller, J. (2012). Geodesy. Walter de Gruyter.
2. Sciences of Geodesy II: innovations and future developments. Springer Science & Business Media.(Ed.II). (2012).
3. Lu, Z., Qu, Y., & Qiao, S. (2014). Geodesy. Berlin, Heidelberg: Springer Berlin Heidelberg.
4. Xu, G. (Ed.). (2010). Sciences of geodesy. Springer.
5. Meyer, T. H. (2018). Introduction to geometrical and physical geodesy: foundations of geomatics. Esri Press.

**Course Title** **Near Surface Geophysics (3 CH)**

Course Outline:

Review of Seismic, Gravity, Magnetic and Electrical methods, Applications of these methods to Environmental and Engineering studies: Delineation of structural trends, contacts and faults, microgravity detection of subsurface voids and cavities, detection of Archaeological objects, Mapping of fracture zones, reflection profiling in ground water studies, dam site investigations, evaluation of aquifer potential, Investigation of waste dump sites.

**Course Aims and Objectives:**

The students will understand to the geophysical methods that geologists and geophysicist use to examine several different geological and environmental problems. The students will understand the main principles behind geophysical measuring techniques. The students will be able to perform simple geophysical computations. Furthermore, it is expected that they will know how to do geological interpretations based on geophysical data.

**Course Outcomes**:

1. The students will be able to understand how geophysics data is used to map the near surface geological conditions.
2. The students will be able to understand the main principles behind geophysical measuring techniques and their application to solve near surface problems.
3. The students will be able to perform simple geophysical computations. Furthermore, it is expected that they should know how to do geological interpretations based on geophysical data.

Reference Books/Materials:

1. Reynolds, J.M., 2011. An introduction to applied and environmental geophysics. John Wiley & Sons.

**Course Title** **Gravity and Magnetic Exploration Techniques (3 CH)**

**Course Outline:**

Physical principles and basic theory; instrumentation; planning of the survey and evaluation of errors; different survey methodologies; rock densities/rock susceptibilities and their measurements Isostasy; data acquisition, processing; interpretation and mapping to identify gravity/magnetic anomalies; regional fields and residual anomalies, derivatives, continuation of the field, two and three dimensional modeling; applications in petroleum industry and case histories.

Course Aims and Objectives:

This course will enable the students to understand the basic concepts, principles and applications of gravity and magnetic exploration techniques used in Exploration of different structure, ores, minerals etc. Familiarize the students with different parameters measured and calculated using Gravity and Magnetic Exploration Techniques and to use them for the interpretation of different lithologies, structures, minerals and ore bodies.

**Course Outcomes**:

On completion of the course, students are expected to be able to:

1. Identify key concepts of the gravity and magnetic exploration techniques.
2. Describe the behavior of different subsurface bodies, minerals, ores etc.
3. Identify the factors affecting the gravity and magnetic surveys.
4. Use, key concepts about the interpretation of Gravity and Magnetic exploration methods.

**Reference Books/Materials:**

1. Li, Yaoguo; Krahenbuhl, Richard, Gravity and Magnetic Methods in Mineral and Oil & Gas Exploration and Production.

**Course Title** **Electrical Exploration Techniques (3 CH)**

**Course Outline:**

Electrical resistivity method, Principal, Electrode Configurations (Wenner Configuration, Schlumberger Configuration, Dipole Dipole Confi, Choice of Array, Refraction of Current Path, Electrical Reflection Co efficient Survey Types, interpretation of Electrical Resistivity Data, Application of Electrical Resistivity Data; Electric exploration methods, Charge body potential Method, Spontaneous Potential method, Induced Polarization Method, Electromagnetic Method, Telluric Method, Magnetotelluric Method, Principle, Mechanism, Important Consideration, Sources of Noise, Instrumentation, Field Procedure, Survey design, Interpretation, Advantages, Disadvantages, Limitations, Applications.

Course Aims and Objectives:

The objectives of this course are to: introduce students to electrical resistivity prospecting methods and their applications in investigating subsurface conditions, and provide students with opportunities to develop basic acquisition, processing and interpretation skills using the electrical methods.

**Course Outcomes:**

Upon successful completion of the course, the student will be able to:

1. Understand the various electrical prospecting methods applicable in geophysical exploration.
2. Explain the basic principles of Self Potential, Induced Polarization and Electrical Resistivity Methods.

3. Explain the field procedures applicable to each method.

**Reference Books/Materials:**

1. Reynolds J.M. (1998). An Introduction to Applied and Environmental Geophysics. Published by John Wiley & Sons Ltd, West Sussex, England. 800p.
2. Keary P., Brooks, M. and Hill I. (2002). An Introduction to Geophysical Exploration, Third Edition, Blackwell Science Ltd. Oxford, England 281p.

**Course Title Unconventional Energy Resources (3 CH)**

**Course Outline:**

energy resources (solar, wind, thermal, water, conventional and unconventional hydrocarbon) and their role in modern society, with both national and global perspectives in multiple fields of applied sciences. The present and future impacts of nuclear and fossil fuels on the environment will be explored. Energy technologies and use of solar, wind, hydro, biomass and fossil fuel energy resources will be introduced, and the relationship between public policy and resource usage will be discussed.

**Course Aims and Objectives:**

The course is designed to expose attendees to the understanding and application of the latest approaches, techniques and requirements being applied to reserves evaluation within unconventional resources. Focus is given to actions and methodologies that are necessary to enhance the reserve categorization. The course is designed to expose attendees to the understanding improvements in techniques such as horizontal drilling and hydraulic fracturing have increased access to unconventional hydrocarbon resources, ushering in the “shale boom” alternate energy resources and disrupting the energy sector.

**Course Outcomes:**

1. At the end of the course, the student should be able to recall the relative energy content per mass of various fuels, and the relative energy efficiency of the most common heat engines.
2. After completion of this course, the student should be able to:
3. Describe the most important energy sources in use today in Norway and worldwide, including the sources, extraction, transport and use of these resources.
4. Calculate the energy content of various energy resources and compare the values available from different sources.
5. Explain the relationship between absorption, emission and the greenhouse effect.
6. Explain and employ the computer models used for characterizing population growth and resource usage.
7. The students should know and understand the methods for production of viscous oil and the methods for recovery of gas from rocks with very low permeability.

**Reference Books/Materials:**

1. Arthur, M.A. and Cole, D.R., 2014. Unconventional hydrocarbon resources: prospects and problems. Elements, 10(4), pp.257 264.
2. Reza Barati, Mustafa M. Alhubail. 2020. Unconventional Hydrocarbon Resources: Techniques
3. Reservoir Engineering Analysis ISBN: 978 1 119 42032 3 American Geophysical Union

**Course Title Practical Technology Use in Geoscience**

**Course Outline:**

Introduction to software used in different industry. How to create and manage a project including establishing project boundaries, choosing an X/Y projection. the use of authors, CRS and its types. Culture (geographic layer) input: creating and entering culture data on the base map including formatted and unformatted data entry and the importing of ESRI shape files. Well data input: using file sources such as HIS Energy and ascii formatted data; loading of well locations, deviation surveys, formation tops, log curves, and local and shared Time Depth information. Using the SEG Y Viewer to examine 2D and 3D trace header data. 2D and 3D data loading from files and the use of Share/Copy feature for seismic data. Introduction Review basic concepts: Waves; Wavelet; Seismic sections 2D vs. 3D; Seismic display, slice, 2D and 3D view, Volume concept, Slicing the data volume, Dynamic range and data loading, Polarity and colour Character and zero phase, Colour principles, Interpretative value of colour, Interpretation procedure/workflow, Synesthetic seismogram, Structural interpretation, Fault recognition and mapping, Horizon mapping and procedures, Visualization and auto tracking. Direct contouring and the importance of the strike perspective, Maps and its types. Depth conversion and procedures. Composite displays. Advantage and disadvantages of different displays, Subtle structural features. Stratigraphic interpretation. Seismic facies analysis. Geological softwares like move, basin mod for basin inversion analysis, corel draw, autocad

Small project based on available data.

**Course Aims and Objectives:**

1. Course will help the students to use different software.
2. This course provides a broad introduction and application of datasets used for G and G industry.
3. Course will help to give awareness t the student to get familiar with state of the art technology used by different industries in the world.

**Course Outcomes**:

The following outcomes will achieve from the course.

1. Students get awareness about different applications of softwares used for seismic and well data interpretation.
2. Students will understand about usage of different software.
3. Students learn about different data formats used to create projects.
4. Graduate can work more scientific way to perform their research.

**Reference Books/Materials:**

1. Bacon, M., Simm, R., and Redshaw, T., 2007, 3 D Seismic Interpretation, Cambridge University Press.
2. Herron, D. A., and Latimer, R. B., 2011, First Steps in Seismic Interpretation, Society of Exploration Geophysicists.
3. Brown, A. R., Geologists, A. A. P., and Geophysicists, S. E., 2011, Interpretation of Three Dimensional Seismic Data, Seventh Edition: AAPG Memoir 42, 7th Edition/SEG Investigation in Geophysics, No. 9, Published jointly by American Association of Petroleum Geologists and the Society of Exploration Geophysicists.

**Course Title Coal Geology**

**Course Outline:**

Introduction, Coalification, Coal types, Tectonic Setting of Coal Basins, Coal bearing Cycles & paleoenvironments, Geology of coal, Coal field exploration, Coal in relation to Delta type, Fluvial Coals, Environmental impact of coal mining, Coal resource estimates, General coal Depositional Model.

Lab: Petrography of coal and associated rocks. Preparation a coal pellets. Petrographic methods of coal analysis. Specified assignments/projects.

**Course Aims and Objectives**:

The course begins with a review of the global coal and coal seam gas industry, and the likely future directions based on the current project pipeline and demand scenarios. The details of coal geology, how it's formed, stratigraphy, the chemistry of coal, understanding reservoirs, groundwater and the different types of coal beds around world. How to assess a coal basin play and then evaluate one and the difference between mining and gas plays. Variability in the subsurface and the relationships between groundwater, Finally, underground coal gasification, sequestration and storage, along with issues with overlapping tenures and other techniques.

**Course Outcomes:**

The expected outcomes of course are to explain how coal is formed, to explain how coal is found and extracted by either surface or underground mines, to discuss how geological problems and environmental issues surrounding extraction affect mining and to explain the reasons for the decline in the coal industry.

**Reference Books/Materials:**

1) Hydrocarbons from Coal (AAPG Studies in Geology)" by B E Law
2) "Coal and Coal bearing Strata: Recent Advances" by Scott A C
3) "Coal Geology" by Thomas and Larry
4) "Coal Geology" by WARD

**Course Title** **Climate Crisis Adaption and Mitigation**

**Course Outline:**

Climate science, Natural and Anthropogenic causes of climate crisis, Role of atmospheric and ocean circulation in climate regulation, Present rapid warming, Projection of future climate change, Uncertainty in climate change projections Climate Change Policy, Impacts of Climate Change in Pakistan, Green Economy, Carbon Footprint, Carbon capture and storage, Technological Development and Changing climate, Climate Change matters, , Climate change mitigation in developing countries, climate and human rights, societal systems, Social attitudes to climate change: Adaptation, Mitigation options: increased energy efficiency, fuel substitution, nuclear power, hydropower, solar energy, wind power, biomass energy, tidal, wave and geothermal energy, hydrogen economy, changes in infrastructure and behavior.

**Course Aims and Objectives:**

The objective of this course is to provide a wide ranging understanding on the impacts of climate change on society, understanding of adaptation and mitigation options in relation to climate change.

**Course Outcomes:**

Students will be able to learn the various mitigation and adaptation measures for climate change problem.

Reference Books/Materials:

1) William James Burroughs (2017) Climate change: A Multidisciplinary Approach, Cambridge University Press, Cambridge, UK.
2) Sharon L. Spray, Karen Leah McGlothlin, (2012) Global climate change, Rowman& Littlefield, Maryland, USA
3) Horace M. Karling, (2010) Global climate change, Nova Publishers, New York, USA

**Course Title Disaster Management**

Course Outline:

Natural hazards and disasters: The need for hazard and disaster studies, Historical background on Hazard and Disaster research; Disaster types: Natural vs anthropogenic; Flooding, Earthquake Landslide; Natural cycles and their role, Prediction; Hazards, Risk and Vulnerability: Definitions and characterization, Different approaches and Indicators; Factors of vulnerability: Demographic factors, Mapping of disaster prone areas, Socio economic factors, Cultural factors, Political factors, Physical factors; The impact of natural disasters: Direct and short term impact of disasters, Indirect and long term consequences of catastrophes, Disaster as an opportunity for development; Disaster Management: Components of management, International phenomenon; Hazard and vulnerability reduction and Mitigation: hard and soft measures; Earthquake Management, Flood Management: Organizational Role; Role of Government and Non Governmental Organizations (NGOs); International phenomenon, Role of Media in Disaster Management; Techniques and methods to assess hazard, vulnerability and risk: Qualitative and Quantitative approaches

**.Course Aims and Objectives:**

This course will provide know how in dealing with natural calamities and their management by encompassing the field of hazard and disaster studies. It discusses a wide range of aspects, i.e., assessment of factors which put societies in vulnerable situations to the disaster management continuum. To underline the importance of disasters in socio economic development, this course also aims to make an assessment of the consequences of 'natural' catastrophic at both short and long terms. It finally tends to provide the students with basic knowledge on hazard reduction and vulnerability mitigation.

Course Outcomes:

Students will be able to learn the assessment of the consequences of 'natural' catastrophic at both short and long terms and in depth knowledge on hazard reduction and vulnerability mitigation.

**Reference Books/Materials**:

1 Natural Disasters Alexander, D., Chapman & Hall, New York.
2. Rising from the Ashes: Development Strategies in Time of Disaster Anderson, M.B., and Woodrow, P.J, Westview Press, Boulder, UNESCO, Paris.
3. The Environment as Hazard Burton I., Kates, R.W., and White G.F., 2nd Edition, The Guilford Press, New York.
4. Disaster Management: A Disaster Manager's Handbook Carter N.W., ADB, Manila.

**Course Title Environmental Impact Assessment**

**Course Outline:**

Introduction: principles, concepts and purposes of IEE and EIA and its significance for the society. Cost and benefits of EIA. Main stages in EIA process. Public consultation and participation in EIA process. Methods and techniques for impact prediction and evaluation. Life cycle assessment, Periodic evaluation. EIA review and post project analysis. EIA process management. Role of quality assurance and quality control in environmental analysis. EIA Regulations and guidelines in Pakistan.

**Course Aims and Objectives:**

The aim of this course is to enable the participants to build their capacity to integrate environmental concerns in project proposals.

Course Outcomes:

Students will be able to learn the principles, skills, procedures and practices of integrating environment in development through EIA; become aware of the legal and regulatory obligations of integrating environment in development projects; will familiarize with the techniques of getting public participation and integrate socio economic aspects in development projects.

**Reference Books/Materials:**

1 Environmental Impact Assessment Handbook for Pakistan, Fischer, T.S. (ed.), 2014, Liverpool University Press, UK

2 Introduction to Environmental Impact Assessment, Glasson, J., Therivel, R., and Chadwick, A., Routledge, London, 2005.

3 EIA Manual: Training Resource Manual, Sadler, B., & McCabe, M., (ed.),2nd Edition, United Nations Environment Programme, 2002.

4 Environmental Impact Assessment in Practice, Harrop, D.O. & Nixon, .A., National Book Foundation, Islamabad, 2000.

**Course Title Geophysical Exploration Techniques**

Course Outline:

An introduction to the physics of the earth. Theory and application of basic geophysical field techniques including, gravity, magnetic, electrical, electromagnetic, GPS, seismic studies, and satellite remote sensing. The present internal structure and dynamics of the earth and constraints from the gravitational and magnetic fields, seismology, mineral phases and wave propagation in earth materials. The earthquake source in terms of seismic and geodetic signals. Contributions of heat flow, gravity, paleomagnetic, and earthquake mechanism data to plate tectonics, the driving mechanism of plate tectonics, and the energy sources of mantle convection.

Application of the basic principles of physics to the earth sciences, including mechanics of rotating bodies, the two body problem, tidal theory, oscillations and normal modes, diffusion and heat transfer, wave propagation, electro and magneto statics.

**Course Aims and Objectives:**

This course will introduce a series of geological and geophysical techniques that can be applied to determine the physical characteristics of the Earth's lithosphere, with direct application to the detection and mapping of mineral and energy resources in three dimensions. The course will be divided into modules covering geophysical exploration techniques commonly used in minerals and energy exploration, (gravity, magnetic, electrical, electro magnetic and seismic surveys). Theoretical basis of each technique will be studied, the methods of data collection, presentation and analysis, and appropriate, geologically constrained, interpretation of the data. Students will explore an industry style data base and softwares with the aim of developing an exploration and targeting model for hydrocarbon resources.

**Course Outcomes:**

The anticipated knowledge, skills and/or attitude to be developed by the student are: Demonstrated proficiency in common practical skills in resource exploration, The scientific basis of mineral, energy and natural resource exploration, he generic characteristics of economic mineral and energy resources – geological, geophysical and geochemical anomalism, The geophysical techniques (seismic, gravity, magnetic, electrical and electro magnetics), The geochemical techniques (sampling media, sampling strategies, analytical techniques), Field based data collection – sampling strategies, Demonstrated understanding of the importance of data quality – collection, analysis, processes techniques

**Reference Books/Materials:**

- Geophysical Exploration Technology by Ming li
- Developments in Geophysical Exploration Methods by Fitch
- An Introduction to Geophysical Exploration by Robert H. Tatham

**Course Title** **Environmental Geophysics**

**Course Outline:**

Importance of geophysics in environmental studies, geological and geophysical characteristics of some environmental problems; Landslides, cavities and sinkholes, groundwater pollution, dam problems, different geophysical techniques and field applications. Fixed and mobile hazards. Applications in contaminant plumes, conduits, fractures, voids, aquifers. buried containers, waste pits, ordnance, landfill delineation. Use of seismic methods, ground penetration radar, electromagnetic methods, tomography and other geophysical methods to environmental problems.

**Course Aims and Objectives:**

Geophysical exploration methods are fundamental tools in the search for mineral resources but are also used widely in engineering, archaeology and in earth and environmental sciences to explore and image the shallow subsurface (< 200 m depth). A wide range of geophysical methods are now used routinely in the search for buried archaeological sites, characterization of groundwater resources, geological imaging of subsurface structures and stratigraphic studies.

**Course Outcomes:**

Introduces geophysical exploration methods with emphasis on techniques used to investigate the near surface (< 200 m depth). These methods include seismic reflection/refraction, ground penetrating radar, electromagnetic, resistivity, gravity and magnetic methods. For each method, we will examine the underlying physical principles, the practical aspects of field data acquisition and signal processing and interpretation

**Reference Books/Materials:**

1. Mussett, A.E. and Khan, M.A., Looking into the Earth: An Introduction to Geological Geophysics, Cambridge University Press, 2000.
2. Kearey, P., Brooks, M., Hill I., An Introduction to Geophysical Exploration, Blackwell, 2002.
3. Reynolds, J.M., An Introduction to Applied and Environmental Geophysics, Wiley, 2011.
4. Lay, T. and Wallance, T.C., Modern Global Seismology, Academic Press, 1995.
5. Sheriff R., and Geldart L., Exploration Seismology, Cambridge University Press, 1995.
6. Sheehan, H.R., Jones, A.F., and Burger C.H., Introduction to Applied Geophysics: Exploring the Shallow Subsurface, W. W. Norton & Company, 2006.

**Course Title** **Advanced Seismic Stratigraphy**

**Course Outline:**

Introduction to sequence and seismic stratigraphy; Philosophy and history of sequence stratigraphy; Fault mechanical stratigraphy; Vail and Galloway sequence theory; Hierarchy and application; Sequence models; Basin development; sediment deposition and accommodation concepts; Geophysical fundamentals; Examples of operational sequences; Basin related depositional systems; Chronostratigraphy construction and interpretation; Sea level curves; Orders of cyclicity; Carbonate and Siliciclastic sequences; System Tracts; Stratigraphic surfaces; Seismic facies; Paleo environmental analysis; Geohistory reconstruction; Biostratigraphic signature; Sequences in Deep marine, Shallow marine, Shelfal, Deltaic and Neritic Environment; Hydrocarbon traps related geometries; Seismic truncations; Data Integration at seismic, log, core and outcrop scale; Demarcation of stratigraphic surfaces on integrated data sets; Static and dynamic models; Optimizing exploration.

**Course Aims and Objectives:**

Students will be able to:

- Understand the use of sequence stratigraphy as a tool in basin exploration, and describe related workflow structure, ensure accurate stratigraphic breakdown of well data, manipulate and use a full dataset in an integrated project: well log, outcrop
- Development of sedimentary basins, and their sedimentary infill, with emphasis on depositional processes/environments and resultant stratigraphic architecture.
- Understand the sequence and sedimentology in a temporal and spatial perspective.

**Course Outcomes:**

After taking this course you will know:

- General principles of sequence stratigraphy and their applications in depositional environments and basin types with main processes and products in a range of depositional environments.
- Spatial and temporal development in sedimentary basins, with a predictive perspective on determining facies distribution.
- Seismic expression of various strata and their sequence stratigraphic expression.

**Reference Books/Materials:**

1. Siliciclastic Sequence Stratigraphy   Concepts and Applications” by H.W. Posamentier and G.P.
2. Allen, 2000; SEPM Concepts in Sedimentology and Paleontology Series 7, Society for Sedimentary Geology, 204 pages.
3. Seismic and Sequence Stratigraphy and Integrated Stratigraphy: New Insights and contributions by Gemma Aiello edition I.2017
4. The Sedimentary Record of Sea Level Change by Angela L.Coe, cmabridge uni press 2nd edition,2003
5. Sequence Stratigraphy and Facies Associations (Special Publication 18 of the IAS) Henry W. Posamentier,haq and Allen,
6. Seismic Stratigraphy and Depositional Facies Models by P.C.H Veeken, 1st edition
7. Seismic Stratigraphy, Basin Analysis and Reservoir Characterisation by P.C.H Veeken, volume 37

**Course Title** **Health Safety and Environment**

Course Outline:

Health, safety and environment: Hazards; Physical, mechanical, biological, chemical and psychological hazards and stress. Health and environment, Environmental safety, Hazards identification and risk assessment and management process. Work place environment: Occupational safety and health issues in industries, construction, agriculture and service sectors, Accidents, injuries and workplace fatalities statistics, Occupational safety and health management systems (international and national). Safety Management: Regulations of health, safety and environment. Industrial hygiene, Internal control and management philosophy, Duties and rights, strategies and goals, Roles and responsibilities of occupational health and safety professionals. Key principles of management and HSE, Measures and models for HSE, Organizational environment, HSE statutes and regulations, Establishing HSE plans, Challenges of health within working environment, external environment and safety, Different tools and instruments. 85 Culture, Behavior, Interactions, participation and communication, health surveillance, injury reporting, Emergency response procedures; fires, spills, leaks etc., Preparedness and monitoring of adverse events and follow ups, Case studies. Work place safety and health: Assessing current practices and promoting change in the profession, Personnel Protective Equipment, Formulation of Standard operating procedures, Human Factors and Ergonomic, Planning, decision making and problem solving.

**Course Aims and Objectives:**

The objective of this course to provide orientation to the students on importance of occupational safety, health and environment. Regulations and guidelines concerning HSE work, Reporting of HSE problems and discrepancies, Reporting of HSE problems and discrepancies

Course Outcomes:

Students will have the necessary knowledge about HSE to ensure their own and other people's safety at working environment. This includes knowledge of the HSE concept, objectives for the HSE work and
how to behave safely in laboratories and during field work. The theoretical and practical basic training in first aid and fire protection shall provide the students with a basis for correct handling of a fire or accident situation.

**Reference Books/Materials:**

1. Hand book of Environmental Health & Safety, principles and Practices By Herman Koren and Mechael Bisesi, Vol.1 , Lewis publishers.
2. English, P. F. 2012. Safety Performance in a Lean Environment: A Guide to Building Safety into a Process (Occupational Safety & Health Guide Series), CRC press. Taylor and Francis group. USA.
3. Salvendy, G. 2012. Handbook of Human Factors and Ergonomics. 4 th ed., John Willey Inc. New Jersey, USA.
4. OHSAS BS 18001 Standard.

## Revised Curriculum MS ES

Program Title: _**MS Environmental Sciences**__
Duration: __**2 to 3 Years**__________________
Total Credit Hours: __**30**________________
Endorsement References: A: Recommendations of DBOS dated **12th August** 2024 (Minutes of DBOS meeting)

**Summary of Credit Hours**

| Sr. No. | Category of course | Credit Hours/Contact Hours | |
|---|---|---|---|
| | | Existing Road Map | Proposed New Road Map |
| 1. | Compulsory Courses | 12 | 12 |
| 2. | Elective courses | 12 | 12 |
| 3. | Thesis | 6 | 6 |
| | **Total** | **30** | **30** |

**Program Educational Objectives**

1. Demonstrate fundamental interdisciplinary knowledge of environmental science, to apply in response to real world environmental science challenges (PEO1)
2. Categorize and assess relevant physical processes and implement appropriate quantitative metrics for addressing critical environmental challenges within their track (PEO2)
3. Synthesize the key insights from new research within their track to develop and implement management improvements of an environmental system (PEO3)

**Program Learning Objectives**

PLO1. An ability to identify, formulate, and solve complex Environmental problems by applying principles of environmental sciences

PLO 2. An ability to recognize ethical and professional responsibilities in environmental and societal contexts.

PLO 3. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

PLO 4. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use environmental concepts to draw conclusions.

PLO 5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

| **Sr. No.** | **Existing Road Map** | | | | **Sr. No.** | **Proposed Road map aligned with HEC new GEP Policy** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Prerequisite | Course Code | Course Title | Credit Hours | | Prerequisite | Course Code | Course Title | Credit Hours | HEC Category | 17 UN SDGs alignment |
| 1 | | ENV 531 | Environmental Analytical Techniques | 3 | 1 | | ENV 731 | Advancement in Environmental Analytical Techniques | 3 | Compulsory | SDGs |
| 2 | | ENV 540 | Climate Change Adaptation and Mitigation | 3 | 2 | | ENV 740 | Climate Crisis Adaption and Mitigation | 3 | Compulsory | 3,4,9,11 |
| 3 | | ENV 502 | Environmental Management | 3 | 3 | | ENV 702 | Environmental Management | 3 | Compulsory | 4,11,13 |
| 4 | | ESC 701 | Research Methodology | 3 | 4 | | ESC 701 | Research Methodology | 3 | Compulsory | 4,8,12 |
| 5 | | ENV | Environmental | 3 | 5 | | ENV | Advanced | 3 | Elective | 4,14,15 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 530 | Biotechnology | | | | 730 | Environmental Biotechnology | | | |
| 6 | | ENV 503 | Energy and Environment | 3 | 6 | | ENV 703 | Ecofriendly Energy Sources | 3 | Elective | SDGs 3,6,11,14,16 |
| 7 | | ENV 520 | Solid and Hazardous Waste Management | 3 | 7 | | ENV 720 | Innovation in waste management approaches | 3 | Elective | 3,4,7,9,11 |
| 8 | | ENV 513 | Health, Safety and Environment | 3 | 8 | | ENV 713 | Health, Safety and Environment | 3 | Elective | 3,4,6,11,12, 15 |
| 9 | | ENV 515 | Environmental Risk Assessment and Management | 3 | 9 | | ENV 715 | Environmental Risk Assessment and Management | 3 | Elective | 3,4,9,11,15 |
| 10 | | GEO 520 | Hydrochemistry and Groundwater Pollution | 3 | 10 | | GEO 720 | Hydrochemistry and Groundwater Pollution | 3 | Elective | 4,11,12,14, 15 |
| 11 | | ENV 509 | Population Dynamics and the Environment | 3 | 11 | | ENV 709 | Population Dynamics, Environment and Sustainability | 3 | Elective | 3,4,6,11,14, 15 |
| 12 | | ENV 510 | Environmental Auditing | 3 | 12 | | ENV 710 | Environmental Auditing | 3 | Elective | 4,5,10,11 |
| 13 | | ENV 511 | Environmental Economics | 3 | 13 | | ENV 711 | Circular and Green Economy | 3 | Elective | SDG 4, 8,12 |
| 14 | | ENV 537 | Environmental Engineering | 3 | 14 | | ENV 737 | Recent Trends in Environmental Engineering | 3 | Elective | 4,8,10,16 |
| 15 | | ENV 514 | Remote Sensing and GIS Applications in Environment | 3 | 15 | | ENV 714 | Remote Sensing and GIS Applications in Environment | 3 | Elective | 3,4,6,9,11 |
| 16 | | ENV 518 | Watershed Management | 3 | 16 | | ENV 718 | Watershed Management | 3 | Elective | 4,9,11,15 |
| 17 | | ENV 519 | Epidemiology | 3 | 17 | | ENV 719 | Environmental Epidemiology | 3 | Elective | 1,2,4,6,11,12,14,15,16 |
| 18 | | ENV 521 | Marine Pollution | 3 | 18 | | ENV 721 | Marine Pollution | 3 | Elective | 3,4,15 |
| 19 | | ENV 505 | | 3 | 19 | | ENV 705 | And Control | 3 | Elective | 3,4,6,11,14, 15 |
| 20 | | ENV 533 | | 3 | 20 | | ENV 733 | Environmental Policies and | 3 | Elective | 4,10,16 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Legal Framework | | | |
| 21 | | GEO 528 | | 3 | 21 | | GEO 728 | Advanced Environmental Chemistry | 3 | Elective | 3,6 ,14 |
| 22 | | ENV 504 | | 3 | 22 | | | Groundwater Modeling | 3 | Elective | 2,3,4,6,11 |
| 23 | | ENV 522 | | 3 | 23 | | ENV 704 | Environmental Impact Assessment | 3 | Elective | 4,12,14 |
| 24 | | ENV 507 | | 3 | 24 | | ENV 722 | Disaster Mitigation and Emergency Management | 3 | Elective | 3,8,11,14,16 |
| 25 | | ENV 508 | | 3 | 25 | | ENV 707 | Sustainability and environmental management | 3 | Elective | 3,8,11,13,4,16 |
| 26 | | ENV 534 | | 3 | 26 | | ENV 708 | Emerging Trends in Environmental Sociology | 3 | Elective | 4,11,17 |
| 27 | | ENV 535 | | 3 | 27 | | ENV 734 | Advanced Environmental Microbiology | 3 | Elective | 4,10,11 |
| 28 | | ENV 536 | | 3 | 28 | | ENV 735 | Freshwater Ecology | 3 | Elective | 4,6,13,14,15 |
| 29 | | ENV 512 | | 3 | 29 | | ENV 736 | Advanced Environmental Geology | 3 | Elective | 4,6,14,15 |
| 30 | | ENV 516 | | 3 | 30 | | ENV 712 | Project Management | 3 | Elective | 11,12,14,15,17 |
| 31 | | ENV 524 | | 3 | 31 | | ENV 716 | Wildlife, Forestry and Wetland Management | 3 | Elective | 3,4,11,12,13,14,15 |
| 32 | | ENV 541 | | 3 | 32 | | ENV 724 | Air and Noise Pollution Control | 3 | Elective | 3,4,11,13,15 |

## Course Outlines

## MS ES

**Course Title** **Climate Crisis Adaption and Mitigation**

**Course Outline**:

Climate science, Natural and Anthropogenic causes of climate crisis, Role of atmospheric and ocean circulation in climate regulation, Present rapid warming, Projection of future climate change, Uncertainty in climate change projections Climate Change Policy, Impacts of Climate Change in Pakistan, Green Economy, Carbon Footprint, Carbon capture and storage, Technological Development and Changing climate, Climate Change matters, , Climate change mitigation in developing countries, climate and human rights, societal systems, Social attitudes to climate change: Adaptation, Mitigation options: increased energy efficiency, fuel substitution, nuclear power, hydropower, solar energy, wind power, biomass energy, tidal, wave and geothermal energy, hydrogen economy, changes in infrastructure and behavior.

**Course Aims and Objectives:** The objective of this course is to provide a wide ranging understanding on the impacts of climate change on society, understanding of adaptation and mitigation options in relation to climate change.

**Course Outcomes:** Students will be able to learn the various mitigation and adaptation measures for climate change problem.

**Reference Books/Materials**:

1. William James Burroughs (2017) Climate change: A Multidisciplinary Approach, Cambridge University Press, Cambridge, UK.

2. Sharon L. Spray, Karen Leah McGlothlin, (2012) Global climate change, Rowman& Littlefield, Maryland, USA

3. Horace M. Karling, (2010) Global climate change, Nova Publishers, New York, USA

**Course Title** **Advances in Plant Ecology**

**Course Outline**:

Ecological zones, physiological responses of plant with considerate environment, plants, survival and extinction, Role of plant growth and defensive hormones in plant life, Plant population dynamics: Species richness, vegetation dynamics, fine–scale to large–scale dynamics. Leaf Energy Budgets: Effects of Radiation and Temperature. Life Cycles: annuals and perennials, environmental influences and plant adaptations. Biotic Influences: Edaphic parameters, symbiotic associations, pathogenicity, parasitic associations and carnivory. Ecological Biochemistry: allelopathy and defense against herbivores. Plant invasions and its threats of plant diversity. Conservation, management and restoration of threatened plant communities.

Course Aims and Objectives: This course is designed to update the students about recent developments in plant ecology and physiological modifications with reference to environment, its conservation and management.

Course Outcomes: Students will be able to learn the various conditions that results in species extinction and also different conservation measures.

**Reference Books/Materials:**

1. Vegetation Ecology Ed. Maarel, ED. Blackwell Publishing, Oxford, UK. 2015.

2. Introduction to Plant Population Biology. Silvertown, J. & Charlesworth, D. Blackwell Publishing. Oxford UK. 2016.

3. Plant Ecology. Shulze, E.D; Beck, E & Muller Hohenstein, K. Springer, Berlin. 2017.

**Course Title Environmental Auditing**

**Course Outline:**

Principle functions of environmental audit, Complaince and management in audut system, corporate auditing, product auditing and understanding the role of standards for environmental assessment and environmental management systems. Introduction to Environmental Auditing, types of audit and audit management systems, the Legal Context, Preaudit activities, audit specifications, obtaining information, Emissions and Other Impacts, Resource Use and Waste Minimization, checklists, open meeting, Corporate Auditing: Procedures and Methods, evaluation and audit results. Audit report writing, Environmental Impacts and Performance, Lifecycle Assessment, Sustainable Products and Services 'Standards' and Reporting.

Course Aims and Objectives: This module is intended to provide a broad understanding of environmental auditing, including an understanding of the increasing importance of corporate social responsibility and the use of standards for environmental management by companies. The legal and procedural context is focused with international standards and such those established by the International Organization for Standardization (ISO) or international labelling.

**Course Outcomes:**

After completing this module student should be able to define environmental auditing and describe the main components of the environmental auditing process, know the methods for auditing specific environmental issues associated with the activities of an organization and product/service. Understand key principles underpinning a range of environmental management tools and techniques, assess critically the use and application of environmental auditing and management tools.

**Reference Books/Materials:**

1. Humphrey N, Hadley M (2000) Environmental Auditing. Palladian Law Publishing Ltd, Bembridge, Isle of Wight.
2. Dagg S (2005) C108 Environmental Auditing. Module prepared for the Distance Learning Programme, Imperial College London.
3. Brady J (2011) The response of organizations. In: Brady J, Ebbage A, Lunn R (eds) Environmental
4. Management in Organizations: The IEMA Handbook, 2nd edn. Earthscan, London, pp. 251–260

**Course Title Advancement in Environmental Biotechnology**

**Course Outline**:

Introduction to biotechnology, Tools in environmental biotechnology, fundamentals of biological interventions, , ,Role in waste water technology, Bio composites for pollution control, Biofertilizers, Biodegradation of novel compounds, microbial consortium application, Recombinant DNA Technology, Genetic manipulations environmental applications of GMOs, biosafety concerns of GMOs, bio strategies for pollution control, bioremediation, phytoremediation, biofilm, Biomarkers, Biosensor, Microbial interaction with plastics, antibiotics and others emerging pollutants, Microbial Principles of Biodegradation Bioreactors. Ethical and legal problems in creations and use of transgenic organisms.

