

**Minutes of
41st Meeting of the Academic Council**

held on 17, 18 & 19 May 2022

through VLC



Directorate of Academics

Bahria University Islamabad

Reference Designators & Terms used in this Document

These designators/terms are meant to introduce clarity, standardization and ease of reference while consulting or referring to this document.

Example: Item 2213 means item No 13 taken up by the 22nd ACM

Decision on ~~conn~~

New Item Example: Decision 2213 means Decision on Item 2213.

Example: Decision 2213.b means Decision 2213, clause 'b'.

Example: Decision 2213.b.3 means Decision 2213, clause 'b', sub-clause '3'

Decision on o₂O₂(o₂o₂nn)

Previous Item Example: Decision 22(1930) means Decision taken by the 22nd ACM on the previous/review Item 1930.

Example: Decision 22(1930).b means Decision 22(1930), clause 'b'.

Example: Decision 22(1930).b.3 means Decision 22(1930), clause 'b', sub-clause '3'.

Action

Authority, Entity, Official, Person, Unit, Dept, Office, etc required to implement the decision

Responsibility

The supra single Authority, Entity, Official, Person, etc required to:

- a. Coordinate the actions taken by the Authorities, Entities, Officials, Persons, Units, Depts, Offices, etc listed against “Action”.
 - b. Report to the Council the progress on the matter, through periodic progress reports and at the meeting of the Council.
 - c. Be responsible to the Competent Authority, and the Council, for the case/issue overall /point/item he or she has been made responsible for.

Statutory Documents affected

Most decisions of the Academic Council imply amendments to the relevant statutory documents. These amendments shall be processed and incorporated into the said documents forthwith and certainly before the next meeting of the Academic Council. The responsibility of processing the amendments and incorporating them into the statutory documents shall be as per the Registrar Notification 23/2015 dated 25th May 2015.

Deadlines

Any time period deadlines shall count from the date of issue of the minutes. Time period in days shall imply working days.

Acronyms and Abbreviations used in this Document

AACSB	Association to Advanced Collegiate School of Business
BBS	Bahria Business School
BSEAS	Bahria School of Engineering and Applied Sciences
BH3S	Bahria Humanities and Social Sciences School
BUAR	Bahria University Academic Rules
BUCPT	Bahria University College of Physical Therapy
BUDC	Bahria University Dental College
BUHSC	Bahria University Health Sciences Campus
BUIC	Bahria University Islamabad Campus
BUKC	Bahria University Karachi Campus
BULC	Bahria University Lahore Campus
BULS	Bahria University Law School
BUMDC	Bahria University Medical & Dental College
BUMC	Bahria University Medical College
CH	Credit Hour(s)
CCH	Course Codes Handbook
CE	Computer Engineering
CS	Computer Sciences
CSE	Computer & Software Engineering
DA	Director Admissions
DAcad	Director Academics
DIPP	Director IPP
DLC	Director Lahore Campus
DS	Dental Section BUMDC
EDC	Estimated Date of Completion
EE	Electrical Engineering
EES	Earth & Environmental Sciences
EP	Examination Policy
ES	Engineering Sciences
FHB	Faculty Handbook
FYP	Final Year Project
HS	Health Sciences
HSS	Humanities & Social Sciences
iaw	in accordance with
IR	International Relations
MS	Management Sciences
NCEAC	National Computing Education Accreditation Council
NBEAC	National Business Education Accreditation Council
PMC	Pakistan Medical Commission
PNC	Pakistan Nursing Council
PNNC	Pakistan Navy Nursing College
PFM	Permanent Faculty Member
PFM	Permanent Faculty Member
PH	Public Health
SE	Software Engineering
SHB	Students Handbook
SCM	Supply Chain Management
UG	Undergraduate
URD	User Requirements Document
VFM	Visiting Faculty Member
wef	with effect from

Attendance**BUHO****Present**

1. Vice Admiral Kaleem Shaukat HI(M) (Retd)	Rector	In Chair
2. Rear Admiral Nasir Mahmood HI(M) (Retd)	Pro-Rector (RIC)	Member
3. Surg Rear Adm Najm Us Saqib Khan HI(M), T.Bt (Retd)	Pro-Rector (HS)	Member
4. Rear Admiral Zaka Ur Rehman HI(M) (Retd)	Pro-Rector (Academics)	Member
5. Cdre Shafqat Azad SI (M), S.Bt (Retd)	Registrar	Member
6. Dr. Atif Raza Jafri	Dean (ES)	Member
7. Dr. Muhammad Naveed	Dean (MS)	Member
8. Dr. Adam Saud	Dean (H & SS)	Member
9. Dr. Usman Hameed	Dean (Law)	Member
10. Cdre Asim Raza SI(M) (Retd)	Dir Academics	Member & Secy
11. Cdre Nasrullah SI(M) (Retd)	Controller of Exams	Member
12. Cdre M Masud Akram SI(M), S.Bt	Dir Admissions	Member
13. Brig Asif Ali Asif (Retd)	Dir Health Sciences	Member
14. Dr. Riaz Ahmed	Dir PGP	Member
15. Mr. Fazal Wahab	Dir DQA	Member
16. Dr. Saleem Aslam	Dir R&D/ ORIC	Member
17. Dr. Sobia Shujaat	Dir LDC	Member

In Attendance

18. Ms. Sundal Mufti	Dir Student Affairs
19. Mr. Rizwan Aamir	Dir IT
20. Captain Azhar Iqbal PN (Retd)	Dy. Registrar (Academics)
21. Cdr Zulfiqar Haider Malik PN (Retd)	Dy. Registrar (Regulations)
22. Cdr Adnan Umer PN	Dy. Director (Academics)
23. Cdr Muhammad Younas PN (Retd)	Coordinator (SMP Dte)
24. Mr. Haroon Khan	Assistant Director (IO)

BUIC**Present**

25. Rear Admiral Naveed Ahmad Rizvi HI(M) (Retd)	DG	Member
26. Dr. Awais Majeed	HOD (SE) BSEAS-IC	Member
27. Dr. Shahzad Hassan	HOD (CE) BSEAS-IC	Member
28. Dr. Junaid Imtiaz	HOD (EE) BSEAS-IC	Member
29. Dr. Samreen Fahim Babar	HOD (MS) BBS-IC	Member
30. Dr. Khalil Ullah Muahmmad	HOD (BS) BBS-IC	Member
31. Dr. Farrukh Shahzad	HOD(Media Studies)BH3S-IC	Member
32. Dr. Muhammad Umar Hayat	HOD (HSS) BH3S-IC	Member
33. Dr. Muhammad Fayyaz	HOD (Law) BH3S-IC	Member
34. Dr. Rizwana Amin	HOD (PP) BH3S-IC	Member
35. Dr. Syed Muhammad Shahid Tirmazi	HOD (IS) BH3S-IC	Member

In Attendance

36. Captain Sarfraz Khan PN (Retd)	Deputy Director (Academics)
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BUKC**Present**

37. Vice Adm Khawaja Ghazanfar Hussain HI(M) (Retd)	DG	Member
38. Cdre Muzammil Hussain SI(M), SE (Retd)	Director Admin	Member
39. Dr. Mustaghis ur Rehman	Associate Dean (MS)	Member
40. Dr. Saima Zia	Principal BBS-KC	Member
41. Dr. Sohaib Ahmed	Principal BSEAS-KC	Member
42. Dr. Oyoon A Razzaq	Principal BH3S-KC	Member
43. Dr. Salma Hamza	HOD (E&ES) BSEAS-KC	Member
44. Engr. Dr. Syed Safdar Ali	HOD (CS) BSEAS-KC	Member
45. Engr. Dr. Najam M. Amin	HOD (EE) KC	Member
46. Dr. Liaqat Ali	HOD (MS) KC	Member
47. Dr. Shoaib Mughal	HOD (CE) KC	Member
48. Dr. Asif Inam	HOD (Maritime Sciences)	Member
49. Dr. Talat Sharafat Rehmani	HOD (H&SS) BH3S-KC	Member
50. Dr. Abdul Qadir	HOD (IS) BH3S-KC	Member
51. Dr. Osama Rehman	HOD (SE) KC	Member
52. Senior Lecturer Mah-e-Darakshan	HOD (Media Studies) BH3S-KC	Member

In Attendance

53. Captain Zaheer Ahmed PN (Retd)	Dy. Director (Academics)
54. Dr. Waqar ud Din	Dy. Director ORIC
55. Engr. Erum Shafiq	Asst Director QA
56. Shaista Iftikhar	Assistant Professor E&ES Deptt

BULC**Present**

57. Cdre Naveed Anwar Cheema SI(M), T.Bt	Director	Member
58. Dr. Adnan Hushmat	HOD (MS)	Member
59. Dr. Khawaja Qasim Maqbool	HOD (CS&IT)	Member
60. Dr. Urooj Sadiq	HOD (PP)	Member

In Attendance

61. Muhammad Umair Saeed	Manager QA
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BUHSC**Present**

62. Vice Admiral Khalid Amin HI(M) (Retd)	DG	Member
63. Cdre Muhammad Irfan SI(M) (Retd)	Director	Member
64. Prof. Dr. Ambreen Usmani	Dean HS/ Principal	Member
65. Prof. Dr. Wahab Bukh Kadri	Principal BUDC	Member
66. Prof. Dr. Khalid Mustafar	Vice Principal	Member
67. Prof. Dr. Kulsoom Fatima	Vice Principal	Member
68. Prof. Dr. Khalid Aziz	Vice Principal (DPT)	Member
69. Cdr Syeda Afshan	Principal PNNC	Member
70. Ms. Abida Razzaq	Vice Principal (PNNC)	Member
71. Prof. Dr. Talea Hoor	Joint Director (DME)	Member
72. Prof. Dr. Shakeel Ahmed	HOD (Paediatrics)	Member
73. Prof. Dr. Naheed Sultan	HOD (Surgery)	Member
74. Prof. Dr. Nasim Karim	HOD (Pharmacology)	Member
75. Prof. Dr. Iqbal Hussain Updipurwala	HOD (ENT)	Member
76. Prof. Khalida Nasreen Abdullah TI(M)	HOD (Obst and Gynae)	Member

77. Prof. Dr. Nighat Rukhsana	HOD (Physiology)	Member
78. Prof. Dr. Hasan Ali	HOD (Biochemistry)	Member
79. Prof. Dr. Mahreen Lateef	HOD MLT (MDRL)	Member
80. Prof. Dr. Inayat Hussain Thavar	HOD (Community Med)	Member
81. Prof. Dr. Sameer Shahid Ameen	HOD (Eye)	Member
82. Prof. Dr. M Sajid Abbas Jaffri	HOD (Medicine)	Member
83. Prof. Dr. Syed Ahmed Omer	HOD (Dental)	Member
84. Dr. Tabassum A Qadeer	HOD (Orthodontists)	Member

In Attendance

85. Prof. Dr. Brig (Retd) Pervez Asghar	Professor of Medicine
86. Prof. M. Najam Shabbir	Professor of Surgery
87. Prof. Naveed Faraz	Professor of Pathology
88. Prof. Dr. Tasneem Fatima	Professor of Anatomy
89. Prof. Dr. Summaya Shawana	Professor of Pathology
90. Prof. Dr. Syed Ijaz Hussain Zaidi	Professor of Pharmacology
91. Prof. Dr. Bibi Kulsoom	Professor of Biochemistry
92. Prof. Dr. Shaikh Abdul Saeed	Professor of Physiology

IPP

Present

93. Dr. Zainab Hussain Bhutto	Dean PP/ Director	Member
94. Dr. Kiran Bashir Ahmed	HOD (IPP) KC	Member

PNSL

Present

95. Cdr Moazzam Afzal PN	CO PNSL	Member
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In Attendance

96. Lt Cdr Syeda Nabila Hassan PN	OI/C Exams Cell
97. Asmat Ullah	Instructor

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Proceedings

Preliminaries

Commencement of the Meeting, Opening Remarks of the Chair and Meeting Schedule

1. With the quorum complete, the proceedings commenced at 10:30 hrs on 17th May 2022 with recitation from the Holy Quran. The meeting was held till 16:30 hrs that day (with lunch & prayer break between 13:00 to 14:00 hrs); continued the next day (18th May 2022) from 10:45 hrs till 17:00 hrs (with lunch & prayer break between 13:00 - 14:00 hrs); and concluded on 19th May 2022 with the session held between 10:45 to 18:00 hrs (with lunch & prayer break between 13:00 to 14:00 hrs).

Confirmation of the Minutes of the 40th ACM held on 5-7 October 2021

2. The Secretary apprised the Council that draft minutes of the 40th ACM were communicated to all Members/ non-member participants on 19 October 2021. Comments thus received were incorporated accordingly, followed by processing on file for approval of the honorable Rector. Approved minutes were thereafter disseminated to all concerned for implementation, on 2 November 2021 through OAS.

3. These Minutes included the **Mapping of BS in Accounting & Finance and BS in Economics Programs with ICAP** vide **Item 4005**, which comprised of approving the equivalence of ICAP courses with BU courses of BS (Accounting & Finance) and BS (Economics) while abiding by relevant BU Rules and procedures. However, during the processing of an ICAP proposal for collaborative degree programme, it was pointed out by the Registrar that the HEC Notification upon which the above stated Decision was taken authorized only the CAF qualification for admission in BS (A&F). As such, Decision 4005 of the last ACM was proposed to be amended as under, which was approved by the Chair after due deliberation:

The Council approved the equivalence of ICAP CAF qualification for transfer of credits in BS (Accounting & Finance) only as presented (tabulated at para 106) based on the reciprocal Policy of ICAP at Appendage 4005; while abiding by BU Rules and procedures for at least 50% completion of courses of BU program roadmap to be eligible for the award of degree. Point dropped.

Decision

4. Minutes of 40th ACM are hereby confirmed with **amended Decision 4005** as given above, for compliance by all concerned accordingly.

Action Required	Action by	Responsibility of
Implementation of the Decision	Registrar, CE, Principal BBS-IC & KC, Dir BULC	Dean MS
Statutory Documents Affected	Updating of Minutes of 40 th ACM	

Review Items

Item 3321: Approval of 4.5 Years as minimum duration of the Bachelor of Science in Supply Chain Management Program being conducted by the PNSL

Responsibility: Dean MS

Decision of the 40th ACM

5. The following was decided:
 - a. Methodology for recording the re-examinations of PNSL students in the final transcript is to be finalized by Dean MS and CO PNSL, in consultation with CE, and progress to be reported in the next ACM.
 - b. PNSL is to pursue a formal mechanism with PNA for conduct of first 3 x semesters of its BS (SCM) programme, in consultation with DQA and progress is to be reported in the next ACM.
 - c. Decision on pursuance of MOU between BU and PNA or otherwise would be taken after finalizing the monitoring mechanism between the PNSL and PNA.
 - d. DQA will include PNA in its audit of BS (SCM) programme at PNSL.

Progress Reported

6. Progress of action items is as under:
 - a. CE will present the proposed methodology for recording the re-examinations of PNSL students in the final transcript, as concurred by Dean MS and DAcad.
 - b. As intimated by PNSL through CE, PNSL is conducting BS (SCM) degree programme through a formal mechanism with PNA since 2010; comprising of Phase-I (Semesters I-III) at Pakistan Naval Academy, Phase-II (6 x months Internship) on board PN Ships, and Phase-III (Semester V-IX) at PNSL.
 - c. QA has included PNA in its audit plan for BS (SCM) programme at PNSL.

Discussion

7. CE presented the methodology for recording the re-examinations of PNSL students in the final transcript, along with proposed new clauses in BU Examination Policy, related additions in Final Transcript and course codes of BS (SCM) Roadmap already approved in 30th and 36th ACM. After detailed deliberation, the Council approved the additions as presented; given at **Appendage 41(3321)** (page 53). The Council further granted consent for the mechanism between PNSL and PNA to conduct the first three semesters of BS (SCM) of PNSL students at PNA, while the Chair directed PNSL to include PNA in all its academic audits by DQA, as and when conducted.

8. While reviewing the observance of BS (SCM) Roadmap, the Chair advised PNSL to ensure compliance of mandatory CSP segment by each student through coordination with BUKC (Dept of MS, BBS-KC).

Decision 41(3321)

9. The following was approved by the Academic Council:
 - a. Addition of new clauses in BU Examinations Policy, course codes of BS (SCM) 4.5 Years Roadmap and related additions in Final Transcripts of PNSL graduates, as given at **Appendage 41(3321)** (page 53).
 - b. Related amendments in BU Academic Rules 7.9.6 and 7.10.3.

- c. Mechanism between PNSL and PNA to conduct the first three semesters of BS (SCM) of PNSL students at PNA.
10. The Chair further directed compliance of the following:
- a. PNSL is to include PNA in all its academic audits by DQA, as and when conducted.
 - b. Compliance of mandatory CSP segment is to be ensured by PNSL for all its students, through coordination with BUKC (as and when required).
11. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	CE, DAcad, DQA, CO PNSL, Principal BBS-KC	Dean MS
Statutory Documents Affected	Updating of BU Examination Policy, BU Academic Rules 2016 and BU Website	

Item 3516: Introduction of New Bachelor of Science Program in Geosciences (with Specialization: Marine Geology, Marine Geophysics; GIS & Remote Sensing)

Responsibility: DG BUKC

Decision of the 40th ACM

12. The Council decided that BUKC is to undertake a study to replace the currently offered programmes of E&ES with alternate programmes covering the contemporary field requirements along with interaction with related job market (i.e, OGDCL). The study is to be submitted for consideration and progress to be reported in next ACM.

Progress Reported

13. Thorough study regarding alternate program covering the contemporary field requirement and job market has been carried out by BSEAS-KC (Dept of E&ES) under the supervision of respective HOD, who will present the progress to Academic Council. Moreover, job market of MS and BS in Remote Sensing & GIS were discussed in detail during the DBOS meeting. After incorporating suggestions given by experts during the DBOS, detailed Roadmaps of MS and BS in Remote Sensing & GIS were presented in 25th FBOS (BSEAS) held on 26 January 2022; being presented as separate/ new agenda items in the ACM.

Discussion

14. HOD (E&ES) BUKC presented the study on *Revamping of Academic Programmes of E&ES*, undertaken by a Committee of the Dept of E&ES, BUKC as given at **Appendage 41(3516)** (page 59). Based on the interaction with the industry and reported persistent demand of *BS in Geosciences* graduates in the country, the Committee proposed to retain the *BS in Geosciences* programme with addition of specializations in Remote Sensing & GIS for mineral/ mining/ groundwater exploration. The Committee further proposed to reduce the fee structure of said programme by 25-30%.

15. During the discussion, it was noted that Public sector universities were offering UG programmes at much lower fee than that of Private sector HEIs like BU. The Chair advised to design the degree programmes with different contents for better competitiveness. It was further noted that the presented study did not cover an important part of the Decision of last ACM, "*replace the currently offered programmes of E&ES with alternate programmes covering the contemporary field requirements.*" This aspect was necessitated because the programmes *BS in Geology* and *BS in Geophysics* were already frozen, while low intake was being encountered for *BS in Geosciences*.

programme. Further, fee reduction recommended by the study lacked the required cost analysis. After further discussion, the Chair directed to improve the study as per already given requirements and process the same for consideration in the next ACM.

Decision 41(3516)

16. BUKC is to review the study on *Revamping of Academic Programmes of E&ES* for conformance of the Decision of the last ACM, along with proper financial proposal for given recommendations. The report is to be processed on priority for early decision and subsequent ratification of approved recommendations in the next ACM. Progress is to be reported.

Action Required	Action by	Responsibility of
Implementation of the Decision	HOD E&ES-BUKC	Dean ES
Statutory Documents Affected	None	

Item 3652: Approval of Case Writing Centers in Bahria Business School Islamabad and Karachi

Responsibility: Dean MS

Decision of the 40th ACM

17. Dean MS is to expedite the RBSC proposal through Principals BBS-IC and BBS-KC. Progress is to be reported in the next ACM.

Discussion

18. Principal BBS-KC presented the proposal for Research and Business Solution Center (RBSC) at BUIC and BUKC as given at **Appendage 41(3652)** (page 64). During subsequent discussion, it was noted by the Chair that the proposal contained the subject Centre only as a segment of a much bigger organization, while not giving the required details of how the Case Writing Centres (CWC) would function. As the CWC at BUIC and BUKC are principally approved in 36th ACM, the Chair directed to process their working mechanism through case file for approval and subsequent ratification in next ACM, while the proposal to set up RBSC at BUIC and BUKC was not approved by the Chair.

Decision 41(3652)

19. Nomenclature and working mechanism of Case Writing Centres (CWC) at BUIC and BUKC are to be processed on file for approval, followed by ratification in next ACM. The proposal for Research and Business Solution Center (RBSC) is not approved. Progress is to be reported for CWC in the next ACM.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principal BBS-KC	Dean MS
Statutory Documents Affected	None	

Item 3804: Maximum Number of Chances for Appearing in MBBS/ BDS Examination

Responsibility: Pro-Rector (HS)

Decision of 40th ACM

20. Proposals for the maximum chances for appearing in MBBS/ BDS exams as per PMC Rules are to be presented to the honorable Rector for suitable decision. Progress is to be reported in the next ACM.

Discussion

21. Policy covering the maximum number of chances for appearing in MBBS/ BDS examinations has been issued as given at **Appendage 41(3804)**. The same may be ratified by the Academic Council, while the point may be dropped.

Decision 41(3804)

22. The Policy at **Appendage 41(3804)** (page 77) is ratified by the Academic Council. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Dean HS	-
Statutory Documents Affected	None	

Item 3906: Addition of New Course “Ideologies and International Relations” as Elective PhD Course

Responsibility: Dean H&SS

Decision of 40th ACM

23. Course outline of the new proposed course Ideologies and International Relations is to be reviewed as directed in early timeframe. Progress is to be reported in next ACM.

Discussion

24. Sponsor of agenda item, HOD (H&SS) BH3S-IC, has requested to withdraw the proposal from ACM agenda. The point may, hence, be dropped.

Decision 41(3906)

25. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Dean H&SS	-
Statutory Documents Affected	None	

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

Responsibility: Pro-Rector (RIC)

Decision of 40th ACM

26. The proposal for School of Maritime and Applied Sciences and the programmes offered therein is to be completed by the Committee in early timeframe. Progress is to be reported in next ACM.

Progress Reported

27. A presentation on School of Maritime & Applied Sciences and the programmes offered therein was given to honorable Rector on 4 February 2022. Finalised proposal will be presented to the Academic Council by the HOD, Dept of Maritime Sciences BUKC.

28. In parallel, a local Committee at BUKC evaluated the possibility of launching the Program “BS Coastal & Marine Sciences” in Fall 2022 Semester. The following has been submitted as its outcome:

- a. Fall 2022 admissions are already in progress and launching an entirely new program without a systematic promotional/ awareness campaign is not advisable as the chance of poor intake is expected.

- b. Generating awareness at ground level (Outreach activity) is not possible as colleges are closed and students are preparing for their upcoming intermediate & A levels exams.
 - c. Running a social media/ digital campaign from April 2022 onwards will not be effective as potential students are busy with exam preparation and the use of social media is minimal before and during exams.
29. The Committee, therefore, was of the view that launching this program in Fall 2022 Semester is not feasible. The program *Bachelor of Science in Coastal & Marine Sciences* would be ready to be launched in Spring 2023 after the approval from ACM. Same will be presented in the forthcoming ACM. In this context, an extensive marketing campaign has been planned to be launched from May 2022 for the admission in Spring 2023 Semester.

Discussion

30. Committee proposal to set up the School of Maritime and Applied Sciences was presented by the HOD, Dept of Maritime Sciences BUKC, which was discussed in detail for its viability and applicability timeframe. After extensive deliberations by all the stake holders, the Council approved the launching of Bahria School of Maritime & Applied Sciences in June 2022, with 2 Departments as proposed by the Committee. The Chair advised to shift the Dept of Earth & Environmental Sciences (presently under BSEAS-KC) within the new School too, subject to feasibility/ consent by Dean ES. The Chair further directed to process the organogram of the new School on file as per standard procedure and promulgate the Committee Report d separately as guidelines for future adherence.

31. HOD, Dept of Maritime Sciences BUKC also presented the proposal for *Bachelor of Science in Coastal & Marine Sciences* for launching in Spring 2023 semester. The Chair showed concern on launching the proposed programme in Fall 2022 semester as intended earlier. The HOD submitted constraints due inadequate time for required aggressive marketing. The Registrar advised caution in launching the new programme to avoid any adverse effects on ongoing academic programme of the same Dept. DAcad indicated that proposed programme did not contain the hybrid structure suggested in the last ACM, nor was the outline included for the proposed new courses. The Chair directed to improve the launch proposal accordingly, including the review of title for Engineering perspective e.g. *Bachelor of Science in Marine & Coastal Engineering*, and process the revised proposal through FBOS for approval on file, followed by ratification in the next ACM. The Chair further advised to engage related public/ private sector departments (Fisheries, WWF, etc) for placement of programme graduates, while pursuing fellowships from related bodies through MoU, etc.

Decision 41(3910)

32. The following was approved by the Council:
- a. Bahria School of Maritime & Applied Sciences (BSMAS) is to be established within available BUKC premises w.e.f June 2022 with 2 x Departments: the Dept of Maritime Sciences and the Dept of Earth & Environmental Sciences.
 - b. Dept of Earth & Environmental Sciences under BSEAS-KC is to be shifted to the newly established BSMAS.
 - c. Organogram of BSMAS is to be processed for approval through the Registrar office, followed by ratification in the next ACM.
 - d. Committee Report for the *School of Maritime and Applied Sciences* is to be processed separately through the Acad Dte and the Registrar office, for approval and subsequent promulgation as guidelines for future adherence; while pursuing various phases of the new School as contained in the Report.

- e. Launch proposal for *Bachelor of Science in Coastal & Marine Sciences* is to be reviewed for hybrid structure, change of title to the *Bachelor of Science in Marine & Coastal Engineering*, and inclusion of outline of proposed new courses; followed by processing of revised proposal through FBOS for approval on file and ratification in the next ACM.
- f. Efforts are to be made to engage related public/ private sector departments (Fisheries, WWF, etc) for placement of the graduates of above stated programme, while pursuing fellowships from related bodies through MoU, etc.
- g. Progress is to be reported.

Action Required	Action by	Responsibility of
Implementation of the Decision	Dean ES, Dean MS, HOD (Maritime Sciences) BUKC	Pro-Rector (RIC)
Statutory Documents Affected	None	

Item 4001: Launch of New Program *Doctor of Philosophy in Computer Science* at BULC

Responsibility: Director BULC

Decision of 40th ACM

33. Launch of new programme *PhD in Computer Science* at BULC w.e.f Fall 2022 was approved by the Council as per the Roadmap, Elective Courses and their Course Descriptions contained in Appendage 4001; subject to NOC by the HEC. Progress is to be reported in next ACM.

Discussion

34. Launch proposal along with details has been submitted to HEC on 26 Jan 22 for scrutiny and NOC. Formal approval is awaited from HEC through DQA.

Decision 41(4001)

35. Progress is to be reported.

Action Required	Action by	Responsibility of
Implementation of the Decision	DQA	Director BULC
Statutory Documents Affected	None	

Item 4004: Introducing *Bachelor of Science in Project and Supply Chain Management*

Responsibility: Dean MS

Decision of 40th ACM

36. Proposed new programme is to be evaluated for effects on other BU programmes of similar composition and success rate by other HEIs. Progress is to be reported in the next ACM.

Discussion

37. HOD (MS) BBS-IC presented the proposal to replace *BS in Supply Chain Management* with the programme *BS in Project and Supply Chain Management*. DQA indicated that BS (SCM) had been launched as a new programme in Spring 2020 semester at BUKC and Fall 2020 semester at BUIC, while fresh intake was suspended in Spring 2022 semester at BUIC due to low intake. He proposed to let the BS (SCM) complete a cycle prior considering its replacement with another programme in case of low

intake. The Chair noted that the course *Project Management* was already taught in BBA programme, hence it may not be necessary to launch a degree programme with that title. DG BUKC also suggested to retain the BS (SCM) programme for some time prior deciding on its replacement. After detailed discussion, the Council did not approve the proposed replacement of academic programme.

Decision 41(4004)

38. Replacing BS (SCM) with the new programme *Bachelor of Science in Project and Supply Chain Management* is not approved. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principal BBS-IC, Principal BBS-KC	Dean MS
Statutory Documents Affected	None	

Item 4009: Vision and Mission of BH3S for Alignment with the BU Mission and Vision

Responsibility: Dean H&SS

Decision of 40th ACM

39. Vision, Mission and Objectives of BH3S-IC and KC are to be processed on case file for approval of the competent authority, followed by ratification in the next ACM. Progress to be reported.

Discussion

40. Vision and Mission statements of BH3S-IC and KC were approved on case file and presented to the Academic Council for ratification as given below:

Vision. To emerge as an internationally reputable school in Humanities and Social Sciences that continues to instill high academic and ethical values to produce socially responsible citizens.

Mission. To achieve high level of intellectual progress by offering conducive learning environment supported through strong linkages with industry and international community enabling students to critically analyze, acquire and disseminate knowledge and conduct rigorous research in the domain of social sciences.

Decision 41(4009)

41. Vision and Mission statements of BH3S-IC and KC are ratified as given above. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principal BH3s-IC, Principal BH3s-KC, DA, DIT	Dean H&SS
Statutory Documents Affected	BU Prospectus and website to be updated	

Item 4010: Vision, Mission and Objectives of Humanities and Social Sciences Department

Responsibility: Dean H&SS

Decision of 40th ACM

42. Vision, Mission and Objectives of H&SS Department, BH3S-IC and KC are to be processed on case file for approval of the competent authority, followed by ratification in the next ACM. Progress to be reported.

Discussion

43. Mission of H&SS Department, BH3S-IC & KC were approved on case file and presented for ratification by the Academic Council as given below:

To deliver quality education in the field of Humanities and Social Sciences using modern techniques enabling students to hone their research and communication skills and becoming positive social change agents of society through acquired knowledge and professional skills.

44. Objectives of H&SS Department, BH3S-IC & KC were finalized by FBOS-HSS and presented to the Academic Council for approval as given below:

- a. To enhance creativity in students assisting them to develop critical thinking so that they can produce reflective and analytical research.
- b. To focus on communication skills so that the students are able to maneuver in the society that may entail conflicting opinions while at the same time be able to resolve the issues.
- c. To provide the students with values of integrity, hard work, emancipation and most importantly loyalty to their future work or personal endeavors.
- d. To produce high quality graduates and researchers of humanities and social sciences who could put into practice the theories of relevant fields and develop understanding of diverse social background for collaborations and coexistence within the society.
- e. To provide appealing and convincing solutions to organizations on social challenges in national and international perspectives so as to develop societal values and venues for human prosperity.

Decision 41(4010)

45. Vision, Mission and Objectives of H&SS Department, BH3S-IC and KC are ratified/ approved by the Council as given above. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principal BH3S-IC, Principal BH3S-KC, DA, DIT	Dean H&SS
Statutory Documents Affected	BU Prospectus and website to be updated	

Item 4011: Vision, Mission and Objectives of Islamic Studies Department

Responsibility: Dean H&SS

Decision of 40th ACM

46. Vision, Mission and Objectives of Islamic Studies Department, BH3S-IC and KC are to be processed on case file for approval of the competent authority, followed by ratification in the next ACM. Progress to be reported.

Discussion

47. Mission of Islamic Studies Department, BH3S-IC & KC was approved on case file and presented to the Academic Council for ratification, as given below:

To impart quality Islamic education using modern techniques and tools and developing strong research and communication skills in our students to produce individuals who can act as effective social agents to bring positive social change in the world by advocating a holistic Islamic worldview.