**Course Aims and Objectives:**
This course will provide sound technical foundation for using biotechnology in solving environmental issues and cleanup of the polluted environments.
Course Outcomes: After completion of this course, students will be able to understand the significance, and application of biotechnology in the environment.

**Reference Books/Materials:**
1. Environmental Microbiology. 2ndEdition. 2010. Edited by Ralph Mitchell and Ji Dong Gu. John Wiley & Sons, Inc., Hoboken, New Jersey.
2. Environmental Biotechnology: Concepts and Applications, Hans Joachim, J. and Josef, W. (ed.). Wiley VCH Verlag, Germany, 2005.
3. Biotechnology, Smith, J.E., 5thEd. Cambridge University Press, New York, USA, 2009.
4. National Biosafety Guidelines. National Biotechnology Commission, Government of Pakistan. 2005.
5. Environmental Biotechnology: Theory and Application. Gareth M. Evans and Judith C. Furlong. John Wiley & Sons Ltd, The Atrium, Southern
6. Gate, Chichester, West Sussex PO19 8SQ, England, 2003.

**Course Title Advanced Environmental Chemistry**

**Course Outline:**
Chemistry of atmosphere, Major layers in atmosphere, temperature changes in the atmosphere, units to describe atmospheric chemistry, chemical reactions in the atmosphere sources and effects of following pollutant on human health Carbon dioxide, Nitrogen oxides, Sulfur dioxide, Volatile organic compounds, automobile pollutants, Industrial smog, Photochemical smog, production of hydroxyl radical, their reaction with hydrocarbons, Indoor air pollution various indoor air pollutants, particulates, chemistry of ground level air pollution. Production of ozone in the stratosphere catalytic destruction of ozone, Hydroxyl Radical cycle, NO cycle, the chlorine cycle, Null cycles, Effects of ozone depletion on human health and environment, Green chemistry, its principles, Green chemistry, its principles, intersections between environmental chemistry and society , Water pollution, Types of water pollutants oxidation Reduction reactions in aqueous systems. Treatment technologies, Suspended solids and sediments, Dissolved solids. Toxic organic compounds, pesticides, organochlorine insecticides, carbamates. Accumulation in biological systems. Biomagnification and Biodegradation. Toxic heavy metals and their Bioaccumulation.
Course Aims and Objectives: This course is designed to provide knowledge about different chemical process occurring in the environment.
Course Outcomes: Students will be able to learn various physical and chemical methods to minimize pollution and adverse effects of various pollutants on human health and toxicity.

**Reference Books/Materials:**

1. Environmental Chemistry. Ibanez, J.G., Hemandez Esparaz, M., Doria Serrano, C., Fregoso Infante, A. and Singh, M.M., Springer, Germany.2018.
2. Principles of Environmental Chemistry, Girard, lE., 1stEdition. Jones and Barlett, USA, 2015.
3. Environmental Chemistry. Baird Collin and Michael Cann. W.H. Freeman and Company, New York USA. 2008.

**Course Title Environmental Impact Assessment**

**Course Outline**

: Introduction: principles, concepts and purposes of IEE and EIA and its significance for the society. Cost and benefits of EIA. Main stages in EIA process. Public consultation and participation in EIA process. Methods and techniques for impact prediction and evaluation. Life cycle assessment, Periodic evaluation. EIA review and post project analysis. EIA process management. Role of quality assurance and quality control in environmental analysis. EIA Regulations and guidelines in Pakistan.

**Course Aims and Objectives:**

The aim of this course is to enable the participants to build their capacity to integrate environmental concerns in project proposals.

**Course Outcomes:**

Students will be able to learn the principles, skills, procedures and practices of integrating environment in development through EIA; become aware of the legal and regulatory obligations of integrating environment in development projects; will familiarize with the techniques of getting public participation and integrate socio economic aspects in development projects.

**Reference Books/Materials:**

1. Environmental Impact Assessment Handbook for Pakistan, Fischer, T.S. (ed.), 2014, Liverpool University Press, UK
2. Introduction to Environmental Impact Assessment, Glasson, J., Therivel, R., and Chadwick, A., Routledge, London, 2005.
3. EIA Manual: Training Resource Manual, Sadler, B., & McCabe, M., (ed.),2nd Edition, United Nations Environment Programme, 2002.
4. Environmental Impact Assessment in Practice, Harrop, D.O. & Nixon, .A., National Book Foundation, Islamabad, 2000.

**Course Title Environmental Policies and Legal framework**

**Course Outline:**

Carrying capacity and sustainable development. Cultural values and flexibility to environment, Conservation Strategies; WCS, NCS, Provincial and Local Strategies. A detailed study of Environmental Problems of Pakistan, National policy for environment protection, Laws for the proction of terrsterial, aqauatic and atmospheric system Ecosystems. Treaties, Conventions and Protocols in Global, Transboudary policies and implementation framework, Regional and International Environmental Issues. Environmental control Policies, Instruments and methods. Role of

Public awareness and community participation in environmental conservation and management. Organizational and Institutional Framework for Environmental Protection and Management: Scope and Status in Pakistan. Role of the State and International Policy, Trade and Globalization.

**Course Aims and Objectives:**

This course aims at giving an understanding of the role of state and its instruments in the governance of environment.

Course Outcomes: Students will be able to learn about responsibilities of state and rights of its citizens to live in environmentally sound conditions to contribute in sustainable development.

**Reference Books/Materials:**


1. Environmental Laws and their implementation in Pakistan, Qadar, S. Law Books House, 2000.
2. Pakistan Environmental Protection Act, 1997, Government of Pakistan
3. Environmental Policies of Govt. of Pakistan.
4. SNBP Local Government Ordinance, 2001.
5. Provincial Environmental Laws.


**Course Title Sustainability and environmental management**

**Course Outline:**

The concept of Sustainability, History and discourses of Sustainable Development. resources problems for sustainability, core environmental indicators, key environmental indicators, indicators for “environmental quality” and indicators for “resource evaluation”, environmental pressure, environmental conditions, and societal responses. Development and Environmental Degradation. Sustainable development goals, Sustainable Development of Natural Resources. Land Degradation: Deforestation and Desertification. Water Resources & Water Degradation: Global Climactic Change; Kyoto Protocol. Population, factors affecting population size, urbanization and urban growth, urban resources and environmental problems, population and consumption Population & Consumption: Poverty, Community Development and Participation, The Green Revolution.

**Course Aims and Objectives**:

The primary objective of the course is to provide students with a broad understanding of environmentally sustainable development (development and it’s linkage with environmental degradation), issues of environment and sustainable development, challenges faced by developing world and sustainable management of natural resources

Course Outcomes: The students will be able to learn the principles of environment and sustainable development and the challenges faced by developing world and sustainable management of natural resources.

**Reference Books/Materials:**


1. “Principle of Environmental Science (Inquiry and Applications)” by William P. Cunningham and
2. Mary Ann Cunningham. (3nd Edition, 2006).
3. “Environmental science” by G.T. Miller Jr (9th edition, 2003)
4. “Living in the Environment” by G.T. Miller Jr . (12th edition, 2002).
5. “Environmental Geology” by Edward A. Keller. (6th Edition, 2006).

**Course Title** **Disaster Mitigation and Emergency Management**

**Course Outline**:

Natural hazards and disasters: The need for hazard and disaster studies, Historical background on Hazard and Disaster research; Disaster types: Natural vs anthropogenic; Flooding, Earthquake Landslide; Natural cycles and their role, Prediction; Hazards, Risk and Vulnerability: Definitions and characterization, Different approaches and Indicators; Factors of vulnerability: Demographic factors, Mapping of disaster prone areas, Socio economic factors, Cultural factors, Political factors, Physical factors; The impact of natural disasters: Direct and short term impact of disasters, Indirect and long term consequences of catastrophes, Disaster as an opportunity for development; Disaster Management: Components of management, International phenomenon; Hazard and vulnerability reduction and Mitigation: hard and soft measures; Earthquake Management, Flood Management: Organizational Role; Role of Government and Non Governmental Organizations (NGOs); International phenomenon, Role of Media in Disaster Management; Techniques and methods to assess hazard, vulnerability and risk: Qualitative and Quantitative approaches

**Course Aims and Objectives:**

This course will provide know how in dealing with natural calamities and their management by encompassing the field of hazard and disaster studies. It discusses a wide range of aspects, i.e., assessment of factors which put societies in vulnerable situations to the disaster management continuum. To underline the importance of disasters in socio economic development, this course also aims to make an assessment of the consequences of ‘natural’ catastrophic at both short and long terms. It finally tends to provide the students with basic knowledge on hazard reduction and vulnerability mitigation.

**Course Outcomes:**

Students will be able to learn the assessment of the consequences of ‘natural’ catastrophic at both short and long terms and in depth knowledge on hazard reduction and vulnerability mitigation.

**Reference Books/Materials:**

1. Natural Disasters Alexander, D., Chapman & Hall, New York.
2. Rising from the Ashes: Development Strategies in Time of Disaster Anderson, M.B., and Woodrow, P.J, Westview Press, Boulder, UNESCO, Paris.
3. The Environment as Hazard Burton I., Kates, R.W., and White G.F., 2nd Edition, The Guilford Press, New York.
4. Disaster Management: A Disaster Manager’s Handbook Carter N.W., ADB, Manila.

**Course Title** **Advancement in Environmental Analytical Techniques**

Course Outline: Introduction: Principles of physical, chemical and microbiological analysis of environmental pollutants. Sampling procedure for the examination of Water, Wastewater, Air and Solid Waste; sampling rules, sample collection and preservation. Sample preparation and Pretreatment, Sample extraction techniques and

removal of interference from sample extracts, quality control and quality assurance program in environmental analysis; errors in quantitative analysis, precision and accuracy in
measurement, statistics in microanalysis, control charts, and detection limit, Laboratory Techniques and Field Monitoring for parameters of importance causing environmental pollution. Environmental Chemical Analysis; role and importance, classical methods: volumetric and gravimetric analysis., Microbiological analysis, Electroanalytical methods, Instrumental Techniques using Spectrophotometery, Chromatography, Atomic Absorption and Emission Analysis etc. Statistical Tools: Assessment and Interpretation of Results.

**Course Aims and Objectives**:
The objective of this course is to impart skills and techniques necessary for measurement of different environmental pollutants.
Course Outcomes: The basic concept of principles of instrumental techniques will be given to students. This course will enable the students to carryout monitoring and evaluation.

**Reference Books/Materials**:

1. Environmental Engineering Laboratory. Ahmed, K.A one Publishers Lahore, Pakistan, 1998.
2. Standard Methods for Examination of Water and Wastewater. L. S. Clesceri, A. E. Greenberg, A. D. Eaton. 20th Edition. APHA publisher, USA, 1998.

**Course Title Environmental Management (3CH)**

Course Outline: Fundamental concepts of Environmental Management, Historical Development of environmental concerns, sustainable development concept. Efficient allocation of resource, control and optimum utilization of energy and non renewable resources, Approaches for waste minimization amnd management of waste in process, Ecological foor printing, circular economy, management of gaps and loopholes, Environmental management of agriculture, forest, water, and land resources. Social, ethical and religious dimensions, economic and technological use. Policy and legal instrument for environmental management: institutional framework, role of public, private sector and civil society. Green manufacturing: marketing, green consumerism. Global efforts for managing environment: Environmental policy and Law. ISO Guidelines (I4000), Environmental Management System, Environmental Auditing, Corporate Social Responsibility.
Course Aims and Objectives: The objective of this course is to give detail insight of Environmental Management. Sources of data, data collection and interpretation. Related Environmental regulations, Principles of cleaner production.

**Course Outcomes:**
After completion of a course, students will be able to apply the principles and tools of environmental management.
Reference Books/Materials:

1. EMS — an implementation Guide for Small and Medium sized Organizations NSF International Ann Arbor, Michigan January 2001.
2. ISO 14000 – Meet the whole family, ISO Central Secretariat, Switzerland, 1998.
3. UNEP/IE (Industry and Environment), 1990b, Environmental auditing, Paris.

4. Inside ISO 14000: The Competitive Advantage of Environmental Management, Sayre, D, St Luise Press. USA. 1997

**Course Title Ecofriendly energy sources**

Reviewed Course Outline: Environment as a framework of energy, Energy resources: Renewable & Non-Renewable, Fossil fuels and their environmental effects: Coal, Oil and Natural Gas, Greenhouse effect and acid rain etc. Nuclear energy, Renewable energy principles: Solar radiation characteristics; Active and Passive use of solar energy (water heating, air heating, crop dryers, space heating, water desalination, solar ponds and solar concentrators etc). Photovoltaic; Hydropower, Micro hydroelectric plants; Wind power; Biofuels; Ethanol from Biomass; Wave, tidal and ocean thermal energy; Geothermal energy. Methods for energy conversion, environmental impacts for electricity, heating and cooling, Energy conversions in industry and buildings, Energy storage (batteries and fuel cells etc.): Hydrogen from renewable energy sources, Energy from waste, Energy efficiency and management.

**Course Aims and Objectives:**

This course is designed to create understanding of the significance of energy in our daily life, its supply position and merits and demerits of different energy resources.

Course Outcomes: After completion of a course, students will be able to learn about different sources of energy and its role in environment.

**Reference Books/Materials:**

1. Towards a Sustainable Energy Future, OECD/IEA, Paris, 2001.
2. Environmental Science: Earth as a Living Planet, Botkin, D.B and Keller, E.A. 6th Edition. John Wiley and Sons. 2007.
3. Environmental Science: Systems and Solutions. McKinney, M.L., Schoch, R.M. and Yonavjak, L. 4th Edition. Jones & Bartlett Publishers, 2007.

**Course Title Circular and Green economy**

**Course Outline**:

Introduction to environmental economics, Distinction between natural resource economics and environmental economics., framework of policies and approaches that accelerates progress toward sustainable development goals. Economic growth and development, Externalities, Market Failure, Trade off, Carbon footprint assessment, carbon trading and carbon sequestration, Circular economy key ideas, butterfly diagram, visualization of circular economy, circular economy principles, don't buy product buy services Evaluating the Environment and Benefit cost Analysis: Measuring environmental benefits: contingent valuation, the travel cost method and the hedonic approach. Benefit cost analysis. Regulation, taxes and fees, Pollution charge, Ecosystem trading and valuation, Vulnerability, Role of Microfinance in Promoting Renewable Energy. Institutional Framework for Renewable Energy and community adaptation.

**Course Aims and Objectives:** The objective of this course is to develop understanding of basic principles of green economy within the economic, energy and food security context of the country and the region. Sector specific challenges and opportunities to advance low carbon, resource efficient and socially inclusive development.
Course Outcomes: participants will be able to define the concept of a green economy and explain its value, distinguish relevant planning processes in support of a green transformation, Identify enabling conditions for greening national economies and discuss principal challenges and opportunities to advance environmental economics

**Reference Books/Materials:**

1. Markandya, Anil and Renat Perelet, et. al. Dictionary of Environmental Economics. London: Earthscan Publications, Ltd., 2002.
2. McCain, Roger A. Essential Principles of Economics: A Hypermedia Text. Drexel University. http://william king.www.drexel.edu/top/prin/txt/EcoToC.htm
3. Hussen, Ahmed. Principles of Environmental Economics, 2e. New York, NY: Routledge, 2004.
4. Henderson, David R. The Concise Encyclopedia of Economics. The Library of Economics and Liberty, 2002. http://www.econlib.org/library/CEE.html

**Course Title Advances in Environmental Engineering (3CH)**

**Course Outline**:

Principles of Environmental Engineering: population, economic growth, industrialization, energy use. Physical and transport properties of mixtures, contaminant partitioning and transport in air, water and solids. Application of environmental principles, life cycle analysis, principles of environmental quality, standards and guidelines. Water and wastewater: characteristics and parameters, standard methods of analysis, treatment plants and systems. Industrial wastewater characteristics, treatment, treatment levels and available technologies. Sanitation, Water distribution Components, Methods of analysis, Water conservation, Sustainable solutions. Sources and classification of atmospheric pollutants and particulates, health and ecological impacts. Gaussian diffusion model, lapse rate and stability conditions. Control of particulates: collection, mechanisms and efficiencies. Control of gases and vapors, adsorption, absorption, incineration, odor and gaseous pollutant control. Solid waste characterization and classification. 3R techniques Solid Waste Management, Soil and its quality, Contaminated site remediation.

Course Aims and Objectives:

1. To equip students with the understanding of basic principles of environmental engineering.
2. To familiarize with the study of environmental hazards, risks prevention, field monitoring, data collection and interpretation of risk management, engineering principles, Technologies and solutions to environmental problems.
3. To give the understanding of principles of environmental quality, standards and guidelines for various environmental parameters.

Course Outcomes: On completion of this course, students are expected to be able to know about basic applications of environmental engineering, environmental remediation and treatment technologies and solution to the hazards.

Reference Books/Materials:

1. Environmental technologies (Engineering & Principles)
2. Environmental Engineering (Wiley)

**Course Title Environmental Epidemiology**

Course Outline: Environmental risks to human health. Epidemics, endemics, and pandemics. Epidemiology triangle. Disease concepts: Communicable and noncommunicable diseases and conditions. Modes of disease transmission and chain of infection. Exposure pathways between humans and environment. Zoonoses. Type of epidemiology: social, occupational, environmental, nutritional and infectious disease epidemiology. Occupational health and industrial hygiene. Disease surveillance and health impact assessment. Basic concepts: rates, ratios, proportions and relative risks. Measures of association and odds ratio analysis: Disease mapping on various scales case control studies, cohort studies, double cohort studies. Role of confounding factors in causation of disease. Web of causation. Sensitivity and Specificity.. Ethics in epidemiologic research. Statistical Methods in Epidemiology: Sample size determination and statistical inference. Integrating toxicological and epidemiological data. Regression methods. Time series, spatial analysis and meta analysis in epidemiology. Field Epidemiology: Epidemiological field work in population based studies. Exposure assessment, surveillance and screening methods. Examples of case studies: cardiovascular, cancer, asthma and vector borne diseases.

Course Aims and Objectives: The objective of the course is to provide the student with insight in the principles and important issues of environmental epidemiology. This course will focus on assessment of disease burden, measurement of exposure and interpretation of mortality, morbidity concepts.

Course Outcomes: Upon completion of this course, it is assumed that students will be able to comprehend emerging diseases in the context of climate change and global environmental change.

Reference Books/Materials:

1. Ahrens, W. and Pigeot, I. (2013). Handbook of Epidemiology. 2nd Ed. Springer, London. UK.
2. Merril, R. M. and Timmreck, T. C. (2016). Introduction to Epidemiology. (4th ed.). Jones and Barlett Publishers. Boston, USA.
3. Merril, R. M. (2008). Environmental Epidemiology: Principles and Methods. (4thed.). Jones and Barlett Publishers. Boston, USA.
4. Aschengrau, A. and Seage, G. R. 2003. Essentials of Epidemiology in Public Health. Jones & Bartlett Learning, 5 Wall Street Burlington, MA

**Course Title Remote Sensing and GIS Applications in Environment**

Course Outline: Fundamentals of Remote Sensing. History and data collection, advantages and limitations of process. Energy Sources, energy matter interaction in the atmosphere. Aerial photography, history and platforms. Active and Passive remote sensing. Remote sensing of vegetation and landscape. Introduction to Photogrammetry, Satellite Imageries, Image Processing, Interpretation, Preparation of thematic maps. Fundamental of Geographic Information System (GIS). Integration with other technologies and its importance. Data acquisition, analysis and output. Types of data used in GIS. Cartography, map projection and coordinate systems. GIS applications in: Environmental protection and resource conservation, Environmental Impact Assessment (EIA), Agriculture, Forestry, Fishery and wildlife. Introduction to relevant Pakistani Institutions working in GIS.

Course Aims and Objectives: The main objective of the GIS/RS are to maximize the efficiency of decision making and planning, provide efficient means for data distribution and handling, eradication of the duplicated data, integration of information from many sources. Geographical information system (GIS) and remote sensing (RS) had been one of the key subprojects envisaged in the National Information System. The attempts of a digital description of that world create a computerized GIS which is usually a partial description of the world in relation with some feature tasks.

Course Outcomes: Students will be able to apply the GIS and RS techniques in the monitoring of environment.

Reference Books/Materials:

1. A Primer of GIS fundamentals Geographic and Cartographic Concepts, Harvey, F. Guilfoud press New York.
2. Dynamic Earth Environmental Remote Sensing Observations from shuttle Mission. Lulla, K and L.
3. V. Dessinov. John Wiley and Sons.
4. Introduction to GIS. Campbell. Mc Graw Hill Education.
5. Remote Sensing of the environment: An Earth perspective. Jensen, R. Pearsons Education, Inc.
6. Remote Sensing for the Earth Sciences. A. Z. Rancez. John Wiley and Sons. Inc.

**Course Title Health Safety and Environment**

Course Outline: Health, safety and environment: Hazards; Physical, mechanical, biological, chemical and psychological hazards and stress. Health and environment, Environmental safety, Hazards identification and risk assessment and management process. Workplace environment: Occupational safety and health issues in industries, construction, agriculture and service sectors, Accidents, injuries and workplace fatalities statistics, Occupational safety and health management systems (international and national). Safety Management: Regulations of health, safety and environment. Industrial hygiene, Internal control and management philosophy, Duties and rights, strategies and goals, Roles and responsibilities of occupational health and safety professionals. Key principles of management and HSE, Measures and models for HSE, Organizational environment, HSE statutes and regulations, Establishing HSE plans, Challenges of health within working environment, external environment and safety, Different tools and instruments. 85 Culture, Behaviour, Interactions, participation and communication, health surveillance, injury reporting, Emergency response procedures; fires, spills, leaks etc., Preparedness and monitoring of adverse events and follow ups, Case studies. Workplace safety and health: Assessing current practices and promoting change in the profession, Personnel Protective Equipment, Formulation of Standard operating procedures, Human Factors and Ergonomic, Planning, decision making and problem solving.

Course Aims and Objectives: The objective of this course to provide orientation to the students on importance of occupational safety, health and environment. Regulations and guidelines concerning HSE work, Reporting of HSE problems and discrepancies, Reporting of HSE problems and discrepancies

Course Outcomes: Students will have the necessary knowledge about HSE to ensure their own and other people's safety at working environment. This includes knowledge of the HSE concept, objectives for the HSE work and how to behave safely in laboratories and during field work. The theoretical and practical basic training in first aid and fire protection shall provide the students with a basis for correct handling of a fire or accident situation.

Reference Books/Materials:

1. Hand book of Environmental Health & Safety, principles and Practices By Herman Koren and Mechael Bisesi, Vol.1 , Lewis publishers.
2. English, P. F. 2012. Safety Performance in a Lean Environment: A Guide to Building Safety into a Process (Occupational Safety & Health Guide Series), CRC press. Taylor and Francis group. USA.
3. Salvendy, G. 2012. Handbook of Human Factors and Ergonomics. 4 th ed., John Willey nc. New Jersey, USA.
4. OHSAS BS 18001 Standard

**Course Title Hydro chemistry and Groundwater pollution**

Course Outline: Introduction and basic concepts: The water molecule: structure and properties; water as a solvent. Ways of expressing the concentrations of substances dissolved in water, Composition and analysis of waters, Types of natural waters. Composition of continental waters: types of constituents and their relative importance. Chemical analysis of groundwater: Types and characteristics. The balance error: concept and utility. TSD and Dry Residue: concept and determination; electrical conductivity as an expression of the total salinity of water. Preliminary interpretation of hydrochemical data: graphical methods (diagrams). Concept of hydrochemical facies. Water chemistry. Chemical equilibria: The Law of Mass Action; activities. Complexes. Water dissociation: pH concept. Dissolved gases: cases of O2 and CO2. Equilibria of the CO2 H2O system; Alkalinities. Dissolution of minerals: solubilities; effects of ionic strength and common ion. Deviations from equilibrium: saturation states. Dissolution of carbonate rocks. Hardness. Oxidation Reduction Processes: concepts of pe and Eh. Oxygen consumption: concepts of BOD and COD. Surface processes: sorption and cation exchange. Hydrogeochemistry . Precipitation water. Water on the ground. Underground flow: regional evolution; modifying processes. Infiltration water in irrigated areas. Origin and hydrogeochemical characteristics of the main dissolved constituents of groundwater. Estimation of hydrological variables from hydrogeochemical data: water mixtures; chloride balance. Water quality and pollution. Concepts. Quality for supply: commentary on Spanish regulations. Quality for agricultural uses. Quality for industrial uses. Modes of groundwater contamination. Main polluting agents. Main potential sources of groundwater contamination. Some examples: Urban waste (liquid and solid); Agricultural pollution; Pollution from industrial activities. Reaction of aquifers to pollution. Behaviour of the main polluting agents on the ground. Research into aquifer contamination. Remediation of aquifer contamination. Protection of groundwater from contamination. Solute transport processes Diffusion, Advection and Dispersion: concepts and numerical expressions. Non aqueous phase liquids. Column experiments. Macroscopic aspects of dispersion. Species retardation. Transport models.
Lab Work: Ground water sampling for chemical analysis.

Course Aims and Objectives:

1. Natural groundwater quality and principles of contaminant transport and common remediation techniques.
2. Ground water sampling for chemical analysis and interpretation methods.
3. The student with an integrated understanding of groundwater chemistry and contaminant hydrogeology as preparation for a career as a geohydrologist or geohydrochemisty

Course Outcomes:

1. Students will understand about Natural groundwater quality and principles of contaminant transport and common remediation techniques.
2. Students will understand Ground water sampling for chemical analysis and interpretation methods.
3. Students will also be prepared to provide expert hydrochemical input to the industry.

Reference Books/Materials:

1. Appelo, C.A.J. and Postma, D., 2004. Geochemistry, groundwater and pollution. CRC press
2. Emmanuel Olutayo, Martins Olorunfemi. 2018. Geophysical and Hydrochemical Investigations of Groundwater Pollution. LAP LAMBERT Academic Publishing

**Course Title Groundwater Modelling**

Course Outline: Concept of groundwater components and aquifers, Purpose of groundwater modelling; Conceptual model, estimation of aquifer parameters, conceptualization of grid and boundary conditions, Steady and transient simulations, conceptualization of aquifer aquitard systems; Three dimensional anisotropy, Specification of boundary conditions; Construction of a steady state model, visualization of groundwater level, regional model, Hydrological stresses; Design of numerical model, finite difference solutions of flow problems; Steady versus unsteady model; One layer versus multi layer model; Lay out of grids; Stress period/time steps; Model inputs, initial conditions; boundary conditions; Hydrogeological parameters, model calibration procedures and validation, selection of model code; Model prediction, purpose of prediction; Simulation of scenarios; Determination of capture zones; Introduction to MODFLOW; Exercises and case study.

Course Aims and Objectives: Upon completion, the participant should be able to: Describe process and procedures of applied groundwater modelling. Construct numerical groundwater models using popular modelling tools with hands on exercises. Use groundwater models to simulate groundwater flow, contaminant transport, and saltwater intrusion with hypothetical examples. Apply groundwater models for groundwater resources management and protection in real world case studies.

Course Outcomes:

At the conclusion of this course, the student will:

1. Have a better understanding of basic components of a groundwater modeling;
2. Be familiar with most common solution methods used in groundwater modeling; and
3. Be able to define boundary conditions and to perform calibration for the computer models.

Reference Books/Materials:

1. Applied Hydrogeology, Author: C.W. Fetter Jr.
2. Fundamentals Of Groundwater Modelling, Authors: Husam Baalousha
3. Applied Groundwater Modeling: Simulation of Flow and Advective Transport: Authors: Mary P. Anderson, William W. Woessner

**Course Title Marine Pollution & Control**

Course Outline: Marine Science, study of marine biology (organism, fisheries and mangroves). Characteristics of marine water and sediment. chronic and acute inorganic and organic marine pollutants, Sources and effect of marine pollution on ecological changes. Effects of pollution discharges, oil spills, coastal development, beach erosion, eutrophication channel dredging and changing sea level on marine environment and their control measures. Seawater intrusion. Modeling for marine pollution dispersion: role of organism, fisheries and mangroves. Coastal geology and estuarine ecology. Marine resources and coastal management. Control of pollution in marine and coastal environments Pollution Management, oil spills contingency plan and combating techniques. Pollution Management, oil spills contingency plan and combating techniques.

Course Aims and Objectives: To develop a basic understanding of marine pollution, its sources, impact of pollutants on the biotic and abiotic environment impacting the marine recourses. Develop a clear understanding of pollution control and management techniques.

Course Outcomes: The course will give an idea of marine pollution, sources and types of pollutants The students will have knowledge of effective management strategies of marine pollution

Reference Books/Materials:

1. Managing Ocean Environments in a Changing Climate: Sustainability and Economic Perspectives
2. Kevin J. Noone' Ussif Rashid SumailaRobert J. Diaz 2013.
3. Marine Pollution and Human Health (Issues in Environmental Science and Technology) R E Hester, R M Harrison RSC Publications 2011
4. Marine Pollution and Its Control (McGraw Hill series in water resources and environmental engineering) by Paul L. Bishop (1982).
5. Protecting the Marine Environment from Land Based Sources of Pollution: Towards Effective International Cooperation by Daud Hassan (2006).

**Course Title Population Dynamics, Environment and sustainability**

Course Outline: World Population: current scenario and future trends. Framework for understanding population environment nexus, population size and environment, Population composition, distribution and environment, Biocapacity, carrying capacity, overshoot, population growth and land use change, research need for correlation studies. Poverty population environment linkages in the context of migration and urbanization. Population development nexus: integrating environment and development. Transition of population migration and urbanization on environmental integrity, pool growth and disease incidence Response to demographic crisis: Government responses, Individual attitudes and perceptions, sustainable approach to population stabilization, Population dynamics in Pakistan, Pakistan's Biocapacity, resource consumption & crisis.

Course Aims and Objectives: This course will provide the conceptual framework to the students for understanding of complex web of multiple dimensions of environmental issues linked with population and development

Course Outcomes: Students will be able to learn the role of population growth in causing and solving environmental problems.

Reference Books/Materials:

1. Botkin D. & Keller E., 2016. Environmental Science: Earth as Living Planet. 8th ed. John Wiley and Sons
2. Cunningham W.P., & Saigo, B.W., 2017. Environmental Science, 6th Ed. McGraw Hill.

**Course Title Research Methodology**

Course Outline: Purpose of Research; Research Project Conceptualization, Choice of Methods; Elements of a Research Proposal, Operationalization choices and illustrations. Research Design: formulation of research design, pretesting of research instruments and procedures, units of Analysis, time dimension; Experimental design and use of indicators in research, Survey Research: Guidelines for asking question and questionnaires construction, Self administered questionnaires, Interview and other survey methods; their strength and weaknesses. Sampling: the logic of sampling, concepts and terminologies, population and sampling frames, types of sampling design. Field Studies: Steps in the conducting field study; Evaluation Research: How to carry out evaluation research; Analytical tools in research: qualitative and quantitative methods; Statistical Analyses: Univariate, Bivariate and Multivariate analyses

Course Aims and Objectives: The objective of this course is to equip the students with the skills to undertake a project by planning, designing and defining a research problem; and select indicators and parameters of research and its methodologies.

Course Outcomes: At the end of this course, the students should be able to understand some basic concepts of research and its methodologies; identify appropriate research topics; select and define appropriate research problem and parameters. The students will learn how to prepare a project proposal (to undertake a project), organize and conduct research (advanced project) in a more appropriate manner.

Reference Books/Materials:

1. Students project in Environmental Science, Harrad,S., Batty,h., Diamon, M. and Arhonditsis, G, John and sons Ltd., Chichester, England, 2018.
2. Designing and Conducting Mixed Methods Research, Creswell, J. W. & Plano Clark, V.L. Thousand Oaks, Sage CA, USA, 2017.
3. The Craft of Research by Wayne C. Booth, 2ndEdition, Univ. of Chicago Press. USA, 2003.
4. Case Study Research: Design and Methods, Robert Yin, 3rdEdition, Sage Publishers. USA, 2003.

**Course Title Innovation in waste management approaches**

Course Outline: Hazardous Wastes: Sources, Classification, Characteristics, and Generation. On site handling and storage, Techniques for measuring and characterizing waste, collection, transfer, optimization of solid waste transport, recycling and disposal techniques of municipal Solid Waste, including equipment and logistics considerations , Characterization of solid waste, Sampling methods, land filling, thermal conversion and composting. Waste to Energy, Concept of integrated solid waste management: existing practices and their hazards. Health and environmental issues related to solid waste management, Incineration and non incineration thermal techniques, Regulations and policies: An understanding of relevant regulations and policies governing the handling, treatment, and disposal of waste, as well as compliance requirements. Economic evaluation of the systems. Hospital waste Management. Hazardous waste management, E waste and Special waste Management, Recent technologies used for solid waste management

Course Aims and Objectives: The students will learn the types, handling and management systems of solid wastes. To give the concept of waste to energy conversion and the importance of waste as energy resource

Course Outcomes: The course will give an idea of safe disposal and effective management strategies of solid and hazardous waste. The energy recovery from solid waste and the application of 3 Rs concept will be delivered.

Reference Books/Materials:

1. Principles and Applications of Microbiology. Salivia, D.M., J.J. Fuhrman, G.P. Hartel and A.D. Zuberer.2 nd Ed. Prentice Hall, Upper Saddle River, NJ, USA. 2005.
2. Organic Waste Recycling: Technology and Management. Polprasent, C. IWA, London, UK. 2007.

**Course Title Watershed Management**

Course Outline: What is watershed, how watershed works, parts of watershed, natural changes within watershed. Current issues in water management. characteristics of effective management, watershed. Physical features and landforms, climate, soil, infiltration and runoff, stream flow, groundwater, water quality, plant and animal communities, land use, social and economic systems, valued features and activities. Land use Planning and Management: evolution of land use planning Identifying current users, need for public involvement, public involvement techniques and processes. Agricultural Resources Management: Existing situation of agriculture sector in Pakistan, agriculture products and their share in GDP, problem in agriculture Agricultural Resources Management: Existing situation of agriculture sector in Pakistan, agriculture products and their share in GDP, problem in agriculture, agriculture chemicals, their pros and cons, national agriculture policy, management options. Developing workable management options: simple and detailed assessment methods, costing and financing, quantifying intangibles, legal and institutional administrative concerns, planning for watershed, choosing and implementing the best plan, case studies.

Course Aims and Objectives: This course will be directed at investigating the social, environmental and economic aspects of watershed Management, to train students on the identification, occurrence and distribution of natural resources, their current status and threats. Use of interdisciplinary approach for sustainable management of the natural resources.

Course Outcomes: Students will be able to learn the various interdisciplinary approach for sustainable management of the of watershed.