48. Objectives of Islamic Studies Department, BH3S-IC & KC were finalized by the FBOS-HSS and presented to the Academic Council for ratification, as given below:

- a. To prepare graduates with comprehensive and constructive Islamic knowledge and provide opportunities to excel in every walk of life.
- b. To enhance creativity in students assisting them to develop critical thinking so that they can produce reflective and analytical research.
- c. To focus on communication skills so that the students are able to develop better strategies for conflict resolution in a multicultural society.
- d. To help students embody Islamic virtues enabling them to be productive for the Muslim community (Ummah).
- e. To strengthen the values of honesty, justice, bravery, leadership and humility by reconnecting 21st century generation with the legends of Islamic history.

Decision 41(4011)

49. Vision, Mission and Objectives of Islamic Studies Department, BH3S-IC and KC are ratified/approved by the Council as given above. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principal BH3S-IC, Principal BH3S-KC, DA, DIT	Dean H&SS
Statutory Documents Affected	BU Prospectus and website to be updated	

Item 4012: Approval of Updated & Unified Mission and Vision of the Department of Media Studies, BH3S-IC & KC
 Responsibility: Dean H&SS

Decision of 40th ACM

50. Vision, Mission and Objectives of the Dept of Media Studies, BH3S-IC and KC are to be processed on case file for approval of the competent authority, followed by ratification in the next ACM. Progress to be reported.

Discussion

51. Mission of Media Studies Department, BH3S-IC & KC was approved on case file and presented to the Academic Council for ratification as given below:

To provide a conducive learning environment to students in order to develop their academic, research and technological skills in the field of Media Studies and professionally groom them for media industry at national and international level.

52. Objectives of Media Studies Department, BH3S-IC & KC were finalized by the FBOS-HSS and presented to the Academic Council for approval as given below:

- a. Knowledge, professional skills, and research on media communication.
- b. Nurture student's ability to effectively communicate in both writing and verbally through various forms of media to articulate their point of view meaningfully and effectively.
- c. Contemporary media knowledge to pursue higher academic excellence and successful career in media industry and beyond.

Decision 41(4012)

53. Vision, Mission and Objectives of the Dept of Media Studies, BH3S-IC and KC are ratified/approved as given above. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principal BH3S-IC, Principal BH3S-KC, DA, DIT	Dean H&SS
Statutory Documents Affected	BU Prospectus and website to be updated	

Item 4013: Align Vision and Mission with BS in English Program Goals (including Vision & Mission of BSEAS, BBS, MS Dept BULC, POs/PLOs of other H&SS Programmes)

Responsibility: All Deans

Decision of 40th ACM

54. The following was decided:

- a. Vision and Mission of all BU Schools and their respective Departments are to be formulated and processed for competent authority approval through Pro-Rector (Acad), followed by ratification by the Academic Council.
- b. Programme Objectives (POs) and Programme Learning Outcomes (PLOs) of all academic programmes are to be approved in respective FBOS and ratified in subsequent ACM.
- c. Course Learning Objectives (CLOs) are to be approved in respective DBoS and ratified in subsequent FBOS.
- d. Progress is to be reported in the next ACM.

Discussion

55. Under the subject Agenda Item heading, Vision and Mission of BU Schools approved through case files and POs/ PLOs of BU academic programmes finalized by respective FBOS were presented as under, for ratification/ approval by the Academic Council:

- a. **Dean ES**

Bahria School of Engineering and Applied Sciences, Islamabad & Karachi (BSEAS-IC & KC)
Vision: To become a distinguished engineering and applied sciences school contributing towards strengthening of knowledge-based economy while addressing local and global societal challenges.
Mission: To groom students by inculcating professional attributes of engineering and applied sciences through deliverance of quality education and provision of conducive environment for applied research while having strong linkages with industry and international community.

b. Dean MS

Bahria Business School Islamabad (BBS-IC)
Vision: To be among leading business schools that produces knowledge and creativity driven business solutions for sustainable development of global society.
Mission: We provide transformational learning experience to a diverse student body to become business professionals through effective collegiate environment comprising of research, academics, and industrial engagement to meet the societal challenges.
Bahria Business School Karachi BBS-KC
Vision: To be among leading business schools to nurture creative minds for diverse solutions for industrial growth and societal development.
Mission: We prepare business leaders through contemporary educational practices and applied research in collaboration with local and international academia and industry while focusing on blue and green economy for sustainable development of society.
Department of Management Sciences, BULC
Vision: To be among leading business schools that develops professionals with competencies to lead and innovate for sustainable societal development.
Mission: We nurture responsible business professionals and entrepreneurs by providing quality education and applied research through immersive and collaborative learning and teaching environment, with strong industry linkages for sustainable societal impact.

c. Dean H&SS

Mission of Law Department, BH3S-IC/ Bahria University Law School (BULS)
To provide intellectual and professional training in legal education with strong focus towards academic excellence and to produce world class legal professionals and research scholars possessing high ethical values.
Objectives of Law Department, BH3S-IC/ Bahria University Law School (BULS)
<ul style="list-style-type: none"> i. To inculcate in students a broad and a nuanced understanding of the social, political and economic contexts within which the Pakistani and global legal systems operate; ii. To equip students with the critical knowledge and understanding of the fundamental doctrines and principles of Law and Jurisprudence. iii. To develop the intellectual and practical skills necessary for the legal profession and employment in public and private spheres. iv. To promote socio-legal research culture. v. To help improve human life through Law. vi. To create legal leadership in Pakistan.

POs and PLOs of Following H&SS Programmes, as given at Appendix 41(4013)		
i- Bachelor of Social Sciences ii- BS in Public Health iii- BS in Media Studies iv- BS in TV Broadcasting & Digital Media v- BS in English vi- LLB	i- LLM ii- LLM (International & Maritime Law) iii- MS in Islamic Studies iv- MS in International Relations v- MS in Applied Anthropology vi- MS in Media Studies	i- PhD (International Relations) ii- PhD (Media Studies) iii- PhD (Law)

56. After detailed discussion, the Council ratified the Vision and Mission statements, and approved the Objectives, POs and PLOs as presented; while deleting 'global' in the Vision of BBS-IC, deleting 'be among leading schools that' and inserting 'business' before 'professionals' in the Vision of the Dept of MS, BULC.

57. During the presentation of POs/ PLOs to the Council, the DQA proposed to review the last ACM decision at para 54. b. above, whereby the POs/ PLOs may be finalized and recommended by respective FBOS but approved by the Academic Council. The Council approved the proposal, while the Chair advised to process the urgent cases on file followed by ratification in the next ACM.

Decision 41(4013)

58. The following was decided by the Academic Council:

- a. Vision and Mission of BSEAS-IC & KC are approved as given at para 55. a. above.
- b. Vision and Mission of BBS-IC & KC and Dept of MS BULC are approved as given below:

Bahria Business School Islamabad (BBS-IC)
Vision: To be among leading business schools that produces knowledge and creativity driven business solutions for sustainable development.
Mission: We provide transformational learning experience to a diverse student body to become business professionals through effective collegiate environment comprising of research, academics, and industrial engagement to meet the societal challenges.
Bahria Business School Karachi BBS-KC
Vision: To be among leading business schools to nurture creative minds for diverse solutions for industrial growth and societal development.
Mission: We prepare business leaders through contemporary educational practices and applied research in collaboration with local and international academia and industry while focusing on blue and green economy for sustainable development of society.
Department of Management Sciences, BULC
Vision: To develop business professionals with competencies to lead and innovate for sustainable societal development.
Mission: We nurture responsible business professionals and entrepreneurs by providing quality education and applied research through immersive and collaborative learning and teaching environment, with strong industry linkages for sustainable societal impact.

- c. Mission and Objectives of the Law Department, BUIC/ BULS are approved as given at para 55. c. above.
- d. POs and PLOs of H&SS programmes listed at para 55. c. above are approved as given at **Appendage 41(4013)**(page 78).
- e. POs and PLOs of all academic programmes are to be finalized by respective FBOS and approved by the Academic Council. However, urgent cases may be processed on file for approval, followed by ratification in next ACM.
- f. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Concerned Principals, DA, DIT	Deans ES, MS, H&SS, Law
Statutory Documents Affected	BU Prospectus and website to be updated	

Item 4015: Launch of New Program *Bachelor of Science in English* at BH3S-IC

Responsibility: Dean H&SS

Decision of 40th ACM

59. Launch proposal for the *Bachelor of Science in English* is approved with amended eligibility criteria and the Roadmap at Appendage 4015; with effect from Spring 2022 semester. POs and PLOs of the programme are to be formulated and processed for approval by the competent authority, followed by ratification by the Academic Council. Progress is to be reported in the next ACM.

Discussion

60. The Programme has been offered at BH3S-IC in Spring 2022 semester. A total of 179 students applied for it, out of which 31 have been given admission against target intake of 30. POs and PLOs of the programme have been finalised by FBOS-HSS, and approved by the Academic Council as part of Agenda Item 4013 (H&SS). As such, the point may be dropped.

Decision 41(4015)

61. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principal BH3S-IC	Dean H&SS
Statutory Documents Affected	BU Prospectus and website to be updated	

Item 4016: Launch of New Program *Master of Science in Government and Public Policy* at BH3S-IC

Responsibility: Dean H&SS

Decision of 40th ACM

62. Launch of *Master of Science in Government and Public Policy* at BH3S-IC is approved for commencement from Fall 2022 semester, subject to NOC from HEC, with amended Minimum Entry Level and the Roadmap as contained in Appendage 4016. Financial Details of the launch proposal are to be reviewed for inclusion of required faculty members and the progress is to be reported in the next ACM.

Discussion

63. HOD HSS, BH3S-IC presented the revised financial details for inclusion of required faculty members given at **Appendage 41(4016)** (page 86); as required in the last ACM. Meanwhile, HEC has been approached through QA Directorate for the NOC to launch subject programme; approval is awaited.

Decision 41(4016)

64. Progress is to be reported.

Action Required	Action by	Responsibility of
Implementation of the Decision	Director QA	Dean H&SS
Statutory Documents Affected	None	

Item 4017: Launch of New Program Bachelor of Science in Mathematics at BH3S-KC

Responsibility: Dean H&SS

Decision 4017

65. Launch of *Bachelor of Science in Mathematics* at BH3S-KC from Fall 2022 semester was in-principle approved by the Council, along with the Roadmap and Elective courses at Appendage 4017; while asking for a review of financial details to justify the cost effects. Progress is to be reported in the next ACM.

Progress Reported

66. The program will be offered at BUKC w.e.f Fall 2022 semester. Revised academic and financial details of the programme will be presented by concerned HOD for consideration by the Academic Council.

Discussion

67. HOD HSS, BH3S-KC presented the revised financial details as given at **Appendage 41(4017)** (page 91). The Chair opined that proposed fee structure appeared to be high vis-à-vis Public sector HEIs. Principal BH3S-KC confirmed that the same was comparable to some other Private sector universities. It was further confirmed that proposed programme structure was iaw HEC UG Education Policy 2020. After further discussion, the Council agreed to continue with already approved launch proposal and review its progress in the next ACM.

Decision 41(4017)

68. Launch of Bachelor of Science in Mathematics at BH3S-KC from Fall 2022 semester is approved based on the revised financial details given at **Appendage 41(4017)** (page 91). Progress is to be reported.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principal BH3S-KC	Dean H&SS
Statutory Documents Affected	None	

Item 4018: Introduction of Mandatory Media Lab Hours for BS in Television Broadcasting and Digital Media from Fall 2021

Responsibility: Dean H&SS

Decision of 40th ACM

69. The Council approved mandatory Media Lab Hours in the programme *BS in Television Broadcasting and Digital Media* at BH3S-IC from Fall 2021 semester as contained in Appendage 4018. Modalities for its depiction in the Final Transcript are to be worked out by Dean H&SS and the CE. Progress to be reported.

Discussion

70. Dean H&SS confirmed that amended Roadmap has been implemented w.e.f Fall 2021 semester, while modalities for its depiction in the Final Transcript have been finalised in FBOS-H&SS. Meanwhile, Media Studies Department is waiting for the appointment of approved Coordinator.

71. CE briefed the Council that Students Record Database (SRD) maintained by the Exams Dte has been updated in respect of related Course Code (MTB 450) and Credit Hours (80) for the segment *Practical Learning*. He presented the amended Transcript showing the Practical Learning (80 hours) as given at **Appendage 41(4018)**. After brief discussion, the Transcript was approved by the Council for adoption as presented.

Decision 41(4018)

72. Recording of Practical Learning (80 hours) on the Final Transcript of the graduates of *BS in Television Broadcasting and Digital Media* (from Fall 2021 Intake) is approved as given at **Appendage 41(4018)** (page 96). Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	CE, Principal BH3S-IC & KC	Dean H&SS
Statutory Documents Affected	None	

Item 4021: Vision, Mission, Objectives and Outcomes of the Institute of Professional Psychology and Departments of Professional Psychology and its Programs

Responsibility: Dean PP

Decision of 40th ACM

73. Vision, Mission and Objectives of IPP, the Dept of PP at BUIC & BULC and their Programmes are to be processed on file for approval of the competent authority, followed by ratification in the next ACM. Progress to be reported.

Discussion

74. Revised Vision and Mission of the IPP proposed by IPP (commensurate with new Vision and Mission of Bahria University) approved on file were presented for ratification by the Academic Council, along with approval of aligned Program Objectives (POs) and Program Learning Outcomes (PLOs) finalized by FBOS for the Professional Psychology programmes offered at IPP, BUIC & BULC; as given at **Appendage 41(4021)**. After brief discussion, the same were ratified/ approved as presented.

Decision 41(4021)

75. Revised Vision and Mission of the IPP are ratified by the Academic Council, while aligned Program Objectives (POs) and Program Learning Outcomes (PLOs) for the Professional Psychology

programmes offered at IPP, BUIC & BULC are approved; as given at **Appendage 41(4021)** (page 97). Point Dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Dir IPP, HOD PP-BUIC & BULC, DA, DIT	Dean PP
Statutory Documents Affected	BU Prospectus and website to be updated.	

Item 4023: Mission of Bahria University College of Physical Therapy

Responsibility: Dean HS

Decision of 40th ACM

76. Mission of BUCPT is to be processed on file for approval of the competent authority, followed by ratification in the next ACM. Progress to be reported.

Discussion

77. Mission statement of BUCPT approved on file was presented along with Mission statements of other BUHSC degree programmes (MBBS, BDS, BSN), for ratification by the Council. After brief discussion, the Academic Council approved the Mission statements for related institutes, i.e. BUMC, BUDC, BUCPT and PNNC; as given at **Appendage 41(4023)**.

Decision 41(4023)

78. Mission statement of BUCPT is approved as presented, along with Mission statements of BUMC, BUDC and PNNC; as given at **Appendage 41(4023)** (page 99). Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Concerned Principals, DA, DIT	Dean HS
Statutory Documents Affected	BU Prospectus and website to be updated	

Item 4024: Approval of Mission Statement of *BS in MLT (Medical Lab Technology)* Programme for alignment with BU Vision

Responsibility: Dean HS

Decision of 40th ACM

79. Mission of academic programme *Bachelor of Science in Medical Lab Technologies* is to be processed on file for approval of the competent authority, followed by ratification in the next ACM. Progress to be reported.

Discussion

80. Mission statements of *BS in MLT* approved on file was presented as given below and ratified by the Academic Council:

To prepare laboratory professionals equipped with knowledge, skills, and innovative research expertise, attained in a collegiate environment supported through national and international linkages, for provision of high quality services in the health care system.

Decision 41(4024)

81. Mission statements of *BS in MLT* is ratified by the Council as given above. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principal BUMC, DA, DIT	Dean HS
Statutory Documents Affected	BU Prospectus and website to be updated	

Item 4025: Formal Approval for Establishing *Bahria University College of Allied Health Sciences*

Responsibility: Dean HS

Decision of 40th ACM

82. The Council approved in-principle the setting up of the *Bahria University College of Allied Health Sciences (BUCAHS)* at BUHSC, Karachi. Organogram and infrastructure of the College are to be formulated and processed for approval of the competent authority, along with phase-wise adoption methodology, followed by ratification by the Academic Council. Progress is to be reported.

Discussion

83. Proposed organogram was presentation to Rector BU on 7 March 2022 along with phase-wise adoption methodology, which was approved with slight modification. HOD (MLT) BUMC present the same to the Academic Council, as given at **Appendage 41(4025)**, which was ratified by the Council after brief discussion.

Decision 41(4025)

84. Organogram and phase-wise adoption methodology of BUCAHS is approved by the Council, as given at **Appendage 41(4025)** (page 100). Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	DG BUHSC	Dean HS
Statutory Documents Affected	-	

Item 4027: Approval to Launch Doctor of Philosophy (PhD) Programme under the Faculty of Health Sciences at BUMDC

Responsibility: Dean HS

Decision of 40th ACM

85. The Council approved in-principle the launch of PhD programme under the Faculty of HS at BUHSC. Comprehensive proposal to this effect is to be presented in the next ACM.

Discussion

86. Chairperson PGP (BUMDC) presented the comprehensive proposal for launch of PhD programme under the Faculty of Health Sciences, as given at **Appendage 41(4027)**. Financial viability of the program was also discussed at length, including the . DG BUHSC indicated that the PhD programme would not be profitable but was being launched as an important capability of the institute. After detailed discussion, the proposal was approved along with relevant details, e.g. academic Roadmap, outlines of new courses, etc, for commencement from Spring 2023 semester; subject to NOC by the HEC.

Decision 41(4027)

87. Launch of PhD programme under the Faculty of Health Sciences is approved, as given at **Appendage 41(4027)** (page 104), for commencement from Spring 2023 semester subject to NOC by the HEC. Progress is to be reported.

Action Required	Action by	Responsibility of
Implementation of the Decision	CE, Chairperson PGP (BUHSC), DQA, DA, DHR, DIT	Dean HS
Statutory Documents Affected	None	

Item 4028: Formal Approval for Induction of Civilian Students in BS (Nursing) Program at PNNC

Responsibility: DG BUHSC

Decision of 40th ACM

88. The Council approved to induct civilian students at PNNC as BU students from Spring 2022 semester onward. Principal NC is to process the case of a suitably qualified Director PNNC through BU channel, while reviewing the fee structure of civilian students in conformance with standard credit-hours based calculations, and arranging hostel facilities for female students through suitable rented premises. Progress is to be reported in the next ACM.

Progress Reported

89. Sixteen civilian students have been inducted at PNNC for BSN programme and their session has started from 7 March 2022. Meanwhile, policy guidelines for nursing education in Pakistan have been received from Pakistan Nursing Council (PNC), which comprises of 10 x BSN/ Post-RN BSN/ Post-RN BSM qualified FMs and 1 x MSN qualified FM for BSN programme.

Discussion

90. Principal PNNC apprised that the College had registered 17 civilian students along with 26 service students (through GHQ) in Spring 2022 semester. Vice Principal PNNC had also joined (MSN qualified) after selection/ employment through BU Head Office. Contours of the first civilian students batch in PNNC was discussed in detail by the Academic Council. It was noted that fee structure for the female candidates from remote area needed to be reviewed, along with provision of hostel facility as an essential PNC requirement. While the first batch comprised of female students only, DG BUHSC proposed to induction the male students as well in subsequent batches for better financial viability. The Chair asked Pro-Rector (HS) to approach Commandant PNS SHIFA for hospital training of male civilian students. DG BUHSC also indicated the need to review the construction timeline for PNNC building due to increasing students and faculty strength. After further discussion, the Chair approved the inclusion of male candidates from next batch of BSN programme. He also asked DG BUHSC to explore the suitable options for provision of hostel facility to female civilian students.

91. Regarding faculty strength, the Chair was briefed that PNNC presently comprised of 4 uniformed FM (all BSN qualified) and 1 recently employed Vice Principal (MSN qualified). The Chair directed to gradually increase the FM strength for compliance with related PNC requirements.

Decision 41(4028)

92. The following is to be complied:

- a. Male applicants are to be included in BSN programme from the next batch onward, in coordination with PNS SHIFA.

- b. Fee structure for female civilian students from remote areas is to be reviewed for compatibility with other nursing institutes.
- c. Provision of hostel facility to female civilian students is to be explored by BUHSC.
- d. Timeline for construction of PNNC is to be reviewed for early availability vis-à-vis increasing strength of students.
- e. Faculty members of PNNC are to be gradually increased to meet the minimum requirement promulgated by PNC.
- f. Progress is to be reported.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principal PNNC, DHS	Dean HS
Statutory Documents Affected	None	

New Items

Item 4101: Interdisciplinary/ Stream Electives Selection in MS (EE) Programme

Sponsor: HOD (EE) BSEAS-IC

Referral Authority: FBOS-ES

Summary of the Case

93. MS (Electrical Engineering) offers specialization in 3 domains at BUIC and BUKC: **Automation & Control; Power Systems; and Communication Systems & IoT Networks**. MS students show interest in research themes that involve two specializations, e.g., **Power Systems & Control**, and **IOTs & Control** or other stream/ elective of MS(EE).

94. As per BU Academic Rule 4.4, "*the PG students may be permitted to choose up to 2 x interdisciplinary electives, if the chosen electives are available, feasible for the University and approved by concerned Departments.*" The same Rule may be made applicable to inter-specialization electives too, as deliberated in 25th meeting of FBOS-ES and referred to the Academic Council.

Discussion

95. The proposal was discussed threadbare by the Academic Council and agreed to amend/amplify BU Academic Rule 4.4 for provision of the option of inter-specialization electives in MS(EE) programme, while not compromising the Roadmap requirement of core courses of the specialization being pursued. It should not be compromised at all, while opting for interdisciplinary streams as proposed. Appropriate clause is to be shown related to information roadmap as BUAR & other documents to be amended accordingly.

Decision 4101

96. The following was approved by the Academic Council:

- a. Following may be added in BU Academic Rule 4.4: *Such choosing of electives is permitted inter-specialization too, subject to completion of the minimum required courses from the basic roadmap for the specialization being shown on the final transcript.*
- b. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Registrar, DAcad, DA, Principal BSEAS-IC & KC	Dean ES
Statutory Documents Affected	Amendment of BU Academic Rules, Updating of SHB	

Item 4102: Inclusion of Supervisor Marks in MS Thesis Evaluation

Sponsor: HOD (EE) BSEAS-KC

Referral Authority: FBOS-ES

Summary of the Case

97. In BU PG Rules 2017, MS Thesis is evaluated by External and Internal Examiners and the marks awarded by examiners are averaged, while the Supervisor is given no weightage in evaluation marks even though he/ she guides the student throughout the research period and has a better understanding of the student's efforts.

98. The point was discussed in FRC-ES, where it was suggested to check related policy of other reputable universities. Based on the information thus obtained, 25th meeting of FBOS-ES has recommended that MS Thesis Supervisor should also be a part of Thesis evaluation and the Thesis shall be graded by the members of the Defense Committee as per following weightage; which is submitted for consideration by the Academic Council:

- a. External Examiner – 40%
- b. Internal Examiner – 40%
- c. Supervisor – 20%

Discussion

99. The proposal was deliberated in detail but not approved by the Council due to the likelihood that provision 20% weightage to the supervisor may compromise the quality of the Thesis.

Decision 4102

100. Proposal is not approved by the Council. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Dean ES	-
Statutory Documents Affected	None	

Item 4103: Approval of PEOs and PLOs for Reconfigured Curriculum of BS(CS), BS(IT) and BS(AI) Programmes iaw OBE

Sponsor: HOD (CS) BSEAS-IC

Referral Authority: FBOS-ES

Summary of the Case

101. A committee was formulated by Dean ES to configure the curricula of Computing Programmes BS(CS), BS(IT) and BS(AI) in accordance with Outcome Based Education (OBE). The Committee, with support of subject experts, re-configured the curricula of these programmes and identified PEOs, PLOs and CLOs for each course along with corresponding mappings as given at **Appendage 4103**. The same were deliberated in 25th meeting of FBOS-ES and decided that OBE framework approved in 31st ACM (Item 3118) should be adopted for BS computing programmes too; subject to approval by the Academic Council.

Discussion

102. HOD (CS) BSEAS-IC presented the PEOs, PLOs and corresponding mapping thus prepared, given at **Appendage 4103**, for approval by the Academic Council. It was further explained that the recommendation included re-designing of the curriculum without changing the Roadmaps. After review of the proposal, the Council approved the PEOs, PLOs and corresponding mapping as presented.

Decision 4103

103. Revised PEOs, PLOs and corresponding mapping of Computing Programmes BS(CS), BS(IT) and BS(AI) are approved by the Council, as given at **Appendage 4103** (page 303). Point dropped

Action Required	Action by	Responsibility of
Implementation of the Decision	Principal BSEAS-IC, DA, DIT	Dean ES
Statutory Documents Affected	BU Prospectus and website to be updated	

Item 4104: Anomaly of using the Title *Power Systems* in Related Stream of BEE Programme

Sponsor: HOD (EE) BSEAS-KC

Referral Authority: FBOS-ES

Summary of the Case

104. According to 30th & 34th ACM, **Power Systems** stream of BEE program was started w.e.f Fall 2017 Intake. However, the PEC has approved this stream with title **Power** only. In order to remove this anomaly, approval has been obtained from honorable Rector through case file to replace **Power System** with **Power** on Final Transcripts for related programme, which may be ratified by the Academic Council.

Discussion

105. The Council ratified the amendment on Final Transcript of BEE programme as described above.

Decision 4104

106. Replacement of the title **Power System** with **Power** on Final Transcript of BEE graduates is ratified by the Academic Council. Point Dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	CE	Dean ES
Statutory Documents Affected	Final Transcript of BEE graduates to be amended accordingly	

Item 4105: Extension in Time-Bar as per Relaxation given by PEC

Sponsor: HOD (SE) BSEAS-IC

Referral Authority: FBOS-ES

Summary of the Case

107. PEC has given time bar relaxation to those students who have been unable to complete their undergraduate degrees within allowed time period of 7 years, to appear in the exams/ evaluations till 31 December 2023, vide letter at **Appendage 4105**. Related Time Bar Waiver cases were processed through case file. However, the DQA has recommended to get one-time approval of said extensions from the ACM.

108. The proposal was accordingly deliberated in 25th meeting of FBOS-ES and recommended for one-time extension in Time Bar by the Academic Council as per PEC Policy at **Appendage 4105** to those students who are willing to complete their incomplete degree programme by 31 December 2023.

Discussion

109. After brief discussion, the Council approved the adoption of above stated Time Bar relaxation given by the HEC. It was, however, indicated that Time Bar Waiver cases of only those applicants would be processed who can complete pending progress by given tentative, i.e. 31 December 2023.

Decision 4105

110. The Council approved one-time extension in Time Bar given by the PEC vide its Policy at **Appendage 4105** (page 309), to those students who are willing to complete their incomplete degree programme by 31 December 2023. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principals BSEAS-IC & KC, Registrar, CE	Dean ES
Statutory Documents Affected	None	

Item 4106: Changes Required in BS (CE) Curriculum 2020

Sponsor: HOD (CE) BSEAS-IC

Referral Authority: FBOS-ES

Summary of the Case

111. BS (CE) 2020 curriculum was approved in 36th ACM. However, certain inconsistencies have been identified in approved Roadmap, as listed at **Appendage 4106**. Review of said curriculum was accordingly deliberated in 25th meeting of FBOS-ES and recommended for approval of updated curriculum by the Academic Council.

Discussion

112. HOD (CE) BSEAS-IC presented the revised curriculum of BS (CE), which was approved by the Council after brief discussion.

Decision 4106

113. Revised curriculum of BS (CE) is approved by the Academic Council, as given at **Appendage 4106** (page 310). Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	CE, Principals BSEAS-IC & KC, DA, DIT	Dean ES
Statutory Documents Affected	BU Prospectus and website to be updated	

Item 4107: Revision of PEOs of BS (CE) Programme

Sponsor: HODs (CE) BSEAS-IC & KC

Referral Authority: FBOS-ES

Summary of the Case

114. Visitation team appointed by Engineering Accreditation Board (EAB) of PEC conducted 2-day accreditation visit of the Dept of Computer Engineering at BSEAS-KC on 27-28 December 2021, to evaluate BS (CE) programme. It was highlighted during the visit that PEOs of the programme need to be reviewed. HOD (CE) BSEAS-KC presented revised PEOs of BS (CE) in 25th meeting of FBOS-ES as given at **Appendage 4107**, which have been recommended for approval by the Academic Council.

Discussion

115. HOD (CE) BSEAS-KC presented revised PEOs of BS (CE), which were approved by the Council after brief discussion.

Decision 4107

116. Revised PEOs of BS (CE) are approved by the Academic Council as given at **Appendage 4107** (page 311). Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principals BSEAS-IC & KC, DA, DIT	Dean ES
Statutory Documents Affected	BU Prospectus and website to be updated	

Item 4108: Applicability of MS Allowance to Faculty Members and Staff

Sponsor: HODs (SE) BSEAS-IC

Referral Authority: FBOS-ES

Summary of the Case

117. BU has been giving MS/ MPhil allowance to FMs/ staff either at the time of joining or once the junior faculty (especially Lab Engineers) improve their qualification; promulgated by DHR on 21 August 2021. However, MS allowance was discontinued in December 2021 while continuing the MPhil allowance.

118. All PG programmes being offered in Engineering, Computing and Earth & Environmental Sciences domains are offered as MS programmes, while MPhil programmes are more specifically offered in Applied Sciences domains, e.g, Mathematics, Physics, Chemistry and most of the H&SS domains.

119. The current Policy is discouraging for the junior faculty of Engineering Sciences, especially the Lab Engineers, and is cause of disparity among the faculty. Being an academic institution itself, it may be noted that there is no difference in MS and MPhil degrees and BU has made no such distinction in the past. HEC also considers both the degrees equivalent vide its letter at **Appendage 4108** (page 312).

120. HOD (SE) BSEAS-IC proposed in 25th meeting of FBOS-ES that faculty and staff members improving educational qualification through MS programme may be included for the MS/ MPhil allowance as per previous practice, for the uniform applicability of pay/ allowances policy. The FBOS-ES has recommended to submit the proposal for consideration and approval by the Academic Council.

Discussion

121. The Chair commented that subject agenda item should have been processed on file. However, considering the presence of the Treasurer and DHR for said item, the proposal was discussed in detail and approved by the Council as recommended.

Decision 4108

122. BU faculty and staff members improving educational qualification through MS programme (18 years education) are included for the MS/ MPhil allowance as per previous practice, with immediate effect. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	DHR	Dean ES
Statutory Documents Affected	DHR Notification to be promulgated	

Item 4109: Launch of New Program – Bachelor of Science in Remote Sensing & GIS at BSAES-KC

Sponsor: HOD (E&ES) BSEAS-KC

Referral Authority: FBOS-ES

Summary of the Case

123. The Department of E&ES (BUKC) has proposed to introduce a new academic program, *Bachelor of Science in Remote Sensing & GIS*, as a 4-years degree programme. HOD E&ES, BUKC will present the launch proposal, that has been recommended by the FBOS-ES.

Discussion

124. HOD (E&ES) BSEAS-KC presented the launch proposal for *Bachelor of Science in Remote Sensing & GIS* at BSAES-KC from Fall 2022 semester, as given at **Appendage 4109**. While the admissions for said semester have already commenced, it was explained that subject programme would be advertised during the 2nd Phase of the admissions and continued in case of good response. The Chair showed concern on general feasibility of the program. The Council advised to review the minimum entry level from proposed minimum 45% marks in HSSC/ equivalent to 50% for conformance with standard BU criteria and induction of good quality students. Reduced Admission Fee amounting Rs 15,000 was consented by the Council. However, the Chair advised to include Maritime related courses in the Electives for the proposed programme. The Council further directed Dean ES/ Principal BSEAS-IC to plan the launch of the same programme at BUIC from Spring 2023 semester, and asked for its launch proposal in next ACM.