Reference Books/Materials:

1. “Principle of Environmental Science (Inquiry and Applications)” by William P. Cunningham and
2. Mary Ann Cunningham. (8th Edition, 2010).
3. “Living in the Environment” by G.T. Miller Jr . (17th edition, 2012).
4. “Natural Resource Conservation” by P.R Trivedi (7st edition, 2014)

**Course Title Environmental Risk Assessment and Management**

Course Outline: Environmental risk assessment and management; the what’s, whys and how’s a historical perspective: Risk assessment to human health from chemicals in the environment. Risk assessment to ecological systems from chemicals, from biological introductions (excluding genetically modified organisms). Evaluation of the likelihood of, major accidents in industrial processes, Assessing risks to ecosystems and human health from genetically modified organisms. Retrospective assessment, eco epidemiology and ecological monitoring. Hazard identification, dose and exposure assessment, risk quantification, Epidemiology and environmental risk assessment. Risk assessment in legislation: Application of risk assessment in policy and legislation in developed and developing countries. Balancing risks with other considerations: The psychology of risk and uncertainty, the economics of risk. Valuing risks. Natural hazards, risk analysis and risk management. Risk management: Principles, approaches and concepts: Corporate chemical management; a risk-based approach. Environmental risk assessment in business. Risk assessment and management for water treatment and disposal. Risk assessment and management in the exploitation of the seas. Risk assessment and management for inland waters. Environmental risk assessment in development programmes, the experience of World Bank. Risk communication. A framework for sustainable product development.

Course Aims and Objectives: The course aims to review the forms of hazards and their associated risks, define the elements of risk assessment and describe the types of information needed for each element of risk assessment.

Course Outcomes: Students will be able to learn the ways to risk identification, estimation of magnitude of the potential risks and illustrate different approaches of exposure assessment, the principles of risk management and control strategies and outline the approaches to managing the environmental emergencies.

Reference Books/Materials:

1. Environmental Risk Analysis. (2001). Larche, I. and Paleologos, E. K. McGraw Hill NY, USA.
2. Occupational Health Hazards and Remedies. (2002). Mohapatra, R. Jaypee Brothers Medical Publishers Pvt. Ltd., India.
3. Biosafety Management: Principles and Applications. (2000). Tarynor, P. L. Virginia Polytechnic Institute Publications. USA.
4. Environmental Risk Evaluation of Polluted Soils. (2000). Riviere, J. Oxford and IBH Publishing Company Pvt. Ltd. India.
5. Environmental Hazards: Plants and People. (2000). Iqbal, M., Srivastava, P. S.and Siddiqi, T. O. CBS Publishers and Distributors, India.

**Course Title Emerging trends in Environmental Sociology**

Course Outline: Introduction to sociology: individualistic, naturalistic and sociological features. Environmental sociology: history and development, Concepts: "Socio Environmental Relations"; "Co evolution"; "Societal metabolism'; "Human expansionism". Local and space based environmental issues, Environment and sociology: Relationship between society and nature, Gidden's theory of structuralism and its suitability as a tool for sociological investigation of environmental issues, Rise of ecological modernization, Co evolution concept; relationship between society and nature. Interdisciplinary approach to environmental issues, Constructive approaches in environmental sociology, social commitments. Environment and development: Development, Environmentalism and conservation in developed and developing countries, Sustainable development, Political economy and political ecology. Environmental social movements, Gender and environment: Women and environment, Gender nature of environmental issues, Environmental degradation and women. Eco feminism. International and national perspectives, e.g. America; Asia; Africa; Europe and Pakistan. Environmental management & Public policy.

Course Aims and Objectives: Environmental sociology is the sociological study of societal environmental interactions, although the focus of the field is on relationship between society and environment in general and the social factors that cause environmental problems in particular

Course Outcomes: After completing this course, the students will be able to explore the various forms of interaction between human society and the environment, focusing on the social dimensions of the surrounding natural and human made environments.

Reference Books/Materials:

1. Gottlieb, Robert. 2015. Forcing the Spring: The Transformation of the American Environmental Movement. Washington, D.C.: Island Press.
2. Guha, Ramachandra. 2010. Environmentalism: A Global History. New York: Longman.

**Course Title Advanced Environmental Microbiology**

Course Outline: Microbiology & Environment: Biological characteristics of wastes. Microbiological quality of water, food and soil. Effects of disinfectants on water and food borne microorganism. Techniques for the control of microbiological pollution. Monitoring microbial activities, Petroleum microbiology, Survival of airborne microorganisms, microbial metabolism of selected pollutants, Microbial biogeochemistry of of selected aquatic and terrestrial ecosystems, Environmental hygiene and sanitation. Health problems and issues related to different occupation. Primary health care and practice. Host pathogen interaction. Communicable and non communicable diseases.

Course Aims and Objectives: This course deals with the in depth understanding about the role of microorganisms in the environment.

Course Outcomes: After completion of this course, students will be able to understand the significance, role and applications of microorganisms in the environment

Reference Books/Materials:

1. Environmental Microbiology, Maier, F.M., Pepper, I.L. and Gerba, C.P. 2nd Edition, Academic Press, London, UK, 2009.
2. Principles and Applications of Soil Microbiology, Sylvia, D.M., Fuhrmann, J.J., Hartel, P.G. and Zuberer, D.A. Prentice Hall, New Jersey, USA, 2005.
3. Microbiology, Prescott, L.M., Harley, J.P. and Klein, D.A. McGraw Hill Inc., USA, 2007.
4. Microbiology. Pelczar M.J., Chan, E.C. and Krige, N.R. McGraw Hill, Inc. New York. 1986

5. Environmental Microbiology: A Laboratory Manual, peppor,I.L.,Gerba,C.P. and Brendecke,J.W. and Jeffery, W.B. Academic Press, USA, 1995

**Course Title Freshwater Ecology**

Course Outline: Hydrology and Physiography of various types of freshwater systems. Chemistry of various freshwater systems and associated organisms. Physical relationships, Movement of light, heat and chemicals in water, Hydrology and Physiography of groundwater and wetland habitats, Physiography of lakes and reservoirs. Types of aquatic organisms: Cyanobacteria, Eukaryotic Algae, Aquatic fungi, Protozoa, Non vascular plants and vascular plants. Animals: Porifera, Cnidaria, Platyhelminthes and Nemertea, Gastrotricha, Ŕotifera, Nematoda, Mollusca, Annelida, Bryozoa, Tardigrada, Arthropoda, Fishes, Tetrapods; Biodiversity of freshwaters, Measures of diversity, Biodiversity of freshwaters, Measures of diversity, temporal and spatial factors, short term factors influencing local distribution. Invasious of Nonnative species, extinction. Chemicals in freshwater, Redox potential, potential energy and chemical transformations Distribution of dissolved oxygen in environment, transformations of carbon, fermentation, methanogenesis, Nitrogen, Sulfur, Phosphorus and other Nutrients. Effects of toxic chemicals and other pollutants on aquatic ecosystems, Fish Ecology, Freshwater Ecosystems: Groundwater Ecosystems, Streams, Lakes and Reservoirs, Wetlands

Course Aims and Objectives: The objective of this course is to train the students for ecological analysis of freshwater habitats in terms of identification of flora and fauna and the interactions among them.

Course Outcomes: After completion of this course, the students are expected to acquire the techniques for study of freshwater habitats

Reference Books/Materials:

1. Lampert, W. and Sommer, U., 2017. Limno ecology: The Ecology of Lakes and Streams. Oxford University Press, New York.
2. Dodds, W.K., 2010. Freshwater Ecology: Concepts and Env. Applications. Academic Press. London.
3. Dodds, W.K. and Whiles, M.R., 2012. Freshwater Ecology: Concepts and Environmental Applications of Limnology. 2nd Ed. Academic Press. London.

**Course Title Advanced Environmental Geology**

Course Outline: Introduction: Geologic framework: the home planet, earth systems and cycles, earth structure and materials. hazardous geologic processes: assessing geologic hazards and risks, earthquakes, volcanic activity, tsunamis, landslides, mass wasting, subsidence, floods, and hazards of ocean and weather and meteorite impacts. Using and Caring for Earth Resources: the nature of earth resources, energy from fossil fuels, energy alternatives, mineral resources, soil resources and water resources. Human Impact on the environment: managing waste disposal contaminants in the geologic environment and atmospheric change. Medical Geology: the role of geologic materials in health; trace elements in natural waters, radon and trace elements in soil. Contamination of air and ground water resources by nuclear wastes and nuclear explosions. The effects of radioactivity on human health, and its remedial measures. Environmental Law: History, development and protection of environment.

Course Aims and Objectives: This course aims to provide knowledge about a wide range of topics in geology, discussing geologic principles to the specific geologic hazards, from an environmental perspective.

Course Outcomes: After completion of this course, the students are expected to learn geologic hazards from the environmental perspectives.

Reference Books/Materials:

1. Environmental geology: Keller, E.A., 9th edition, Prentice Hall, 2011.
2. Introduction to environmental geology: Keller, E.A., 5th edition, Prentice Hall, 2012.

**Course Title Project Management**

Course Outline: Introduction: What is a Project, Project Life Cycle, Writing Project Proposal, Defining Project objectives. Project Planning: Project Initiation; Need identification, feasibility study, economic evaluation. Logical Framework: Explanation of Vertical Logic; inputs, activities, outputs, specific objectives, development objectives, work breakdown structure. Explanation of Horizontal Logic; indicators, means of verification, assumptions. Stakeholders Analysis and Participation. Participatory project monitoring and evaluation. Reasons for Project success or failure. Planning Commission Performa's, Project Planning and Approval Processes, Resource Mobilization.

Course Aims and Objectives: This course aims to provide knowledge about a wide range of topics in project management and development.

Course Outcomes: After completion of this course, the students will be able to know the steps in project Management.

Reference Books/Materials:

1. A Guide to Project Management; Body of Knowledge PMBOK Guide, Project Management Institute,2000.
2. Project Management: A Managerial Approach, Meredith J. R., Mantel s. J., John Wiley and Sons, Inc. 1997

**Course Title Wildlife and Forestry Management**

Course Outline: Introduction to wildlife and their relationship with human population. Concepts of wildlife conservation: sustainable development and ecosystem. Conservation and preservation, Effects of Industrial and Agricultural development and urbanization on wildlife. Endangered species: causes and measures for the conservation. National Parks: Wildlife sanctuaries and game reserves of Pakistan. their management and environmental problems. Modern techniques for control of environmental pollution in wildlife areas. International Conventions. Wildlife Parks in the world; their habitat and conservation, Case studies of forestry management

Course Aims and Objectives: This course will make the students familiar with the concepts of wildlife and forest management practices.

Course Outcomes: after completion of this course, students will be able to learn the factors that lead towards loss of wildlife and forest resources and its consequences on ecosystems.

Reference Books/Materials:

1. Bailey, J. A. 1998. Principals of Wildlife Management. John Wiley and Sons, New York, USA.
2. Hosetti, B.B. 2015. Concepts in Wildlife management. Daya Publishing House, New Delhi, India.
3. Sinclair, A. R. E., J. M. Fryxell and G. Caughley. 2016. Wildlife Ecology, Conservation and Management. 2nd Ed. Blackwell Publishing, New York, USA.

**Course Title Air and Noise Pollution Control**

Course Outline: Physical and chemical composition of the atmosphere; Physical and chemical characteristics of gaseous and particulate air pollutants; Air pollution meteorology; Classification, pathways and atmospheric reactions of air pollutants; Monitoring / control techniques and strategies for air pollutants Carbon foot printing. Air Pollution Essentials; The Risks of Air Pollution; Measurement and Monitoring of Air Pollution; The methodology of Air Pollution; The Regulatory Control of Air Pollution; The Engineering Control of Air Pollution; Introduction to Noise Pollution; Basic concepts of sound and noise; Noise and its effects; approaches to noise problems; Planning to control noise pollution; Noise reduction; Characteristics and impact of surface transportation noise; Traffic noise reduction; Aircraft noise reduction; Preventing airport noise; Control of noise pollution from diesel generator sets; Noise pollution in oil exploring and its control; noise pollution and its control in mining and product industries Sound control technologies and instrumentation. Electromagnetic waves generated by cellular tower and its potential impact on humans and the environment.

Course Aims and Objectives: The course aims to introduce types of air, noise and electromagnetic waves. Causes and sources of air pollution, particulate matter, techniques of measurement of air pollutants and particulate matters, greenhouse gases, global warming, causes sources and effects, ozone depletion, acid rain.

Course Outcomes: After completion of this course, students will be able to learn air pollution prevention and control, strategies/methodology compliance of NEQS standards for air pollutants and impact of noise pollution on health.

Reference Books/Materials:

1. Electromagnetic Surface Waves: A Modern Perspective (Elsevier Insights) by John Polo 2012.
2. Fundamentals of Air Pollution. Daniel Vallero. 4thEdition. ISBN10: 0 12 373615 3 (2007).
3. Textbook of Noise Pollution and its Control. S.C. Bhatia. Atlantic Publishers and Distributors, (2007).

Program Title: **MS Geophysics**
Duration: **2 to 3 Years**
Total Credit Hours: **30**
Endorsement References: A: Recommendations of DBOS dated **12th August** (Minutes of DBOS meeting)

**Summary of Credit Hours**

| Sr. No. | Category of course | Credit Hours/Contact Hours | |
|---|---|---|---|
| | | Existing Road Map | Proposed New Road Map |
| 1. | Compulsory Courses | 12 | 12 |
| 2. | Elective courses | 12 | 12 |
| 3. | Thesis | 6 | 6 |
| | **Total** | **30** | **30** |

**Program Educational Objectives**

1. Establishing skillful and knowledgeable graduates in the industrial fields including oil and gas industries as well as higher institutions (PEO1)
2. Produce human resources that are able to apply logical, critical and analytical concepts to exploit, develop and manage the knowledge based resources (PEO2)
3. Developing graduates who are able to lead and contribute effectively (PEO3)

**Program Learning Objectives**

PLO1. Apply skills developed in fundamental courses to geophysical problems

PLO 2. Research, analyze, and synthesize solutions to an original and contemporary geophysics problem

PLO 3. Work independently and as part of a team to develop and improve geophysics solutions

PLO 4. Apply written, visual, and oral presentation skills to communicate scientific knowledge

PLO 5 An in depth technical understanding of geophysics problems at an advanced level

| | Pre requisite | Course Code | Course Title | Credit Hours | | Pre requisite | Course Code | Course Title | Credit Ho | HEC Category | 17 UN SDGs alignmen |
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| | | | | | | | | | urs | | t |
| 1. | N/A | GEO 603 | Unconventional Hydrocarbon Resources | 3 | **1** | N/A | GEO 761 | Unconventional energy Resources | 3 | Core | 7 & 9 |
| 2. | N/A | GEO 548 | Advanced Seismic Stratigraphy | 3 | **2** | N/A | GEO 748 | Advanced Seismic Stratigraphy | 3 | Core | 11 |
| 3. | N/A | GEO 520 | Advanced Seismic Techniques | 3 | **3** | N/A | GEO 781 | Advanced Seismic Techniques | 3 | Core | 9 & 11 |
| 4. | N/A | ESC 701 | Research Methodology | 3 | **4** | N/A | ESC 701 | Research Methodology | 3 | Core | 4 |
| 5. | N/A | GEO 541 | Applications of GIS in Geosciences | 3 | **5** | N/A | GEO 741 | Applications of GIS in Geoscience | 3 | Electiv e | 9 & 11 |
| 6. | N/A | GEO 501 | Global Tectonics | 3 | **6** | N/A | GEO 701 | Global Tectonics | 3 | Electiv e | 7 |
| 7. | N/A | GEO 505 | Advanced Sedimentology | 3 | **7** | N/A | GEO 705 | Sedimentary Petrology | 3 | Electiv e | 7 |
| 8. | N/A | GEO 518 | 3D Seismic Interpretation | 3 | **8** | N/A | GEO 766 | 3D Seismic Data interpretation | 3 | Electiv e | 7 |
| 9. | N/A | GEO 507 | Basin Analysis | 3 | **9** | N/A | GEO 707 | Basin Analysis | 3 | Electiv e | 7, 9 & 11 |
| 10. | N/A | GEO 508 | Stratigraphy and Petroleum Prospects of Pakistan | 3 | **10** | N/A | GEO 708 | Stratigraphic analysis and Petroleum Prospects | 3 | Electiv e | 7, 9 & 11 |
| 11. | N/A | GEO 545 | Petrophysical Analysis | 3 | **11** | N/A | GEO 745 | Petrophysical Analysis | 3 | Electiv e | 7, 9 & 11 |
| 12. | N/A | GEO 509 | Drilling Operations and Well Site Geology | 3 | **12** | N/A | GEO 747 | Drilling Operations and Well Site Geology | 3 | Electiv e | 7, 9 & 11 |

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| 13. | N/A | GEO 510 | Development of Groundwater Resources | 3 | **13** | N/A | GEO 710 | Groundwater development and management | 3 | Electiv e | 3, 6, 13 & 15 |
| 14. | N/A | GEO 531 | Advanced Structural Geology | 3 | **14** | N/A | GEO 731 | Techniques in Structural Geology | 3 | Electiv e | 9 & 11 |
| 15. | N/A | GEO 517 | Seismic Data Analysis | 3 | **15** | N/A | GEO 717 | Seismic Data conditioning and analysis | 3 | Electiv e | 9 & 11 |
| 16. | N/A | GEO 515 | Exploration Geophysics | 3 | **16** | N/A | GEO 715 | Advances in Exploration Geophysics | 3 | Electiv e | 9, 11 & 15 |
| 17. | N/A | GEO 544 | Borehole Geophysics | 3 | **17** | N/A | GEO 744 | Borehole Geophysics | 3 | Electiv e | 7 & 9 |
| 18. | N/A | GEO 513 | Advanced Seismology | 3 | **18** | N/A | GEO 713 | Applied Seismology | 3 | Electiv e | 7 & 9 |
| 19. | N/A | GEO 524 | Clastic Sedimentology | 3 | **19** | N/A | GEO 724 | Clastic Sedimentology | 3 | Electiv e | 9 |
| 20. | N/A | GEO 525 | Carbonate Sedimentology | 3 | **20** | N/A | GEO 725 | Non clastic Sedimentology | 3 | Electiv e | 9 |
| 21. | N/A | GEO 543 | Advanced Earthquake Seismology | 3 | **21** | N/A | GEO 743 | Advanced Earthquake Seismology | 3 | Electiv e | 11 |
| 22. | N/A | GEO 514 | Mining Geophysics | 3 | **22** | N/A | GEO 714 | Mining Geophysics | 3 | Electiv e | 3&6 |
| 23. | N/A | GEO 528 | Groundwater Modeling | 3 | **23** | N/A | GEO 728 | Groundwater Modeling | 3 | Electiv e | 3&6 |
| 24. | N/A | GEO 542 | Geodesy | 3 | **24** | N/A | GEO 742 | Geodesy | 3 | Electiv e | 7&9 |
| 25. | N/A | GEO 530 | Advanced Marine Geology | 3 | **25** | N/A | GEO 730 | Advanced Marine Geology | 3 | Electiv e | 7&9 |
| 26. | N/A | GEO 534 | Reservoir Geology | 3 | **26** | N/A | GEO 734 | Reservoir Geology | 3 | Electiv e | 7&9 |

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| 27. | N/A | GEO 601 | Gravity and Magnetic Exploration Methods | 3 | **27** | N/A | GEO 763 | Gravity and Magnetic Exploration Techniques | 3 | Electiv e | 7&9 |
| 28. | N/A | GEO 549 | Near Surface Geophysics | 3 | **28** | N/A | GEO 749 | Near Surface Geophysics | 3 | Electiv e | 7&9 |
| 29. | N/A | GEO 602 | Electrical Exploration Methods | 3 | **29** | N/A | GEO 757 | Electrical Exploration Techniques | 3 | Electiv e | 11 |
| 30. | N/A | ENV 540 | Climate Change Adaption and Mitigation | 3 | **30** | N/A | ENV 740 | Climate Crisis Adaption and Mitigation | 3 | Electiv e | 3, 6, 13 & 15 |
| 31. | N/A | ENV 5 | Health Safety and Environment | 3 | **31** | N/A | ENV 713 | Health Safety and Environment | 3 | Electiv e | 3, 6, 13 & 15 |
| 32. | N/A | GEO 502 | Geophysical Exploration Methods | 3 | **32** | N/A | GEO 702 | Geophysical Exploration Technique | 3 | Electiv e | 7 |
| 33. | N/A | GEO 519 | Coal Geology | 3 | **33** | N/A | GEO 719 | Coal Geology | 3 | Electiv e | 7, 8 & 9 |
| 34. | N/A | GEO 608 | Practical Applications of Geosciences Softwares | 3 | **34** | N/A | GEO 760 | Practical Technology Use in the Geoscience | 3 | Electiv e | 13 |
| 35. | N/A | GEO503 | advanced Petroleum Geology | 3 | **35** | N/A | GEO 703 | Advanced petroleum system Analysis | 3 | Electiv e | 11 |
| 36. | N/A | ENV 504 | Environmental Impact Assessment | 3 | **36** | N/A | ENV 704 | Environmental Impact Assessment | 3 | Electiv e | 13 & 15 |
| 37. | N/A | GEO 516 | Applied Environmental Geophysics | 3 | **37** | N/A | GEO 716 | Environmental Geophysics | 3 | Electiv e | 3, 6, 13 & 15 |
| 38. | N/A | ~~GEO 603~~ | ~~Engineering Geophysics~~ | 3 | 38 | N/A | GEO 771 | Engineering Geophysics | 3 | Electiv e | 11 |

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| 39. | N/A | ~~GEO 604~~ | ~~Machine Learning for Geosciences~~ | 3 | 39 | N/A | CSC 719 | Machine Learning | 3 | Electiv e | 4, 8 & 9 |
| 40. | N/A | ~~GEO 605~~ | ~~Applications of Geostatistics in Geosciences~~ | 3 | 40 | N/A | GEO 770 | Applications of Geostatistics in Geosciences | 3 | Electiv e | 4, 8 & 9 |
| 41. | N/A | ~~GEO 606~~ | ~~Reservoir Geomechanics~~ | 3 | **41** | N/A | GEO 786 | Reservoir Geomechanics | 3 | Electiv e | 7 & 9 |
| 42. | N/A | ~~GEO 512~~ | ~~Mineral prospecting and Exploration~~ | 3 | **42** | N/A | GEO 712 | Mineral prospecting and Exploration | 3 | Electiv e | 9& 11 |
| 43. | N/A | THS 701 | MS Thesis | 3 | **43** | N/A | THS 799 | MS Thesis | 6 | Core | |

## Course Outlines of MS Geo-Physics

**Course Title** **Advanced Petroleum System Analysis**

Course Outline:

Hydrocarbons in a global context; the philosophy and structure of the oil industry; energy trends, petroleum environment: source rocks, reservoirs, traps, seals and the timing of generation relative to trap formation, basic stratigraphic principles as they relate to correlation, the importance of establishing markers and datum lines, the use of macro and micro fossils in chronostratigraphy, correlation of well logs, production of structural maps, construction of net and gross reservoir maps, cross sections and reserve calculations, mapping faults, pinch outs and sub crops, play and Field examples from around the world, reserves and risk, use of modern seismic and new technology, petroleum System and play fairway analysis, prospect evaluation, petroleum basins of Pakistan, case history.

**Course Outcomes:** On completion of the course, students are expected to get a good knowledge of key concepts regarding,

1. Hydrocarbon habitat and exploration approaches
2. Petroleum Play and its components; Organic matter deposition, Hydrocarbon generation, migration, distribution and preservation in a petroleum basin. Reservoir types and their properties
3. Types, usage and display of subsurface geological data and the limits on the reliability of such data
4. Description and evaluation of relatively simple subsurface datasets from wells and evaluate these data to conduct a geological evaluation of a field and undertake a reserves calculation

Reference Books/Materials:


1. Petroleum Geology by F.K. North
2. Petroleum Geology Manual by Baker Hughes INTEQ
3. Petroleum Geology by R.E. Chapman

4. Petroleum Geology of Pakistan by Iqbal B. Qadri
5. Petroleum Geosciences by Knut Bjorlykke
6. Startigraphy of Pakistan by Syed Ibrahim Shah.

**Course Title Global Tectonics (3 CH)**

Course Outline: Overview of plate tectonics, geological techniques in tectonics, principal tectonic features of the earth, divergent margins and rifting, transform faults, strike slip faults and related fracture zones, convergent margins, tectonics and geology of selected triple junctions, collision orogenesis, anatomy of orogenic belts, the external thrust complex, foreland fold and thrust belts, the crystalline core zone, underplating, uplift and exhumation, nappe formation, back folding/thrusting and rotation, tectonics and metamorphism, neotectonics, case studies of orogenic belts.

Course Aims and Objectives: The course presents a broader global view of plate tectonics processes, including plate kinematics, the nature of plate boundaries, the forces responsible for those processes and the implications of plate tectonics. It will develop a concept of current global geography in the context of global tectonic processes.

**Course Outcomes:**

1. To acquire Knowledge about plate tectonics that control large scale structures of the Earth.
2. To understand the causes and impact of natural calamities such as earthquakes, tsunamis, land sliding and climate change and their mitigation
3. To understand geotectonic framework of Pakistan

Reference Books/Materials:

1. Global Tectonics 3rd Edition by Philip Kearey, Keith A. Klepeis, Frederick J. Vine (2009), Wiley Blackwell publisher
2. Geology and tectonics of Pakistan by Kazmi and Jan (1997)
3. Plate Tectonics: How it works by A. Cox and R.B. Hart (1991), Wiley Blackwell publisher
4. Regional Geology and Tectonics by Nicola Scarselli, Jurgen Adam et al (2020), Elsevier Science publisher
5. Research papers related to global tectonics
6. Tectonics by Moores, E.M. and Twiss, R.J., 1995. Freeman and Company, New York.
7. Structural geology of rocks and regions by Davis, G.H. and Reynolds, S.J., 1996. 2nd Edition, John Wiley and Sons, Inc, New York.
8. Structural geology by Twiss, R.J. and Moores, E.M., 2007. 2nd Edition, Freeman and Company, New York.
9. Global Tectonics by Keary, P. and Wine, F., 1990. Blackwell Scientific Publications, London

**Course Title Petrophysical Analysis**

Course Outline: Introduction to well logs and Petrophysics; Basic Wireline logging methods (electrical, radioactive, nuclear, acoustic and mechanical logs) and logging procedures; Application and use of open hole and cased hole logs for evaluating/estimating the Petrophysical properties of reservoir; Qualitative and Quantitative interpretation of well logs (lithology identification, shale content, porosities measurement fluid saturation, permeability, identification of pay intervals, well correlation based on the log characters/signatures and determination of lateral variations of Petrophysical parameters using well correlation etc.); Identification of Facies and evaluation of Depositional environments using wireline logs; Application of image logs and their analysis; Application of conventional logs in evaluation of unconventional reservoirs (Tight & Self Contained/shale reservoirs); Application of core analysis and its integration in Petrophysical analysis; Software based quick look Petrophysical interpretation in Geographix/Tecklog/Vizdom solutions VGS.

Course Aims and Objectives: The aim of this course is to convey conceptual understanding of wireline logging techniques, logging procedures under certain well bore conditions/environments. This course will also communicate practical evaluation of these mentioned logs for the measurement/estimation of petrophysical evaluation of reservoir rocks for further testing and completion.

**Course Outcomes:**

1. Familiarize with key concepts of the wireline logging techniques and their applications.
2. Identify the factors affecting the log quality and their remedial measures.
3. Able to describe the behavior of different curves on different wireline logs regarding rock characteristics
4. Use of key concepts about the interpretation of different wireline logs to evaluate the lithology, depositional environments and hydrocarbon availability & its quantification.

Reference Books/Materials:

1. The Geological Interpretation of well logs by Malcolm Rider, edition II, 2002
2. Basic Well Log analysis for Geologist by George Asquith & Charls Gibson
3. Log Interpretation Principles/Applications by Schlumberger 1991

**Course Title Applications of GIS in Geosciences**

Course Outline: Introduction to the GIS; Data exploration and preparation for GIS studies; Uses of GIS in hydrocarbon exploration, and in geological studies; Spatial Interpolation; GIS in flood management; Terrain Processing; GIS for watershed delineation; Geospatial Analysis, field development and planning; Analyzing Surfaces, spatial analysis for creating contours, hillshades and calculating viewshed; Map Algebra, working with NoData values, doing conditional processing, and merging multiple Rasters together.

Course Aims and Objectives: The main focus of this course is to develop understanding of advanced concepts and techniques used in modeling geographic reality and analysis of geo data. Educate students to explore issues, problem solve, and evaluate situations in a spatial context. It is focused to develop students' GIS and spatial analysis skills, allowing them to become independent learners able to solve complex spatial problems

Course Outcomes: Students will acquire the advanced knowledge of GIS and will use GIS to:

1. Explore mapped data and Relate GIS with remote sensing technologies
2. Analyze spatial data and perform spatial analysis, using GIS analysis tools and develop and manage geodatabases
3. Create maps, images and apps to communicate spatial data in a meaningful way to others

Reference Books/Materials:

1. Introduction to GIS and Remote sensing by Kang tsung Chang , 9th edition
2. Campbell, J. B., & Wynne, R. H. (2011). Introduction to Remote Sensing. Guilford Press.
3. Geographic Information Systems and Science, Longley, P., Goodchild et al, 2005, Wiley.

**Course Title Sedimentary Petrology**

Course Outline: Classification of sedimentary rocks on the basis of textures, classification criteria, texture and fabric, petrography of common clastic rocks, grains classification, matrix textural maturity, recognition of cements and its types, sedimentary rock forming minerals, their fabric and modal analysis, compositional and textural classification systems of chemically precipitated rocks, petrography of carbonate rocks, chert, phosphatic and glauconitic rocks, ironstone, evaporites, organic rocks: coal and lignite, volcaniclastic and zeolitic sedimentary rocks, soils & mud rocks.

Course Aims and Objectives: The course will help in enhancing the concept of facies and the connection between tectonics and deposition. The students will be able to discuss the processes acting, and the resulting facies and facies associations in modern depositional environments. Further, they will learn how facies and facies associations can be used in the interpretation of ancient deposits from all continental and marine environments will be examined.

**Course Outcomes:**
1. Describe and interpret sediments from all sedimentary environments.
2. Locate, synthesize and interpret data, information and observations on marine sedimentary successions at an advanced level.
3. Apply knowledge and appropriate techniques, including those associated with fieldwork, to interpret the geological importance of marine and terrestrial sedimentary populations at an advanced level.

Reference Books/Materials:
1. Lindholm, R. (2012). A practical approach to sedimentology. Springer Science & Business Media.
2. Potter, P. E., Maynard, J. B., & Pryor, W. A. (2012). Sedimentology of shale: study guide and reference source. Springer Science & Business Media.

3. Perry, C., & Taylor, K. (Eds.). (2009). Environmental sedimentology. John Wiley & Sons.
4. Nichols, G. (2009). Sedimentology and stratigraphy. John Wiley & Sons.

**Course Title Stratigraphic Analysis and Petroleum Prospects**

Course Outline: Introduction to Stratigraphy and Facies analysis; Lithostratigraphy; Biostratigraphy; Controls of sedimentary environments on the development of hydrocarbon and coal resources; Sedimentary basins; Potential source rocks, Potential reservoir rocks; Trapping mechanism in different sedimentary basins of Pakistan; Unconventional hydrocarbon prospects; Review of case histories for Conventional and Unconventional hydrocarbon prospects of Pakistan; Brief review of Stratigraphy of Pakistan

Course Aims and Objectives: To provide theoretical knowledge to the student and practical application of the subject in the industry. Main focus of the course is on the development of hydrocarbon resources in different depositional environments. Introduce the students with the Petroleum Prospects of Pakistan including Conventional and Unconventional.

**Course Outcomes:**
1. Be able to apply this understanding to the description of sedimentary rocks in order to deduce depositional processes and environments.
2. To produce better useful petroleum stratigrapher working hand in the field and able to work in the industry.
3. Apply this understanding for the analysis of the petroleum prospects in the subsurface using geophysical data.

Reference Books/Materials:
1. Stratigraphy of Pakistan, By Shah, S. M. I., 2009. Geological Survey of Pakistan. Memoir, Vol. 22.
2. Stratigraphy and Historical Geology of Pakistan by Kazmi, A. H. and Abbasi, I. A., 2008, Graphic Publishers, Karachi, Pakistan.

**Course Title Basin Analysis**

Course Outline: The foundation of sedimentary basins: basin in their plate tectonic environment, lithospheric mechanics, the mechanics of sedimentary basin formation: basin due to lithospheric stretching, basin due to flexure, basin associated with strike slip deformation, the sedimentary basin fill, control on basin stratigraphy: depositional style, evolution of the basin fill: subsidence history, thermal history, application to petroleum play assessment: the petroleum play, quatification of undiscovered potential.

Course Aims and Objectives: This course will deal with the concrete theoretical foundation building regarding basin studies along with Practical approach to learn about different basins and their formation processes, depositional patterns and filling of basin with sediments.

**Course Outcomes:**

After studying the course students will be able to

1. To fully understand and get equipped with regional petroleum play assessment of basins along with its theoretical background.
2. To give a quantitative as well as qualitative fundament for analyzing sedimentary basins, particularly from seismic data
3. To integrate the data set to develop static and dynamic basin models

Reference Books/Materials:

1. Basin Analysis: Principles and Application to Petroleum Play Assessment, 3rd Edition by Philip A. Allen, John R. Allen, 2013
2. Physical Principles of Sedimentary Basin Analysis, by Magnus Wangen, 2010
3. AAPG memoir 60: The petroleum system from source to trap by Leslie b. Morgan and Wallace G Dow
4. Seismic stratigraphy, basin analysis and reservoir characterizations by p. C. Veeken

**Course Title Drilling Operations and Well Site Geology**

Course Outline: Well Planning and its pre requisites; Drilling of a well (Vertical & Directional); Drilling Rig Types; Components of a drilling Rig and their Operation (Derrick/Mast, Sub structure, Hoisting, Rotary, Circulatory, Well Control, Bits etc.); Introduction to Drilling Fluids, Their Types & Selection; Casing, Casing Design and casing /cementing operation; Coring, its requirement, Types & Operation; Fishing; Mud Logging and its benefits; Lag Time Calculation; Drill Return (Cuttings) collection/ Sampling; Master Log and recorded parameters with their interpretation; Visual and microscopic analysis of cuttings at well site for lithological identification, porosity measurement, fluorescence/oil shows and formation tops; Chromatographic Analysis and interpretation of Gas Shows; Wireline logging Operations and their quality control; Measurement while drilling and its utilization; Well Testing (DST, MDT etc.); Perforation & Completion of a successfully tested well.

Course Aims and Objectives: This course describes the complete package of well site operations required for a well site geologist to interpret/evaluate drilling as well as mud logging parameters with a very effective & practical approach.

**Course Outcomes:**

On completion of the course, students are expected to:

1. Familiarize with key concepts of Well Planning and its drilling according to the analysed, estimated and prognosed parameters.
2. Have basic knowledge about drilling fluid, its system and selection as per prognosed drilling as well as formation / reservoir pressure parameters.
3. Monitoring & Quality control of all well site operations, their outcomes, issues with them and their possible solutions.

Reference Books/Materials:

1. The Wellsite Guide (An Introduction to Wellsite Geological Operations) by Bernhard W. Seubert
2. Wellsite Geology (Reference Guide) by Baker Hughes INTEQ

3. The Online Mud Logging Handbook by Alun Whittaker
4. Properties of Petroleum Fluids (2nd Edition) by W.D. McCain
5. Field Methods for Petroleum Geologists by Fakhry A. Assaad
6. Introduction To Oil Well Drilling (International Edition) by Natraj Vaddadi
7. Oilwell Drilling Engineering: Principles and Practice by H.Rabia
8. Working Guide to Drilling Equipment and Operations by William Lyons

**Course Title Groundwater development and management**

Course Outline: Introduction of ground water resources: Global perspectives Occurrence of ground water Geological factors governing the occurrence of ground water Hydraulics of ground water Aquifers and their types and important terms related to ground water Governing equation of ground water flow in aquifers Geophysical methods in ground water exploration Open wells or dug wells Tubewells Yield of wells and tubewells by Thiem's and Dupuit's equilibrium formula Hydraulics of wells Quality and quantity of ground water and its usefulness in Saline water intrusion Relationship between fresh and saline water Structure of fresh salt water interface Control of saline water intrusion. An introduction to geophysical and geochemical methods of exploration for planning, and design of regional water resources investigations; Groundwater Exploration, reconnaissance survey, surface investigation methods, subsurface investigations including test drilling, drilling methods, resistivity logging, radiation logging, temperature logging, velocity measurement and other methods; Groundwater Management, groundwater monitoring, observation network, water table fluctuation, selection of sites for the observation network. Contaminant transport in groundwater and management Concepts of basin management Equations of hydrologic equilibrium Groundwater basin investigation. Case histories in the sustainable management of ground water resources.