Decision 4109

125. The following is approved by the Academic Council:

- a. Launch of *Bachelor of Science in Remote Sensing & GIS* at BSAES-KC from Fall 2022 semester.
- b. Details of the programme as given at **Appendage 4109** (page 313), with minimum entry level to be at least 50% marks in HSSC/ equivalent and reduced Admission Fee of Rs 15,000.
- c. Approved programme to be launched at BSEAS-IC from Spring 2023 semester, with the launch proposal presented in the next ACM.
- d. Progress is to be reported.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principals BSEAS-IC, KC, CE, DA, DIT	Dean ES
Statutory Documents Affected	BU CCH, Prospectus and website to be updated	

Item 4110: Launch of New Program Master of Science in Remote Sensing & GIS at BSAES-KC

Sponsor: HOD (E&ES), BSAES-KC

Referral Authority: FBOS ES

Summary of the Case

126. The Department of E&ES (BUKC) has proposed to introduce a new academic program, *Master of Science in Remote Sensing & GIS*, as a 2-years degree programme. HOD E&ES, BUKC will present the launch proposal, that has been recommended by the FBOS-ES.

Discussion

127. HOD (E&ES) BSEAS-KC presented the launch proposal for *Master of Science in Remote Sensing & GIS* at BSAES-KC, as given at **Appendage 4110**. During the discussion, it was noted that the Dept presently does not have any relevant PhD qualified faculty to support the programme as per HEC

requirements. After further discussion, DG BUKC asked to withdraw the launch proposal for later processing, after the earlier proposed BS (RS & GIS) has matured. The Chair conceded the same.

Decision 4110

128. The proposal stands withdrawn by BUKC. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principal BSEAS-KC	Dean ES
Statutory Documents Affected	None	

Item 4111: Restructuring of Departmental Board of Studies (DBOS) and Departmental Research Center (DRC)

Sponsor: Principal BBS-KC

Referral Authority: FBOS-MS

Summary of the Case

129. BU Rules need amendments after the establishment of Bahria Business School for restructuring of Departmental Board of Studies (DBOS) and Departmental Research Committee (DRC). The proposal will be presented by the Principal BBS-KC.

Discussion

130. Principal BBS-KC presentation the proposal as given at **Appendage 4111** (page 349); comprising of two options. Dean ES proposed to retain the existing structure with addition of Principals in DBOS and FBOS. Principal BBS-KC explained that in existing mechanism, FBOS agenda was forwarded directly by the HODs, without respective Principal's involvement. However, the Council agreed that FBOS agenda should be processed through respective Principals. It was further agreed that Principals and Associated Deans should be members of the FRC and FBOS. DAcad confirmed that the same had been complied in revised BU Statutes under review at Naval Headquarters. After further discussion, the Council decided to maintain status quo, with routing of FBOS and FRC agenda from DBOS and DRC through respective Principals (compliance to be ensured by respective Deans).

Decision 4111

131. Status quo is to be maintained with respect to the composition of DBOS and DRC, with routing of FBOS and FRC agenda from these Committees through respective Principals; compliance to be ensured by respective Deans. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principal BBS-KC	All Deans
Statutory Documents Affected	None	

Item 4112: Inclusion of *Project Management* Course in MBA 2-years program in lieu of course *Contemporary Issues in Business*

Sponsor: HOD (BS) BBS-IC

Referral Authority: FBOS-MS

Summary of the Case

132. Roadmap of MBA 2-year program may be modified to include the course *Project Management* in place of the course *Contemporary Issues in Business*. HOD (BS) BBS-IC will present the proposal to the Academic Council.

Discussion

133. HOD (BS) BBS-IC presented the proposal to replace *Contemporary Issues in Business* as Core Course with *Project Management* in MBA 2-years Roadmap, with the justification that the proposed course is already offered in other Roadmaps of MBA programmes, carries more market attractiveness and was replaced in 2-years Roadmap in 33rd ACM. However, the Chair opined that adoption of *Project Management* as a Core Course was not suitable for MBA programme. During further discussion, the Council conceded that the course *Contemporary Issues in Business* was more relevant to the advanced Business degree (MBA) and, hence, should be retained as approved in 33rd ACM.

Decision 4112

134. The proposal to replace the course *Project Management* with the course *Contemporary Issues in Business* in MBA 2-years programme is not approved by the Council. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principal BBS-IC	Dean MS
Statutory Documents Affected	None	

Item 4113: Review of New Undergraduate HEC Roadmap for BBA

Sponsor: HOD (BS) BBS-IC

Referral Authority: FBOS-MS

Summary of the Case

135. In order to realign the roadmaps for inclusion of *Project Management* as Major, new Undergraduate Roadmap of BBA needs be revised. Additionally, changes in courses are also required in the UG roadmap. HOD (BS) BBS-IC will present the changes proposed in BBA Roadmap as given at **Appendage 4113**, recommended by FBOS-MS, for approval by the Academic Council.

Discussion

136. HOD (BS) BBS-IC explained that proposed changes were being sought in the Roadmap based on HEC UG Education Policy 2020, which was approved in 37th (Special) ACM. DAcad explained that adoption of Roadmaps based on said Policy was pending decision on implementation timeline, which was being covered separately as Agenda Item 4130 in the ACM. He proposed to postpone any review of the Roadmap approved in 37th (Special) ACM till the time a definite timeline is given for its adoption, and pursue the changes according to the requirement at that time. The proposal was accepted by the Academic Council for compliance by all concerned.

Decision 4113

137. Any review of the Roadmaps approved in 37th (Special) ACM is to be undertaken, if required, when a definite timeline is given for its adoption; pursuing the changes according to the requirement at that time. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principal BBS-IC	All Deans
Statutory Documents Affected	None	

Item 4114: Eligibility Criteria for MS/MPhil Programmes as per HEC Policy

Sponsor: HOD (MS) BBS-IC

Referral Authority: FBOS-MS

Summary of the Case

138. Eligibility criteria for MS/ MPhil programmes offered by the MS Department is too specific and it is observed that students' applications get screened out as they do not meet the specified eligibility criteria. However, HEC Policy (2015) is broad and does not restrict the universities to follow a narrow admission framework. HOD (MS) BBS-IC will present the proposed amended criteria within the HEC Policy framework; recommended by 36th FBOS-MS for approval by the Academic Council.

Discussion

139. HOD (MS) BBS-IC presented the proposal as given at **Appendage 4114** (page 354), to replace the existing requirement of "*16 years of business/ relevant education*" with "*16 years of business education, social sciences and other relevant education (e.g. Economics, Commerce, Management, Supply Chain Management, Project Management, Finance or Business etc.)*" to broaden the base of eligible applicants. DA indicated that eligibility criteria for MS/ MPhil/ programmes contained in BU Admission Policy was already very broad as it required the applicants to have, "*16 years of education with Masters/ bachelors/ equivalent degree from HEC recognized university in the relevant discipline/ field of study*". DPGP indicated that eligibility criteria for PG programmes was approved by the HEC while issuing related NOC, and that any change in the same may require HEC consent too. HOD (MS) BBS-IC explained that the proposed change was felt necessitated due to actual case(s) of BU graduate(s) not being eligible for the PG programme within the same Dept. After further discussion, the Council decided that the current criteria for MS/ MPhil programmes was quite appropriate for intended intake, and that any implication at CUs level is to be resolved on case to case basis.

Decision 4114

140. Status quo is to be maintained for the eligibility criteria for MS/ MPhil programmes. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principal BBS-IC	Dean MS
Statutory Documents Affected	None	

Item 4115: Assigning Course Codes to Internship in BS (Media Studies)

Sponsor: HODs (Media Studies) BH3S-IC & KC

Referral Authority: FBOS-HSS

Summary of the Case

141. New Roadmap of BS (Media Studies) approved in 32nd ACM includes non-credited Internship which also requires a course code. Dept of Media Studies, BH3S-IC & KC presented the agenda in the FBoS-HSS, whereby a new course code was finalized for Internship in BS (Media Studies) as tabulated below; subject to approval by the Academic Council:

Course	Program	Credit Hours	Proposed Course Code
Internship	BS (Media Studies)	0 (Non Credited)	SDW 496

Discussion

142. Course code was **SDW 496** was approved by the Academic Council for **Internship**, as presented.

Decision 4115

143. Course Code **SDW 496** is approved by the Academic Council for **Internship** (0 x CH) in BS (Media Studies) programme. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principals BH3S-IC & KC, CE, DA, DIT	Dean H&SS
Statutory Documents Affected	BU CCH, Prospectus and website to be updated	

Item 4116: Inclusion of Mandatory Media Lab Hours in BS (Media Studies) from Fall 2022 Semester

Sponsor: HODs (Media Studies) BH3S-IC & KC

Referral Authority: FBOS-HSS

Summary of the Case

144. Media Studies Departments of BH3S-IC and KC have proposed mandatory Media Lab hours approved for *BS (Television Broadcasting and Digital Media)* in 40th ACM for *BS (Media Studies)* as well. The proposal was discussed in detailed in the FBOS-HSS and recommended for approval by the Academic Council.

Discussion

145. HOD (Media Studies) BH3S-IC presented the proposal as given at **Appendage 4116**. After brief discussion, the Council approved the same for compliance at BH3S-IC and KC.

Decision 4116

146. Mandatory Media Lab hours are approved for *BS (Media Studies)* programme at BH3S-IC and KC as given at **Appendage 4116** (page 359). Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principals BH3S-IC & KC, DA & DIT	Dean H&SS
Statutory Documents Affected	BU Prospectus and website to be updated	

Item 4117: Including Research Methodology course in MS (Islamic Studies) Programme

Sponsor: HODs (Islamic Studies) BH3S-IC & KC

Referral Authority: FBOS-HSS

Summary of the Case

147. *Research Methodology* (ISS 506) is one of the compulsory courses of *MS (Islamic Studies)* taught in 2nd semester of MS programme. It has been observed that students of this programme need to be taught this course in the 1st semester. After detailed discussion, it was suggested in FBOS-HSS that the course *Research Methodology* should be taught in the 1st semester as a compulsory course by replacing with the course *Islam and Society* which is currently taught in the 1st semester; and approval of the same may be sought from the Academic Council.

Discussion

148. Swapping of the courses *Research Methodology* and *Islam and Society* was contemplated by the Academic Council and approved for adoption at BH3S-IC and KC.

Decision 4117

149. Shifting of course *Research Methodology* from 2nd to 1st semester and course *Islam and Society* from 1st to 2nd semester in *MS (Islamic Studies)* programme is approved for adoption at BH3S-IC and BH3S-KC. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principals BH3S-IC & KC, DA, DIT	Dean H&SS
Statutory Documents Affected	BU Prospectus and website to be updated	

Item 4118: Ratification of Change of Programme Title from *MS in Professional Psychology* to *MS in Clinical Psychology*

Sponsor: Dean PP

Referral Authority: Case File

Summary of the Case

150. *MS in Clinical Psychology* program has been running successfully in all 3 x BU Campuses. The program was approved as *MS in Clinical Psychology* in the 20th ACM and NOC of the program obtained from HEC for IPP (Karachi) and BUIC. During revision of the Roadmap, the program title was erroneously written as *MS in Professional Psychology* instead of *MS in Clinical Psychology* at page 38 of 28th ACM MOM. However, correct title *MS in Clinical Psychology* is mentioned in Appendixe 2812 of the same MoM.

151. The matter was discussed in 39th (Special) meeting of the Academic Council held on 7 June 2021. The honorable Rector advised to process the case on file for necessary approval and subsequent ratification by the Academic Council. The same has been complied accordingly, and approval for reverting to programme title *MS in Clinical Psychology* has been approved by the honourable Rector on relevant case file. The same may be ratified by the Academic Council.

Discussion

152. After brief discussion, the Council ratified the change of programme title as presented.

Decision 4118

153. Change of programme title ***MS in Professional Psychology*** to ***MS in Clinical Psychology*** approved on case file is ratified by the Council. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Director IPP, HODs PP BUIC & BULC, CE,DA, DIT	Dean PP
Statutory Documents Affected	BU Prospectus and website to be updated	

Item 4119: Establishment of Bahria University Health Sciences Post-Graduate Institute

Sponsor: Chairperson PGP (BUMDC)

Referral Authority: FBOS-HS

Summary of the Case

154. BUMDC has proposed the establishment of Bahria University Health Sciences Postgraduate Institute (BUHS-PGI) at BUHSC-K. Approval of the same is to be accorded by the Academic Council.

Discussion

155. Chairperson PGP (BUMDC) presented the proposal as given at **Appendage 4119** (page 360), comprising of the organogram and other details of the proposed Institute, including the minimal

supporting staff (05) to cater the approved MPhil & PhD programs and initial phase of BUHS-PGI; with no immediate requirement of human/ material resources. After considerable discussion, the Council in-principle approved the proposal, with implementation timeline to be after the shifting of BUDC to its new premises. The Chair further advised to process the proposal on case file for final approval and ratification by the Academic Council, as per standard procedure for raising of new BU organisations/institutions.

Decision 4119

156. The following is approved by the Academic Council:

- a. In-principle approval of the establishment of Bahria University Health Sciences Postgraduate Institute (BUHS-PGI) at BUHSC-K, with implementation timeline after the shifting of BUDC to its new premises.
- b. Details of the proposed Institute, including its organogram and supporting staff, are to be processed on separate case file for approval and subsequent ratification by the Academic Council.
- c. Progress is to be reported.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principal BUMC, DHS	Dean HS
Statutory Documents Affected	None	

Item 4120: Approval of Amendments in MPhil Roadmaps for Anatomy, Pharmacology, Physiology, Biochemistry, and HEC aligned Course Titles of MPhil Biochemistry

Sponsor: Chairperson PGP (BUHSC)

Referral Authority: FBOS-HS

Summary of the Case

157. Revised Roadmap of *MPhil (Pathology)* was approved in 40th ACM, which is also applicable to other MPhil programmes, i.e. Anatomy, Pharmacology, Biochemistry and Physiology but the last ACM approval does not cover these programmes. Further, Roadmap of *MPhil (Biochemistry)* has course titles of 6 x courses slightly different from the Roadmap approved in 35th ACM; which were changed to get the programme launch NOC from the HEC. These changes have been recommended by the FBOS-HS for approval by the Academic Council.

Discussion

158. Chairperson PGP (BUHSC) presented amended Roadmaps of 5 x MPhil programmes of the Faculty of HS for approval by the Academic Council, as given at **Appendage 4120** (page 371). After detailed review of the changes incorporated, the Council approved the same as presented.

Decision 4120

159. Amendments in Roadmaps of 5 x MPhil programmes of the Faculty of HS are approved as given at **Appendage 4120** (page 371). Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principal BUMC, CE, DA, DIT	Dean HS
Statutory Documents Affected	BU CCH, Prospectus and website to be updated	

Item 4121: Launch of New Programme *Bachelor of Science in Biotechnology* in BU College of Allied Health Sciences, BUHSC

Sponsor: HOD (MLT/MDRL) BUHSC

Referral Authority: FBOS-HS

Summary of the Case

160. As per proposed sequential plan for the establishment of *BU College of Allied Health Sciences*, finalized in the meeting chaired by Rector BU with all stake holders through VLC on 7 March 2022, an Undergraduate Biotechnology programme is to be added in BUCAHS in Fall 2022 semester. FBOS-HS has recommended to pursue the same by launching the new *BS (Biotechnology)* programme at BUCAHS after shifting of BU Dental College in Fall 2022 semester subject to approval by the Academic Council.

Discussion

161. HOD MLT/ MDRL presented the proposed UG programme *BS in Biotechnology* as given at **Appendage 4121**; comprising of the Programme Objectives, Outcomes, Roadmap and other details of the new courses contained therein. After brief review of the proposal, the Council approved its launching from Fall 2022 semester at BUHSC-K, with amended admission criteria (deletion of preference for Pre-Medical).

Decision 4121

162. Launch of *BS in Biotechnology* at BUHSC-K from Spring 2023 semester is approved by the Council, as per the details given at **Appendage 4121** (page 383). Progress is to be reported.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principal BUMC,CE, DA, DIT	Dean HS
Statutory Documents Affected	BU CCH, Prospectus and website to be updated	

Item 4122: Adoption of Methodology for Improvement of Academically Weak Students

Sponsor: Dean HS

Referral Authority: Case File

Summary of the Case

163. Academically weak students need to be identified to cater to their areas of improvement. Such students sometimes result in being Dropped if their academic issues are not addressed in due time.

164. Dean HS will present the proposal for improvement of academically weak students of their respective Faculty, for approval by the Academic Council.

Discussion

165. HOD (DME) BUMDC presented the methodology adopted for MBBS and BDS students (Annual exams based) at BUMDC, as per the detail at **Appendage 4122-A** (page 396). After brief discussion, the Council consented to approve the proposed methodology for Annual based programmes.

166. Dean H&SS subsequently presented the methodology adopted for weak students in the Faculty of H&SS, as given at **Appendage 4122-B** (page 399). The Chair conveyed concern that Dropped cases were still on a rise despite the fact that proposed methodology had been adopted by the Faculty of H&SS since 2014. Dean ES then explained the mechanism proposed for the faculty of ES, as given at **Appendage 4122-C** (page 400); based on the systematic identification of weak students and recorded performance after given support. Dean PP subsequently explained the mechanism adopted for its own students/ programmes, whereby weak students are identified through mentors assigned to the 1st

semester students. As per current practice, for other students, faculty advisors are assigned to deal with their problems related to studies and personal issues.

167. During the discussion on faculty specific methodologies, DQA indicated that CU based mechanisms lacked the internationally recognized tutorials based approach. The Chair desired to pursue the same across all BU CUs. He also advised to identify the weak students at mid-term exams level, so as to provide the required support for improvement in the final exams. After further discussion, the Chair directed that standard methodology should be adopted for improvement of academically weak students in semester based programmes across all CUs/ faculties. DAcad indicated that the same may be resolved through the Deans Committee, which is already working on this aspect as an agenda item. The Council consented the same.

Decision 4122

168. Methodology for improvement of academically weak students presented by Dean HS is approved for adoption on annual HS programmes, i.e. MBBS and BDS. For all other/ semester-based programmes, standard methodology is to be adopted across all CUs/ faculties through the Deans Committee forum; taking lead from the tutorial based approach. Progress is to be reported.

Action Required	Action by	Responsibility of
Implementation of the Decision	All Deans	DAcad/ Secy Deans Committee
Statutory Documents Affected	None	

Item 4123: Ratification of Amendments in BU Admission Policy Clause 2.8, 2.9 and 2.10

Sponsor: Director Admissions

Referral Authority: Case File

Summary of the Case

169. Certain anomalies were observed in existing BU Admission Policy clause 2.8, 2.9 and 2.10 during admissions cycle for Fall 2021 semester, e.g, Eligibility/ Ineligibility Criteria, etc, as given at **Appendage 4123-A**. Required amendments were processed on file and approved by the honorable Rector, which need to be ratified by the Academic Council.

Discussion

170. Director Admissions presented the amendments in BU Admission Policy that were approved on case file. During its scrutiny by the Council, it was noted that proposed amendment does not mention the ineligibility given at current clause 2.10.1.f. of the Admission Policy, i.e. "GMAT/GRE taken more than 2 years before the BU admission deadline". The Chair advised to include the same in amended text. After further review, updated amendments in BU Admission Policy were ratified by the Council as presented, with addition of the current clause 2.10.1.f.

Decision 4123

171. Updated amendments in BU Admission Policy clause 2.8, 2.9 and 2.10 are ratified by the Academic Council at given in **Appendage 4123-B** (page 403). Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Director Admissions	Director Admissions
Statutory Documents Affected	BU Admission Policy to updated	

Item 4124: Ratification of Amended Weightage of CBT/ Admission Test Subjects of PG Programmes

Sponsor: Director Admissions

Referral Authority: Case File

Summary of the Case

172. During admissions of Fall 2021 Semester, it was noted that applicants faced problems while attempting the CBTs of certain PG programs, i.e.s *MS in Islamic Studies, Applied Anthropology, Psychology*, etc, due to their previous education i.e. non-Mathematics background. Candidates of such programs were unable to attempt the Quantitative part of CBT (Maths). In this regard, Admissions Dte obtained the input of respective Deans and processed the amended weightage on file for approval by honorable Rector, as given at **Appendage 4124**, which needs to be ratified by the Academic Council.

Discussion

173. Director Admissions presented the amended weightage of CBT/ Admission test subjects as approved on case file. After brief discussion, the same was ratified by the Council.

Decision 4124

174. Amended weightage of CBT/ Admission test of PG programmes is ratified, as given at **Appendage 4124** (page 403). Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Director Admissions	Director Admissions
Statutory Documents Affected	BU Admission Policy to be updated	

Item 4125: Ratification of 2% Sports Based Admissions in BU

Sponsor: Director Admissions

Referral Authority: Case File

Summary of the Case

175. HEC has issued instructions to reserve 2% seats of sports persons for admission in all HEIs and also devised to make a foolproof mechanism for selection of candidates on sports quota seat(s) in UG Programs only. The case was processed on file and approved by the honourable Rector, with amplifying instructions/ SOPs as given at **Appendage 4125** (page 405). The same needs to be ratified by the Academic Council.

Discussion

176. Dir Admissions present the amendment/ addition in BU Admission Policy for 2% sports based admissions (clause 2.26) as approved on case file. During the discussion, the Council agreed to delete the Gender based distribution/ quota, and addition of “any other sports where the applicant’s performance is of District level or above” in the list of Recommended Games. The amendment/ addition was thereafter ratified with the above stated amendments.

Decision 4125

177. Amendment/ addition of clause 2.26 in BU Admission Policy for 2% sports based admissions is ratified with deletion of Gender based distribution/ quota, and addition of “any other sports where the applicant’s performance is of District level or above” in the list of Recommended Games. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Director Admissions	Director Admissions
Statutory Documents Affected	BU Admission Policy to be updated	

Item 4126: Ratification of the Decision to Obtain Students' Undertaking on Plain Paper

Sponsor: Director Admission

Referral Authority: Case File

Summary of the Case

178. As per the guidelines received from the HEC vis-à-vis a decision of the Supreme Court of Pakistan, instructions have been promulgated to obtain the *Undertaking* from the students *to abide by the University's Statutes, Regulations and Rules, and the Code of Conduct* at the time of admission on plain paper instead of stamped Paper. Related amendments in BU Admissions Policy, Academic Rules and Students Handbook were processed on file as given at **Appendage 4126** and approved by the Rector. The same need to be ratified by the Academic Council.

Discussion

179. Director Admissions presented the amendments in BU Admission Policy, Academic Rules and Students Handbook pertaining to the students' Undertaking on plain paper instead of Rs 20 stamped paper; as approved on case file. After brief discussion, the Council ratified the approved amendments, with instructions that the format/ wording of the *Undertaking* should be as per the specimen given on BU website.

Decision 4126

180. Amendments in BU Admissions Policy, Academic Rules and Students Handbook are ratified as given at **Appendage 4126** (page 407) with instructions that the format/ wording of the *Undertaking* should be as per the specimen given on BU website. Point Dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	DA, DAcad	Director Admissions
Statutory Documents Affected	BU Academic Rules, Admission Policy and SHB to be updated	

Item 4127: Ratification of Weightage for Admissions in All PG Programmes

Sponsor: Director Admission

Referral Authority: Case File

Summary of the Case

181. Final Merit List for admissions in BU PG programmes is prepared on the basis of weightage of CBT/ GAT test, Bachelor (16-year qualification) result and interview marks. The weightage has been reviewed and approved on file by honorable Rector, which needs ratification by the Academic Council.

Discussion

182. Director Admission presented the following changes in the weightage for admissions in all PG programmes, as approved on case file:

Category	Existing	Amended
Admission Test/ ETS	35%	55%
Undergraduate Result	35%	35%
Admission Interview	30%	10%

183. The Council agreed to ratify the amended weightage as presented.

Decision 4127

184. Revised weightage of CBT/ GAT test, Bachelor (16-year qualification) result and interview marks for admissions in all PG programmes is ratified as tabulated in para 182. above. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Director Admissions	Director Admissions
Statutory Documents Affected	BU Admission Policy to be updated	

Item 4128: Ratification of SOP for Merit Lists Implementation of UG Programmes

Sponsor: Director Admissions

Referral Authority: Case File

Summary of the Case

185. Merit lists of all UG programmes were generated on single choice while the candidates were not offered to select multiple choices. During Fall 2021 semester, the candidates were first time allowed to select multiple choices i.a.w the compatibility of CBT test and eligibility criteria of the programmes. The candidates have been allowed to select maximum of 3 choices only. The SOP thus prepared was processed on case file and approved by honourable Rector, as given at **Appendage 4128**, which needs ratification by the Academic Council for inclusion in BU Admission Policy as the new clause 7.5.

Discussion

186. Director Admissions presented the SOP/ proposed new clause in BU Admission Policy, as approved on case file. The Council reviewed its contents in detail and ratified the same, with inclusion of the person/ mechanism for intended compliance in proposed clause 7.5.12, i.e. intimating the applicant that his/ her merit has improved in higher opted programme.

Decision 4128

187. The SOP/ proposed new clause 7.5 in BU Admission Policy is ratified as given at **Appendage 4128** (page 409), with inclusion of the person/ mechanism for intended compliance in clause 7.5.12, i.e. intimating the applicant that his/ her merit has improved in higher opted programme. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Director Admissions	Director Admissions
Statutory Documents Affected	BU Admission Policy to be updated	

Item 4129: Ratification of Revised Final Transcript of PhD Graduates

Sponsor: Controller of Examinations

Referral Authority: Case File

Summary of the Case

188. During the processing of a case for award/ signing of PhD degree, the honorable Rector observed that there was no reflection of number of years taken by the scholars in their research work – neither on the Degrees nor the Final Transcripts. Accordingly, the format of PhD degree awarded to BU scholars was revised by the Registrar office. While the Exams Dte prints Final Transcripts of PhD awardees as per given format, relevant changes have been incorporated and revised Final Transcript of PhD graduates has been approved by the honorable Rector as given at **Appendage 4129**, which need to be ratified by the Academic Council.

Discussion

189. CE presented the changes incorporated in revised Final Transcripts of PhD graduates, as approved by the Rector. After due deliberation, the same was ratified by the Council.

Decision 4129

190. Revised Final Transcript of PhD graduates is ratified as given at **Appendage 4129** (page 409). Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Controller of Examinations	Controller of Examinations
Statutory Documents Affected	Revised format of Final Transcript to be adopted	

Item 4130: Implementation of HEC Undergraduate Education Policy 2020

Sponsor: Director QA

Referral Authority: Case File

Summary of the Case

191. HEC Undergraduate Education Policy 2020 was received in August 2020 for adoption by Fall 2021 semester, which was later suspended till fresh instructions by the HEC, based on review of the Policy. Meanwhile, roadmaps of all BU academic programmes upon which the Policy was applicable were reviewed for suitable alignment, and revised roadmaps were approved in 37th (Special) ACM held on 24 February 2021.

192. HEC has intimated through its fresh instructions promulgated in December 2021 to adopt the Undergraduate Education Policy 2020 from Fall 2022 semester. Compliance of the same may be deliberated by the Academic Council, for gradual adoption of the Policy, as deemed appropriate.

Discussion

193. DQA in capacity of the Secretary HEC UGE Policy Implementation Committee presented the summary of the case, salient features of the UGE Policy 2020, BU readiness for its implementation and the recommendations of the Committee, as given at **Appendage 4130** (page 413). During detailed deliberation on each aspect of the Policy, the Chair shared concern on awaited response from the HEC on the queries submitted earlier by BU. He further pointed out that the HEC response on the recommendations of the VCs Committees with respect to stated Policy was also awaited. Dean Law further indicated that the LLB programme Roadmap had also been reviewed for compliance with the new UGE Policy whereas the Supreme Court ruling restricted any such review with the consent of Pakistan Bar Council. DAcad explained that the LLB curriculum has been issued by the HEC and its review was also iaw the latest HEC Policy. He further indicated that revised LLB Roadmap was different from the existing only in terms of increased credit hours (from 2CH to 3CH each) of *Pakistan Studies* and *Islamic Studies*, and inclusion of another course *Introduction to Environmental Sciences* to meet the minimum *General Education* requirement. He proposed to approach the HEC for clarity on implementation of UGE Policy on LLB and DPT programme, as the former was also a 5-years professional degree programme. After detailed discussion on the Recommendations presented by DQA, the Chair approved their adoption in form of intimating the HEC of the BU constraints in adopting certain Policy requirements, and further deliberation by respective Deans/ Principals for the adoption methodology, resources requirement and implementation timeline of the Policy features currently not practiced.

Decision 4130

194. The Academic Council decided the following:

- a. Implementation of HEC UGE Policy 2020 is to be pended till the time queries raised to HEC by BU and VCs Committees are responded and deliberated by the Academic Council.
- b. HEC is to be intimated through DQA office of the BU constraints in adopting the following features of UGE Policy:
 - i. Centralized Admission System, due implications on low intake programmes.
 - ii. Entry test weightage for all admissions, due BU weightage already close to HEC.
 - iii. Option of Double Major and Minor at this stage, while it may be adopted gradually.
 - iv. Awarding Associate Degree after 2-years education, due need of more clarity.
 - v. Switching between General and Professional Degree programmes, due different educational background.
- c. All Deans are to deliberate the following aspects of the UGE Policy for adoption methodology, resources requirement and adoption timeframe for respective academic programmes:
 - i. Introduction of Practical Learning Lab (PLL).
 - ii. Mandatory 9-weeks Internship for all UG programmes.
 - iii. Establishment of Academic Advisement System at all CUs.
- d. Progress is to be reported.

Action Required	Action by	Responsibility of
Implementation of the Decision	DQA, All Deans	Director QA
Statutory Documents Affected	None	

Item 4131: HEC Relaxation for Minimum and Maximum Duration of MS/ MPhil/ PhD/ Equivalent

Sponsor: Director Academics

Referral Authority: HEC Notification

Summary of the Case

195. Maximum duration for the students of MS/ MPhil/ PhD/ equivalent programmes who have achieved the time limit of their study programme in Fall 2021 Session has been extended by the HEC for one year (2 semesters) due to COVID-19 pandemic vide its Notification at **Appendage 4131-A**; for completion of the programme till 28 February 2023 vide its Notification at **Appendage 4131-B**. Adoption of the same may be approved by the Academic Council as one-time relaxation, which cannot be used as precedence.

Discussion

196. HEC Notifications were presented by DAcad, which were approved by the Council after due deliberation.

Decision 4131

197. HEC Notifications at **Appendage 4131-A** (page 417) and **Appendage 4131-B** (page **Error! Bookmark not defined.**) are approved for adoption, as one-time relaxation which cannot be used as precedence. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Registrar, CE, DPGP, DAACAD	DAACAD

Statutory Documents Affected	None
Item 4132: Amendment of BU Academic Rule 14.4 for Students' Appellate Authority	
Sponsor: Director Academics	Referral Authority: Case File

Summary of the Case

198. Appellate Authorities for disciplinary penalties specified for students are contained in BU Academic Rules Chapter 14. Appellate Authority for some of these penalties need to be reviewed for more appropriate level, as proposed below:

Penalty	For		Read	
	Awarding Authority	Appellate Authority	Awarding Authority	Appellate Authority
Expulsion from the hostel	Head of the CU	Head of the CU	Director CU/ Director Admin	Head of the CU
Cancellation of remission of fees/ assistantship/ scholarship, etc	Head of the CU	Next Higher Authority	Director/ Principal	Head of the CU
Rustication for one or more semester	Rector	Pro-Chancellor	Head of the CU	Rector
Expulsion from the CU	Rector	Pro-Chancellor	Head of the CU	Appellate Panel

Discussion

199. DAcad presented the above stated proposal to the Academic Council for approval and adoption through Registrar Notification, followed by amendment in BU Academic Rules Chapter 14 Table 11; composition of the Appellate Panel proposed for the Expulsion being as under:

- a. DCNS (Training & Personnel) – President.
- b. DG CU concerned – Member.
- c. Principal BU Law School – Member.