Course Aims and Objectives: The aim of this course is to impart knowledge about the importance and physical distribution of groundwater resources at the global scale with a special emphasis on Pakistan under drivers or climate change. Methods for the groundwater quantitative and qualitative assessment and for evaluation of the interactions between groundwater discharge and ecosystems. Substantiable Groundwater Management.

**Course Outcomes:**

1. The students will be able to impart knowledge about the importance and physical distribution of groundwater resources at the global scale with a special emphasis on Pakistan under drivers or climate change.
2. The students will be able to understands the exploration methods for the groundwater quantitative and qualitative assessment and for evaluation of the interactions between groundwater discharge and ecosystems.
3. The students will be able to develop Substantiable Groundwater Management plan.

Reference Books/Materials:

1. Anderson, M and Woessner, William: Applied Groundwater Modelling, Simulation of Flow and
2. Advective Transport, 381 pages, Academic Press; 1st edition (1991) ISBN 10: 0120594854, ISBN
3. 13: 978 0120594856
4. Freeze, R .A. and J.A. Cherry (1979): Groundwater. Prentice Hall, Englewood Cliffs
5. Fetter,C.W.(2001): Applied Hydrogeology. Prentice Hall, Englewood Cliffs
6. Fetter, C.W. (1993): Contaminant Hydrogeology. Macmillan Publishing Company, New York; S.

**Course Title Techniques in Structural Geology**

Course Outline: Geological mapping and cross sections, stereographic projections, fold morphology, fold orientations: projection techniques, fold classification, fold sections and profiles, fold mechanism (single and multilayers), strain and small scale structures in folds, superposed folding, fault geometry and morphology, faults and the construction of balanced cross sections, mechanical analysis of fractures, fracture analysis and plotting techniques, ductile and brittle shear zones, joints, structural analysis of an area that has experienced a single episode of deformation, multiple deformations, examples and labs..

Course Aims and Objectives: The course includes a quantitative approach of stress and strain in various tectonic setting, advanced aspects of rock deformation and rheology in the light of brittle, ductile and plastic deformation processes, an appraisal of the spectrum of complex deformation geometries, approaches of balancing and restoring deformation, as well as aspects of climate tectonic interaction.

**Course Outcomes:**

The student will be able to

1. Recognize moderately complex structures and can relate these to specific deformation regimes as well as quantitatively describe stress and strain
2. Know that tectonic styles can result from a combination of endogenous and exogenous processes
3. Discuss aspects in structural geology and tectonics with respect to the regional geology of Pakistan

Reference Books/Materials:

1. Bond, C.E., Lunn, R.J., Shipton, Z.K., and Lunn, A.D., 2012, What makes an expert effective at interpreting seismic images? Geology, v. 40, p. 75 78, doi:10.1130/G32375.1
2. Bond, C.E., Gibbs, A.D., Shipton, Z.K., and Jones, S., 2007, What do you think this is? "Conceptual uncertainty" in geosciences interpretation: GSA Today, v. 17, no. 11, p. 4 10.
3. Pilkey, O.H. and Pilkey Jarvis, L., 2007, Useless arithmetic: why environmental scientists can't predict the future: New York, Columbia University Press, 230

**Course Title Clastic Sedimentology**

Course Outline: Classification of sediments and sedimentary rocks (sedimentary rock types), sediment movement by fluid flow and sediment transport processes including transport, – basic concepts of fluid mechanics, , textures of terrigenous clastic sedimentary rocks (properties of sedimentary particles),Terrigenous clastic sediments, Sediment Types, Sediment texture, Sedimentary structures, Detrital components, Classification schemes and detailed description of terrigenous clastic sediments, Sandstone digenesis, Facies analysis and Depositional environments, Porosity and permeability. Lab. Petrographic study of elastic rocks. Heavy mineral analysis. Recording, plotting and analysis of Paleocurrent data. Field techniques for study of elastic sedimentary rocks.

Course Aims and Objectives: This objective of this course is to acquire knowledge about texture and classification of sedimentary rocks, Sedimentary environments and facies analysis, Paleocurrent analysis and Diagenesis and provenance analysis of clastic rocks

**Course Outcomes:**

After studying clastic sedimentology students will be able to

1. Understand about various clastic rocks and their diagenesis
2. Understand the classification and depositional system of clastic rocks
3. Know about the sediments play in global climate system as well as how energy and other resources come from clastic rock.

Reference Books/Materials:

1. Sedimentary Environments and Facies by Reading, H. G., 1986, Blackwell Scientific Publications.
2. Ancient Sedimentary Environments by Selley, R. C., 1978, Chapman and Hall.
3. Origin of Sedimentary Rocks by Blatt. H., Middleton, G and Murrey, R., latest Ed., Prentice Hall.
4. Depositional Sedimentary Environments by Renieck, H. E. and Singh, I. B., 1980, Springer Verlag.
5. Sand and Sandstones by Pettijohn by F.J., Potter, P. E. and Sever, R., latest Edition., Springer Verlag.
6. Principles of Sedimentology by Friedman, G. M. and Sanders, J. E., 1978, John Wiley and Sons.
7. Petrology of Sedimentary Rocks by Boggs Jr. S., 1992, Merril Publishing Co.
8. Sedimentary Rocks by Pettijohn, F. J., latest Ed., Harper and Row.
9. Depositional Systems, A Genetic Approach to Sedimentary Geology by Davis, R. A. Jr., 1983. Prentice Hall.
10. Sedimentary Petrology, An Introduction by Tucker, M. E., 1981, Black Well Scientific Publications Osney Mead.
11. Terrigenous Clastic Depositional Systems, Application to Petroleum, Coal and Uranium Exploration by Galloway, W. E. and Hobday, D. K., 1983, Springer Verlag, New York, Inc.
12. A Practical Guide to the Study of Glacial Sediments by David J. Evans, 2004, Oxford University Press.
13. Microfacies of carbonate rocks. Analysis, interpretation and application by Flugel, E., 2004, Springer

**Course Title Non Clastic Sedimentology**

Current Course Outline: Mineralogy of non clastic rocks, classification of carbonate rocks, carbonate depositional environments, carbonate diagnosis, dolomite and dolomitization, model nature & origin of evaporites, nature and origin of phosphatic rocks, ironstones, economic significance of non clastic rocks. • fracturing in carbonate and evaporitic reservoirs • Fracture terminology and classification • Fractures in different data types • Evolution of carbonate porosity systems; Lab. Identification of carbonate sediments in hand specimen and thin sections. Microfacies interpretations Staining and XRD techniques.

Course Aims and Objectives: This objective of this course is to study carbonate rocks and the processes associated to it. Study the different depositional systems of carbonate rocks and diagenesis

**Course Outcomes:**

After studying clastic sedimentology students will be able to

1. To know about carbonate mineralogy and chemistry
2. Understand classification, and depositional models,
3. Understand microfacies, cyclicity in carbonates, carbonate depositional systems.

Reference Books/Materials:

1. Carbonate Sediments and their Diagenesis by Bathurst, R. G., latest Edition., Elsevier.

2. Marine Carbonate by Milliman, J. D., 1974, Springer Verlag.

3. Carbonate Depositional Environment by Scholle, P. A. Bebout, D. G. and Moore, C. H., AAPG Mem.

4. Carbonate Sedimentology by Tucker, M. E. and Wright, V. P., 1990, Blackwell Scientific Publications.

5. Carbonate Depositional Environments by Scholle, P. A.,, Bebout, D. G. and Moore, C. H., 1993, Mem. Am. Assoc. Petrol. Geol.

**Course Title Groundwater Modeling**

Course Outline: Concept of groundwater components and aquifers, Purpose of groundwater modelling; Conceptual model, estimation of aquifer parameters, conceptualization of grid and boundary conditions, Steady and transient simulations, conceptualization of aquifer aquitard systems; Three dimensional anisotropy, Specification of boundary conditions; Construction of a steady state model, visualization of groundwater level, regional model, Hydrological stresses; Design of numerical model, finite difference solutions of flow problems; Steady versus unsteady model; One layer versus multi layer model; Lay out of grids; Stress period/time steps; Model inputs, initial conditions; boundary conditions; Hydrogeological parameters, model calibration procedures and validation, selection of model code; Model prediction, purpose of prediction; Simulation of scenarios; Determination of capture zones; Introduction to MODFLOW; Exercises and case study.

Course Aims and Objectives: Upon completion, the participant should be able to: Describe process and procedures of applied groundwater modelling. Construct numerical groundwater models using popular modelling tools with hands on exercises. Use groundwater models to simulate groundwater flow, contaminant transport, and saltwater intrusion with hypothetical examples. Apply groundwater models for groundwater resources management and protection in real world case studies.

Course Outcomes:

At the conclusion of this course, the student will:

4. Have a better understanding of basic components of a groundwater modeling;

5. Be familiar with most common solution methods used in groundwater modeling; and

6. Be able to define boundary conditions and to perform calibration for the computer models.

Reference Books/Materials:

4. Applied Hydrogeology, Author: C.W. Fetter Jr.

5. Fundamentals Of Groundwater Modelling, Authors: Husam Baalousha

6. Applied Groundwater Modeling: Simulation of Flow and Advective Transport: Authors: Mary P. Anderson, William W. Woessner

**Course Title Advanced Marine Geology**

Course Outline:

Introduction to marine environment and geological processes and shapes of world's modern oceans. Evolution of ocean basin; Types of marine/ocean basins; Concept of Oceanography; Modern and ancient deep marine processes; Key processes over timescales and past climate changes due to ocean volume change, Deposits and environments;

Physical and Biological processes in shallow and deep marine environments; Sediments and facies, beds, their sedimentary characteristics and interpreted depositional processes; Deep water ichnology, Mineral resources of sea; Time space integration including sedimentary marine deposition; Statistical properties of sediment; Gravity flow deposits; mass transport Deposits; Bed thickness distributions; Sea bed morphology; Sediment drifts and abyssal sediment waves, Contourites; Submarine fans and related depositional systems; Interpretations of offshore and sub environments using multiple data sets;

Course Aims and Objectives:

Students will have a clear overview of how ocean basins form and change in time also they will understand the dynamics of the earth's crust and its importance for geomorphology and evolution. Types of sediments and rocks, the reason for the existence of oceans and continents and the spatio temporal dynamics of marine sedimentary and igneous processes. Climatic variations over the period of time. Numerous case studies demonstrated in the class will illustrate concepts such a plate tectonics via island formation, and sedimentology via discussion of attractive sedimentary systems, such as coral reefs. Students will have a broad understanding of geological ocean dynamics

**Course Outcomes:**

1. A solid grounding in marine geology and the driving forces behind, consequences, and importance of sea level changes in the geological record.
2. Be able to describe sediments found in different water depths and settings, and understand the sedimentary processes leading to their deposition.
3. Be able to describe the main geological and geophysical techniques for observing the seabed and sub seabed. Impacts of climate change and global warming

Reference Books/Materials:


1. Kevin T. Pickering & Richard N. Hiscott (Deep Marine Systems, to be published by Wiley Blackwell in late 2014)
2. Haq, B. U., & Milliman, J. D. (1985). Marine geology and oceanography of Arabian Sea and coastal Pakistan.
3. Wright, D. J., & Barlett, D. J. (Eds.). (1999). Marine and coastal geographical information systems. CRC press.
4. BUL The Sea Floor An Introduction to Marine Geology By E. Seibold W. H. Berger. 3rd Ed 1996


**Course Title Reservoir Geology**

Course Outline:

Introduction to reservoir characterization, Reservoir characterization and modeling objectives; Reservoir characterization and modeling workflows; Data and related uncertainty; Data integration; Reservoir heterogeneities. Petrophysics based reservoir properties from cores & logs evaluation; Coring; Porosity: definition and measurements (effective and total porosity); pore size, Reservoir properties; effects of Depositional and digenetic controls on reservoir properties; Fluid properties and their saturation; Hydrocarbon distribution and fluid contacts; Reservoir zonation and thickness mapping; Reservoir pore spaces configuration; Mapping reservoir heterogeneity; Field observations to understand reservoir; Migration of hydrocarbons from source rock to reservoir; Estimation and calculation of reservoir volumetrics; Material balance and production decline curve methods; Appraisal and development of reservoir basic concepts.

Course Aims and Objectives:

Students will know about different type of reservoir rocks, fluid properties and its impact on reservoir rocks. Reservoir heterogeneity and reserves estimation.

**Course Outcomes:**

Students will be able to understand

1. Different types of reservoir rocks, their properties, different depositional environments,
2. Fluid properties and their saturations, reserve estimation methods.
3. Reservoir heterogeneity appraisal and development of reservoir basic concepts.

Reference Books/Materials:

1. Elements of Petroleum Geology by Richard C. Selley, Stephen A. Sonnenberg
2. Sandstone Petroleum Reservoirs by John H. Barwis, John G. McPherson, Joseph
3. Basin Analysis Principles and Application to Petroleum Play Assessment by Philip A. Allen

**Course Title Mineral Prospecting & Exploration**

Course Outline:

Mineral prospects and economic deposits, its types, Mineral exploration through to underground and open pit extraction and the processing and marketing of mining products. The environmental impact of mining and sustainable mining techniques are introduced, as well as monitoring and remediation techniques, target selection, deposit modeling, exploration technology, international exploration, environmental issues, program planning, proposal development. Geochemical prospecting methods, Development of primary and secondary haloes around ore deposits. Distribution of detrital material and solutions by streams, glaciers, etc. Dispersion of trace metals from mineral deposits and their discovery. Principles and application of primary dispersion to the search for metallic mineral deposits. Secondary dispersion processes (mechanical and chemical) applied to the search for metalliferous mineral deposits. Field methods of analysis for trace amount of metals. Labs consists of analysis and statistical interpretation of data from soils, stream sediments, vegetation, and rock in connection with field problems. Individual special investigations of a laboratory or field problem in exploration geochemistry. The mineralogy of economic deposits. Mineral deposit geology and models. Mineral exploration data and evaluation techniques.

Course Aims and Objectives

Aims: The course aim is to train students to discover and exploit economically viable mineral deposits that can benefit the country.

Objectives:

1. To impart knowledge about economic geology in terms of prospecting and exploration of minerals and familiarize them with the geological processes responsible for mineralization.

. To impart knowledge for understanding different field and laboratory techniques required for mapping, prospecting and analysis.

3. To train the students for the identification of metallic and industrial minerals and to prepare projects.

**Course Outcomes**:

The course is designed to impart practical knowledge to the students to understand the basics of economic geology in terms of acquiring knowledge in the fields of ore and industrial minerals. They will know how to explore economically viable ore resources and how to prepare development projects. They will also study some case studies related to important mega mines. Their ultimate aim will be to discover and exploit economically viable mineral deposits to the benefit of society.

Reference Books/Materials:

1. Introduction to mineral exploration Edited by Charles J. Moon, Michael E.G. Whateley and Anthony M. Evans (2012), Blackwell publisher
2. Mineral Exploration, 2nd Edition Principles and Applications by Swapan Haldar (2018), Elsevier publisher
3. Mineral Deposit Evaluation A Practical Approach by Alwyn E. Annels (1991), Chapman & Hall Publisher.
4. An introduction to economic geology and its environmental impact by Anthony M. Evans (1997), Wiley Blackwell publisher
5. Gems and Gemology in Pakistan by Tahseenullah Khan and Allah Bakhsh Kausar (2010), Geological Survey of Pakistan
6. Journal of Economic Geology
7. Research papers on economic geology

**Course Title Engineering Geophysics**

Course Outline:

Introduction to Geophysical and engineering tools used for underground analysis, Relevant physical properties of rocks and soil; Seismic reflection, Optimum window and optimum offset techniques; Identifying environmental and engineering problems as well as geophysical technique; Field procedure, techniques, and instrumentation; Data correction and interpretation; Seismic refraction, Interpretation techniques such as GRM and others; Electrical Images, 2D Resistivity Modelling; Finite difference method; 2D electrical imaging exploration and multi electrodes, Electromagnetic methods (Slingram, VLF, TEM), Georadar, Radiometry and well logging, Data collection and interpretation; Introduction to 3D electrical imaging; Relevant topics such as GPR and others; Field examples for environmental, engineering and hydrogeology; Latest research articles related the subject will be discussed in class.

Course Aims and Objectives:

The students should understand to expose you to the geophysical methods that geologists and geophysicist use to examine several different geological and environmental problems. Furthermore, it is expected to perform field examples processing and interpretation for environmental, engineering and hydrogeology. The students should understand the relevant physical properties of rocks and soil. The students should able to perform simple geophysical computations and data interpretation. Furthermore, it is expected that they should know how to do geological interpretations based on geophysical data.

Course Outcomes:

1. The students will be able to understand how geophysics data is used to map the near surface geological conditions and fields examples interpretations.
2. The students will be able to understand the main relevant physical properties of rocks and soil.

3. The students will be able to perform simple geophysical computations and data interpretation. Furthermore, it is expected that they should know how to do geological interpretations based on geophysical data.

Reference Books/Materials:

1. Philip Kearey, Michael Brooks, Ian Hill: An Introduction to Geophysical Exploration, Wiley Blackwell, 2002.
2. Dorbin, M. B. and Savit, C. H.: Introduction to Geophysical Prospecting (4th edition), McGraw Hill, 1998.
3. Telford, W. M., Geldart, L. P. and Sheriff, R. E.: Applied Geophysics (2nd edition), Cambridge University Press, 1990.
4. Reynolds, J. M.: An Introduction to Applied and Environmental Geophysics, Wiley, 1998.

**Course Title Machine Learning in Geoscience**

Course Outline:

Introduction and Inference in Geosciences (In verse Method, Geostatistics, NN), Introduction to python, Big Data Analytics and ML Overview, Python libraries, Optimization methods and Sampling Introduction to Machine Learning; Types, Supervised, Unsupervised; Model Representation; Cost Function; Supervised learning, Generative/discriminative learning, parametric/nonparametric learning, neural networks, and support vector machines; Gradient Descent; Gradient descent for Linear Regressions; Clustering, dimensionality reduction, kernel methods; Machine learning for seismic interpretation, fault extraction, horizon mapping, surface generation, facies analysis through supervised and unsupervised methods.

Course Aims and Objectives:

Machine Learning has made a huge impact on helping operating companies improve operational efficiency, eliminate unplanned downtime, improve safety, and overall reduce costs. Based on fundamental knowledge of computer science principles and skills, probability and statistics theory, and the theory and application of linear algebra. This course provides a broad introduction to machine learning and statistical pattern recognition.

Course Outcomes:

1. Students will have an understanding about applications of machine learning, such as to robotic control, data mining
2. How machine learning will help in understanding complex geophysical processes.
3. How to extract geophysical properties through machine learning

Reference Books/Materials:

1. Moseley, B., and Krischer, L., 2020, Machine Learning and Artificial Intelligence in Geosciences, Elsevier Science.
2. Langer, H., Falsaperla, S., and Hammer, C., 2019, Advantages and Pitfalls of Pattern Recognition: Selected Cases in Geophysics, Elsevier Science.
3. Misra, S., Li, H., and He, J., 2019, Machine Learning for Subsurface Characterization, Elsevier Science.
4. Alexej Gvishiani, Jacques O. Dubois., 2013, Artificial Intelligence and Dynamic Systems for Geophysical Applications, Springer Science & Business Media,

**Course Title Applications of Geostatistics in Geoscience**

Course Outline:

fundamental concepts and algorithms for geostatistical modelling and demonstration of application in the geosciences and spatial distribution, Geostatistical simulation and simple interpolation difference, Introduction to Geostatistics; Computer application in geo statistics; Collection and editing of data, primary data and secondary data; Measures of central tendency or averages, types of averages, arithmetic mean, median, mode, empirical relation between mean, median and mode; Relative merits and demerits of various averages; Measures of dispersion range, semi interquartile range or quartile deviation, mean deviation, standard deviation, skewness; Correlation and simple regression, coefficient of correlation, scatter diagram, rank correlation, regression; Geo statistical analysis, variogram calculation, interpretation, linking variogram behaviour with physical causes (geology, sampling); Extension variances and estimation variances/simple calculations in one and two dimensions; Global reserve/resource estimation; Optimal estimation and introduction to kriging.

Course Aims and Objectives:

This unit is designed to provide students with an introduction to the geostatistical techniques used in estimation from spatial data. Applications will be mainly in the areas of mining, petroleum, soil science and environmental management.

Course Outcomes:

On successful completion of this course, students will be:

1. Apply the concepts of spatial variability to geological, geomechanical and/or environmental variables,
2. Calculate variograms for simple one and two dimensional data sets
3. Assemble models to experimental variograms and interpret model parameters and Evaluate simple calculations of estimation variances
4. Formulate and solve kriging equations

Reference Books/Materials:

1. Hohn, M. (2013). Geostatistics and petroleum geology. Springer Science & Business Media.
2. Wackernagel, H. (2013). Multivariate geostatistics: an introduction with applications. Springer Science & Business Media.
3. Chilès, J. P., & Delfiner, P. (2012). Geostatistics: Modeling Spatial Uncertainty. Wiley Publishing.
4. Armstrong, M. (2012). Basic Linear Geostatistics. Springer Science & Business Media.

**Course Title** **Reservoir Geomechanics**

Course Outline:

Basic stress and strain analysis; pore pressure and in situ stress estimation and measurement; deformation mechanisms in rock; rock fracture description and analysis; wellbore stresses and failure; wellbore stability analysis; fault classification and stability analysis; depletion induced reservoir deformation; and hydraulic fracturing. Emphasis on applications to petroleum engineering. Structural Geology,Stress and strain analysis; Tectonic stress, Review of Earth Stresses; Stresses in various types of basins; Determining initial stress conditions in typical reservoir cases; Mechanical Behavior of Reservoir Rocks, Diagenetic processes in reservoir rocks; Transport Properties of Reservoir Rocks; Thermal conductivity and expansion properties of rocks and minerals; Effect of high temperatures on clay minerals and hydrous minerals; Permeability vs. effective stresses in porous media; Fractured media. Pore Pressure Prediction.

Course Aims and Objectives:

This course is interdisciplinary and encompasses the different geological and geophysical disciplines including fields of rock mechanics and structural geology. Also deals with the geomechanical problems that arise during the exploitation of oil and gas reservoirs. This course will also cover Pore pressure, estimation of hydrocarbon column heights, determination of optimally stable well trajectories, casing set points and mud weights, changes in reservoir performance during depletion, and production induced faulting and subsidence.

Course Outcomes:
1. Relevancy of Geomechanics throughout the reservoir life cycle
2. Applications of the principles of geomechanics to solve real world problems and reduce risk
3. How to be proactive instead of reactive towards geomechanical issues.

Reference Books/Materials:

1. Zoback, M.D., 2010. Reservoir geomechanics. Cambridge University Press.
2. Zoback, M.D. and Kohli, A.H., 2019. Unconventional reservoir geomechanics. Cambridge University Press.
3. Zhang, J.J., 2019. Applied Petroleum Geomechanics. Gulf Professional Publishing.
4. Nauroy, J.F., 2011. Geomechanics applied to the petroleum industry. Editions Technip.


**Course Title** **Advanced Seismic Techniques**

Course Outline:

Introduction to seismic data processing. Processing sequences, Introduction to seismic data interpretation: Overview of Seismic Stratigraphy. Wavelet analysis for seismic stratigraphic interpretation. Overview of Seismic Stratigraphy. Study of seismic section and other geological aspects of prospecting, structural interpretation, construction of isochron and isopach maps, thin bed resolution and pitfalls, LRLC interpretation, AVO and attribute analysis, Prospect evaluation & Ranking, Basis of seismic interpretation in workstation environment using standard packages.

Course Aims and Objectives:

This course is focused to familiarize students with advance seismic techniques that are being used in Oil Industry and to develop understanding of modeling/Gridding, linear interpolation/extrapolation techniques. The course will familiarize students with Reservoir Characterization Techniques such as AVO/AVA, Inversion, Post Stack Attributes

**Course Outcomes:**
1. Students would be able to transform seismic data in time domain to frequency domain
2. Students would be able to carry out modeling on any given data set using triangulation gridding techniques
3. Students would be able to harmonize sonic and checkshot data for modeling purposes
4. Students would be able to utilize Seismic Attributes, AVO/AVA and Seismic Inversion techniques for Reservoir Characterization
5. Students would be able to execute modeling and reservoir characterization related workflows on modern Softwares

Reference Books/Materials:

1. 3D Seismic Interpretation by M. Bacon Cambridge University Press
2. Interpreting Seismic Data by J. A. Coffeen
3. Chiburis, E, Leany, S, Skidmore, C, Franck, C, and McHugo, S. Hydrocarbon detection with AVO. Netherlands: N. p., 1993. Web.
4. Barclay, F. & Bruun, A. & Rasmussen, K.B. & Alfaro, J.C. & Cooke, A. & Cooke, D. & Salter, D. & Godfrey, R.

5. Lowden, D. & McHugo, S. & Özdemir, H. & Pickering, S. & Pineda, F.G. & Herwanger, Jorg & Volterrani, S.
6. Murineddu, A. & Rasmussen, A. & Roberts, R.. (2008). Seismic inversion: Reading between the lines. Oilfield Review. 20. 42 63.

**Course Title 3D Seismic Data Interpretation**

Course Outline:

Recapitulation of the fundamentals that are of direct relevance for interpretation, reflection coefficients, polarity convention etc. Exercises on seismic fundamentals. Brief summary on seismic acquisition and processing, focusing on aspects that have direct relevance for interpretation, such as minimum/maximum offset, multiplicity, type of imaging, phase issues etc. Seismic acquisition/processing related exercises. Generation of synthetic seismograms and well to seismic matching. Well to seismic Matching exercise. Summary of well geophysics. Interpretation fundamentals and introduction of 2D/3D seismic interpretation workflows. Marker recognition and transfer. Seismic (volume) attributes for seismic interpretation. Seismic illustration of structural styles: extension, compression, wrench and halokinesis. Exercise with examples from the different styles. Structural interpretation workflow in detail. Exercise with round correlation of shallow markers. Horizon tracking exercises. Mechanics of faulting and Fault interpretation. Exercise with hand interpretation of fault segments. Brief summary of stratigraphic interpretation. Exercise on stratigraphic interpretation. Interpretation pitfalls. Interpretation project QAQC. Overview of seismic velocities. Time to depth conversion. Exercise on seismic velocities, and time do depth conversion. Mapping and contouring. Contouring exercise. Volumetrics and uncertainties. Exercise on volumetrics. Seismic expression of DHI's. Introduction to rock and fluid prediction from seismic. Seismic inversion and AvO, exercises.

Course Aims and Objectives:

The students are introduced to methodologies and strategies for interpretation of 3D seismic data. Students will know how to do interpretation, what are the basics and practicality to start seismic interpretation, workflow and advance interpretation methods.

Course Outcomes:
1. They will develop skills in structural and stratigraphic interpretation.
2. Students will acquire knowledge about seismic amplitude reflections from lithological boundaries within the subsurface.
3. Students will understand basics and practical seismic data interpretation

Reference Books/Materials:

1. Seismic Amplitude by Rob Simm and Mike Bacon
2. Three Dimensional Seismic Interpretation by Alstair Borwn
3. 3D seismic Interpretation by Mike Bacon
4. Seismic Data Interpretation and Evaluation for hydrocarbon Exploration and Production by Nanda

**Course Title Seismic Data conditioning and Analysis**

Course Outline:

Basic Concepts of Seismic Surveying, What makes a seismic trace – Body & Surface waves Reflection and refraction Basics of seismic fold and image or stacked traces – Stacking Diagrams, Land Acquisition Systems and Operations, Sources – Sensors – Positioning Recording the Data – Arrays or Single Sensor Recording – Full Azimuth recording Simultaneous Sources – Industry Trends Quality Assurance, Principles of wave propagation Physical basis of wave types – Huygens's principle Refractions and Diffractions Seismic Velocities and Reflection amplitude, Waves in time and space, Frequency and Wavenumber, Aliasing both spatial and temporal – FK transform Convolution Cross & Auto correlation. Properties of Seismic Waveforms and traces – Polarity Vertical Resolution – Lateral Resolution – Tuning Amplitude Effects, Types of Seismic Data Acquisition – Marine, Land, Transition, Borehole, Ocean Bottom, TimeLapse – Signal and Noise – Field Array Design – Alternatives to arrays – Common Reasons for Failure, Causes of Distortions – Seismic Datum – Long & short wavelength statics, Surface Consistency Methods of Correction – Identifying errors, Wavelets and Wavelet Shaping, Reasons why Wavelet Shaping is necessary – Types of wavelets – Zero & Minimum phase, Types of Deconvolution Decon.'s place in the sequence – Examples. Noise Attenuation Noise Types – Noise Removal Methodologies – Organised Noise, Seismic Interference Random Noise – Examples, Multiple Attenuation, What are multiples? – Types of multiple Classifications and examples of removal methods, Types of velocity – NMO stretch – Velocity Analysis Techniques – Potential pitfalls, Velocity Model Building, Importance of velocity Types of Model geometries – Tomography – Velocity model building techniques – Imaging, Differences between Time and Depth Imaging – Limitations of Post stack imaging Current Imaging Techniques Their strengths and weaknesses Examples – Likely future trends, Migration and effects of seismic migration

Course Aims and Objectives:

The course emphasizes for each process and various existing underlying geophysical models. This course is designed to provide basic background and training for the processing of digital seismic data, particularly used by the petroleum industry. The emphasis is placed on the principles and practicality of the major processing methods, statics, deconvolution, velocity analysis, stacking, and migration.

**Course Outcomes:**

1. At the end of the course the participants will have obtained an understanding and appreciation of the many alternative processing approaches that are representative for the practice of current seismic data processing.
2. This course provides the participants with a working knowledge of the different processing methods and enables them to assess the quality of a processing result.
3. At the end of the course the participants will have obtained an understanding on the principles and practicality of the major processing methods, statics, deconvolution, velocity analysis, stacking, and migration.

Reference Books/Materials:

1. Zhou, H.W., 2014. Practical seismic data analysis. Cambridge University Press.

2. Yilmaz, Ö., 2001, Volume 1. Seismic data analysis: Processing, inversion, and interpretation of seismic data. Society of exploration geophysicists.

3. Yilmaz, Ö., 2001, Volume 2. Seismic data analysis: Processing, inversion, and interpretation of seismic data. Society of exploration geophysicists

**Course Title Advances in Exploration Geophysics**

Course Outline:

Introduction to geophysical methods and their applications. The course will provide a comprehensive overview on seismic methods, an introduction to gravity, electric, magnetic, electromagnetic, and radar techniques, and a short overview on other methods. Applications include hydrocarbon exploration, mineral exploration, studies of the shallow sub surface and the deep Earth.

Course Aims and Objectives:

This course aims to introduce students to the techniques used to measure and map geologic, geophysical and geochemical characteristics of the lithosphere, with applications to mineral and energy exploration. It also aims to provide students with the theoretical background to each technique, the methods of data collection, analysis and interpretation and an appreciation of the exploration scenarios in which each technique may apply.

Course Outcomes:

1. This course will take a generic view, about different geophysical methods to understand economical natural resources
2. The course will be divided into modules covering geophysical exploration techniques commonly used in minerals and energy exploration, (gravity, magnetic, electrical, electro magnetic and seismic surveys).
3. Students will be able to analyze and interpret all the studied geophysical data sets.

Reference Books/Materials:

1. An Introduction to Geophysical Exploration by P. Keary, M. Brooks and I. Hill
2. Introduction to mineral exploration (Moon, Whateley and Evans), 2nd Ed, 2006, Blackwell Publishing
3. Geophysics for the Mineral Exploration Geoscientist (Dentith and Mudge), 2014, Cambridge University Press

**Course Title Borehole Geophysics**

Course Outline:

Borehole geophysics as critical link Introduction, Fundamentals of rock physics, Borehole seismic methods – introduction, Borehole seismic methods – Data acquisition, Borehole seismic methods – Data processing principles, 3D VSP, Introduction to well logging

Course Aims and Objectives:

This course will enable the students to understand about the role of borehole geophysics in oil and gas industry by covering the fundamentals of petrophysics and its use in the analysis of cores and geophysical well logs for reservoir characterization and hydrocarbon assessment. The objective of this course is to enable students to learn about borehole geophysics builds that link between rock physics, well logging and surface seismic. The students are also required to apply some of these concepts analytically and numerically to familiarize their use in practical applications.

**Course Outcomes:**

On completion of the course, students are expected to be able to:

1. To understand the theoretical basis and practical limitations of logging tools. And evaluate reservoir intervals defined in clastic and shaly sandstone systems.
2. Integrate all other available data with wireline log data, including mud logs, sample descriptions, VSP, and core.
3. Illustrate the principle petrophysical differences between conventional reservoirs and unconventional shale reservoirs.

Reference Books/Materials:

1. Ellis, Darwin V, & Singer, Julian M. (2007). Well Logging for Earth Scientists (2 ed.). Dordrecht, The Netherlands: Springer
2. Labo, J. (1987). A Practical Introduction to Borehole Geophysics: An Overview of Wireline Well
3. Logging Principles for Geophysicists: Society of Exploration Geophysicists.
4. Sayers, Colin M. (2010). Geophysics under stress: Geomechanical applications of seismic and

5. borehole acoustic waves: Society of Exploration Geophysicists and European Association of Geoscientists & Engineers.Principles of Electric Methods in Surface and Borehole Geophysics, Volume 44 by Alex Kaufman B. Anderson

**Course Title Applied Seismology**

Course Outline:

This course will provide the students with an advance understanding of Seismology, i.e., Investigating Earth's structures by seismic waves, Active seismic zones, ground motion and penetration, Tsunami and Earthquake parameters, Focus and epicentre, Magnitude and intensity, Natural Earthquakes, Man made energy movement causes, parameters, prediction, Earthquake mitigation, Earthquake and its relationship to plate boundaries

Course Aims and Objectives:

This course will enable the students to understand the applications of seismology for earthquake studies The objective of this course is to enable students to acquire the knowledge of earthquake seismology. The students are also required to apply some of these concepts to determine the potential risks due to earthquakes and microzonate those areas accordingly

**Course Outcomes:**

On completion of the course, students are expected to be able to:

1. Understand the methodologies adopted for seismic risk assessment with Peak ground acceleration (PGA) and its applications
2. Advanced methods used for evaluation of earthquake hazards with microzonation and macrozonation
3. Use of microtremors to reveal the subsurface structure

Reference Books/Materials:

1. Micro Earthquake Seismology and Seismotectonics of South Asia by J.R. Kayal
2. Surface Wave Methods for Near Surface Site Characterization by Foti et al.
3. Manual for zonation on seismic geotechnical hazards (Revised version), ISSMGE,1999

**Course Title Mining Geophysics**

Course Outline:

This course presents the most widely used methods of applied geophysics and their applications, with emphasis on mining projects. For each method and for specific combinations of methods, the advantages and limitations for prospecting various raw materials are discussed. Methods covered include seismic reflection and refraction, geoelectric, gravimetric, magnetic, and electromagnetic. In addition, the economic benefits of geophysical exploration are addressed.