200. The Chair directed that no change was required in Appellate Authorities for the first two penalties (Expulsion from the hostel; Cancellation of remission of fees/ assistantship/ scholarship, etc). As such, status quo may be retained for these. Proposal for Rustication cases was approved as presented, while for Expulsion cases the Council decided to adopt the Rector as the Appelleate Authority.

Decision 4132

201. Amendment of Appellate Authorities for disciplinary penalties specified for BU students is approved as under:

Penalty	For		Read	
	Awarding Authority	Appellate Authority	Awarding Authority	Appellate Authority
Rustication for one or more semester	Rector	Pro-Chancellor	Head of the CU with concurrence of BUHO	Rector
Expulsion from the CU	Rector	Pro-Chancellor	Head of the CU with concurrence of BUHO	Rector

202. Above stated amendment is to be promulgated through Registrar Notification, followed by amendment in BU Academic Rules Chapter 14 Table 11. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Registrar, DAcad	Director Academics
Statutory Documents Affected	BU Academic Rules to be updated	

Item 4133: Merging of MS (*Management Sciences*) and MPhil (*Management Sciences*) Programmes

Sponsor: Dean MS

Referral Authority: FBOS-MS

Summary of the Case

203. Dean MS has proposed to merge the *MS in Management Sciences* and *MPhil in Management Sciences* programmes offered at BU. The proposal has been supported by FBOS-MS for consideration by the Academic Council.

Discussion

204. Dean MS presented the proposal to merge the above stated separate programmes into the new programme titles *MS in Project and Management Sciences*. DQA indicated separate nature of both programmes with different student streams, whereby *MS in Management Sciences* is a weekend programme of 1.5 years duration, while *MPhil in Management Sciences Sciences* is an evening programme of 2 years duration. HOD (MS) BBS-IC indicated that MPhil programme is pursued by govt employees due to service benefits while the MS programme is preferred by the private sector employees due lesser duration and weekend classes. During further discussion, the constraints were noted in merging the two programmes as proposed. It was, accordingly, decided to maintain the status quo.

Decision 4133

205. Status quo is to be maintained w.r.t the proposed merging. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Dean MS	-
Statutory Documents Affected	None	

Item 4134: Launching of PhD Foundation Research Certification Course

Sponsor: Dean MS

Referral Authority: FBOS-MS

Summary of the Case

206. Dean MS has proposed to launch the PhD Foundation Certification Course at BBS-IC, and will present the proposal for consideration by the Academic Council.

Discussion

207. Dean MS presented the proposal comprising of 6 x CH course for PhD scholars, as given at **Appendage 4134** (page 419). He explained that the course could be proposed to PhD students who are evaluated as weak in research during the admission interview, so as to improve the quality of research in PhD domain. DLDC suggested that the proposed course could also be offered to non-BU students as a general course through LDC. The Council deliberated upon the conduct of such course and was

apprised by Dean MS that it would be Dissertation based. The Chair noted that modalities of the proposal needed to be further refined. As such, the proposal may be processed through case file.

Decision 4134

208. Modalities of the proposal are to be worked out further and processed through case file. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Dean MS	Dean MS
Statutory Documents Affected	None	

Item 4135: Exemption of BS (Accounting & Finance) Courses to ACCA Students

Sponsor: HOD (MS) BBS-IC

Referral Authority: FBOS- MS

Summary of the Case

209. An MOU has been signed between Association of Chartered Certified Accountants (ACCA) Pakistan and Bahria University on 15th December 2021. As per said MoU, ACCA is providing exemption of 9 x paper to BU students of BS (Accounting & Finance) at all its CUs. ACCA has approached BU for reciprocal exemptions in BS (A&F) courses for the papers passed in ACCA. Accordingly, Dept of Management Studies, BBS-IC has mapped the ACCA papers with 16 x courses (48 credit hours) of BU offered BS (Accounting & Finance) programme, as given at **Appendage 4135** (page 420). FBOS-MS has recommended the approval of proposed exemption by the Academic Council.

Discussion

210. HOD (MS) BBS-IC presented the proposal for exemption of BS (A&F) courses to ACCA students. Registrar observed that equivalence of courses could be given only to the HEC recognized HEIs. DAcad indicated previous practice of giving said equivalence to non HEC recognized institutes too against MOUs with BU. HOD (MS) BBS-IC explained that HEC recognized the ACCA qualification equivalent to BBA. After further discussion, the Chair directed to process the proposal on file, followed by its ratification (if approved) in the next ACM.

Decision 4135

211. The proposal for exemption of BS (A&F) courses to ACCA students is to be processed on file and ratified in next ACM, if approved. Progress is to be reported.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principal BBS-IC	Dean MS
Statutory Documents Affected	None	

Item 4136: Approval to Increase 1 x Section in BSE Program at BSEAS-IC

Sponsor: Dean ES

Referral Authority: Case File

Summary of the Case

212. Dean ES has proposed to increase 1 x section of Bachelor of Software Engineering (BSE) programme offered at BSEAS-IC, which has been approved on file by the honourable Rector. However, formal approval/ ratification from the Academic Council is required as per PEC requirement at **Appendage 4136** (page 421).

Discussion

213. Dean ES explained the requirement of Academic Council approval to approach the PEC for increasing 1 x Section of BSE programme at BSEAS-IC, so as to accommodate the expanding students strength. After due deliberation, the Council approved said increase for subsequent consent by the PEC.

Decision 4136

214. Increase of 1 x section of BSE programme offered at BSEAS-IC is approved for subsequent consent by the PEC. Point dropped.

Action Required	Action by	Responsibility of
Implementation of the Decision	Principal BSEAS-IC	Dean ES
Statutory Documents Affected	None	

Closing the Meeting

215. The Secretary drew the attention of the House to the following timelines for follow-up actions and the next ACM, which were approved by the Chair for compliance as indicated:

- a. 1st Progress Report on Action Items of 41st ACM – 25 July 2022
- b. 2nd Progress Report on Action Items of 41st ACM – 05 September 2022
- c. Agenda Items for 42nd ACM (including points from respective FBOS) – 05 September 2022
- d. Scheduled dates of 42nd ACM – 04 & 05 October 2022

216. In closing remarks, the Chair thanked all the participants for their active participation throughout the three days of the Meeting.

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



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

Dated: 22 June 2022

**FINALIZED EXAMINATION/ RE-EXAMINATION RULES APPLICABLE ON BS(SCM) DEGREE PROGRAMME
AT PNSL**

1. Baseline Academic Qualification Criteria. At the end of each term, a comprehensive theoretical examination in each subject/ section of the course will be conducted as per the weightage/ marks allocated to various subjects. In order to qualify for progression to the next semester, following baseline academic qualification criteria shall be mandatory:

- a. A minimum of **50%** marks (i.e. "**D**" **Grade**) in each subject taken during a semester as per approved academic roadmap of BS (SCM) degree programme.
- b. A minimum of **60%** marks in aggregate (i.e. **CGPA 2.0**) during a semester as per approved academic roadmap of BS (SCM) programme.

2. Re-Examination of Final Semester Exam. If a student fails to meet the qualification criteria given in Para 1 (a & b) above after conduct of final semester examination, following re-examinations rules shall apply under any of the following conditions:

- a. When a student fails in a maximum of two courses, but obtains pass percentage in the aggregate / CGPA of a semester, the student shall be re-examined in the failed course(s) only. In case the student does not qualify the failed course(s), no re-examinations shall be conducted and the student shall repeat the whole semester (*relegated*).
- b. When the student fails in one course and also does not obtain pass percentage in the aggregate/ CGPA of the semester, then the student shall be re-examined in the failed course. To give him a fair chance to obtain the minimum aggregate i.e. 60% of the semester, the student shall have the option to be re-examined in another course in addition to the failed course of a semester in which the student has obtained less than 60% marks. In case the student is unable to achieve the required aggregate Percentage / CGPA of the semester and pass the failed course, no re-examination will be conducted and the student shall repeat the whole semester (*relegated*).
- c. When a student obtains pass percentage in each course individually but fails to pass in aggregate, the student shall be re-examined in only two courses of his choice in which the student has obtained less than 60% marks. In case the student is unable to achieve the required aggregate Percentage / CGPA of the semester after re-examination, the student shall repeat the whole semester (*relegated*).
- d. In case a student fails in three courses but obtains pass percentage in aggregate / CGPA during a semester, no re-examination is to be conducted and the student shall repeat the whole semester (*relegated*).

3. Course Repeat Policy. Following conditions are applicable to repeat a course during the Summer semesters as per Clause 3.20 of BU Academic Rules 2016:

- a. Repeating a course shall be permitted in cases where the grade obtained by a student is '**Less than B'**.
- b. Only the highest of the grade obtained after repeating a course will be used for the calculation of aggregate percentage / CGPA. The improvement of grades during summer semesters shall be capped at '**B Plus**'.

- c. A student shall register himself for the Summer course and his performance in each course will be evaluated on a continuous basis throughout the semester. Summer semester courses registered by a student shall be depicted on his Transcript denoting 'REPEAT'.
4. **Re-Examination Attempt(s) on the Final Transcript.** All attempts by a student for appearing in re-examination(s) in a subject regardless of the reasons are to be recorded on the Final Transcript. The grades / percentage obtained by a student after re-examination shall only be depicted on the transcript against title of such course(s) denoting 'RE-EXAM' and used for calculation of aggregate percentage / CGPA.
5. **Semester Repeat (Relegation).** In case a student repeats a semester for the reasons cited in Para 2 above and / or service reasons as intimated by PNSL, the same shall be depicted on the student's Final Transcript against respective semester heading followed by superscript symbol '#' e.g. **Spring Semester 2021[#]** with mentioning of the previous semester repeated at the bottom left of transcript. The grades / percentage achieved by a student for the courses taken during the repeat semester shall only be depicted on the transcript and used for calculation of CGPA.
6. **Dropped (Withdrawn) from the Degree Program.** A student will be dropped from the degree program under the following conditions and the final transcript shall depict the program as "Incomplete":-
- a. Fails in a maximum of three subjects / courses and also does not obtain aggregate percentage of 60% / CGPA 2.0.
 - b. Fails in more than three subjects / courses irrespective of obtaining the aggregate percentage of 60% / CGPA 2.0.
 - c. Attains CGPA of less than 2.0 at the end of academic programme.
 - d. Has already repeated a semester (relegated) twice in the duration of the program.
 - e. Expulsion on disciplinary grounds as intimated by PNSL after obtaining approval of the relevant service authorities.
7. **Re-Take Examinations.** Re-Take (Supplementary / Make-Up) Examination shall be held for those students who were unable to appear in the end semester or re-examination due to personal sickness or any other reason beyond their control in line with Clause 7.9 of BU Academic Rules 2016. All such examinations shall not be considered as Re-Examination and details of the same are to be shared by PNSL with Exams Dte, BUHO.
8. **Bar on Re-Admission of Dropped Students on Disciplinary Grounds.**
- a. A student once dropped (withdrawn) from the degree programme for reasons given in Para 6 (a to d) above shall not be permitted to register again in the same program title at Bahria University. However, they can register for other programmes as per BU academic rules applicable at that time after meeting the necessary pre-requisites.
 - b. Students dropped / expelled on disciplinary grounds under Para 6(e) above shall not be re-admitted to any of the Constituent or Affiliated Units of Bahria University. All such cases shall be marked accordingly in the university records and notified to all CUs / AUs of Bahria University.
9. **Implementation.** These rules shall come into force with immediate effect upon ratification by the BU Academic Council and incorporated in BU Examination Rules. Transcripts will be issued to the graduates including previous batches conforming to their applicable roadmaps as per approved format (specimen attached).

ROADMAP OF BS(SCM) 4.5 YEARS (SPRING -2018 & ONWARD INTAKES)					
PNA	Semester 1				
	S.No.	Course Code	Course Title	Credit Hour	
	1	HUM 101	Communication & IP Skills	2	
	2	HUM 103	English Literature	2	
	3	SOC 110	Islamic Studies	2	
	4	MGT 121	Introduction to Management *	3	
	5	SOC 111	Pakistan Studies	2	
	Total Semester Credit Hours				11
	Semester 2				
	S.No.	Course Code	Course Title	Credit Hour	
	1	AMB 261	Applied Maths for Business I	3	
	2	HSS 402	Sociology	3	
	3	HSS 208	Theories of Personalities	3	
	4	SOC 350	Business Ethics *	3	
	5	ITE 140	Software Application in Business	3	
	Total Semester Credit Hours				15
	Semester 3				
	S.No.	Course Code	Course Title	Credit Hour	
	1	AMB 261	Applied Maths for Business II	3	
	2	HSS 150	History	3	
	3	MIT 210	Management Information Systems	3	
	4	ENG 232	Oral Communication	3	
	5	MGT 231	Organizational Theory & Behavior	3	
	Total Semester Credit Hours				15
PN SHIP	Semester 4				
	S.No.	Course Code	Course Title	Credit Hour	
	1	SDW 496	Internship	0	
PNSL	Semester 5				
	S.No.	Course Code	Course Title	Credit Hour	
	1	BCM 204	Business Communication	3	
	2	QTM 110	Business Statistics	3	
	3	ITB 471	E-Commerce	3	
	4	ECO 210	Principles of Economics	3	
	5	ACC 102	Financial Accounting	3	
	6	MKT 110	Principles of Marketing	3	
Total Semester Credit Hours				18	

Semester 6				
S.No.	Course Code	Course Title	Credit Hour	
1	MGT 132	Fundamental of Supply Chain Management	3	
2	FIN 380	Fundamentals of Finance	3	
3	HRM 353	Human Resource Management	3	
4	MKT 371	Marketing Management	3	
5	SOC 112	Critical Reasoning & Logic	2	
6	QTM 204	Statistical Inference	3	
Total Semester Credit Hours			17	
Semester 7				
S.No.	Course Code	Course Title	Credit Hour	
1	LAW 319	Business Law	3	
2	PEC 510	Pakistan Economy	3	
3	FIN 381	Financial Management	3	
4	ACC 391	Cost & Managerial Accounting	3	
5	RMT 240	Research Methods & Techniques	3	
6	IRS 403	Theories of Globalization	3	
Total Semester Credit Hours			18	
Semester 8				
S.No.	Course Code	Course Title	Credit Hour	
1	SOC 113	Socio Economic Philosophy of Islam	3	
2	RMT 360	Operations Research	3	
3	PRO 428	Procurement Management	3	
4	MGT 435	Project Management	3	
5	MGT 436	Strategic Management	3	
6	MGT 437	Total Quality Management	3	
Total Semester Credit Hours			18	
Semester 9				
S.No.	Course Code	Course Title	Credit Hour	
1	PRO 426	Applied Financial Management	3	
2	MGT 438	Freight & Transportation Management	3	
3	SOC 416	International Relations & Law	3	
5	PRO 427	Logistics Management	3	
6	PRO 416	Naval Laws & General Regulations	3	
7	RPT 361	Research Project **	3	
Total Semester Credit Hours			18	
Grand Total Program Credit Hours			130	
Community Support Program			Credit Hour	
	CSP 311	Community Support Program	0	
Note: CSP can be taken by the students any time after the second semester as per 33rd ACM decision.				
* 36th ACM Item 3321		** 30th ACM Item 3004		

DRAFT

PN SCHOOL OF LOGISTICS
Bachelor of Science in Supply Chain Management*

**FINAL TRANSCRIPT**

Reg #: 48172
Name : ASIM SHAHZAD
Father's Name : MOHAMMAD SAJJAD

Enrollment No: 07-116162-001
Date of Birth: 16 October 1996

Entry: 2016/A

Fall Semester 2016

Course Code	Title	Grade	Grade Point	Credit Hours	Prod.
HUM 101	Communication & IP Skills	RE-EXAM	C+	2.5	2
HUM 103	English Literature		C	2	2
SOC 110	Islamic Studies		C	2	2
MGT 120	Management		B	3	3
SOC 111	Pakistan Studies		B	3	2

GPA : 2.55 CGPA: 2.55

Fall Semester 2017

Course Code	Title	Grade	Grade Point	Credit Hours	Prod.
QTM 251	Applied Math for Business - II	B	3	3	9
ECO 121	Macroeconomics	B	3	3	9
MIS 210	Management Information Systems	B	3	3	9
ENG 232	Oral Communication	C+	2.5	3	7.5
MGT 231	Organizational Theory & Behavior	B	3	3	9