Course Aims and Objectives:

The Mining Geophysics will focus on geology, mining methods, exploration technology, surveying, and computer applications for mining operations and mineral explorations. Students learn hands on science and mining skills

**Course Outcomes:**

Mining Geophysics concentrates how to apply the knowledge for example in exploration, mapping and management of natural resources, and in environmental and engineering studies. In the life cycle of a mine, geophysics plays an important role in all stages: before opening the mine in mineral exploration and resource assessment, during active mining operations in exploration for additional resources and environmental monitoring, and after the closure of the mine in environmental monitoring and mapping of potentially contaminated areas

**Reference Books/Materials:**

1. Glazer, S. N., 2016, Mine Seismology: Data Analysis and Interpretation: Palabora Mine Caving Process as Revealed by Induced Seismicity, Springer International Publishing.

2. Kaufman, A. A., Alekseev, D., and Oristaglio, M., 2014, Principles of Electromagnetic Methods in Surface Geophysics, Elsevier Science.

3. Schön, J. H., 2015, Physical Properties of Rocks: Fundamentals and Principles of Petrophysics, Elsevier Science.

4. Dentith, M., and Mudge, S. T., 2014, Geophysics for the Mineral Exploration Geoscientist, Cambridge University Press.

**Course Title Geodesy**

**Course Outline:**

The course involves: the fundamentals and modern concerns of geodesy, recent developments and applications of global and satellite geodesy; the gravity field of the earth and how it affects observations; the geometry of the ellipsoid; determination of geographical and map projection coordinates from geodetic observations; and the concept of a geodetic datum and how to transform coordinates from one datum to another.

**Course Aims and Objectives:**

The fundamentals and modern concerns of geodesy, recent developments and applications of global and satellite geodesy; the geometry of the ellipsoid; The principles of various global/satellite geodetic techniques; Determination of geographical and map projection coordinates from geodetic observations; and the concept of a geodetic datum and how to transform coordinates from one datum to another.

**Course Outcomes:**

On successful completion of the course students will be able to:

1. Understand how the earth's gravity field affects surveying observations, and how these observations can be reduced from the earth's topography to the map. Locate and use web based resources for the latest developments in geodesy.
2. Demonstrate a basic understanding of the geometry of the ellipsoid and of map projections.
3. Demonstrate their understanding of the Geocentric Datum of Pakistan

**Reference Books/Materials:**


1. Torge, W., & Müller, J. (2012). Geodesy. Walter de Gruyter.

2. Sciences of Geodesy II: innovations and future developments. Springer Science & Business Media.(Ed.II). (2012).
3. Lu, Z., Qu, Y., & Qiao, S. (2014). Geodesy. Berlin, Heidelberg: Springer Berlin Heidelberg.
4. Xu, G. (Ed.). (2010). Sciences of geodesy. Springer.
5. Meyer, T. H. (2018). Introduction to geometrical and physical geodesy: foundations of geomatics. Esri Press


**Course Title Near Surface Geophysics**

Course Outline:

Review of Seismic, Gravity, Magnetic and Electrical methods, Applications of these methods to Environmental and Engineering studies: Delineation of structural trends, contacts and faults, microgravity detection of subsurface voids and cavities, detection of Archaeological objects, Mapping of fracture zones, reflection profiling in ground water studies, dam site investigations, evaluation of aquifer potential, Investigation of waste dump sites.

Course Aims and Objectives:

The students will understand to the geophysical methods that geologists and geophysicist use to examine several different geological and environmental problems. The students will understand the main principles behind geophysical measuring techniques. The students will be able to perform simple geophysical computations. Furthermore, it is expected that they will know how to do geological interpretations based on geophysical data.

**Course Outcomes:**

1. The students will be able to understand how geophysics data is used to map the near surface geological conditions.
2. The students will be able to understand the main principles behind geophysical measuring techniques and their application to solve near surface problems.
3. The students will be able to perform simple geophysical computations. Furthermore, it is expected that they should know how to do geological interpretations based on geophysical data.

Reference Books/Materials:


1. Reynolds, J.M., 2011. An introduction to applied and environmental geophysics. John Wiley & Sons.


**Course Title Gravity and Magnetic Exploration Techniques**

Course Outline:

Physical principles and basic theory; instrumentation; planning of the survey and evaluation of errors; different survey methodologies; rock densities/rock susceptibilities and their measurements Isostasy; data acquisition, processing; interpretation and mapping to identify gravity/magnetic anomalies; regional fields and residual anomalies, derivatives, continuation of the field, two and three dimensional modeling; applications in petroleum industry and case histories.

Course Aims and Objectives:

This course will enable the students to understand the basic concepts, principles and applications of gravity and magnetic exploration techniques used in Exploration of different structure, ores, minerals etc. Familiarize the students with different parameters measured and calculated using Gravity and Magnetic Exploration Techniques and to use them for the interpretation of different lithologies, structures, minerals and ore bodies.

**Course Outcomes:**

On completion of the course, students are expected to be able to:

1. Identify key concepts of the gravity and magnetic exploration techniques.
2. Describe the behavior of different subsurface bodies, minerals, ores etc.
3. Identify the factors affecting the gravity and magnetic surveys.
4. Use, key concepts about the interpretation of Gravity and Magnetic exploration methods.

Reference Books/Materials:

1. Li, Yaoguo; Krahenbuhl, Richard, Gravity and Magnetic Methods in Mineral and Oil & Gas Exploration and Production.

**Course Title** **Electrical Exploration Techniques**

Course Outline:

Electrical resistivity method, Principal, Electrode Configurations (Wenner Configuration, Schlumberger Configuration, Dipole Dipole Confi, Choice of Array, Refraction of Current Path, Electrical Reflection Co efficient Survey Types, interpretation of Electrical Resistivity Data, Application of Electrical Resistivity Data; Electric exploration methods, Charge body potential Method, Spontaneous Potential method, Induced Polarization Method, Electromagnetic Method, Telluric Method, Magnetotelluric Method, Principle, Mechanism, Important Consideration, Sources of Noise, Instrumentation, Field Procedure, Survey design, Interpretation, Advantages, Disadvantages, Limitations, Applications.

Course Aims and Objectives:

The objectives of this course are to: introduce students to electrical resistivity prospecting methods and their applications in investigating subsurface conditions, and provide students with opportunities to develop basic acquisition, processing and interpretation skills using the electrical methods.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

1. Understand the various electrical prospecting methods applicable in geophysical exploration.
2. Explain the basic principles of Self Potential, Induced Polarization and Electrical Resistivity Methods.
3. Explain the field procedures applicable to each method.

Reference Books/Materials:

1. Reynolds J.M. (1998). An Introduction to Applied and Environmental Geophysics. Published by John Wiley & Sons Ltd, West Sussex, England. 800p.

2. Keary P., Brooks, M. and Hill I. (2002). An Introduction to Geophysical Exploration, Third Edition, Blackwell Science Ltd. Oxford, England 281p.

**Course Title Unconventional Energy Resources**

Course Outline:

energy resources (solar, wind, thermal, water, conventional and unconventional hydrocarbon) and their role in modern society, with both national and global perspectives in multiple fields of applied sciences. The present and future impacts of nuclear and fossil fuels on the environment will be explored. Energy technologies and use of solar, wind, hydro, biomass and fossil fuel energy resources will be introduced, and the relationship between public policy and resource usage will be discussed.

Course Aims and Objectives:

The course is designed to expose attendees to the understanding and application of the latest approaches, techniques and requirements being applied to reserves evaluation within unconventional resources. Focus is given to actions and methodologies that are necessary to enhance the reserve categorization. The course is designed to expose attendees to the understanding improvements in techniques such as horizontal drilling and hydraulic fracturing have increased access to unconventional hydrocarbon resources, ushering in the “shale boom” alternate energy resources and disrupting the energy sector.

**Course Outcomes**:

1. At the end of the course, the student should be able to recall the relative energy content per mass of various fuels, and the relative energy efficiency of the most common heat engines.
2. After completion of this course, the student should be able to:
3. Describe the most important energy sources in use today in Norway and worldwide, including the sources, extraction, transport and use of these resources.
4. Calculate the energy content of various energy resources and compare the values available from different sources.
5. Explain the relationship between absorption, emission and the greenhouse effect.

6. Explain and employ the computer models used for characterizing population growth and resource usage.
7. The students should know and understand the methods for production of viscous oil and the methods for recovery of gas from rocks with very low permeability.

Reference Books/Materials:

1. Arthur, M.A. and Cole, D.R., 2014. Unconventional hydrocarbon resources: prospects and problems. Elements, 10(4), pp.257 264.
2. Reza Barati, Mustafa M. Alhubail. 2020. Unconventional Hydrocarbon Resources: Techniques
3. Reservoir Engineering Analysis ISBN: 978 1 119 42032 3 American Geophysical Union

**Course Title Practical Technology Use in Geoscience**

Course Outline:

Introduction to software used in different industry. How to create and manage a project including establishing project boundaries, choosing an X/Y projection. the use of authors, CRS and its types. Culture (geographic layer) input: creating and entering culture data on the base map including formatted and unformatted data entry and the importing of ESRI shape files. Well data input: using file sources such as HIS Energy and ascii formatted data; loading of well locations, deviation surveys, formation tops, log curves, and local and shared Time Depth information. Using the SEG Y Viewer to examine 2D and 3D trace header data. 2D and 3D data loading from files and the use of Share/Copy feature for seismic data. Introduction Review basic concepts: Waves; Wavelet; Seismic sections 2D vs. 3D; Seismic display, slice, 2D and 3D view, Volume concept, Slicing the data volume, Dynamic range and data loading, Polarity and colour Character and zero phase, Colour principles, Interpretative value of colour, Interpretation procedure/workflow, Synesthetic seismogram, Structural interpretation, Fault recognition and mapping, Horizon mapping and procedures, Visualization and auto tracking. Direct contouring and the importance of the strike perspective, Maps and its types. Depth conversion and procedures. Composite displays. Advantage and disadvantages of different displays, Subtle structural features. Stratigraphic interpretation. Seismic facies analysis. Geological softwares like move, basin mod for basin inversion analysis, corel draw, autocad

Small project based on available data.

Course Aims and Objectives:

1. Course will help the students to use different software.
2. This course provides a broad introduction and application of datasets used for G and G industry.
3. Course will help to give awareness t the student to get familiar with state of the art technology used by different industries in the world.

Course Outcomes:

The following outcomes will achieve from the course.

1. Students get awareness about different applications of softwares used for seismic and well data interpretation.
2. Students will understand about usage of different software.
3. Students learn about different data formats used to create projects.
4. Graduate can work more scientific way to perform their research.

Reference Books/Materials:


1. Bacon, M., Simm, R., and Redshaw, T., 2007, 3 D Seismic Interpretation, Cambridge University Press.
2. Herron, D. A., and Latimer, R. B., 2011, First Steps in Seismic Interpretation, Society of Exploration Geophysicists.
3. Brown, A. R., Geologists, A. A. P., and Geophysicists, S. E., 2011, Interpretation of Three Dimensional Seismic Data, Seventh Edition: AAPG Memoir 42, 7th Edition/SEG Investigation in Geophysics, No. 9, Published jointly by American Association of Petroleum Geologists and the Society of Exploration Geophysicists.


**Course Title Coal Geology**

Course Outline:

Introduction, Coalification, Coal types, Tectonic Setting of Coal Basins, Coal bearing Cycles & paleoenvironments, Geology of coal, Coal field exploration, Coal in relation to Delta type, Fluvial Coals, Environmental impact of coal mining, Coal resource estimates, General coal Depositional Model.

Lab: Petrography of coal and associated rocks. Preparation a coal pellets. Petrographic methods of coal analysis. Specified assignments/projects.

Course Aims and Objectives:

The course begins with a review of the global coal and coal seam gas industry, and the likely future directions based on the current project pipeline and demand scenarios. The details of coal geology, how it's formed, stratigraphy, the chemistry of coal, understanding reservoirs, groundwater and the different types of coal beds around world. How to assess a coal basin play and then evaluate one and the difference between mining and gas plays. Variability in the subsurface and the relationships between groundwater, Finally, underground coal gasification, sequestration and storage, along with issues with overlapping tenures and other techniques.

Course Outcomes:

The expected outcomes of course are to explain how coal is formed, to explain how coal is found and extracted by either surface or underground mines, to discuss how geological problems and environmental issues surrounding extraction affect mining and to explain the reasons for the decline in the coal industry.

Reference Books/Materials:

1) Hydrocarbons from Coal (AAPG Studies in Geology)" by B E Law
2) "Coal and Coal bearing Strata: Recent Advances" by Scott A C
3) "Coal Geology" by Thomas and Larry
4) "Coal Geology" by WARD

**Course Title Climate Crisis Adaption and Mitigation**

Course Outline:

Climate science, Natural and Anthropogenic causes of climate crisis, Role of atmospheric and ocean circulation in climate regulation, Present rapid warming, Projection of future climate change, Uncertainty in climate change projections Climate Change Policy, Impacts of Climate Change in Pakistan, Green Economy, Carbon Footprint, Carbon capture and storage, Technological Development and Changing climate, Climate Change matters, , Climate change mitigation in developing countries, climate and human rights, societal systems, Social attitudes to climate change: Adaptation, Mitigation options: increased energy efficiency, fuel substitution, nuclear power, hydropower, solar energy, wind power, biomass energy, tidal, wave and geothermal energy, hydrogen economy, changes in infrastructure and behavior.

**Course Aims and Objectives:**

The objective of this course is to provide a wide ranging understanding on the impacts of climate change on society, understanding of adaptation and mitigation options in relation to climate change.

**Course Outcomes:**

Students will be able to learn the various mitigation and adaptation measures for climate change problem.

**Reference Books/Materials:**

1) William James Burroughs (2017) Climate change: A Multidisciplinary Approach, Cambridge University Press, Cambridge, UK.

2) Sharon L. Spray, Karen Leah McGlothlin, (2012) Global climate change, Rowman& Littlefield, Maryland, USA

3) Horace M. Karling, (2010) Global climate change, Nova Publishers, New York, USA

**Course Title Disaster Management**

Course Outline:

Natural hazards and disasters: The need for hazard and disaster studies, Historical background on Hazard and Disaster research; Disaster types: Natural vs anthropogenic; Flooding, Earthquake Landslide; Natural cycles and their role, Prediction; Hazards, Risk and Vulnerability: Definitions and characterization, Different approaches and Indicators; Factors of vulnerability: Demographic factors, Mapping of disaster prone areas, Socio economic factors, Cultural factors, Political factors, Physical factors; The impact of natural disasters: Direct and short term impact of disasters, Indirect and long term consequences of catastrophes, Disaster as an opportunity for development; Disaster Management: Components of management, International phenomenon; Hazard and vulnerability reduction and Mitigation: hard and soft measures; Earthquake Management, Flood Management: Organizational Role; Role of Government and Non-Governmental Organizations (NGOs); International phenomenon, Role of Media in Disaster Management; Techniques and methods to assess hazard, vulnerability and risk: Qualitative and Quantitative approaches

**Course Aims and Objectives:**

This course will provide know how in dealing with natural calamities and their management by encompassing the field of hazard and disaster studies. It discusses a wide range of aspects, i.e., assessment of factors which put societies in vulnerable situations to the disaster management continuum. To underline the importance of disasters in socio economic development, this course also aims to make an assessment of the consequences of 'natural' catastrophic at both short and long terms. It finally tends to provide the students with basic knowledge on hazard reduction and vulnerability mitigation.

**Course Outcomes:**

Students will be able to learn the assessment of the consequences of 'natural' catastrophic at both short and long terms and in depth knowledge on hazard reduction and vulnerability mitigation.

Reference Books/Materials:

1. Natural Disasters Alexander, D., Chapman & Hall, New York.
2. Rising from the Ashes: Development Strategies in Time of Disaster Anderson, M.B., and Woodrow, P.J, Westview Press, Boulder, UNESCO, Paris.
3. The Environment as Hazard Burton I., Kates, R.W., and White G.F., 2nd Edition, The Guilford Press, New York.
4. Disaster Management: A Disaster Manager's Handbook Carter N.W., ADB, Manila.

**Course Title Environmental Impact Assessment**

Course Outline:

Introduction: principles, concepts and purposes of IEE and EIA and its significance for the society. Cost and benefits of EIA. Main stages in EIA process. Public consultation and participation in EIA process. Methods and techniques for impact prediction and evaluation. Life cycle assessment, Periodic evaluation. EIA review and post project analysis.

EIA process management. Role of quality assurance and quality control in environmental analysis. EIA Regulations and guidelines in Pakistan.

**Course Aims and Objectives:**

The aim of this course is to enable the participants to build their capacity to integrate environmental concerns in project proposals.

**Course Outcomes:**

Students will be able to learn the principles, skills, procedures and practices of integrating environment in development through EIA; become aware of the legal and regulatory obligations of integrating environment in development projects; will familiarize with the techniques of getting public participation and integrate socio economic aspects in development projects.

**Reference Books/Materials:**

1) Environmental Impact Assessment Handbook for Pakistan, Fischer, T.S. (ed.), 2014, Liverpool University Press, UK

2) Introduction to Environmental Impact Assessment, Glasson, J., Therivel, R., and Chadwick, A., Routledge, London, 2005.

3) EIA Manual: Training Resource Manual, Sadler, B., & McCabe, M., (ed.),2nd Edition, United Nations Environment Programme, 2002.

4) Environmental Impact Assessment in Practice, Harrop, D.O. & Nixon, .A., National Book Foundation, Islamabad, 2000.

**Course Title Geophysical Exploration Techniques**

Course Outline:

An introduction to the physics of the earth. Theory and application of basic geophysical field techniques including, gravity, magnetic, electrical, electromagnetic, GPS, seismic studies, and satellite remote sensing. The present internal structure and dynamics of the earth and constraints from the gravitational and magnetic fields, seismology, mineral phases and wave propagation in earth materials. The earthquake source in terms of seismic and geodetic signals. Contributions of heat flow, gravity, paleomagnetic, and earthquake mechanism data to plate tectonics, the driving mechanism of plate tectonics, and the energy sources of mantle convection.

Application of the basic principles of physics to the earth sciences, including mechanics of rotating bodies, the two body problem, tidal theory, oscillations and normal modes, diffusion and heat transfer, wave propagation, electro and magneto statics.

**Course Aims and Objectives:**

This course will introduce a series of geological and geophysical techniques that can be applied to determine the physical characteristics of the Earth's lithosphere, with direct application to the detection and mapping of mineral and energy resources in three dimensions. The course will be divided into modules covering geophysical exploration techniques commonly used in minerals and energy exploration, (gravity, magnetic, electrical, electro magnetic and seismic surveys). Theoretical basis of each technique will be studied, the methods of data collection, presentation and analysis, and appropriate, geologically constrained, interpretation of the data. Students will explore an industry style data base and softwares with the aim of developing an exploration and targeting model for hydrocarbon resources.

**Course Outcomes:**

The anticipated knowledge, skills and/or attitude to be developed by the student are: Demonstrated proficiency in common practical skills in resource exploration, The scientific basis of mineral, energy and natural resource exploration, he generic characteristics of economic mineral and energy resources – geological, geophysical and geochemical anomalism, The geophysical techniques (seismic, gravity, magnetic, electrical and electro magnetics), The geochemical techniques (sampling media, sampling strategies, analytical techniques), Field based data collection – sampling strategies, Demonstrated understanding of the importance of data quality – collection, analysis, processes techniques

Reference Books/Materials:

1) Geophysical Exploration Technology by Ming li
2) Developments in Geophysical Exploration Methods by Fitch
3) An Introduction to Geophysical Exploration by Robert H. Tatham

**Course Title Environmental Geophysics**

Course Outline:

Importance of geophysics in environmental studies, geological and geophysical characteristics of some environmental problems; Landslides, cavities and sinkholes, groundwater pollution, dam problems, different geophysical techniques and field applications. Fixed and mobile hazards. Applications in contaminant plumes, conduits, fractures, voids, aquifers. buried containers, waste pits, ordnance, landfill delineation. Use of seismic methods, ground penetration radar, electromagnetic methods, tomography and other geophysical methods to environmental problems.

**Course Aims and Objectives:**

Geophysical exploration methods are fundamental tools in the search for mineral resources but are also used widely in engineering, archaeology and in earth and environmental sciences to explore and image the shallow subsurface (< 200 m depth). A wide range of geophysical methods are now used routinely in the search for buried archaeological sites, characterization of groundwater resources, geological imaging of subsurface structures and stratigraphic studies.

**Course Outcomes:**

Introduces geophysical exploration methods with emphasis on techniques used to investigate the near surface (< 200 m depth). These methods include seismic reflection/refraction, ground penetrating radar, electromagnetic, resistivity, gravity and magnetic methods. For each method, we will examine the underlying physical principles, the practical aspects of field data acquisition and signal processing and interpretation

**Reference Books/Materials:**

1. Mussett, A.E. and Khan, M.A., Looking into the Earth: An Introduction to Geological Geophysics, Cambridge University Press, 2000.
2. Kearey, P., Brooks, M., Hill I., An Introduction to Geophysical Exploration, Blackwell, 2002.
3. Reynolds, J.M., An Introduction to Applied and Environmental Geophysics, Wiley, 2011.
4. Lay, T. and Wallance, T.C., Modern Global Seismology, Academic Press, 1995.
5. Sheriff R., and Geldart L., Exploration Seismology, Cambridge University Press, 1995.

6. Sheehan, H.R., Jones, A.F., and Burger C.H., Introduction to Applied Geophysics: Exploring the Shallow Subsurface, W. W. Norton & Company, 2006.

**Course Title Advanced Seismic Stratigraphy**

Course Outline:

Introduction to sequence and seismic stratigraphy; Philosophy and history of sequence stratigraphy; Fault mechanical stratigraphy; Vail and Galloway sequence theory; Hierarchy and application; Sequence models; Basin development; sediment deposition and accommodation concepts; Geophysical fundamentals; Examples of operational sequences; Basin related depositional systems; Chronostratigraphy construction and interpretation; Sea level curves; Orders of cyclicity; Carbonate and Siliciclastic sequences; System Tracts; Stratigraphic surfaces; Seismic facies; Paleo environmental analysis; Geohistory reconstruction; Biostratigraphic signature; Sequences in Deep marine, Shallow marine, Shelfal, Deltaic and Neritic Environment; Hydrocarbon traps related geometries; Seismic truncations; Data Integration at seismic, log, core and outcrop scale; Demarcation of stratigraphic surfaces on integrated data sets; Static and dynamic models; Optimizing exploration.

Course Aims and Objectives:

Students will be able to:

1. Understand the use of sequence stratigraphy as a tool in basin exploration, and describe related workflow structure, ensure accurate stratigraphic breakdown of well data, manipulate and use a full dataset in an integrated project: well log, outcrop
2. Development of sedimentary basins, and their sedimentary infill, with emphasis on depositional processes/environments and resultant stratigraphic architecture.
3. Understand the sequence and sedimentology in a temporal and spatial perspective.

Course Outcomes:

After taking this course you will know:

1. General principles of sequence stratigraphy and their applications in depositional environments and basin types with main processes and products in a range of depositional environments.
2. Spatial and temporal development in sedimentary basins, with a predictive perspective on determining facies distribution.
3. Seismic expression of various strata and their sequence stratigraphic expression.

Reference Books/Materials:

1. Siliciclastic Sequence Stratigraphy Concepts and Applications" by H.W. Posamentier and G.P.
2. Allen, 2000; SEPM Concepts in Sedimentology and Paleontology Series 7, Society for Sedimentary Geology, 204 pages.
3. Seismic and Sequence Stratigraphy and Integrated Stratigraphy: New Insights and contributions by Gemma Aiello edition I.2017
4. The Sedimentary Record of Sea Level Change by Angela L.Coe, cmabridge uni press 2nd edition,2003
5. Sequence Stratigraphy and Facies Associations (Special Publication 18 of the IAS) Henry W. Posamentier,haq and Allen,
6. Seismic Stratigraphy and Depositional Facies Models by P.C.H Veeken, 1st edition
7. Seismic Stratigraphy, Basin Analysis and Reservoir Characterisation by P.C.H Veeken, volume 37

**Course Title Health Safety and Environment**

**Course Outline**:

Health, safety and environment: Hazards; Physical, mechanical, biological, chemical and psychological hazards and stress. Health and environment, Environmental safety, Hazards identification and risk assessment and management process. Work place environment: Occupational safety and health issues in industries, construction, agriculture and service sectors, Accidents, injuries and workplace fatalities statistics, Occupational safety and health management systems (international and national). Safety Management: Regulations of health, safety and environment. Industrial hygiene, Internal control and management philosophy, Duties and rights, strategies and goals, Roles and responsibilities of occupational health and safety professionals. Key principles of management and HSE, Measures and models for HSE, Organizational environment, HSE statutes and regulations, Establishing HSE plans, Challenges of health within working environment, external environment and safety, Different tools and instruments. 85 Culture, Behavior, Interactions, participation and communication, health surveillance, injury reporting, Emergency response procedures; fires, spills, leaks etc., Preparedness and monitoring of adverse events and follow ups, Case studies. Work place safety and health: Assessing current practices and promoting change in the profession, Personnel Protective Equipment, Formulation of Standard operating procedures, Human Factors and Ergonomic, Planning, decision making and problem solving.

**Course Aims and Objectives**:
The objective of this course to provide orientation to the students on importance of occupational safety, health and environment. Regulations and guidelines concerning HSE work, Reporting of HSE problems and discrepancies, Reporting of HSE problems and discrepancies

**Course Outcomes**:
Students will have the necessary knowledge about HSE to ensure their own and other people's safety at working environment. This includes knowledge of the HSE concept, objectives for the HSE work and
how to behave safely in laboratories and during field work. The theoretical and practical basic training in first aid and fire protection shall provide the students with a basis for correct handling of a fire or accident situation.

Reference Books/Materials:

1. Hand book of Environmental Health & Safety, principles and Practices By Herman Koren and Mechael Bisesi, Vol.1 , Lewis publishers.
2. English, P. F. 2012. Safety Performance in a Lean Environment: A Guide to Building Safety into a Process (Occupational Safety & Health Guide Series), CRC press. Taylor and Francis group. USA.
3. Salvendy, G. 2012. Handbook of Human Factors and Ergonomics. 4 th ed., John Willey Inc. New Jersey, USA.
4. OHSAS BS 18001 Standard

**Appendage 4705**

10/28/2024

# MBBS CURRICULUM

## Bahria University College Of Medicine
Bahria University Health Sciences Campus Islamabad

1

# PM & DC Standards

| | 2019 | 2024 |
|---|---|---|
| **Total Teaching Hours** | 6000 | 6200 |
| **Courses Introduced** | - | • Quran Kareem<br>• Expository Writing<br>• Infectious Diseases<br>• Medical Oncology |
| **Sub-Specialities (Medicine and Surgery Allied)** | **2** subspecialities were required for a **total teaching hours of 100** | **3** subspecialities are compulsory for **a total teaching hours of 225 (75 hours each)** |
| **Curriculum Content (Community Medicine)** | - | Alignment of common health problems with NHV and SDG. |

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10/28/202

# Summary Of Teaching Hours

| SUBJECT | 2019 | 2024 |
|---|---|---|
| Anatomy | 500 | 500 |
| Physiology | 450 | 450 |
| Medical Biochemistry | 250 | 250 |
| Pharmacology and Therapeutics | 300 | 300 |
| Pathology | 500 | 500 |
| Forensic Medicine and Toxicology | 100 | 100 |
| Otorhinolaryngology (ENT) | 150 | 150 |
| Ophthalmology (EYE) | 150 | 150 |
| Gynaecology & Obstetrics | 300 | 300 |
| Community Medicine and Public Health | 170 | 200 |
| Research and Evidence-Based Medicine (EBM) | 100 | 100 |
| Quran Kareem (Tajweed-Tafseer-Seerat) | - | 50 |
| Pakistan Studies | 15 | 25 |
| Islamic Studies/ Ethics | 15 | 25 |
| PLACE (Professionalism, Leadership-25, Applied Research, Communication skills, Ethics) | Included with behavioral sciences | 100 |
| Expository Writing | - | 25 |
| Introduction to Computer/AI | - | 60 |
| Humanities-Medical Anthropology | - | 25 |
| Entrepreneurship | - | 35 |
| General Surgery | 600 | 600 |
| Anesthesia | 50 (critical care included) | 50 |
| Emergency Medicine/Critical Care | - | 25 |
| Orthopedics &Trauma | 100 | 100 |
| Urology | 50 | 75 |
| Vascular Surgery | 50 | 75 |
| Paediatric Surgery | 50 | 75 |
| General Medicine | 500 | 600 |
| Neurology | 50 | 75 |
| Endocrinology | - | 75 |
| Infectious Diseases | - | 75 |
| Psychiatry | 50 | 150 (including behavioural sciences) |
| Behavioural Sciences | 150 | 75 |
| Dermatology | 50 | 50 |
| Cardiology | 50 | 50 |
| Pulmonology | 50 | 50 |
| Nephrology | 50 | 50 |
| Gastroenterology | 50 | 50 |
| Paediatrics and Neonatology | 300 | 300 |
| Family Medicine | 100 | 75 |
| Infection Control | 25 | 25 |
| Patient Safety | 25 | 25 |
| Medical Oncology | - | 25 |
| Basics of Radiology | 25 | 25 |
| SDL | 500 | 500 |
| TOTAL | 6000 | 6200 |

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# Curriculum Map

Curricula framework at BUCM is organized into 3 categories:

1. Pre Clinical and Para Clinical
2. Clinical
3. PLACE

Curriculum Map

Professionalism, Leadership, Applied Research, Communication skills, and Ethics will be part of all five years. (PLACE)

| Year | Modules / rotations | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year 1 | Block 1: Orient 1 week | FDN I 5 weeks | Hematology I 5 weeks | EOB | Block 2: SMS I 10 weeks | EOB | Block 3: CVS I 6 weeks | RESPIRATION I 4 weeks | EOB | PRE PROFF | PROFF | | |
| | Humanities & AI<br>Clinical Rotations in Skills Lab | | | | | | | | | | | | |
| Year 2 | Block 1: GIT I 6 weeks | KUB I 4 weeks | EOB | Block 2: Neuroscience 10 weeks | EOB | Block 3: MP & SS 4 weeks | E & R I 6 weeks | EOB | PRE PROFF | PROFF | | | |
| | Humanities & AI<br>Clinical Rotations in Skills Lab | | | | | | | | | | | | |
| Year 3 | Block 1: FDN II 4 weeks | Hematology II 3 weeks | CVS II 3 weeks | EOB | Block 2: KUB II 3 weeks | GIT & Hepat II 4 weeks | Resp II 4 weeks | EOB | Block 3: E & R II 3 weeks | CNS & SS II 3 weeks | SMS II 4 weeks | EOB | PRE PROFF / PROFF |
| | Clinical Rotation in the Hospital (KRL & PNS HAFEEZ)<br>EOR assessment in General Surgery and Allied, General Medicine and Allied<br>Electives | | | | | | | | | | | | |
| Year 4 | Community Medicine, Pathology Rotations & their EORs will continue throughout the year. | | | | | | | | | | | | |
| | ENT 4 weeks | EOR | EYE 4 weeks | EOR | Pediatrics 4 weeks | EOR | Gynae/OBs 4 weeks | EOR | Medicine 4 weeks | Med Allied 4 weeks | EOR | Surgery 4 weeks | Surgery Allied 4 weeks, EOR, PRE PROFF, PROFF |
| | Clinical Rotation in the Hospital (KRL & PNS HAFEEZ)<br>Electives | | | | | | | | | | | | |
| Year 5 | Medicine and Allied 12 weeks | EOR | Surgery and Allied 12 weeks | EOR | Gynae/OBS 5 weeks | AI in Healthcare 1 week | EOR | Pediatrics 5 weeks | Entrepreneurship 1 week | EOR | PRE PROFF | PROFF | |

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10/28/2024

# Recommendation

The revised MBBS curriculum as per PM&DC Curricular Standards 2024 may be approved by the Academic Council as presented, for adoption by BU College of Medicine from academic session 2024-25

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**Appendage 4706**

## REVISED BSN ROADMAP FOR IMPLEMENTATION FROM SPRING 2025

10/25/2024

### ALIGNMENT OF ROADMAP OF BSN (NURSING) AS PER HEC APPROVED REVISED FRAMEWORK

Assoc. Prof. Abida Razzaq
Vice Principal PNNC

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### Preamble

- HEC revised framework received on March 01,2024.
- Consortium Nursing Sindh implementing it from spring 2025.
- Roadmap of revised BSN curriculum is being presented
- Course content of Revised roadmap is under final review by consortium and will be presented through case file for approval

2

### Categories of Undergraduate Education

HEC-UGP-VERSION 1.1

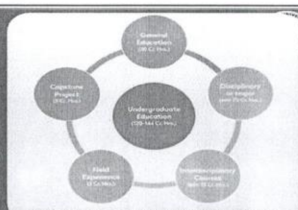

Figure 1: Graphical Representation of Undergraduate Degree Programs

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### Summary of Credit Hours of BSN

| Sr. No. | Category as per HEC new UG Policy | Credit Hours/Contact Hours | |
|---|---|---|---|
| | | Existing Road Map | Proposed New Road Map |
| 1. | General Education (Mandatory) | 22 CH | 33 CH |
| 2. | Major/Disciplinary (Mandatory) | 75 CH | 77 CH |
| 3. | Interdisciplinary (Mandatory) | 24 CH | 15 CH |
| 4. | Electives toward specialization | Nil | 05 CH |
| 5. | Non-Credit courses (contact hours) – Tajweed, Quran and Hadith (Compulsory) | Nil | 08 Hrs. (Non-Credit) |
| 6. | Internship (Mandatory) | 1 year | 1 year |
| 7. | Capstone Project (Mandatory) | Nil | 04 CH |
| 8. | Double Major (Optional) | Nil | Nil |
| 9. | Minor (Optional) | 12 CH Mandatory | Nil |
| Total | | 133 CH | 134 CH |

Aligned: UN SDGs 3, 4, 9, 13 & 16

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### Core Competencies of BSN Graduates

- Clinical Expertise
- Critical Thinking and Decision-Making
- Communication Skills
- Leadership and Management
- Professionalism and Ethics
- Lifelong Learning
- Cultural Competence
- Research and Evidence-Based Practice
- Collaboration and Teamwork
- Health Promotion and Education

Aligned with HEC

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### Subjects with Changed Credit Hours

| Sem | Course Name | Credit hours | Changed to | Remarks |
|---|---|---|---|---|
| I | Microbiology | 2.5+0.5 | 1.5+ 0.5 | |
| I | Fundamentals of Nursing – I | 02+02 | 02+01 | |
| I | Anatomy & Physiology – I | 03 | 2.5 +0.5 | |
| I | Information and Communication Technology | 0-01 | 01+01 | |
| II | Anatomy & Physiology-II | 03 | 2.5+0.5 | |
| II | Applied Nutrition | 01 | 02 | |
| III | Pathophysiology-I | 1.75 + 0.25 | 02+01 | |
| IV | Pathophysiology-II | 2.75 + 0.5 | 02 | |
| VII | Critical Care Nursing | 2.5+04 +0.5 | 02+04 +01 | |

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10/25/202

## Subjects with Changed Credit Hours and/or Name Changed

| Sem | Course Name | Credit hours | Changed to course name | Credit hours | Remarks |
|---|---|---|---|---|---|
| I | Biochemistry For Nurses | 02+01 | Biochemistry | 1.5+ 0.5 | |
| I | English -I For Nursing | 02 | English – Functional English | 03 | |
| I | Pakistan Studies | 02 | Ideology and Constitution of Pakistan | 02 | Shifted from Semester II |
| II | Mathematics | 01 | Quantitative Reasoning – I | 03 | Shifted from Semester III |
| II | Introduction To Nursing Theories | 02 | Theoretical Basis of Nursing | 02 | Shifted from Semester VII |
| III | Pharmacology-I | 02 | Clinical Pharmacology and Drug Administration – I | 02 | |
| III | Adult Health Nursing -I | 04+03 +01 | Medical Surgical Nursing – I | 03+03 +01 | |
| IV | Adult Health Nursing -II | 04+03 +01 | Medical Surgical Nursing – II | 03+03 +01 | |
| IV | Pharmacology-II | 02 | Clinical Pharmacology and Drug Administration – II | 02 | |

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## Subjects with Changed Credit Hours and/or Name Changed – (Cont.)

| Sem | Course Name | Credit hours | Changed to course name | Credit hours | Remarks |
|---|---|---|---|---|---|
| IV | Nursing Ethics | 01 | Professional Ethics for Nurses | 02 | |
| V | Community Health Nursing-II | 2.5+2.5 +01 | Maternal, Neonatal and Child Health Nursing | 02+01 | |
| VI | Teaching / Learning: Principals And Practices | 03 | Principles of Teaching & Learning | 03 | Shifted from Semester V |
| VI | Community Health Nursing-III | 05 | Public Health Nursing | 02+02 | Shifted from Semester VIII |
| VII | Leadership And Management in Nursing | 02+01 | Leadership & Management | 02+01 | |
| VII | Nursing Research | 03 | Introduction to Nursing Research | 03 | |
| VIII | English-VIII For Nursing | 02 | Expository Writing | 03 | |
| VIII | Nursing Seminar/ Role Transition | 02 | Nursing Seminar/ Role Transition | 02 | |

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## Deleted & New Courses

| Sem | Deleted Courses | Credit hours | Sem | New added courses | Credit hours |
|---|---|---|---|---|---|
| II | Community Health Nursing- I | 03 | III | Professional Communication Skills | 03 |
| II | English -II For Nursing | 02 | IV | Applied Psychology | 03 |
| III | English-III For Nursing | 02 | IV | Infectious Diseases | 02 |
| IV | Developmental Psychology | 02 | IV | Civics and Community Engagement | 02 |
| IV | English-IV For Nursing | 02 | VII | Entrepreneurship | 02 |
| IV | English-V For Nursing | 02 | VII | Elective | 02 |
| VI | English-VI For Nursing | 02 | VIII | Geriatric Nursing | 1.5+1.5 |
| VI | Behavioral Psychology | 03 | VIII | Elective | 03 |
| VII | English-VII For Nursing | 02 | | | |

**Elective Courses**

- ELC 407 – Professionalism 03 Cr.
- ELC 408 – Palliative Care 03 Cr.
- ELC 409 – Health Informatics 03 Cr.

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## Recommendation

- HEC Approved Roadmap 2024 may be approved by ACM for implementation from Spring 2025

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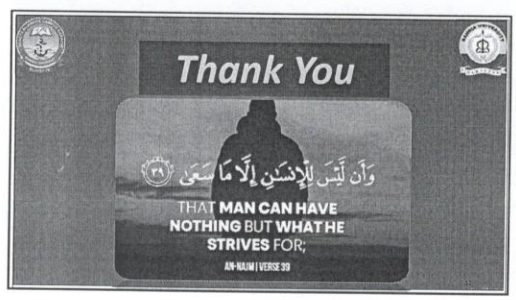


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HIGHER EDUCATION COMMISSION

Government of Pakistan, Islamabad

*Office of the*
Deputy Director (Curriculum)

No. [illegible]
March 01, 2024

**SUBJECT: REVISED CURRICULUM – NURSING 2024**

Dear Sir / Madam,

Development and review of academic standards at tertiary level is one of the major functions of Higher Education Commission (HEC) of Pakistan. HEC in collaboration with Pakistan Nursing and Midwifery Council (PNMC) has revised the curriculum of Nursing at undergraduate and graduate levels.

1. BS in Nursing (BSN)
2. MS in Nursing (MSN)

The same is shared for information and implementation by all Higher Education Institutions offering programs in the above-mentioned discipline.

**Encl:** As above

**HIDAYATULLAH KASI**

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| Core competencies | Core competencies | Courses focusing on competencies |
|---|---|---|
| Clinical Expertise<br>Lifelong Learning | Understanding of Human body and Mind | Microbiology<br>Biochemistry<br>A & P I & II<br>Pathophysiology I & II<br>Applied psychology |
| Professionalism and Ethics Critical Thinking and Decision-Making | Professional, Ethical practice and legalpractice | FON I<br>Professional Ethics for Nurses<br>Islamic Studies/Ethics |
| Research and Evidence-Based Practice<br>Clinical Expertise<br>Critical Thinking and Decision-Making<br>Lifelong Learning<br>Collaboration and Teamwork | Provision of care (Quality management/improvement) | Theoretical Basis of Nursing<br>FON I & II<br>Health Assessment I & II<br>Medical & Surgical Nursing I & II<br>Maternal, Neonatal and Child health<br>Nursing<br>Pediatric Health Nursing<br>Mental Health Nursing<br>Critical Care Nursing<br>Applied Nutrition<br>Clinical Pharmacology and Drug Administration I & II<br>Infectious Disease<br>Clinical Practicum |

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| | | |
|---|---|---|
| Critical Thinking and Decision-Making<br>Communication Skills | Critical thinking | Quantitative Reasoning – I<br>Principles of Teaching and Learning<br>Leadership and Management |
| Research and Evidence-Based Practice<br>Clinical Expertise | Evidence- based Nursing Practice | Introduction to Biostatistics (QR-II)<br>Research in Nursing<br>Clinical Practicum |
| Communication Skills | Communication Skill | Information and Communication Technology<br>Fundamentals of Nursing I & II<br>Functional English |
| Health Promotion and Education<br>Lifelong Learning<br>Cultural Competence | Health Promotion | Culture Health and Society<br>Epidemiology<br>Public Health Nursing<br>Infectious Disease<br>Trends and Issues in Health care<br>Pakistan Studies |
| Leadership and Management<br>Cultural Competence<br>Communication Skills<br>Lifelong Learning | Professional Development | Leadership and Management<br>Expository Writing<br>Trends and Issues in Health care<br>Academic Writing |

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**Pakistan Navy Nursing College**
**Bahria University Health Sciences Karachi**

**New Academic Road Map Template for UG programs 2024**

Program Title: **BS Nursing**
Duration: 4 Years + 01 year internship
Total Credit Hours: 134 CH

Endorsement References:
A: Recommendations of CAC dated July 30, 2024 (Minutes of CAC meeting)
B: Recommendations of DBOS dated August 9, 2024 (Minutes of DBOS meeting)
C: Recommendations of FBOS dated September 19, 2024 (Minutes of FBOS meeting)

1. **Summary of Credit Hours**

| Sr. No. | Category as per HEC new UG Policy | Credit Hours/Contact Hours | |
|---|---|---|---|
| | | **Existing Road Map** | **Proposed New Road Map** |
| 1. | General Education (Mandatory) | 22 CH | 33 CH |
| 2. | Major/Disciplinary (Mandatory) | 75 CH | 77 CH |
| 3. | Interdisciplinary (Mandatory) | 24 CH | 15 CH |
| 4. | Electives toward specialization | Nil | 05 CH |
| 5. | Non-Credit courses (contact hours) – Tajweed, Quran and Hadith (Compulsory) | Nil | 08 CH Non-Credit |
| 6 | Internship (Mandatory) | 1 year | 1 year |
| 7. | Capstone Project (Mandatory) | Nil | 04 CH |
| 8 | Double Major (Optional) | Nil | Nil |
| 9. | Minor (Optional) | 12 CH Mandatory | Nil |
| **Total** | | **133 CH** | **134 CH** |

## 2. Program Learning Outcomes (PLOs)

The PLOs of the BSN program are to:

Program Learning Outcomes (PLOs):

1) Prepare competent and committed nurse clinicians for all healthcare and community settings.
2) Provide safe and quality nursing care for the prevention of disease, promotion, and maintenance of health to individuals, families, and communities.
3) Equip the graduates with the knowledge, skills, and attitudes required for the provision of safe nursing and quality care.
4) Integrate research findings for the provision of evidence-based best care for individuals, families, and communities.
5) Develop the graduates' critical thinking, problem-solving, and decision making and leadership skills for confronting the complexities and demands of health care in the 21st century.
6) Adhere to an established pattern of professional practices within the cultural, religious, legal, and ethical framework at the national and international level.
7) Inculcate effective communication skills, while dealing with peers, patients, families, communities, and inter-disciplinary professionals.
8) Enable the graduates to utilize concepts, standards, and strategies while leading and coordinating planning, implementation, and evaluation of patients, families, and communities' care.
9) Equip the graduates to maintain a safe and healthy environment for the prevention of disease, promotion, and maintenance of health.
10) Prepare the graduates to participate actively in professional organizations for the improvement of the nursing profession.
11) Inculcate the importance of continuing competence and the value of lifelong learning.
12) Able to assess, support and work as an active team member during disaster management.
13) Identify and report issues resulting from climate changes on individuals and community health.
14) Use healthcare informatics and technology legally and ethically to improve patients' care outcomes.
15) Provide respectful services during end-of-life care.

### 3. Eligibility Criteria

- HSSC/A-levels/Equivalent (12 years of schooling) in Pre-Medical Group with minimum of 50% marks is the basic eligibility for the BSN program.
- SSC Passed with 50% marks with science subjects (Biology)
- Computer Based Test through BU testing body.

### 4. Core Competencies

1.Clinical Expertise
2.Critical Thinking and Decision-Making
3.Communication Skills
4.Leadership and Management
5.Professionalism and Ethics

6. Lifelong Learning
7. Cultural Competence
8. Research and Evidence-Based Practice
9. Collaboration and Teamwork
10. Health Promotion and Education

**Scheme of Studies (8 Semesters)**

BSN program is comprised of 134 credit hours spread over a minimum of four years duration. The broader framework of the BSN program is given below:

| | |
|---|---|
| **Credit Hours** | 134 |
| **Program Duration** | 4-6 years (extendable to another 1 year in special cases) |
| **Semester Duration** | 16-18 weeks (1-2 weeks for examination) |
| **Course Load** | As per HEC Semester Guidelines |
| **Summer Semester Credit Hours** | Maximum 8 (for remedial/deficiency/failure/repetition courses) |
| **Summer Semester** | Duration 8-9 weeks |
| **Attendance** | 75 % |
| **3 Credit Hours (Theory)** | 3 classes (1 hour each) OR<br>2 classes (1.5 hour each) OR 1 class (3 hours) |
| **1 Credit Hour (Practical / Laboratory / Field)** | 3 hours |

**Four-year standardized scheme of study for BSN**

**Semester-wise Road map**

**Semester 1**

| **Sr. No.** | **Existing Road Map** | | | | **Sr. No.** | **Proposed Road map aligned with HEC new UG Policy** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Pre-requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | | **Pre-requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | **HEC Category** | **17 UN SDGs alignment (please mention relevant SDG No.** |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | - | MIC 102 | Microbiology | 2.5+0.5 | | - | MIC 101 | Microbiology | 1.5+ 0.5 | GE(NS) | SDG # 3 |
| 2. | - | BIO 104 | Biochemistry For Nurses | 02+01 | | - | BIO 102 | Biochemistry | 1.5+ 0.5 | GE | |
| 3. | - | ENG 115 | English -I For Nursing | 02 | | - | ENG 101 | English – Functional English | 03 | GE | |
| 4. | - | FON 101 | Fundamental Of Nursing-I | 02+02 | | - | FON 104 | Fundamentals of Nursing – I | 02+01 | MAJOR | |
| 5. | - | ANP 103 | Anatomy And Physiology-I | 03 | | - | ANP 103 | Anatomy & Physiology – I | 2.5 +0.5 | MAJOR | |
| 6. | - | PAK 101 Sem - II | Pakistan Studies | 02 | | - | PAK 109 | Ideology and Constitution of Pakistan | 02 | GE | |
| 7. | - | COS 106 | Computer Skills | 0+01 | | - | COS 108 | Information and Communication Technology | 01+01 | GE | |
| 8. | | | | | | | ISL 107 | Tajweed | Non CH 1 hour/week | Compulsory* | |
| **Total Credit Hours** | | | | **16** | **Total Credit Hours** | | | | **17** | | |

**SDG-3: Ensure healthy lives and promote well-being for all at all ages**

**<u>Semester 2</u>**

| **Sr. N** | **Existing Road Map** | | | | **Proposed Road map aligned with HEC new UG Policy** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Pre-requ** | **Course** | **Course** | **Credit** | **Pre-requisi** | **Course** | **Course** | **Credit** | **HEC Categ** | **17 UN SDGs** |

| o. | isite<br><br>Cour<br>se<br>Cod<br>e | Code | Title | Hours | te<br><br>Cours<br>e Code | Code | Title | Hours | ory | alignme<br>nt<br>(please<br>mention<br>relevant<br>SDG No. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. | | MAT 205<br><br>Sem-III | Mathematics | 01 | | QUR 111 | Quantitative Reasoning – I | 03 | GE | |
| 2. | | INT 402<br><br>Sem-VII | Introduction To Nursing Theories | 02 | | TBN 110 | Theoretical Basis of Nursing | 02 | GE (AH) | |
| 3. | | ANP 108 | Anatomy & Physiology -II | 03 | | ANP 108 | Anatomy & Physiology – II | 2.5+0.5 | Maj | SDG # 3 |
| 4. | | APP 106 | Applied Nutrition | 01 | | APP 113 | Applied Nutrition | 02 | ID | |
| 5. | | FON 107 | Fundamental Of Nursing-II | 02+01+01 | | FON 107 | Fundamentals of Nursing – II | 02+01+01 | Maj | |
| 6. | | ISL 101 | Islamic Studies/Ethics | 02 | | ISL 101/SOC 360 | Islamic Studies / Ethics | 02 | GE | |
| 7. | | CHN 109 | Community Health Nursing- I | 03 | | ISL 108 | Understanding Quran-I | Non CH 1 hour/week | Comp * | SDG # 3 & 6 |
| | | ENG 117 | English -II For Nursing | 02 | | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| **Total Credit Hours** | **17** | **Total Credit Hours** | **16** | | |

**SDG-6: Ensure availability and sustainable management of water and sanitation for all**
Shifted- Pakistan Studies (2cr)

## Semester 3

| Sr. No. | Existing Road Map | | | | Proposed Road map aligned with HEC new UG Policy | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Pre-requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | **Pre-requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | **HEC Category** | **17 UN SDGs alignment (please mention relevant SDG No.** |
| **1.** | | ENG 119 | English-III For Nursing | 02 | | PFS 201 | Professional Communication Skills | 03 | GE | **SDG # 3** |
| **2.** | | PHR 204 | Pharmacology-I | 02 | | CPD 202 | Clinical Pharmacology and Drug Administration –I | 02 | MAJOR | |
| **3.** | | AHN 201 | Adult Health Nursing -I | 04+ 03 +01 | | MSN 203 | Medical Surgical Nursing – I | 03+03 +01 | MAJOR | |
| **4.** | | HEA 203 | Health Assessment -I | 01+ 01 | | HEA 203 | Health Assessment – I | 1+1 | MAJOR | |
| **5.** | | PTH 202 | Pathophysiology-I | 1.75 + 0.25 | | PTH 204 | Pathophysiology – I | 2+1 | MAJOR | |
| **6.** | | | | | | ISL 109 | Understanding Quran-II | Non CH 1 hour/ week | Comp* | |
| **Total Credit Hours** | | | | **17** | **Total Credit Hours** | | | **17** | | |

Shifted- Mathematics (1cr)

**Semester 4**

| Sr. No. | Existing Road Map | | | | Proposed Road map aligned with HEC new UG Policy | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Pre-requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | **Pre-requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | **HEC Category** | **17 UN SDGs alignment (please mention relevant SDG No.** |
| 1. | | DVP 201 | Developmental Psychology | 02 | | APP 205 | Applied Psychology | 03 | ID | **SDG # 3** |
| 2. | | AHN 207 | Adult Health Nursing -II | 04+ 03 +01 | | MSN 206 | Medical Surgical Nursing – II | 03+03 +01 | MAJOR | |
| 3. | | PHR 211 | Pharmacology-II | 02 | | CPD 207 | Clinical Pharmacology and Drug Administration – II | 02 | MAJOR | |
| 4. | | HEA 209 | Health Assessment -II | 01+ 01 | | HEA 209 | Health Assessment –II | 01+01 | MAJOR | |
| 5. | | NRE 213 | Nursing Ehtics | 01 | | PEN 210 | Professional Ethicsfor Nurses | 02 | MAJOR | **SDG # 3 & 16** 16.1, 16.3, 16.6 &16.10 |
| 6. | | PTH 208 | Pathophysiology-II | 2.75 + 0.5 | | PTH 211 | Pathophysiology – II | 02 | MAJOR | **SDG # 3** |
| 7. | | ENG 212 | English-IV For Nursing | 02 | | ISL 110 | Understanding Quran-III | Non CH 1 hour/week | Comp * | |
| **Total Credit Hours** | | | | **20** | **Total Credit Hours** | | | **18** | | |

**SDG-16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels**

**Semester 5**

| Sr. No. | Existing Road Map | | | | Proposed Road map aligned with HEC new UG Policy | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Pre-requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | **Pre-requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | **HEC Category** | **17 UN SDGs alignment (please mention relevant SDG No.** |
| 1. | | CHN 302 | Community Health Nursing-II | 2.5+2.5 +01 | | MNC 302 | Maternal, Neonatal and Child Health Nursing | 02+01 | MAJOR | **SDG # 3 & 13** |
| 2. | | | | | | IND 303 | Infectious Diseases | 02 | ID | |
| 3. | | PHN 301 | Pediatric Health Nursing | 03+03 +01 | | PHN 301 | Pediatric Health Nursing | 03+03 +01 | MAJOR | |
| 4. | | | | | | HSS 219 | Civics and Community Engagement | 02 | GE | |
| 5. | | EPI 308 Sem -VI | Epidemiology | 02 | | EPI 308 | Epidemiology | 02 | ID | **SDG # 3, 9** |
| 6. | | ENG 316 | English-V For Nursing | 02 | | ISL 111 | Understanding Quran-IV | Non CH 1 hour/week | Compulsory* | |
| **Total Credit Hours** | | | | **18** | **Total Credit Hours** | | | **16** | | |

**SDG- 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation**
Shifted- Teaching / Learning: Principals and Practices (3cr)

**Semester 6**

| Sr. No. | Existing Road Map | | | | Proposed Road map aligned with HEC new UG Policy | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Pre-requisi** | **Course** | **Course Title** | **Credit** | **Pre-requisi** | **Course** | **Course Title** | **Credit** | **HEC Catego** | **17 UN SDGs** |

| | te Course Code | Code | | Hours | te Course Code | Code | | Hours | ry | alignment (please mention relevant SDG No. |
|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | | TEL 303 Sem - V | Teaching / Learning: Principals And Practices | 03 | | TEL 304 | Principles of Teaching & Learning | 03 | ID | **SDG # 3 , 4, & 9** |
| **2.** | | CHN 406 Sem - VIII | Community Health Nursing-III | 05 | | PBN 304 | Public Health Nursing | 02+02 | MAJOR | **SDG # 3, 9 & 13** |
| **3.** | | CHS 210 | Culture, Health And Society | 02 | | CHS 210 | Culture, Health & Society | 02 | GE | **SDG # 3, 9 & 13** |
| **4.** | | INB 306 | Introduction To Biostatistics | 03 | | INB 306 | Introduction to Biostatistics (QR II) | 03 | GE | **SDG # 3, 9 & 13** |
| **5.** | | MHN 305 | Mental Health Nursing | 03+03 | | MHN 305 | Mental Health Nursing | 03+02 +01 | MAJOR | **SDG # 3** |
| **6.** | | ENG 315 | English-VI For Nursing | 02 | | ISL 112 | Understanding Quran-V | Non CH 1 hour / wk | Comp* | |
| | | BHP 307 | Behavioral Psychology | 03 | | | | | | |
| **Total Credit Hours** | | | | **18** | **Total Credit Hours** | | | **16** | | |

**SDG-4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all**

Shifted- Epidemiology (2cr)

**Semester 7**

| Sr. No. | Existing Road Map | | | | Proposed Road map aligned with HEC new UG Policy | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Pre-requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | **Pre-requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | **HEC Category** | **17 UN SDGs alignment (please mention relevant SDG No.** |
| 1. | | | | | | MGT 363 | Entrepreneurship | 02 | GE | |
| 2. | | | | | | | Elective | 02 | MAJOR | |
| 3. | | CCN 401 | Critical Care Nursing | 2.5+04 +0.5 | | CCN 401 | Critical Care Nursing | 02+04 +01 | MAJOR | |
| 4. | | LIV 403 | Leadership And Management in Nursing | 02+01 | | LIV 402 | Leadership & Management | 02+01 | ID | **SDG # 3, 9 & 13** |
| 5. | | NUR 404 | Nursing Research | 03 | | INR 403 | Introduction to Nursing Research | 03 | MAJOR | |
| 6. | | ENG 415 | English-VII For Nursing | 02 | | ISL 113 | Seerah-I | Non CH 1 hour/ wk | Comp* | |
| **Total Credit Hours** | | | | **17** | **Total Credit Hours** | **17** | | | | |

Shifted- Introduction to Nursing Theories (2cr)

**Semester 8**

| Sr. No. | Existing Road Map | | | | Proposed Road map aligned with HEC new UG Policy | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Pre-requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | **Pre-requisite Course Code** | **Course Code** | **Course Title** | **Credit Hours** | **HEC Category** | **17 UN SDGs alignment (please mention relevant SDG No.** |
| 1. | | | | | | GEN 404 | Geriatric Nursing | 1.5+1.5 | MAJOR | **SDG # 3, 9 & 13** |
| 2. | | | | | | | Elective | 03 | MAJOR | |
| 3. | | NST 407 | Nursing Seminar / Role Transition | 02 | | TIH 405 | Trends and Issues in Health Care | 02 | MAJOR | |
| 4. | | ENG 416 | English-VIII For Nursing | 02 | | ENG 123 | Expository Writing | 03 | GE | |
| 5. | | CLP 408 | Clinical Practicum | 05 | | CLP 406 | Clinical Practicum | 04 | CP | |
| 6. | | | | | | ISL 114 | Seerah-II | Non CH 1 hour/ wk | Comp* | |
| **Total Credit Hours** | | | | **14** | **Total Credit Hours** | | | **15** | | |

**Shifted:** Community Health Nursing-III (5cr)

**Appendage 4707**

## NEW ELECTIVE COURSES IN PHD IN HEALTH SCIENCES PROGRAMME

| | |
|---|---|
| Course Code | PBH 809 |
| Credit Hour | 3+0 |
| Course Title | Advanced Techniques of Research Data Analysis |
| Pre-Requisite | MED 802 (Epidemiology and Biostatistics). |
| Course Objectives | 1. To revise the concepts of statistical analysis in Public Health.<br>2. To equip students with the skills of using statistical analysis software (SPSS and/or Epi-Info) for research data analysis and statistical testing, including tests for continuous and categorical data, regression analysis, and survival analysis.<br>3. To introduce the principles and approaches for interpreting and presenting research results.<br>4. To equip the students with the skills required for developing tables, charts, and graphs for presentation of research results. |
| Course Outcomes | Upon successful completion of this course, the students will be able to:<br>1. Conduct data analysis using statistical software to calculate and compare means, correlation coefficients, and regression models and to carry out statistical tests such as Z-test, t-test, Chi-squared test, and ANOVA.<br>2. Decide the statistical analysis plans for the data from cross-sectional, case-control, prospective and retrospective cohort studies and randomized clinical trials.<br>3. Conduct simple and multiple linear and logistic regression and survival analysis using SPSS; apply diagnostic tests for such analysis; and interpret the results.<br>4. Develop tables and generate graphs and charts, including simple and compound bar charts, pie charts, line graphs, box plots, scatter plots, and hi-lo graphs to depict confidence intervals.<br>5. Write the Results section of their research data after completing the analysis. |
| Course Contents | This course is designed as an elective for PhD students to equip them with the skills required for research data analysis including basic and advanced research data. The students will review the most commonly used basic statistical tests and learn how to carry out those tests using SPSS and/or Epi-Info. They will then focus on analyzing the data from cross-sectional studies, case-control studies, cohort studies, and randomized controlled trials. The students will learn advanced data analysis methods, including regression models and survival analysis. The students will also master the art of selecting the right method (s) of data analysis, interpreting their results, and presenting the research results in tables and graphs. |

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|---|---|
| Recommended Text Books | Latest edition of following books:<br>1. Oxford University Press: Statistical Analysis of Epidemiologic Data, by Michael J. Haines.<br>2. Blackwell Publishing: Essential Medical Statistics, by Betty Kirkwood and Jonathan Sterne (supported by a website that provides statistical datasets to download: www.blackwellpublishing.com/essentialmedstats<br>3. MedCalc: Applied Spatial Statistics for Public Health Data, by Lance A. Waller and Carol A. Gotway. |
| Recommended Reference Books | 1. Springer: Statistics for Health Data Science: An Organic Approach, by Ruth Etzioni, Micha Mandel, and Roman Gulati. https://link.springer.com/book/10.1007/978-3-030-59889-1<br>2. Springer: Innovative Statistical Methods for Public Health Data, edited by Ding-Geng (Din) Chen and Jeffrey Wilson. https://link.springer.com/book/10.1007/978-3-319-18536-1. |
| Web and other resources | Websites:<br>National Institute of Population Studies https://nips.org.pk/<br>National Center for Health Statistics https://www.cdc.gov/nchs/index.htm<br>Online SPSS https://www.onlinespss.com/<br>E-Book on SPSS Manual:<br>https://books.google.com.pk/books?id=FMkvEAAAQBAJ&printsec=copyright&redir_esc=y#v=onepage&q&f=false |

**18 Weeks Lecture Plan**

| Week | Lecture Topic | Duration 3CH | Outcome |
|---|---|---|---|
| **1** | Review of basic research concepts: Identifying and stating the problem; Formulating research question and research hypothesis; Epidemiological study designs: Cross-sectional; Case-control; Prospective and retrospective cohort; Experimental studies. | 3 Hours | Comprehend research problem, question, and hypothesis |
| | Exercise: Study design examples from published research – identify the study design | | Identify study designs |
| **2** | Analysis and interpretation of population-based cross-sectional studies (surveys): Introduction to Demographic and Health Surveys (DHS) | 3 Hours | Analyze and interpret population-based cross-sectional studies (surveys) |
| | SPSS: DHS data (Pakistan 2018): view database and do preliminary analysis | | Practice preliminary analysis of DHS data (Pakistan 2018) |

| Week | Lecture Topic | Duration 3CH | Outcome |
|---|---|---|---|
| **3** | Data quality management (DQM): data quality checks and preparing raw data for analysis. | 3 Hours | Prepare raw data for analysis |
| | Classroom exercises on Pakistan DHS data. | | Practice standard DQM using SPSS |
| **4** | Data creation in SPSS: Introduction to data view and variable view; data entry process and rules. Preliminary analysis of cross-sectional data using SPSS (data cleaning, quality checks, frequencies) | 3 Hours | Practice new data entry and creation of files. |
| | Hands-on practice of data cleaning and preliminary analysis using SPSS | | Practice data cleaning and preliminary analysis using SPSS |
| **5** | Cross-tabulation and applying Chi-squared test using SPSS. Carrying out Z-test, t-test, and ANOVA using SPSS. | 3 Hours | Apply Chi-squared and other common tests using SPSS. |
| | Preparing a descriptive report of the data analyzed by students (using SPSS). | | Prepare descriptive report of the data |
| **6** | Correlation and regression: review of correlation coefficient and simple linear regression. | 3 Hours | Comprehend the concepts of Correlation and linear regression |
| | Multiple linear regression: multiple regression models and their interpretation; introduction of diagnostic tests and their interpretation. | | Comprehend the concepts of Multiple linear regression |
| **7** | Study design: Case-control Study. | 3 Hours | Identify case-control study |
| | Analysis of case-control data – basic principles and techniques. | | Comprehend basic principles and techniques of case-control data |
| **8** | Analyzing case-control data using SPSS Part-I: Students will have hands-on practice with data provided and explained by tutors. | 3 Hours | Analyze basic case-control data using SPSS |
| | Hands-on practice of analyzing case-control data: Students will prepare and interpret tables. | | Prepare, analyze and interpret case-control data |
| **9** | Mid-term Exam | | |
| **10** | Review of logistic regression. Introduction to logistic regression analysis using SPSS. | 3 Hours | Demonstrate steps of logistic regression in SPSS. |
| | Analyzing case-control data using SPSS Part-II: Students will have hands-on practice with data provided and explained by tutors. | | Analyze advanced case-control data using SPSS |
| | | | |

| Week | Lecture Topic | Duration 3CH | Outcome |
|---|---|---|---|
| **11** | Study design –experimental studies (Examples from published research) | 3 Hours | Comprehend the experimental design of studies |
| | Classroom exercises on interpreting the results from experimental studies (published articles to be reviewed by students). | | Interpret the results from experimental studies |
| **12** | Randomized controlled trial (RCT): Preliminary data analysis techniques. Comparison of data analysis techniques for RCT and prospective/retrospective cohort studies. | 3 Hours | Apply preliminary data analysis techniques of RCT |
| | Practice of data analysis of RCT and cohort studies using SPSS: cross-tabulation, Chi-squared test, risk ratio. | | Practice data analysis of RCT and cohort studies |
| **13** | Introduction to survival analysis: revision of the concept, objectives, and methods. | 3 Hours | Comprehend basic principles of survival analysis |
| | Conducting survival analysis using SPSS: Kaplan Meier charts; statistical tests. | | Conduct survival analysis using SPSS |
| **14** | Practice of data analysis of RCT and cohort studies using model data. | 3 Hours | Practice data analysis of RCT and cohort studies using model data |
| | Students' presentations followed by critiques from faculty and fellow students. | | Critically analyze presentations |
| **15** | Data presentation techniques for research paper and conference presentations. | 3 Hours | Apply data presentation techniques for research paper and conference presentations |
| | Practice interpretation of published results without reading the full article. | | Interpret published results without reading the full article |
| **16** | How to make tables for a scientific publication and a conference presentation? How to write the Results section for publication? | 3 Hours | Develop tables and result write-up for a scientific publication and conference presentation |
| | Practice of making tables and preparing their interpretation. Writing the Results section using the tables produced by students earlier in the course. | | Practice table development and its interpretation |
| **17** | Pictorial presentation of research results: principles for selecting the correct depiction of research results. | 3 Hours | Describe data presentation through charts and graphs |
| | Graphs and charts: introduction to bar charts, line charts, histograms, box-plot, scatter-diagrams, and hi-lo graphs. | | Practice formulation of graphs and charts |

| **Week** | **Lecture Topic** | **Duration 3CH** | **Outcome** |
|---|---|---|---|
| 18 | Final-Term Exam | | |

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|---|---|
| Course Code | PBH 810 |
| Credit Hour | 3+0 |
| Course Title | Applied Demography and Family Planning (Population Dynamics) |
| Prerequisite | MED 802 (Epidemiology and Biostatistics) |
| Course Objectives | 5. Provide an overview of population dynamics and its implications for public health program planning at the national and local levels.<br>6. Prepare the students to intelligently discuss and apply the concepts of population change and population composition, demographic transition, and measures of mortality and fertility.<br>7. Help the students to identify and explore data sources for key demographic indicators.<br>8. Provide the skills to calculate and interpret populations' commonly used fertility, mortality, and migration measures.<br>9. Introduce the principles of population projections and their application in planning public health interventions, with special emphasis on maternal, newborn and child health (MNCH). |
| Course Outcomes | Upon successful completion of this course, the students will be able to:<br>6. Describe mortality, fertility, migration, population size, distribution, and composition.<br>7. Demonstrate skills in computing and interpreting demographic measures about mortality, fertility, and migration.<br>8. Identify the common sources of population data and their strengths and limitations.<br>9. Apply demographic methods to public health program planning.<br>10. Describe the key health policy interventions that affect population change.<br>11. Discuss the key MNCH interventions and programmatic inputs to integrate family planning into health services with special emphasis on postpartum family planning. |
| Course Contents | This course is designed as an elective for PhD students to equip them with the knowledge and skills for addressing the population and health issues of the developing countries, with special focus on Pakistan. The course will introduce demography, population dynamics, and family planning in Pakistani settings. The course will introduce the commonly used demographic methods and indicators necessary for policymaking and planning. It will also provide a full understanding of contraceptive technology and family planning programming, again in the context of Pakistan. The course will be highly interactive. Students must also complete a research |

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|---|---|
| | project using secondary data from available resources. |
| Recommended Text Books | Latest editions of followingbooks:<br>1. Arthur Haupt and Thomas T. Kane. "Population Handbook – 4th International Edition." Population Reference Bureau, USA, 2000.<br>2. Palmore JA and Gardner RW. "Measuring Mortality, Fertility and Natural Increase – A Self- teaching Guide to Elementary Measures". 5th Edition. East-West Center, Honolulu, USA. (EWC Guide).<br>3. Anne SK, Loretta G and Christine G. "The Integration of Family Planning with other Health Services: A Literature Review". International Perspectives on Sexual and Reproductive Health, 2010, 36(4):189–196<br>4. World Health Organization. "WHO Medical Eligibility Criteria for Contraceptive Use 2015 Update". |
| Recommended Reference Books | 1. Faruq, R. "Integrating family planning with health services – does it help?" World Bank Staff Working Paper No. 515; The World Bank, USA, 1982.<br>2. Joseph AM, Jr. "Population – A Lively Introduction". 5th Edition. Population Bulletin (62)1, Mar 2007. Population Reference Bureau.<br>3. Cahill N, Sonneveldt E, Stover J, Weinberger M, Williamson J, Wei C, Brown W, Alkema L. "Modern contraceptive use, unmet need, and demand satisfied among women of reproductive age who are married or in a union in the focus countries of the Family Planning 2020 initiative: a systematic analysis using the Family Planning Estimation Tool". Lancet 2018; 391: 870–82. Published Online December 5, 2017. http://dx.doi.org/10.1016/S0140-6736(17)33104-5<br>4. Hatcher RA, Rinehart W, Blackburn R, Geller JS, Shelton JD. "The Essentials of Contraceptive Technology". Johns Hopkins School of Public Health Population Information Program, 4th Printing, 2003. |
| Web and other resources | Websites:<br>Population Reference Bureau https://www.prb.org/<br>Population Education https://populationeducation.org/<br>National Institute of Population Studies https://nips.org.pk/<br>Family Planning Association of Pakistan https://fpapak.org/<br>Interactive Population Websites:<br>Population Growth Calculator https://calculator.academy/population-growth-calculator/<br>World Population Clock https://www.worldometers.info/world-population/<br>Data Visualisations https://dhsprogram.com/data/visualizations/index.cfm<br>Demographic and Health Surveys website https://dhsprogram.com/<br>Journals:<br>Demography – official journal of Population Association of America https://www.jstor.org/journal/demography<br>Contraception – an international reproductive health journal https://www.contraceptionjournal.org/<br>Health Policy and Planning https://academic.oup.com/heapol |

**8 Weeks Lecture Plan:**

| Week | Lecture Topic | Duration 3CH | Outcomes |
|---|---|---|---|
| 1. | How big a threat is population increase?<br>- Pakistan's population imbroglio (focusing on Census 2023 results)<br>- World's population outlook (introduce 'Inferno' by Dan Brown) | 3 hours | Comprehend population change and its impacts in context of Pakistan |
| 2. | Demographic data sources:<br>- Pakistan Demographic Surveys Pakistan Demographic and Health Surveys (PDHS)<br>- Vital registration | 3 hours | Describe formal sources of population and related data in Pakistan |
| 3. | - Calculation of inter-census growth rates (1951 – 2023)<br>- Comparison of PDHS 1991 – 2018 | 3 hours | Address research questions using the data from census and DHS |
| 4. | Computing and interpreting demographic indicators:<br>- Rates, ratios, percentages<br>- Crude birth and death rates | 3 hours | Calculate and interpret rates and ratios |
| 5. | Population composition and change:<br>- Age-sex composition<br>- Population pyramids<br>- Dependency ratios<br>- Young and elderly population<br>- Basic demographic equation<br>- Population growth rates<br>- Population projections | 3 hours | Comprehend population change and composition using Pakistan's data (from census and/or PDHS) etc. |
| 6. | Introduction of group assignments: objectives, rules and regulations, grading criteria | 3 hours | Present short report (6-10 pages) on a given topic |
| 7. | Measures of fertility:<br>- General fertility rate<br>- Age-specific fertility rates<br>- Total fertility rate<br>- Replacement level fertility<br>- Net reproduction rate | 3 hours | Comprehend concepts of fertility rates |
| 8. | Fertility determinants in Pakistan:<br>- Proximate determinants of fertility<br>- Socio-cultural and economic factors affecting fertility and family planning choices<br>- Men and family planning<br>- Abortion and family planning | 3 hours | Develop opinion based short report on the given topic |
| 9. | **Mid-Term Exam** | | |

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|---|---|---|---|
| 10. | Contraceptive Technology:<br>- Classification of contraceptives<br>- Description and side effects<br>- Medical Eligibility Criteria (MEC)<br>- Principles of follow-up<br>- Post-pregnancy family planning | 3 hours | Interact with an invited speaker, seasoned family planning provider in QA session |
| 11. | Family planning programs:<br>- History of family planning<br>- Family planning in Pakistan<br>- Why family planning programs are not successful in Pakistan? | 3 hours | Comprehend family planning programs in Pakistan |
| 12. | Monitoring and evaluating family planning programs:<br>- Couple years of protection (CYP) and contraceptive prevalence rate (CPR)<br>- Inputs, processes, outputs and impacts of family planning | 3 hours | Monitor and evaluate family planning programs in a province of Pakistan through hypothetical data |
| 13. | Integration of family planning in other health services in Pakistan:<br>- Historical/political barriers<br>- Policies and priorities | 3 hours | Generate panel discussion by addressing pros and cons of family planning integration in Pakistani scenarios. |
| 14. | Review of small group projects (students will present their draft project reports to get a chance for critical comments and improvements):<br>- Class presentations<br>- Questions and answers | 3 hours | Provide feedback on presentations and reports |
| 15. | Health policy interventions related to family planning:<br>- Health impacts of population growth and change<br>- Introduction of post-pregnancy family planning<br>- Role of health workers in family planning programs<br>- Community-based family planning interventions | 3 hours | Comprehend policy-level interactions between health and family planning interventions, focused on public sector and donor-funded initiatives |
| 16. | Seminars by external speakers:<br>- Political economy of population growth and family planning<br>- Healthcare providers' biases against family planning<br>- Population challenges of Pakistan | 3 hours | Write brief synopsis of a discussion topic |
| 17. | Family planning and maternal, newborn, and child health (MNCH) interventions: | 3 hours | Comprehend MNCH programs in Pakistan and |

| | | | |
|---|---|---|---|
| | - When to introduce family planning to couples<br>- Integrating family planning in antenatal, natal and postnatal care<br>- Family planning and immunization<br>- Barriers to acceptance of family planning as a health service | | sharing of family planning in public sector, NGO sector, and donor assisted intervention programs and projects |
| 18. | **Final-Term Exam** | | |

**Appendage 4708**

Serial No.

# BAHRIA UNIVERSITY

Leadership & Professional Development Centre

This is to certify that

______________________________

has successfully attended the 6 Months Course titled

## Certificate in Health Professions Education

Held from ____________ to ____________

at Bahria University Health Sciences Campus Islamabad

organized by

**Department of Medical Education**

Director General
Bahria University
Health Sciences Campus Islamabad

Director
LPDC
Bahria University

Princiapl
Bahria University
College of Medicine

HOD DME
Bahria University
Health Sciences Campus Islamabad

**Appendage 4709**

## RESEARCH MENTORSHIP PROGRAMME (RMP) FOR ALL UG STUDENTS AT BUHSCK

10/25/2024

### Establishing: Research-Mentorship Program for Undergraduate Students

Bahria University Health Sciences
Research Cell
in collaboration with
Department of Community Health Sciences

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### Scheme of Presentation

1. Introduction & Rationale
2. Objectives of the Program
3. Proposed Targets for Three Years
4. Program mechanism
5. Strategic Approaches from Other Institutions
6. Issues & challenges
7. Required Resources
8. Expected Benefits
9. Recommendations

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### Introduction & Rationale

- Structured initiative for UG research support
- Pairs experienced faculty with students
- Inculcate research skills and critical thinking
- Enhances student confidence and research outputs
- Aims to foster a productive research learning environment
- Significant impact on student's educational journey

4

3

### Objectives of the Program

RMP pairs 50 undergraduate students with faculty mentors annually

- Achieve five published research papers in two years
- Conduct training workshops for faculty mentors
- Increase student research participation by 30% in three years
- Foster a culture of inquiry and innovation

4

4

### Proposed Targets for Three Years

| | |
|---|---|
| Y01 | Recruit 50 students and 15 faculty members |
| Y02 | Publish 5 student-research projects |
| Y03 | Expand to 100 students and 30 faculty mentors |
| Y04 | • Conduct comprehensive program evaluations |

5

5

### Program Mechanism

- Establish an Oversight Body for Implementation
- Define roles and responsibilities for mentors and students
- Create a mentorship framework with matching processes
- Develop training modules on research methodologies
- Launch awareness campaigns to promote the program

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10/25/202

## Strategic Approaches from Other Institutions

- UCLA: Combines peer and faculty mentoring with assessments
- Harvard: Pairs students with faculty based on research interests
- UCT: Integrates multidisciplinary teams for broader research areas

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7

## Issues & challenges

- Interdisciplinary coordination
- Time constraints
- Standardization VS. flexibility
- Managing conflicts (ethical, inter-disciplinary, mentor-mentees)

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8

## Required Resources

- **Human Resources**: Existing Faculty and administrative staff
- **Physical Resources**: Access to research facilities and meeting spaces
- **Financial Resources**: Budget for workshops and research grants—PKR 1.0 Million (for two years)

11

9

## Expected Benefits

- Enhanced research skills for students
- Increased student-led research publications
- Stronger faculty-student relationships
- Development of a culture of inquiry at BUHS
- Preparation for future challenges in healthcare

12

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## Recommendations

- This will be a pioneer initiative in Pakistan among the Health Sciences University.
- It will solidify BUHS's position as a leader in healthcare education & research
- It is proposed that this program be approved commencing in January 2025.

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**Thank you**

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**Appendage 4711**

**Amendments in BU Affiliation Policy 2024**

| S No | Existing BU Affiliation Policy | Revised BU Affiliation Policy | Remarks |
|---|---|---|---|
| a. | The transcript of the student from the affiliated college/institute must be issued by the affiliating university/DAI, mentioning the name of the college/institute on the transcript. | The transcript of the student from the affiliated college/institute must be issued by the affiliating university/DAI, mentioning the name of the college/institute on the transcript **as well as on the degree**. | Minor amendment in Clause 4.3.1 (para x) of Chapter 4 |
| b. | -- | **Removal of difficulties/interpretation:**<br><br>If any difficulty arises as to the interpretation of any provision of the HEC institutional Affiliation Policy, it shall be placed before the Executive Director of Higher Education Commission whose decision thereon shall be final. | New addition as Clause 4.7 in Chapter 4 and shifting of existing Clauses 4.7 & 4.8 |
| c. | HEC Institutional Affiliation Policy-2024 | Revised HEC institutional Affiliation Policy including amendments | Old policy will be replaced at Annex A |

**Appendage 4712**

## AMENDMENTS IN BU HR POLICY MANUAL 2023

## CHAPTER 3 – FACULTY WORKLOAD

**New Clause**

**3.7 Standard Workload**

3.7.1 Minimum workload of Permanent Faculty Members (PFMs) will be at least 1 x course in each semester, keeping in view the Faculty Course Load tabulated below; subject to fulfilment of minimum course load requirements of related accreditation bodies for the counting of full-time faculty members (where applicable):

| Category | Course Load |
|---|---|
| Engineering Sciences courses | All Faculty Members: 9-12 contact hours<br>Lab Engineers: 12-15 contact hours |
| All other courses | Professor: 2-3 courses/ 6-9 credit hours<br>Associate Professor: 2-3 courses/ 6-9 credit hours<br>Assistant Professor: 3-4 courses/ 9-12 credit hours<br>Lecturer: 4 courses/ 12 credit hours |

3.7.2 Minimum course load for the Prof/ Assoc Prof (2-3 courses) and Asstt Prof (3-4 courses) should be adopted after the Rector approval, as per the standard procedure.

Current clause 3.7 to be renumbered as 3.8

Current clause 3.8 to be renumbered as 3.9, and the CLR table to be replaced with the following:

| Notified Admin Assignment | No. of Credit Hours Remitted |
|---|---|
| Dean, Principal, HOD | 06/ 09 credit hours |
| Associate Dean | 03 credit hours |
| Dean Coordinator, Thesis/ Final Year Project Coordinator, Internship & Placement Coordinator | 03/ 06 credit hours |
| PGP Coordinator, Accreditation Coordinator, Evening Programme Coordinator, | 03 credit hours |
| Cluster Head | 03 credit hours |
| Incharge Psychological Services Centre | 06 credit hours |

**New Clauses**

3.9.2 Criteria for the above-stated remittances is given at Annex H of this Policy.

3.9.3 Course Load Reduction (CLR) of Dean, Principal and HOD will be based on actual workload. However, FMs performing the dual responsibilities may avail the cumulative CLR, while complying the above stated.

Current clause 3.9 to be renumbered as 3.10

Current clause 3.10 to be renumbered as 3.11

## ANNEX H – ADMINISTRATIVE POSTS AND CRITERIA FOR COURSE LOAD REDUCTION

a. **Dean**. 2 x CLR for single-campus faculty and 3 x CLR for multi-campus faculty.

b. **Associate Deans**. No CLR for Associate Deans for the FMs performing the Principal duties, while 1 x CLR for the concerned FMs not performing the Principal duties.

c. **Principals**. 2 x CLR for upto 500 students and 3 x CLR for more than 500 students.

d. **Heads of Departments (HODs)**. 2 x CLR for up to 500 students and 3 x CLR for more than 500 students.

e. **Cluster Heads**. 1 x CLR only, for more than 1 x section intake per year or where the number of courses offered for related stream/ program are more than 50 per semester in a cluster. Another Cluster Head may be appointed in case the number of courses offered for related stream/ program are more than 75 per semester in a cluster.

f. **Dean Coordinators**. At least two course load teaching to be undertaken in each semester (1 x CLR for ES; 2 x CLR for other faculties).

g. **PGP Coordinator**. PGP Coordinator is to be appointed only when at least one PG program is being conducted, with 1 x CLR where at least 20 students are enrolled.

h. **Accreditation Coordinator**. Only one Accreditation Coordinator is to be appointed in each Dept which has some program accredited with relevant body, with 1 x CLR. In case of any international accreditation, the CU may have an additional Accreditation Coordinator with similar 1 x CLR.

i. **Evening Program Coordinator**. Evening Program Coordinator is to be appointed only when the UG/PG programs are being conducted in the evening, with 1 x CLR only when the no. of UG/PG students is more than 200.

j. **Weekend Program Coordinator**. Weekend Program Coordinator is to be appointed one per School (CU in case of BULC), and not Dept wise, when a Weekend program is being conducted.

k. **Thesis/ Final Year Project Coordinator**. For Thesis/ Final Year Project Coordinator one per Department with 1 x CLR for UG and MBA programs. Where the number of students exceeds 500, the coordinator may either be given 2 x CLR or 2 x *Thesis/ FYP Coordinator* may be appointed with 1 x CLR each (in case of different program only).

l. **Internship & Placement Coordinator**. For Internship & Placement Coordinator one per Department with 1 x CLR. Where the number of students exceeds 500, the Coordinator may either be given 2 x CLR or 2 x *Internship & Placement Coordinator* may be appointed with 1 x CLR each (in case of different programs only).

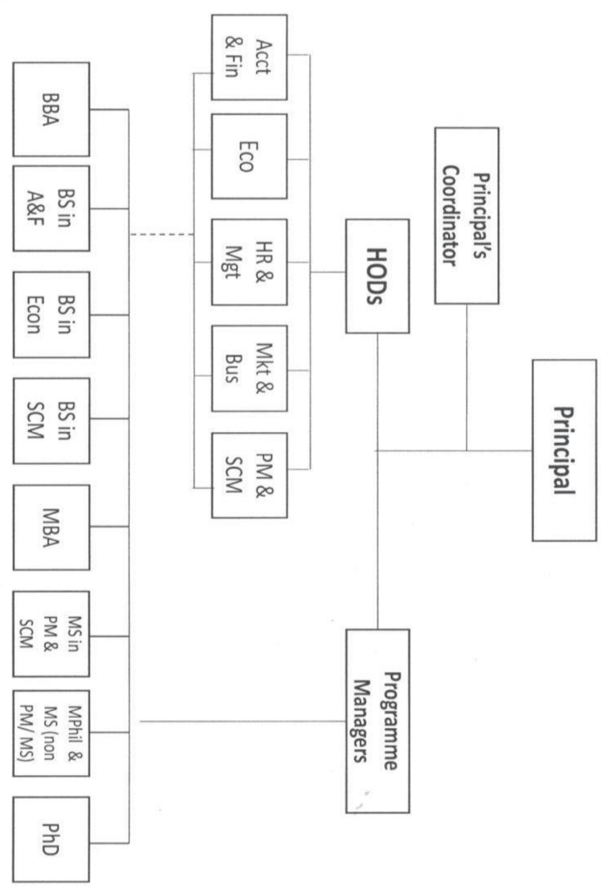
m. **<u>CLR to I/C WBC BUIC</u>**. For I/C WBC BUIC 2 x CLR; similar to the other WBCs (*Umeed-e-Nau*) at IPP and BUHSCK. However, all CUs will have separate Internship & Placement Coordinator in each Dept of PP.

n. **<u>CLR to FMs</u>**. CLR to FMs transferred to Research Centres/ Cells will be reviewed as part of the related review of BU R&D Policy by the sponsoring Dte (ORIC), as and when required.

o. Only those CLR will be availed by the CUs which are mentioned in BU HR Policy. Any incorrect designation will be corrected accordingly, while any CLR approved on file but not covered in HR Policy will be processed for related amendment(s).

**Appendage 4714**

## APPROVED RE-ORGANISATION OF BBS-IC




**Abbreviations:**
Acct & Fin/ A&F – Accounting & Finance
Eco – Economics
Mgt – Management
Mkt – Marketing
Bus – Business
PM – Project Management
SCM – Supply Chain Management

**Appendage 4715**

**7.6 Departmental Coordinator**

7.6.1 Each academic department will have a Departmental Coordinator for up to 1,000 students. Another Departmental Coordinator may be employed in case of more than 1,000 students. Eligibility criteria of the Departmental Coordinator would be minimum 16 years education with demonstrated IT skills.

7.6.2 Duties/ responsibilities of Departmental Coordinators would be as follows:

a. Assist the HOD in all academic and administrative matters.
b. Assist in the selection process of fresh intakes.
c. Prepare timetables, date sheets, and allocate course loads for the permanent/ visiting faculty members in consultation with the HOD.
d. Liaise with the IT Dte (BUHO) for the courses being offered in each semester.
e. Update roadmaps on BU website/ CMS and facilitate the students in registration of courses.
f. Process cases for alternate course(s), time bar waivers, credit transfers, disciplinary matters and any other cases pertaining to the students' admin support.
g. Prepare daily log of classes and undertake its timely distribution.
h. Monitor punctuality of classes and report their status to the HOD.
i. Monitor students' attendance.

**7.7 Class Adviser**

7.7.1 Permanent Faculty Members (PFMs) will be appointed as Class Advisers for one or more sections (up to a maximum 50 students per CA) for the UG programmes only, with the duties/ responsibilities as given in BU Academic Rules.

7.7.2 The PFMs so appointed should have a minimum experience of 2 regular semesters at BU CUs and should continue the Class Adviser duties for a minimum of 4 regular semesters.

7.7.3 No course load reduction would be given to the Class Advisers. However, suitable endorsement should be made in their annual performance evaluation for the assigned duties.

**Appendage 4716**

## SOP for Students Exchange with Istanbul Kultur University, Türkiye

Based on the maximum provision of students to be sent in an academic year, as permitted by Istanbul Kultur University, Türkiye, there shall be students selected from each campus of Bahria University including, Islamabad, Karachi & Lahore, to go on the exchange program to Istanbul Kultur University, Türkiye. The maximum number of students that can be recommended by any Campus would be based on the percentage of number of relevant students at that Campus. In case suitable candidate(s) are not available in a campus, the seat may be transferred to the other campus.

The recommendation of students is to be made by the Director of Academics of the respective Campus/Campus Director/CO, as applicable.
The above authorities will interview and shortlist students from their respective campuses based on following selection criteria, which should reflect the highest quality of students:
Selection Criteria:
The students must be a regular student of Bahria University taking full course load.

**The minimum CGPA of the student should be 3.0.**

The student must have studied for more than a year (2 semesters) with Bahria University. Students in 2nd semester will be eligible to apply.

The student must be proficient in English and have good communication skills. The student must not have any disciplinary cases against them and should be void of any attitude problem.

The shortlisted students will be re-evaluated by the following member committee at Bahria University to shortlist students for final approval of Rector:

| | | |
|---|---|---|
| Pro-Rector (Academics) | - | Chairperson |
| Registrar | - | Member |
| Director Academics | - | Member |
| Director Admissions | - | Member |
| Controller of Examinations | - | Member |
| Director Students Affairs | - | Member |
| Director International Office | - | Member |

The selected students must sign a written bond with Bahria University to return to Pakistan to continue their remaining studies with Bahria University or to complete remaining degree requirements.

The responsibility of accommodation arrangement in Türkiye, during the course of stay, will be on student. The International office will assist the selected students in finding suitable accommodation. In addition to the expenses pertaining to accommodation, students will also be responsible for travelling & visa/pass expenses, medical/health insurance or any additional service charges they wish to avail or are required for travel to Türkiye for exchange programme.

The student will defer/freeze their semester prior going to Istanbul Kultur University, Türkiye, under the Exchange Programme. There shall be no tuition fee charged for this process. The decision on duration & number of semesters, to defer/freeze, is to be taken by the relevant Head of Department according to number of days the student will spend at Istanbul Kultur University, Türkiye, under exchange program. The student must adhere to departure and return dates as specified by his/her department. The duration of the semester(s) studied abroad will not be counted towards the calculationof time bar.

**Eligibility for Honors & Awards:**
Students availing the exchange programme at the Istanbul Kultur University, Türkiye, will be eligible for academic honors & awards, as long as they are taking full semester loads in their studies at Bahria University and finishing remaining degree requirement with their batch of registration.
If, as a result of the exchange activity, any of their courses are affected, these students would be permitted to make up for the shortfall (of the affected courses only) on return to Bahria University either during the summer sessions, if offered, or during succeeding regular semester, in excess to their regular course load.

**If during the summer session,**
the students take shortfall courses, they will be awarded actual grades and no capping will apply.
the students take any course, which were not affected by the exchange programme, summer session rules will apply and the students will become ineligible for Honors & Awards.

**Transfer of Credits as a result of an Outbound Exchange Program:**

Student interested in registering for the courses at Istanbul Kultur University, Türkiye, for which they can avail ***credits transfer*** at Bahria University, shall be properly advised by the relevant Head of Department about the compatibility of the courses they wish to take, based on the course content, before departure. The student must inform their Head of Department about the possible courses they wish to take at Istanbul Kultur University, Türkiye, along with the course outline. A preliminary meeting of the Equivalence Committee should take place, before the departure of student. The committee shall give clear instructions to the student, in writing, on a prescribed form (attached), on the course(s) he/she can take to avail ***credits transfer***, against course(s) of similar nature, at Bahria University as per the road map of the program he/she is studying.

The final decision on ***credits transfer*** is to be taken, on return of the student, and successful completion of the courses, as per following criteria:
Students applying for ***credits transfer*** are to submit original interim transcript and the course outlines of the course(s) studied at Istanbul Kultur University, Türkiye, to their relevant Head of Department

(HOD) on return. The HOD will then formulate an Equivalence Committee to make final recommendations to their relevant Director of Institute. The Director will then forward recommendation of the Equivalence Committee to Director International Office for processing case for final approval. There shall be no fee charged from the student for ***credits transfer***.
***Credits transfer*** of courses will only be allowed for Degree level programs *(equivalent to similar level program at Bahria University)* offered on campus.
***Credits transfer*** for only those courses will be allowed for which a course with at least similar standard, credit hours and matching description is available in the relevant academic program of Bahria University. As the marking criteria at Istanbul Kultur University, Türkiye, is different from what is followed at Bahria University, therefore following grade mapping mechanism is to be followed:

| | **Istanbul Kultur University (Grading System)** | | **Bahria University (Grading System)** | |
|---|---|---|---|---|
| | **Grade** | **Grade Point** | **Grade** | **Grade Point** |
| b | A | 4.0 | A | 4.0 |
| c | A- | 3.7 | A- | 3.67 |
| d | B+ | 3.3 | B+ | 3.33 |
| e | B | 3.0 | B | 3.0 |
| f | B- | 2.7 | B- | 2.67 |
| g | C+ | 2.3 | C+ | 2.33 |
| h | C | 2.0 | C | 2.0 |
| i | C- | 1.7 | C- | 1.67 |
| j | D+ | 1.3 | D+ | 1.33 |
| k | D | 1.0 | D | 1.00 |
| l | D- | 0.7 | | |
| m | F, FD, FF | 0.0 | F | 0.0 |

** For postgraduate students, BU equivalent grade C- and below will be converted into an F grade*

The courses must equate in description and laboratory work, if any, with the similar course of the relevant academic program of Bahria University.

***Credits transfer*** of courses equating to maximum of 50% of the total credit hours of the relevant academic program of Bahria University will be allowed.

**SOP FOR INBOUND EXCHANGE STUDENTS FROM ISTANBUL KULTUR UNIVERSITY, TÜRKIYE**,

Bahria University will accept students from Istanbul Kultur University, Türkiye, under the exchange program in any given academic year. The maximum number of students to be accepted will be decided for each department in consultation with the Dean and relevant HoD.

Only students recommended by the International office of Istanbul Kultur University, Türkiye, will be entertained under this arrangement.

The inbound students from Istanbul Kultur University, Türkiye, will be advised on the availability of courses, which they want to take at Bahria University, after consultation with the HOD of the relevant department. The HOD must ensure that there are no clashes between the selected courses by the individual.

The student will be responsible for own accommodation arrangement in Pakistan, but the International office of BU will assist in finding suitable accommodation.

There shall be no tuition fee charged by Bahria University from students of Istanbul Kultur University, Türkiye, under student's Exchange program.

On successful completion of the course work at Bahria University, the student will be responsible to meet the ***credits transfer*** requirements of Istanbul Kultur University, Türkiye, as per its own policy. Bahria University will only award official interim transcript to the student for courses he / she has studied at Bahria University.

## PRE-VISIT EQUIVALENCE FORM

**CONFIRMATION OF COURSE TRANSFER AS A RESULT OF STUDENTS' EXCHANGE WITH ISTANBUL KULTUR UNIVERSITY, TÜRKIYE**

(DECISION AFTER PRELIMINARY MEETING OF THE EQUIVALENCE COMMITTEE)

**Section A: Student Details:**

Student Name: ……………………………………………………………………………………………………………………..

Programme of Study: ………………………………………………………………………………………………………..........

Semester: ……………………………………………………………………………………………………………………………

Enrolment No: ……………………………………………………………………………………………………………………..

Campus: Islamabad Lahore Karachi IPP

**Section B: Course Mapping**

| List of courses planned to be studied at Istanbul Kultur University, Türkiye | | Transferable Courses at Bahria University, recommended by the Equivalence Committee: | |
|---|---|---|---|
| **Course Code** | **Course Title & Credit Hours** | **Course Code** | **Course Title & Credit Hours** |
| ………………… | ……………………………………….. | ………………… | ……………………………………….. |
| ………………… | ……………………………………….. | ………………… | ……………………………………….. |
| ………………… | ……………………………………….. | ………………… | ……………………………………….. |

**Section C: Student Declaration:**

I fully understand that the final decision of transfer of courses will be taken on my return and will be conditional to successful completion of course work. In case any other course is studied, which is not stated in the list above (section B) then the decision for the transfer of credits for that course will be taken on my return, based on Credit Transfer procedure as specified in Bahria University SOP for Students' Exchange with Istanbul Kultur University, Türkiye.

| **Member 1** | **Member 2** | **Member 3** |
|---|---|---|
| Name: | Name: | Name: |
| Designation: | Designation: | Designation: |

______________________

**Head of Department**

______________________________

Director/Principal of Concerning Constituent Unit/School

***This form is to be forwarded to Director (IO), along with the copy of course outline of recommended programmes, which are transferable.**

**POST-VISIT EQUIVALENCE FORM**

**CONFIRMATION OF COURSE TRANSFER AS A RESULT OF STUDENTS' EXCHANGE WITH ISTANBUL KULTUR UNIVERSITY, TÜRKIYE**

**Section A: Student Details:**

Student Name: ………………………………………………………………………………………………………………

Programme of Study: ……………………………………………………………………………………………………………........

Semester: ……………………………………………………………………………………………………………………….

Enrolment No: …………………………………………………………………………………………………………………

Campus: Islamabad Lahore Karachi IPP

**Section B: Course Mapping**

| List of courses planned to be studied at Istanbul Kultur University, Türkiye | | Transferable Courses at Bahria University, recommended by the Equivalence Committee: | |
|---|---|---|---|
| **Course Code** | **Course Title & Credit Hours** | **Course Code** | **Course Title & Credit Hours** |
| ………………… | ……………………………………….. | ………………… | ……………………………………….. |
| ………………… | ……………………………………….. | ………………… | ……………………………………….. |
| ………………… | ……………………………………….. | ………………… | ……………………………………….. |
| ………………… | ……………………………………….. | ………………… | ……………………………………….. |
| ………………… | ……………………………………….. | ………………… | ……………………………………….. |
| ………………… | ……………………………………….. | ………………… | ……………………………………….. |
| ………………… | ……………………………………….. | ………………… | ……………………………………….. |
| ………………… | ……………………………………….. | ………………… | ……………………………………….. |

**Section C: Student Declaration:**

I fully understand that the final decision on Transfer of Credits is subject to policy outlined in the Bahria University SOP FOR OUTBOUND EXCHANGE STUDENTS FOR ISTANBUL KULTUR UNIVERSITY, TÜRKIYE

____________________

**Student's Signature**

**EQUIVALENCE COMMITTEE**

Remarks: (If any) ……………………………………………………………………………………………………………….

……………………………………………………………………………………………………………………………………

…………………………………………………………………………………………………………………………………………

……………………………………………………………………………………………………………………………………

| **Member 1** | **Member 2** | **Member 3** |
|---|---|---|
| Name: | Name: | Name: |
| Designation: | Designation: | Designation: |

**Head of Department**

**Director/Principal of Concerning Constituent Unit/School**
***This form is to be forwarded to Director (IO), along with the copy of course outline of recommended programmes, which are transferable, for approval.**

APPROVED/NOT APPROVED

**Director Academics**

**Appendage 4717**

**SOP FOR OUTBOUND EXCHANGE STUDENTS FOR UNIVERSITY OF MALAGA, SPAIN**

a) Based on the maximum provision of students to be sent in an academic year i.e. 2, as set by University of Malaga, Spain; there shall be students selected from each campus of Bahria University including, Islamabad, Karachi & Lahore, to go on the exchange program to University of Malaga. The maximum number of students that can be recommended by any Campus would be based on the percentage of number of relevant students at that Campus. In case suitable candidate(s) are not available in a campus, the seat may be transferred to the other campus.

b) The recommendation of students is to be made by the following authorities:

| CAMPUSES | Nominating Authority |
|---|---|
| • Islamabad Campus | Director Campus Islamabad |
| • Karachi Campus | DG Karachi Campus |
| • Lahore Campus | Director Campus Lahore |

c) The above authorities will interview and shortlist students from their respective campuses based on following selection criteria, which should reflect the highest quality of students:

**Selection Criteria:**

i. The students must be a regular student of Bahria University taking full course load.
ii. The minimum CGPA of the student should be 3.0.
iii. The student must have studied for more than a year (2 semesters) with Bahria University.
iv. The student must be proficient in English and have good communication skills.
v. The student must not have any disciplinary cases against them and should be void of any attitude problem.

d) The shortlisted students will be re-evaluated by a following member committee at Bahria University to shortlist students for final approval of Rector:

| | | | |
|---|---|---|---|
| i. | Pro-Rector | - | Chairperson |
| ii. | Registrar | - | Member |
| iii. | Advisor/Director Academic Affairs | - | Member |
| iv. | Director Admissions | - | Member |
| v. | Director Examinations | - | Member |
| vi. | Director Students Affairs | - | Member |
| vii. | Dy. Director (FCP) | - | Member |

e) The selected students must sign a written bond with Bahria University to return to Pakistan to continue their remaining studies with Bahria University or to complete remaining degree requirements.

f) The responsibility of accommodation arrangement in Spain, during the course of stay, will be on student. The International office will assist the selected students in finding suitable accommodation. In addition to the expenses pertaining to accommodation, students will also be responsible for travelling & visa/pass expenses, medical/health insurance or any additional service charges they wish to avail.

g) The student will defer their semester prior going to University of Malaga, Spain, under the Exchange Programme. There shall be no tuition fee charged for this process. The decision on duration & number of semesters, to defer, is to be taken by the relevant Head of Department according to number of days the student will spend at University of Malaga under exchange program. The student must adhere to departure and return dates as specified by his/her department.

h) The duration of the semester(s) studies abroad will not be counted towards the calculation of time bar.

**Eligibility for Honors & Awards:**

i) Students availing the exchange programme at the University of Malaga will be eligible for academic honors & awards, as long as they are taking full semester loads in their studies at Bahria University.

j) If, as a result of the exchange activity, any of their courses are affected, these students would be permitted to make up for the shortfall (of the affected courses only) on return to Bahria University either during the summer sessions, if offered, or during succeeding regular semester, in excess to their regular course load.

k) If during the summer session,

    i. the students take shortfall courses, they will be awarded actual grades and no capping will apply.

    ii. the students take any course, which were not affected by the exchange programme, summer session rules will apply and the students will become ineligible for Honors & Awards.

**Transfer of Credits as a result of an Outbound Exchange Program:**

l) Student interested in registering for the courses at University of Malaga, for which they can avail ***credits transfer*** at Bahria University, shall be properly advised by the relevant Head of Department about the compatibility of the courses they wish to take, based on the course content, before departure.

m) The student must inform their Head of Department about the possible courses they wish to take at University of Malaga along with the course outline. A preliminary meeting of the Equivalence Committee should take place, before the departure of student. The committee shall give clear instructions to the student, in writing, on a prescribed form (attached), on the course(s) he/she can take to avail ***credits transfer***, against course(s) of similar nature, at Bahria University as per the road map of the program he/she is studying.

n) The final decision on ***credits transfer*** is to be taken, on return of the student, and successful completion of the courses, as per following criteria:

    i. Students applying for ***credits transfer*** are to submit original interim transcript and the course outlines of the course(s) studied at University of Malaga to their relevant Head of Department (HOD) on return. The HOD will then formulate an Equivalence Committee to make final recommendations to their relevant Director of Institute. The Director will then forward recommendation of the Equivalence Committee for final approval to Advisor/Director Academic Affairs. There shall be no fee charged from the student for ***credits transfer***.

ii. ***Credits transfer*** of courses will only be allowed for Degree level programs *(equivalent to similar level program at Bahria University)* offered on campus.

iii. ***Credits transfer*** for only those courses will be allowed for which a course with similar standard, credit hours and matching description is available in the relevant academic program of Bahria University. As the marking criteria at University of Malaga is different from what is followed at Bahria University, therefore following grade mapping mechanism is to be followed:

| | **Grade at University of Malaga** | **Eq. Grade** | **Points at UoM** | **Equivalent Grade at Bahria University** | **GPA Points at BU** |
|---|---|---|---|---|---|
| a | Matrícula de Honor | A | 9.50-10 | A | 4.00 |
| b | Sobresaliente (SOB) | A | 9-9.49 | A- | 3.67 |
| c | Notable (NOT) | B | 8.66-8.99 | B+ | 3.33 |
| d | Notable (NOT) | B | 8.33-8.65 | B | 3.00 |
| e | Notable (NOT) | B | 8-8.32 | B- | 2.67 |
| f | Notable (NOT) | C | 7.67-7.99 | C+ | 2.33 |
| g | Notable (NOT) | C | 7.33-7.66 | C | 2.00 |
| h | Notable (NOT) | C | 7-7.32 | C- | 1.67 |
| i | Aprobado (APR) | D | 6.5-6.99 | D+ | 1.33 |
| j | Aprobado (APR) | D | 6-6.49 | D | 1.00 |
| k | Aprobado (APR) | E | 5-5.99 | F | 0.00 |
| l | Suspenso (SUS) | F | 0-4.99 | F | 0.00 |
| m | FF | | 0.0 | F | 0.00 |

iv. The courses must equate in description and laboratory work, if any, with the similar course of the relevant academic program of Bahria University.

v. ***Credits transfer*** of courses equating to maximum of 50% of the total credit hours of the relevant academic program of Bahria University will be allowed.

**SOP FOR INBOUND EXCHANGE STUDENTS FROM UNIVERSITY OF MALAGA**

a) Bahria University will accept two students from University of Malaga under the exchange program in any given academic year.

b) Only students recommended by the International office of University of Malaga will be entertained under this arrangement.

c) The inbound students from University of Malaga will be advised on the availability of courses, which they want to take at Bahria University, after consultation with the HOD of the relevant department. The HOD must ensure that there are no clashes between the selected courses by the individual.

d) The student will be responsible for own accommodation arrangement in Pakistan, but the International office of BU will assist in finding suitable accommodation.

e) There shall be no tuition fee charged by Bahria University from students of University of Malaga under student's Exchange program. An admission fee for the relevant programme would be applicable to the selected students.

f) On successful completion of the course work at Bahria University, the student will be responsible to meet the ***credits transfer*** requirements of University of Malaga, as per its own policy. Bahria University will only award official interim transcript to the student for courses he / she has studied at Bahria University.

**Appendage 4718**

**SOP FOR OUTBOUND EXCHANGE STUDENTS FOR UNIVERSITY OF MALAGA, SPAIN**

Based on the maximum provision of students to be sent in an academic year i.e. 2, as set by University of Malaga, Spain; there shall be students selected from each campus of Bahria University including, Islamabad, Karachi & Lahore, to go on the exchange program to University of Malaga. The maximum number of students that can be recommended by any Campus would be based on the percentage of number of relevant students at that Campus. In case suitable candidate(s) are not available in a campus, the seat may be transferred to the other campus.
The recommendation of students is to be made by the following authorities:

| CAMPUSES | Nominating Authority |
|---|---|
| • Islamabad Campus | Director Campus Islamabad |
| • Karachi Campus | DG Karachi Campus |
| • Lahore Campus | Director Campus Lahore |

The above authorities will interview and shortlist students from their respective campuses based on following selection criteria, which should reflect the highest quality of students:

**Selection Criteria:**

i. The students must be a regular student of Bahria University taking full course load.
ii. The minimum CGPA of the student should be 3.0.
iii. The student must have studied for more than a year (2 semesters) with Bahria University.
iv. The student must be proficient in English and have good communication skills.
v. The student must not have any disciplinary cases against them and should be void of any attitude problem.

The shortlisted students will be re-evaluated by a following member committee at Bahria University to shortlist students for final approval of Rector:

| | | |
|---|---|---|
| Pro-Rector | - | Chairperson |
| Registrar | - | Member |
| Advisor/Director Academic Affairs | - | Member |
| Director Admissions | - | Member |
| Director Examinations | - | Member |
| Director Students Affairs | - | Member |
| Dy. Director (FCP) | - | Member |

The selected students must sign a written bond with Bahria University to return to Pakistan to continue their remaining studies with Bahria University or to complete remaining degree requirements.

The responsibility of accommodation arrangement in Spain, during the course of stay, will be on student. The International office will assist the selected students in finding suitable accommodation. In addition to the expenses pertaining to accommodation, students will also be responsible for travelling & visa/pass expenses, medical/health insurance or any additional service charges they wish to avail.

The student will defer their semester prior going to University of Malaga, Spain, under the Exchange Programme. There shall be no tuition fee charged for this process. The decision on duration & number of semesters, to defer, is to be taken by the relevant Head of Department according to number of days the student will spend at University of Malaga under exchange program. The student must adhere to departure and return dates as specified by his/her department.

The duration of the semester(s) studies abroad will not be counted towards the calculation of time bar.

**Eligibility for Honors & Awards:**
Students availing the exchange programme at the University of Malaga will be eligible for academic honors & awards, as long as they are taking full semester loads in their studies at Bahria University.

If, as a result of the exchange activity, any of their courses are affected, these students would be permitted to make up for the shortfall (of the affected courses only) on return to Bahria University either during the summer sessions, if offered, or during succeeding regular semester, in excess to their regular course load.

**If during the summer session,**

i. the students take shortfall courses, they will be awarded actual grades and no capping will apply.
ii. the students take any course, which were not affected by the exchange programme, summer session rules will apply and the students will become ineligible for Honors & Awards.

**Transfer of Credits as a result of an Outbound Exchange Program:**

Student interested in registering for the courses at University of Malaga, for which they can avail ***credits transfer*** at Bahria University, shall be properly advised by the relevant Head of Department about the compatibility of the courses they wish to take, based on the course content, before departure.

The student must inform their Head of Department about the possible courses they wish to take at University of Malaga along with the course outline. A preliminary meeting of the Equivalence Committee should take place, before the departure of student. The committee shall give clear instructions to the student, in writing, on a prescribed form (attached), on the course(s) he/she can take to avail ***credits transfer***, against course(s) of similar nature, at Bahria University as per the road map of the program he/she is studying.

The final decision on ***credits transfer*** is to be taken, on return of the student, and successful completion of the courses, as per following criteria:

vi. Students applying for ***credits transfer*** are to submit original interim transcript and the course outlines of the course(s) studied at University of Malaga to their relevant Head of Department (HOD) on return. The HOD will then formulate an Equivalence Committee to make final recommendations to their relevant Director of Institute. The Director will then forward recommendation of the Equivalence Committee for final approval to Advisor/Director Academic Affairs. There shall be no fee charged from the student for ***credits transfer***.

vii. ***Credits transfer*** of courses will only be allowed for Degree level programs *(equivalent to similar level program at Bahria University)* offered on campus.

viii. ***Credits transfer*** for only those courses will be allowed for which a course with similar standard, credit hours and matching description is available in the relevant academic program of Bahria University. As the marking criteria at University of Malaga is different from what is followed at Bahria University, therefore following grade mapping mechanism is to be followed:

| | **Grade at University of Malaga** | **Eq. Grade** | **Points at UoM** | **Equivalent Grade at Bahria University** | **GPA Points at BU** |
|---|---|---|---|---|---|
| a | Matrícula de Honor | A | 9.50-10 | A | 4.00 |
| b | Sobresaliente (SOB) | A | 9-9.49 | A- | 3.67 |
| c | Notable (NOT) | B | 8.66-8.99 | B+ | 3.33 |
| d | Notable (NOT) | B | 8.33-8.65 | B | 3.00 |
| e | Notable (NOT) | B | 8-8.32 | B- | 2.67 |
| f | Notable (NOT) | C | 7.67-7.99 | C+ | 2.33 |
| g | Notable (NOT) | C | 7.33-7.66 | C | 2.00 |
| h | Notable (NOT) | C | 7-7.32 | C- | 1.67 |
| i | Aprobado (APR) | D | 6.5-6.99 | D+ | 1.33 |
| j | Aprobado (APR) | D | 6-6.49 | D | 1.00 |
| k | Aprobado (APR) | E | 5-5.99 | F | 0.00 |
| l | Suspenso (SUS) | F | 0-4.99 | F | 0.00 |
| m | FF | | 0.0 | F | 0.00 |

ix. The courses must equate in description and laboratory work, if any, with the similar course of the relevant academic program of Bahria University.

x. ***Credits transfer*** of courses equating to maximum of 50% of the total credit hours of the relevant academic program of Bahria University will be allowed.

# SOP FOR INBOUND EXCHANGE STUDENTS FROM UNIVERSITY OF MALAGA

Bahria University will accept two students from University of Malaga under the exchange program in any given academic year.

Only students recommended by the International office of University of Malaga will be entertained under this arrangement.

The inbound students from University of Malaga will be advised on the availability of courses, which they want to take at Bahria University, after consultation with the HOD of the relevant department. The HOD must ensure that there are no clashes between the selected courses by the individual.

The student will be responsible for own accommodation arrangement in Pakistan, but the International office of BU will assist in finding suitable accommodation.

There shall be no tuition fee charged by Bahria University from students of University of Malaga under student's Exchange program. An admission fee for the relevant programme would be applicable to the selected students.

On successful completion of the course work at Bahria University, the student will be responsible to meet the ***credits transfer*** requirements of University of Malaga, as per its own policy. Bahria University will only award official interim transcript to the student for courses he / she has studied at Bahria University.

**Appendage 4722**

**Changes in MBA Thesis/Projects Rules 2024**

| S. # | | Previous | Updated |
|---|---|---|---|
| 1 | 2.12. Thesis/Project Re-registration | "Thesis/Project Re-registration" means re-registration by the student in the second part of the thesis constituting **04 credit** hours in the subsequent semester after having been declared failed in the thesis or after having failed to submit the approved thesis/project within the prescribed time. | "Thesis/Project Re-registration" means re-registration by the student in the second part of the thesis constituting **03 credit** hours in the subsequent semester after having been declared failed in the thesis or after having failed to submit the approved thesis/project within the prescribed time. |
| 2 | 2.14. "Thesis/Project Duration | "Thesis/Project Duration" is one semester period wherein the students have to complete and submit a thesis/project constituting **04 credit hours** of research work | "Thesis/Project Duration" is one semester period wherein the students have to complete and submit a thesis/project constituting **03 credit hours** of research work |
| 3 | 2.18 Thesis project tutor and 2.19 Third Examiner | Both these clause have been deleted | Replaced by "Thesis Examiner" |
| 4 | 3.1 | Students shall be registering for 2 credit hours out of 6 credit hours in the second last semester of their MBA program. During this semester, students shall be undergoing 30 contact hour tutorials with the thesis/project tutor on thesis writing skills. The tutorials will culminate at preparation of tentative thesis proposal. The research proposal shall be 6-10 pages printed on A-4 size page with double line spacing and using font size 12. | Students of MBA shall be registering for Dissertation-1 (proposal Development) 3 credit hours (zero contact hours) out of 6 credit hours in the second last semester of their program. The tutorials will conclude with the preparation of a tentative thesis proposal. The thesis proposal shall be 6-10 pages printed on an A-4 size page with double line spacing and using font size 12. |
| 5 | 3.2 | Attendance rules applicable to a course during a semester shall also be applicable to the thesis/project tutorials held in the second last semester. | No attendance rules shall apply to this course however, students shall be required to have scheduled 3 to 6 meetings with the supervisor during the semester. |
| 6 | 3.3 | To become eligible for registration for remaining 4 credit hours in the final semester of the MBA program, the students must have got thesis proposal | To become eligible for registration for the remaining 3 credit hours in the final semester of their program, the |

| | | | |
|---|---|---|---|
| | | approved by the thesis/project tutor and the HoD(MS). | students must appear for proposal defense at the end of the semester and get at least passing marks as per BU policy. |
| 7 | 3.4 | During the final semester, the students after having registered themselves for the remaining 04 credit hour, shall undertake research work under the supervision of the thesis/project supervisor assigned to them for that purpose. | During the final semester, the students after having registered themselves for the remaining 03 credit hour, shall undertake research work under the supervision of the thesis/project supervisor assigned to them for that purpose. |
| 8 | 3.6 | - | **Addition of this clause** Students will not be allowed to change the supervisor after 20 days of allocation of the supervisor or once the model is finalized. |
| 9 | 4.2 | If the student is unable to submit the thesis/project duly approved by the thesis/project supervisor and the HOD on a prescribed form within the deadline announced by the Examination Department, the student shall have to re-register for 4 credit hour thesis/project work during the next semester. | If the student is unable to submit the thesis/project duly approved by the thesis/project supervisor and the HOD on a prescribed form within the deadline announced by the Examination Department, the student shall have to re-register for 3 credit hour thesis/project work during the next semester. |
| 10 | 6.1 | Students who have fulfilled the minimum attendance requirement during the thesis tutorials and have got the thesis/project proposal approved shall be assigned thesis/project supervisor by the HoD(MS). | Students who have fulfilled the requirement of the semester shall be assigned thesis/project supervisor by the HOD. |
| 11 | 10.2 | The students shall have to submit three spiral bound copies of their approved thesis/project to the Thesis/Project Coordinator along with the 2nd half-semester progress report and thesis/project approval statement by the thesis/project supervisor on the prescribed form placed at Annexure 5, within due date. | 10.2. The students shall have to submit two spiral bound copies of their approved thesis/project to the Thesis/Project Coordinator along with the 2nd half-semester progress report and thesis/project approval statement by the thesis/project supervisor on the prescribed form placed at Annexure 5, within due date. |
| 12 | 10.4 | If a student fails to submit a | If a student fails to submit a |

| | | | |
|---|---|---|---|
| | | thesis/project within the due date, he/she shall have to re-register for the 4 credit hour thesis/project work during the next semester as provided in section 3 of these rules. | thesis/project within the due date, he/she shall have to re-register for the 3 credit hour thesis/project work during the next semester as provided in section 3 of these rules. |
| 13 | 13.Proposal Evaluation | Previously it was Thesis Evaluation | Inclusion of this clause |
| 14 | 15.2 | 15.2. However, if both the panel members propose certain amendments to the thesis/project work, the students shall be required to make necessary changes accordingly under the supervision of their supervisor and re-submit to the Thesis/Project Coordinator within a period of one week, for review by the thesis/project evaluation panel. In such a case, another open defense shall not be required. | 16.2. However, if both the panel members propose certain amendments to the thesis/project work, the students shall be required to make necessary changes accordingly under the supervision of their supervisor and re-submit to the Thesis/Project Coordinator within a period of one week, for review by the thesis/project evaluation panel. In such a case, another open defense shall not be required. |
| 15 | 15.3 | 15.3 Furthermore, if both the thesis/project evaluation panel members rule the thesis/project work unsatisfactory then the student shall have to re-register in the 3 credit hour thesis/project next semester and undertake the research work anew under the supervision of the thesis/project supervisor. In such a case, the thesis evaluation shall be held through open defense again. | 16.3. Furthermore, if both the thesis/project evaluation panel members rule the thesis/project work unsatisfactory then the student shall have to re-register in the 3 credit hour thesis/project next semester and undertake the research work anew under the supervision of the thesis/project supervisor. In such a case, the thesis evaluation shall be held through open defense again. |
| 16 | 19.Role of Thesis/Project Coordinator | | Addition of these 2 clause<br>iv. Collecting evaluation reports for both the first and second half of the thesis, ensuring that all assessments are properly recorded.<br>v.Processing the payments of examiners and supervisors, ensuring that all financial transactions related to the thesis are handled efficiently |

| | | | |
|---|---|---|---|
| | | | and in a timely manner. |
| 17 | 20.Remunerations | Remuneration of Thesis/Project Supervisor Rs. 6,000/-To be paid in two installments | Remuneration of Thesis/Project Supervisor Rs. 8,000/-To be paid after the thesis defense. |
| 18 | | Rs. 1000 per member per thesis/project to be paid upon submission of result | Remuneration of Thesis/Project Evaluation by internal member panel Rs. 2,000/- per member per thesis/project To be paid upon submission of the result.<br>Thesis/Project Evaluation by external member panel Rs. 3,000/- per member per thesis/project To be paid upon submission of the result. |
| 20 | Annexure 1 | | Addition of Area |
| 21 | Annexure 2 and 3 | | Addition in the footnote *In alignment with SDG 12: Responsible Consumption and Production, and SDG 13 Climate Action that emphasizes on paperless approach. These forms will be collected online via Google Forms. |
| 21 | Annexure 11 | - | Addition of Proposal Evaluation Form |

**Appendage 4723**

**ACADEMIC ROADMAPS OF BBA AND AD(BA) PROGRAMMES FOR INCLUSION OF *PAKISTAN STUDIES* COURSE**

# HIGHER EDUCATION COMMISSION

H-9, ISLAMABAD, PAKISTAN, Website: http://www.hec.gov.pk

**Prof. Dr. Zia Ul-Qayyum**
**Executive Director**

No. HEC/ACAD/UGEP/2024/6537
Thursday, the September 19, 2024

Subject: **OFFERING OF A COURSE OF PAKISTAN STUDIES IN UNDERGRADAUTE DEGREE PROGRAMS**

Respected Vice Chancellor/Rector/Head of the Institute,

السلام علیکم ورحمة اللہ وبرکاتہ

The Higher Education Commission (HEC) developed the Undergraduate Education Policy (V 1.1) after extensive consultations and feedback from various stakeholders within the higher education sector across the country. This policy, finalized and issued in July 2023, was crafted with the intention of ensuring that students receive a holistic education that prepares them as well-rounded individuals.

02. One of the key components of this policy is the inclusion of a general education requirement, consisting of eleven (11) mandatory courses for all undergraduate degree programs. Among these, the course of "Ideology and Constitution of Pakistan" has been specifically designed to expand the students' knowledge base, building on their prior understanding of Pakistan Studies. However, it is noted that there are some concerns within the higher education community regarding the limited scope of the course as the same does not adequately cover the range of topics around Pakistan Studies. Some universities have also highlighted that their Acts or Charters necessitate the offering of the course of "Pakistan Studies" as a mandatory component for the award of degrees, and that the course of "Ideology and Constitution of Pakistan" may not satisfy this requirement.

03. In view of these concerns and in recognition of the importance of the course of "Pakistan Studies", all the varsities are hereby advised to offer the course of "Pakistan Studies" of two-credits in all undergraduate degree programs without substituting it with the course of "Ideology and Constitution of Pakistan". For the guidance of the varsities, the two courses as designed by HEC are enclosed with this letter for use and reference.

(Prof. Dr. Zia Ul-Qayyum)

**Vice Chancellors / Rectors / Heads of the Institutes**
All Public and Private Sector Universities / DAIs of Pakistan

**Cc. To:-**

i. The Secretary to the President / Chancellor, Islamic Republic of Pakistan, Islamabad.
ii. The Secretary to the President / Chancellor, Azad Jammu and Kashmir.
iii. The Secretary, Ministry of Federal Education and Professional Training, Islamabad.
iv. The Secretary to the Governor / Chancellor, Punjab, Sindh, Balochistan, Khyber Pakhtunkhwa and Gilgit Baltistan.
v. The Secretary HEDs/Universities & Boards Department, all provinces and regions.
vi. The Chairman, PHEC and SHEC.
vii. All Concerned Divisions of HEC, Islamabad.

E-mail: z.qayyum@hec.gov.pk, Ph: +92-51-90400150, Fax: +92-51-90400154

ہائیر ایجوکیشن کمیشن

# HIGHER EDUCATION COMMISSION

Government of Pakistan, Islamabad

(Curriculum Division)

## ENDORSEMENT OF THE COURSE DESIGN COMMITTEE

A meeting of a Course Design Committee (CDC) was held on 11 March 2024 in the Higher Education Commission, Karachi (Regional Office) to design a two credits course of **"Pakistan Studies"** as part of the General Education component of the HEC Undergraduate Education Policy (V 1.1).

Following members of the CDC attended the meeting and developed the draft of the course:

1. Dr. Abdul Qadir Mushtaq, Professor & Chairperson, Department of Pakistan Studies, Government College University, Faisalabad
2. Dr. Javed Akhtar Salyana, Professor & Chairman, Department of Pakistan Studies, Bahauddin Zakariya University, Multan
3. Dr. Mahboob Hussain, Professor & Chairman, Department of History & Pakistan Studies, University of the Punjab, Lahore
4. Dr. Muhammad Usman, Professor & Director, Pakistan Study Centre, University of Balochistan, Quetta
5. Dr. Naumana Kiran, Professor & Director, Pakistan Study Centre, University of the Punjab, Lahore
6. Dr. Shuja Ahmed Mahesar, Professor & Director, Pakistan Study Centre, University of Sindh, Jamshoro
7. Dr. Muhammad Hanif Khan, Associate Professor & Director, National Institute of Pakistan Studies, Quaid-i-Azam University, Islamabad
8. Dr. Robina Yasmin, Associate Professor & Chairperson, Department of Pakistan Studies, The Islamia University of Bahawalpur, Bahawalpur
9. Dr. Erum Muzaffar, Assistant Professor & in-charge, Pakistan Study Centre, University of Karachi, Karachi
10. Mr. Muhammad Ali Baig, Deputy Director, Curriculum Division, Higher Education Commission, Islamabad

The committee unanimously proposed the following recommendations:

1. The course of Pakistan Studies may be made mandatory part of the General Education (GenEd) component of the Undergraduate Education Policy V 1.1.
2. The course is proposed for two-credits. However, the offering departments may increase the recommended credits if needed subject to approval of the relevant statutory body of the concerned universities.
3. The course is not to substitute the course of "Ideology and Constitution of Pakistan" as prescribed in the Undergraduate Education Policy V 1.1.

That, after consultation and endorsement of the committee, the final draft of the course along-with recommendation is hereby submitted to the office of the Director Curriculum Division, HEC, Islamabad by us / the undersigned on behalf of the committee for consideration of HEC.

| | | |
|---|---|---|
| Dr. Shuja Ahmed Mahesar<br>(Convener) | Dr. Robina Yasmin<br>(Co-Convener) | Mr. Muhammad Ali Baig<br>(Secretary) |

**Appendage 4724**

## NEW PROGRAMME MS (SUPPLY CHAIN MANAGEMENT) AT PNSL

10/21/2024

Bahria University
Discovering Knowledge

### Item 4724

### Launch of New Programme MS (SCM) at Pakistan Navy School of Logistics

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**Item 4724: Launch of New Programme MS (Supply Chain Management) at PNSL**

**Summary**

152. The PNSL intends to launch a new degree programme MS in Supply Chain Management at its premises. The proposal has been reviewed by the FBOS-MS and recommended for consideration by the Academic Council.

153. HOD PNSL will present the launch proposal for approval by the Academic Council.

**Recommendation**

154. The proposal for the launch of MS in Supply Chain Management at PNSL may be approved by the Academic Council subject to scrutiny and verification of the fulfilment of requirements by the QA and Exams Dtes. Progress may be reported in the next ACM.

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### Launch of New Program MS Supply Chain Management (MS-SCM)

PAKISTAN NAVY SCHOOL OF LOGISTICS, PNS KARSAZ, KARACHI

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### Scheme of Presentation

- Program Rationale
- Degree Title
- Salient Features of the Program
- Brief Description of the Program
- Roadmap
- Recommendations

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### Program Rationale

- PNSL is already offering a Supply Management Advanced Course (SMAC) for Lt/ Lt Cdrs
- To further enhance knowledge, skills, and abilities, it is considered vital to transform SMAC into a degree program
- This will equip officers to navigate challenges and learn latest trends in the field of SCM

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### Degree Title

MS Supply Chain Management (MS-SCM)

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## Salient Features of the Program

- Program offered to Officers who have already earned BS (SCM) from BU
- The proposed program's roadmap is fully aligned with BU Islamabad's MS SCM program

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Brief Description of the Program

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## Program Description

- In line with BU's existing degree, the proposed MS-SCM is
  - 1.5-year full-time program
  - 3 semesters
  - 33 Credit Hours

| Sr. No. | Category as per HEC new GE Policy 2023 | Credit Hours |
|---|---|---|
| 1. | Major/Disciplinary | 27 |
| 2. | Electives toward specialization/ thesis | 06 |
| 3. | Deficiency course in case of candidate from other domain or interdisciplinary domain | - |
| | Total | 33 |

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Roadmap

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## Roadmap of MS(SCM) Semester 1

| Proposed Road map aligned with HEC new GE Policy | | | | |
|---|---|---|---|---|
| S No. | Course Codes | Course Titles | Credit Hours | UN SDGs Alignment |
| 1 | SCM 701 | Fundamentals of SCM | 3 | 1-17 |
| 2 | SCM 734 | Advanced Negotiation, Contracting & Law in Procurement and Supply | 3 | 1-17 |
| 3 | SCM 728 | Advanced Supplier Selection & Bid Evaluation | 3 | 1-17 |
| | | Total Credit Hours | 09 | |

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## Roadmap of MS(SCM) Semester 2

| Proposed Road map aligned with HEC new GE Policy | | | | |
|---|---|---|---|---|
| S No. | Course Codes | Course Titles | Credit Hours | UN SDGs Alignment |
| 1 | SCM 729 | Advanced Business Research Methods (Focus on SCM) | 3 | 1-17 |
| 2 | SCM 707 | Contemporary Issues in Supply Chain | 3 | 1-17 |
| 3 | SCM 730 | Advanced Inventory & Logistics Operations | 3 | 1-17 |
| 4 | SCM 706 | Operations Management & Supply Chain | 3 | 1-17 |
| | | Total Credit Hours | 12 | |

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10/21/2024

## Roadmap of MS(SCM) Semester 3

| Sr. No. | Course Codes | Course Titles | | | | Credit Hours | | UN SDGs Alignment |
|---|---|---|---|---|---|---|---|---|
| 1 | SCM 708 | Strategic Supply Chain Management | | | | 3 | | 1-17 |
| 2 | SCM 731 | Advanced Supply Chain Finance | | | | 3 | | 1-17 |
| 3 | | Option 1 | | Option 2 | | | | |
| | SCM XXX | Elective- 1 | SCM 711 | Research Thesis | | 3 | 6 | 1-17 |
| | SCM XXX | Elective- 2 | | | | 3 | | |
| | | Total Credit Hours | | | | 12 | | |

Proposed Road map aligned with HEC new GE Policy

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## Roadmap of MS(SCM) List of Electives

Proposed Road map aligned with HEC new GE Policy

| Sr. No. | Course Codes | Course Titles | Credit Hours | UN SDGs Alignment |
|---|---|---|---|---|
| 1 | SCM 721 | Leadership in Procurement and Supply | 3 | 1-17 |
| 2 | SCM 722 | Managing Risks in SCs | 3 | 1-17 |
| 3 | SCM 732 | Advanced SC Diligence | 3 | 1-17 |
| 4 | SCM 724 | Category Management in Proc. & Supply | 3 | 1-17 |
| 5 | SCM 725 | Regulatory Framework for Trade Harmonization in International SC | 3 | 1-17 |
| 6 | SCM 726 | Mathematical Modeling & Optimization Techniques in Supply Chain | 3 | 1-17 |
| 7 | SCM 733 | Advanced Software & Simulations | 3 | 1-17 |

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## Recommendation

- Requesting Approval to launch the MS-SCM program at PNSL starting Spring 2025 (March 2025) subject to:
  - Availability of PhD faculty duly recommended by RAC
  - PNSL currently has one PhD faculty, NHQ has assured transfer of another PhD by November 2024
- Principal approval is needed from the respected Academic Council to also apply for the NOC from HEC.

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## Program Need Analysis

- Corporate Feedback
- Admissions Analysis
- Alumni Feedback
- Academia Feedback

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## Program Need Analysis

1. The MS(SCM) program at PNSL is closely aligned with the existing MS(SCM) program at BUIC.
2. Program Educational Objectives (PEOs), Program Learning Outcomes (PLOs), and the roadmap are identical to BUIC's MS(SCM) program.
3. The key distinction: PNSL's MS(SCM) program is exclusively for PN officers, with no civilian participation at this stage.

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## Program Educational Objectives (PEOs)

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10/21/2024

## Program Educational Objectives (PEOs)

1. To equip students with advanced knowledge and skills in SCM domain
2. To prepare students so that they can contribute to organizational competitiveness and sustainability (leadership and innovative thinking)
3. Graduates will be proficient in conducting research and data analysis
4. Graduates exhibit strong ethical foundation and global perspective
5. To engage students in continuous professional development and lifelong learning

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## Program Educational Objectives (PEOs)

1. **Advanced Knowledge and Skills:**
   Graduates will possess advanced knowledge and skills in supply chain management domain enabling them to excel in complex and dynamic business environments
2. **Leadership and Innovation:**
   Graduates will contribute to organizational competitiveness and sustainability by demonstrating not only leadership capabilities but also innovative thinking
3. **Research and Analytical Expertise:**
   Graduates will be proficient in conducting research and data analysis, using quantitative and qualitative methods to solve real-world supply chain problems

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## Program Educational Objectives (PEOs)

4. **Ethical and Global Perspective:**
   Graduates will exhibit strong ethical foundation and global perspective, understanding the impact of supply chain decisions on society and the environment, and will be committed to sustainable and socially responsible practices.
5. **Professional Development and Lifelong Learning:**
   Graduates will engage in continuous professional development and lifelong learning, staying current with emerging trends, technologies, and best practices in supply chain management to maintain their professional relevance and effectiveness

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## Program Learning Outcomes (PLOs)

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## Program Learning Outcomes (PLOs)

1. Supply Chain Management (SCM) Knowledge
2. Problem Solving
3. Industrial Liaison
4. Research
5. Certifications in SCM
6. Ethics

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## Program Learning Outcomes (PLOs)

1. **Supply Chain Management (SCM) Knowledge:**
   Gain SCM knowledge, including skills, tools, techniques, in all the Knowledge Areas and Process Groups intrinsic to SCM and in the fields of learning that support, or are essential to, SCM. Apply knowledge gained in the intrinsic and extrinsic fields of SCM.
2. **Problem Solving:**
   Able to identify problems arising on Projects, preventively and in real time, analyze them in all their dimensions and offer viable solutions. Develop ability to work individually when situations so demand, through individual exercises and foster a sense of teamwork through group activities, a project being a team effort.
3. **Industrial Liaison:**
   Observe and discuss SCM in practice through visits of Transportation hubs, Production houses, Industrial plants, Project sites and corporate head offices.

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10/21/2024

## Program Learning Outcomes (PLOs)

4. **Research:**
   Develop research acumen through project case studies and project reports and learn the essentials of research methodology leading to a full-fledged MS-level thesis.
5. **Certifications in SCM:**
   Prepare the students for SCM certifications, including certifications in related fields.
6. **Ethics:**
   Develop a strong sense of ethics, and commitment to professional ethics and responsibilities, by identifying and case studying contemporary malpractices in SCM.

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## PEOs & PLOs Mapping

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## PEOs & PLOs Mapping

| | PLOs | PEO 1 | PEO 2 | PEO 3 | PEO 4 | PEO 5 |
|---|---|---|---|---|---|---|
| PLO 1 | Supply Chain Management (SCM) Knowledge | ✓ | | | | |
| PLO 2 | Problem Solving | | ✓ | ✓ | | |
| PLO 3 | Industrial Liaison | | ✓ | | | ✓ |
| PLO 4 | Research | | | ✓ | | |
| PLO 5 | Certifications in SCM | ✓ | | | | ✓ |
| PLO 6 | Ethics | | | | ✓ | |

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## Salient Features of the Program

- Blend of supply chain, data analytics, research and development skills
- Integration of digital transformation and advanced technologies relevant to naval logistics
- Graduates will focus on practical applications for improving efficiency in PN supply chains, such as optimizing inventory for combat readiness and managing critical logistics during deployment
- Guest Speaker Sessions by SCM Corporate Professionals
- Experiential Learning from PN different divisions/department/depots and Industrial nation wide Visits

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## Job Market

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## Job Market

- Part of OJT (on-job-training) for the currently working individuals in different supply chain management roles in PN organization
- MS SCM degree program will be offered to the PN Officers having following attributes:
  - BS SCM degree
  - Rank of Lt and Lt Cdr with seniority bracket or working experience in the supply chain field of 9 to 12 years

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10/21/2024

## Job Market

The MS SCM prepare graduates for supply chain management field for the following roles, responsibilities and careers:

- Strategic Supply Chain Roles
- Senior Procurement Management
- Advanced Risk Management
- Supply Chain Analytics
- Leadership Positions
- Consultancy

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## Job Market

The MS SCM prepare graduates for supply chain management field for the following roles, responsibilities and careers:

- Global Logistics Coordination
- Integrated Logistics Support
- Project Coordinator
- Policy and Compliance
- Operational Excellence
- Technology Integration

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## Minimum Entry Level/Eligibility Criteria

- Admission to an MS/MPhil/Equivalent Degree Programs
  - Basic Academic Qualification: Sixteen years of schooling or 4 year education (minimum 120 credit hours) after HSSC/F.A./F.Sc/Grade 12 or Equivalent shall be required for admission in the MPhil/MS/Equivalent program.
  - CGPA 2.0 or 60%
  - Admission Test: PNSL is required to:
    - Conduct a rigorous admission test as an eligibility condition for admission to MS/MPhil/Equivalent programs, with a passing score of 50%. OR
    - Accept the GRE/HAT General/Equivalent tests, with a passing score of 50%.

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## Skills Set of the MS-SCM Graduate

- Supply Chain Management Skills
- Strategic Thinking and Decision Making
- Procurement and Supplier Relationship Management
- Financial Acumen in Supply Chain Contexts
- Risk Management and Mitigation
- Sustainable Supply Chain Practices
- Advanced Analytical and Simulation Skills
- Legal and Regulatory Compliance
- Maritime and Logistics Operations Expertise
- Research and Analytical Skills
- Leadership and Team Management

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Program Financials

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## Program Financials

- **Proposed Date of Commencement:** Spring 2025 (from March 2025)
- **PNSL, already offering a rigorous Supply Management Advanced Course (SMAC) that combines theory and practical modules for extensive career growth. Transform to a degree program.**
- **Existing infrastructure can be utilized to most of the extent?**
- **PNSL has initiated hiring process for a PhD faculty member specializing in the SCM domains**
- **Number of Admissions Expected for First semester Intake:** 15 to 20

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Program Title: **MS (SCM)**
Duration: 1.5 Years
Total Credit Hours: 33
Endorsement References:
A: Recommendations of CAC dated 21/05/2024 (recorded in the minutes of CAC meeting)
B: Recommendations of DBOS dated 24/05/2024 (recorded in the minutes of DBOS meeting)
C: Recommendations of FBOS dated 26/06/2024 (recorded in the minutes of FBOS meeting)

**Summary of Credit Hours**

| Sr. No. | Courses as per HEC new GE Policy 2023 | Credit Hours/Contact Hours | |
|---|---|---|---|
| | | Existing Road Map | Proposed New Road Map |
| 1. | Major/Disciplinary | 27 | 27 |
| 2. | Electives toward specialization/Thesis | 6 | 6 |
| 3. | Deficiency course in case of candidate from other domain or interdisciplinary domain | - | - |
| Total | | 33 | 33 |

**Semester-wise Road map**

**Semester 1**

| Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | | |
|---|---|---|---|---|---|---|
| | Pre-requisite Course Code | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment (please mention relevant SDG No. | Remarks |
| 1 | | SCM701 | Fundamentals of Supply Chain Management | 3 | 1-17 | |
| 2 | | SCM 734 | Advanced Negotiation, Contracting & Law in Procurement and Supply | 3 | 1-17 | |
| 3 | | SCM 728 | Advanced Supplier Selection & Bid Evaluation | 3 | 1-17 | |
| | | | Total Credit Hours | 9 | | |

**Semester 2**

| Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | | |
|---|---|---|---|---|---|---|
| | Pre-requisite Course Code | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment (please mention relevant SDG No. | Remarks |
| 1 | | SCM 729 | Advanced Business Research Methods (Focus on SCM) | 3 | 1-17 | |
| 2 | | SCM707 | Contemporary Issues in Supply Chain | 3 | 1-17 | |
| 3 | | SCM 730 | Advanced Inventory & Logistics Operations | 3 | 1-17 | |
| 4 | | SCM706 | Operations Management & Supply Chain | 3 | 1-17 | |
| | | | Total Credit Hours | 12 | | |

**Semester 3**

| Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | | |
|---|---|---|---|---|---|---|
| | Pre-requisite Course Code | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment (please mention relevant SDG No. | Remarks |
| 1 | | SCM708 | Strategic Supply Chain Management | 3 | 1-17 | |
| 2 | | SCM 731 | Advanced Supply Chain Finance | 3 | 1-17 | |
| 3 | | SCMXXX | Elective- 1 (Specialization) | 3 | 1-17 | |
| 4 | | SCMXXX | Elective- 2 (Specialization) | 3 | 1-17 | |
| | | | Total Credit Hours | 12 | | |

**List of Elective Courses**

| Sr. No. | Proposed Road map aligned with HEC new PG Policy | | | | | |
|---|---|---|---|---|---|---|
| | Pre-requisite Course Code | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment (please mention relevant SDG No. | Remarks |
| 1 | | SCM721 | Leadership in Procurement and Supply | 3 | 1-17 | |
| 2 | | SCM722 | Managing Risks in Supply Chains | 3 | 1-17 | |
| 3 | | SCM 732 | Advanced Supply Chain | 3 | 1-17 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | Diligence | | | |
| 4 | | SCM724 | Category Management in Procurement and Supply | 3 | 1-17 | |
| 5 | | SCM725 | Regulatory Framework for Trade Harmonization in International Supply Chain | 3 | 1-17 | |
| 6 | | SCM726 | Mathematical Modeling & Optimization Techniques in Supply Chain | 3 | 1-17 | |
| 7 | | SCM 733 | Advanced Software & Simulations | 3 | 1-17 | |

**List of Projects**

| Sr. No. | Proposed Road map aligned with HEC new UG Policy | | | | | |
|---|---|---|---|---|---|---|
| | Pre-requisite Course Code | Course Code | Course Title | Credit Hours | 17 UN SDGs alignment (please mention relevant SDG No. | Remarks |
| 1 | Nil | Nil | Nil | 3 | Nil | |

**Appendage 4725**

10/25/2024

## REVISED TABLE OF SPECIFICATION FOR MBBS & BDS PROGRAM WITH 70% BCQs & 30% SAQs

### SUBJECT WITH 150 MARKS

- BCQS OF 84 MARKS
- SAQS OF 36 MARKS (09 QUESTIONS WITH 04 MARKS EACH)

### SUBJECT WITH 100 MARKS

- BCQS OF 56 MARKS
- SAQS OF 24 MARKS (06 QUESTIONS WITH 04 MARKS EACH)

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