GPA : 2.90 CGPA: 3.06

Fall Semester 2018

Course Code	Title	Grade	Grade Point	Credit Hours	Prod.
BCM 243	Business Communication	B+	3.5	3	10.5
QTM 252	Business Statistics	A	4	3	12
MIS 510	E-Commerce	A	4	3	12
SOC 360	Ethics	B+	3.5	3	10.5
ACC 110	Principles of Accounting I	A	4	3	12
MKT 110	Principles of Marketing	A	4	3	12

GPA : 3.83 CGPA: 3.30

Fall Semester 2019

Course Code	Title	Grade	Grade Point	Credit Hours	Prod.
MGT 301	Business Law	A	4	3	12
ACC 391	Cost & Managerial Accounting	A	4	3	12
FIN 202	Financial Management	A	4	3	12
OPM 360	Operation & Production Management	B+	3.5	3	10.5
RMT 240	Research Methods & Techniques	B+	3.5	3	10.5
MKT 655	Services Marketing	B+	3.5	3	10.5

GPA : 3.75 CGPA: 3.43

Summer Session 2020

Course Code	Title	Grade	Grade Point	Credit Hours	Prod.
ENG 232	Oral Communication	REPEAT	B	3	9

GPA : 3.00 CGPA: 3.49

Thesis/Internship/CSP

Course Code	Title	Grade	Grade Point	Credit Hours	Prod.
CSP 311	Community Support Program Completed on 31 March 2019			0	
RPT 360	Research Project Completed on 19 February 2020	A	4	6	24

GPA : 4.00 CGPA: 3.54

Spring Semester 2017

Course Code	Title	Grade	Grade Point	Credit Hours	Prod.
AMB 260	Applied Maths for Business I	A	4	3	12
SOC 112	Critical Reasoning & Logic	B	3	2	6
ECO 110	Microeconomics	B	3	3	9
SPI 361	Socio Economic Philosophy of Islam	A	4	3	12
SAB 260	Software Application in Business	A	4	3	12

GPA : 3.64 CGPA: 3.16

Spring Semester 2018

Course Code	Title	Grade	Grade Point	Credit Hours	Prod.
SDW 466	Internship			0	

GPA : CGPA: 3.06

Spring Semester 2019

Course Code	Title	Grade	Grade Point	Credit Hours	Prod.
MGT 132	Fundamental of Supply Chain Management	B+	3.5	3	10.5
FIN 201	Fundamentals of Finance	B+	3.5	3	10.5
MGT 333	Human Resource Management	B+	3.5	3	10.5
MKT 231	Marketing Management	B+	3.5	3	10.5
ACC 160	Principles of Accounting II	A	4	3	12
QTM 204	Statistical Inference	B	3	3	9

GPA : 3.50 CGPA: 3.35

Spring Semester 2020

Course Code	Title	Grade	Grade Point	Credit Hours	Prod.
FIN 612	Analysis of Financial Statements	A	4	3	12
RMT 360	Operations Research	A	4	3	12
PRO 428	Procurement Management	A	4	3	12
MGT 435	Project Management	B+	3.5	3	10.5
MGT 436	Strategic Management	B+	3.5	3	10.5
MGT 437	Total Quality Management	B+	3.5	3	10.5

GPA : 3.75 CGPA: 3.48

Spring Semester 2021

Course Code	Title	Grade	Grade Point	Credit Hours	Prod.
PRO 426	Applied Financial Management	B+	3.5	3	10.5
MGT 438	Freight & Transportation Management	A	4	3	12
SOC 418	International Relations & Law	A	4	3	12
LSM 102	Logistics & Secretarial Management	A	4	3	12
PRO 427	Logistics Management	B+	3.5	3	10.5
PRO 416	Naval Laws & General Regulations	B	3	3	9

GPA : 3.67 CGPA: 3.52

GENERAL INFORMATION

CNIC/Passport No of Student

13503-4267013-5

Basic Admission Requirement for the Program

FSc/A-Level (Physics - Mathematics and Chemistry/ Computer Science/ Statistics) with 60% marks.

Previous Degree Held by the Student

HSSC Pre-Engineering from Islamabad Model College for Boys F-10/4, Islamabad, (FBISE Islamabad)

Bahria University Charter Date

7 February 2000

Academic Honors

Students achieving high standards are awarded following honors upon completion of their degree requirements. Honors designations are indicated on the transcript:

Summa Cum Laude	3.90 - 4.00
Magna Cum Laude	3.80 - 3.89
Cum Laude	3.60 - 3.79

Criteria for Award of Academic Honors

The student should have been regular in the entire degree program and should have taken full load in all semesters required from the degree program as per road map/course outline.

Ineligibility for the Academic Honors

- . Any course withdrawn or dropped.
- . Any semester frozen.
- . Repetition or retake of any course.
- . An 'F' or an 'I' endorsement in any subject/course.
- . Credit transfers
- . Any of the degree requirements not completed within the roadmap time frame.

Grading System

Following grading system (absolute) is used at Bahria University:

Letter Grade	Percentage	Grade Point
A (Outstanding)	87 - 100	4.0
B+ (Very Good)	80 - 86	3.5
B (Above Average)	72 - 79	3.0
C+ (Satisfactory)	66 - 71	2.5
C (Barely Acceptable)	60 - 65	2.0
D (Poor)	50 - 59	1.5
F (Fail)	Below 50	0.0
W	Withdrawal	
I	Incomplete	

Medium of Teaching

English is the medium of teaching for all programs conducted at Bahria University.

Transcripts

Following type of transcripts are issued to the students at Bahria University:

a. Final Transcript

When all the degree requirements have been completed.

b. Interim Transcript

It is issued at the end of each semester (except final semester). Program incomplete is depicted on interim transcript. Procedure to apply for transcripts is given on Bahria University website www.bahria.edu.pk

Authentication

Final transcripts are light beige in colour. They bear embossed university seal, security water markings & Controller of Examinations signatures on its face (Alteration and/or forgery of this document is a criminal offense liable to be tried in the Court of Law).

Prepared by: _____
Checked by _____
Asst Controller Exams : _____
Date: 02 March 2022

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**Report
Revamping of Academic Programs at
E&ES- BUKC**

Agenda 3516

**Department of Earth & Environmental Sciences
Bahria University Karachi Campus**

SUMMARY

1. With reference to decision 40 (3516) in 40th ACM a committee was formulated by the HoD E&ES vide HoD (E&ES) Letter No. E&ES/14/2021 on the 8th of November 2021 (Annexure-1), to study the academic programs at E&ES, BUKC. Dr Salma Hamza (President), Ms. Shaista Iftikhar, Mr. M. Jahangir Khan, Mr. M. Irfan, Ms. Sadia Hashmi and Mr. Ahsan Majeed Qureshi were nominated as the committee members. The committee was tasked to revamp the existing programs and propose new academic programs.
2. BS Geosciences (4 Years program) was approved in 35th ACM July 2020. The Geoscience program was designed to offer specialization in Geology, Geophysics and GIS. Till spring 2018, one under graduate program (BS Geophysics) and four post-graduate (MS Environmental Sciences, MS Geophysics, PhD Environmental Science & PhD Geophysics) were offered. After Fall 2018 Environmental Sciences Program is continuing at BS and MS levels. With all this infrastructure and grants, E&ES department is able to enroll 546 students in all its offered programs since 2008. In 2015 Digital Geophysical Data Lab (DGDL) was established which is equipped with state-of-the-art software and geophysical equipment. Pakistan Petroleum Limited sponsored hardware for the lab and licenses for latest industry level software were given by LMKR, dGB-Holland, RadExPro, CGG, Hampson-Russell, and others.

SUMMARY

3. The committee held meetings with senior industry persons and academicians for understanding the importance of Geoscience programs in the current job market.
 4. The fee structure of other universities were also studied and found to be very low as compared with the BU fee structure for E&ES programs.
 5. In the light of DBOS and meetings with industry experts, the committee proposed to retain BS Geosciences program with addition of specializations in RS & GIS for mineral/mining/groundwater exploration.
 6. This high intake of students in Environmental and Geoscience Program of UoK and FUUAST is due to their low fee structure. Keeping this in view the fee structure should also be revised and at least 25-30% reduction is suggested.

FINDINGS:

1. BS Geosciences program was approved in 35th ACM and advertised for the first time for admission in Spring 2021 and Fall 2021, along with BS Environmental Sciences. However, it could not get started due to very low intake. BS Geosciences was not advertised for admission in Spring 2022.
 2. Meetings were held with the senior energy personnel and discussed the importance of Geosciences programs and its job market in future. Followings are the views of senior energy personnel on the Geosciences program:

FINDINGS:

- a. Pakistan is an energy deficit country and rely heavily on fossil fuel to run business, transport and for domestic need. E&P (Exploration & Production) in Pakistan has ambitious target to fill the gap of energy demand to reduce foreign exchange. For this the demand of Geoscience graduate is still high for Pakistan (Director Exploration MPCL). Therefore, exploration activities will not subside in Pakistan.
- b. Recent business model of PPL and Federal government toward mineral sector is also an indication of new avenues for Geoscience students (senior exploration officials from PPL).
- c. BS Geosciences provide the seed field for GIS application in mineral, groundwater, oil and gas (Senior Geophysicist OGIL).
- d. OGDCL announce a graduate training internship program for Geoscience students and also hire geoscientists on permanent positions regularly (Senior Exploration Professional from OGDCL). Besides Oil & Gas exploration, OGDCL, PPL & GHPL, in collaboration with Canadian firms are opening new ventures in Coal mining sector & Reko Diq, Balochistan.

FINDINGS:

3. Due to the recession of oil and gas industry there is a shift towards new exploration opportunities in Groundwater and Mineral/Mining sector, particularly in Balochistan and Govt. of Pakistan. This will open new opportunities for students in the job market.
4. Four well equipped laboratories, Digital Geophysical Data Lab (DGDL), GIS lab, Geochemical and Geological Labs exists in the department of E&ES. The labs, along with the faculty have the capabilities of providing training to industry/organizations' personnel like SGS and PPL, etc.
 - a- With the existing state of the art Digital Geophysical Data and GIS Labs, the department has a capability of participating in student competitions at both national and international levels.
 - b- Technical resources of Digital Geophysical Data Lab (DGDL) & GIS Lab established by PPL, LMKR, dGB, which are providing platform for R&D / training / teaching in collaboration with industry (Sindh Energy, Urban Planning, PCSIR, etc).

FINDINGS:

5. In the light of DBOS and meetings with industry experts, the committee proposed to retain BS Geosciences program with addition of specializations in RS & GIS for mineral/mining/groundwater exploration.
6. The findings of low intake in BS Geosciences and BS Environmental Sciences Program are under:
 - a. It is observed that the programs related to Earth and Environmental Sciences offered by other universities in Karachi (e.g. Federal Urdu University of Arts, Science & Technology and University of Karachi) have very low Fee structure in comparison with Bahria University Karachi Campus.
 - b. Keeping in view the above mentioned, the fee structure should also be revised and at least 25-30% reduction is suggested

FINDINGS:

S.No.	University	Undergrad Program	Fee Structure (PKR)
1	University of Karachi	Geology	22,000
2		Environmental Studies	40,000
3	Federal Urdu University of Arts, Science and Technology	Geology	20,500
4		Environmental Sciences	23,000

Recommendations:

- The demand for Geosciences graduate is still high in Pakistan, as we are an energy deficit country and need to explore energy resources is not subsiding. The focus of E&P companies and government of Pakistan is now shifting toward mineral/mining/groundwater exploration. Considering the DBOS and meetings with industry experts, it proposed by the committee to retain BS Geosciences program with addition of specializations in RS & GIS for mineral/mining/groundwater exploration.
- Fee structure should also be revised and reduced at least 25-30%.

**Proposal for the Research and Business Solutions Centre
Bahria Business School, BUKC**

1. Research and Business Solutions Centre

1.1 Introduction

Bahria Business School, Karachi Campus has a lot of potential for research; however, it is deficient of two things.

1. Platform to orchestrate new ideas
2. Mechanism of integration with other expertise.
3. In essence, Bahria Business School is a resource integrating branch of knowledge encompassing disciplines like marketing, employment of human resource, efficient investments and orchestration of information using tools like information technology, software development expertise, economic and financial analysis tools.
4. The research resources of the department include:
5. PhD faculty
6. Research inquisitive faculty members with requisite education track records
7. Research students of all disciplines and programs
8. Corporate linkages
9. Development of indigenous material (Case writing Centre)
10. Research funding and
11. Consultancy Projects

At the moment, we are working through individual efforts of research groups. The practice, though working satisfactorily, has not been able to produce significant number of research work worth presenting at national, international levels and accreditation bodies (highlighted by Mock Academic Visit held on 29th and 30th March 2021). Plan to overcome these issues were also presented to Honorable Rector by PBBS(A)/HoD Business Studies Department. It was proposed to establish Research Centre and Centre of Excellence to meet the NBEAC requirements. After doing thorough background working, it is now proposed to establish one center named “Research and Business Solution Centre” to achieve synergy. It is therefore, envisaged that intended RBS center shall bring about a change in enhancing research output of the department quantitatively as well as qualitatively and improve industry academia liaison.

1.2 Objectives of Research and Business Solution Centre

1. To establish a system or mechanism of increasing research output and its facets in the school
2. To promote the development of a research culture: faculty members and students stimulating research and, in so doing, influence a systematically distinguished research environment.
3. To create an enabling environment to stimulate the research and establishing the infrastructure.
4. To enable the co-operation with trade and industry concerning research and cooperative projects.
5. To provide essential research-related services and liaison at a local, national and international level.
6. To meet the University's social obligation through:
7. the development of technology that benefits the community

8. research that contributes to the economic development
9. expansion of advanced skills and understanding of human capital
10. The improvement of the environment, e.g., research related to green finance and energy; green HRM, and Supply Chain Management.

1.3. Organization/HR Implication

1. Head of RBSC
2. Assistant RBSC
3. PhD Scholars
4. Teaching Assistant

He will be supervising the teams to involve maximum faculty members. List of established committees at school level is as follows to cater the research related facets.

1. **Quantitative Research:** PhD scholars will be required to spend 4 hours weekly at university and train the other scholars in the areas of their expertise
2. **Assistant RBSC for English Proof Reading and paper formatting:** For the proofreading of thesis and research papers to be submitted to the department. (English faculty may also be involved)

1.4. Job Description of Manager RBS

Manager RBS center will be responsible for:

1. Generating research funds through the different committees
2. Studies and research council
3. Ensuring output from applied research team
4. Ensuring consultancy projects from industry
5. Involving maximum faculty to bring new Industrial projects from the industry
6. Manage Final Year Project Team
7. Manage Plagiarism of student thesis
8. Ensure thesis quality and maintain record of publications
9. Maintain record of Corporate Advisory Committee and add new members from industry. Also ensure fruitful outcomes from the CAC meetings.
10. Manage Case writing Centre
11. Maintain Citation record
12. Any other team may be added

Some of the teams are already been established and working in isolation. Although basic, applied (problem-solving) and developmental research are not always seen in isolation, thereby Bahria Business School Karachi campus wishes to actively promote Applied and Developmental Research by:

1. creating a relevant research culture,
2. promoting research outputs,
3. increasing funds available for research,
4. continually reviewing its research policy,
5. Recognizing research performance.

Therefore, it is recommended to bring all these teams under one umbrella to achieve synergies.

1.5. Resources

Following are the resources for RBS:

1. Office and office supplies:
 - a. Office

- b. Computer Systems for manager, TA, databases installed
- c. Telephone extension
- 2. Research Financial databases:
 - a. DataStream,
 - b. Bank Scope,
 - c. Eikon
 - d. Bloomberg
- 3. Licensed Research Software
 - e. SPSS,
 - f. Smart-PLS,
 - g. E-views,
 - h. STATA,
 - i. MATLAB,
 - j. AMOS

1.6. Financial Implication

Case Writing Centre is already established which will be converted to Research and Business Solution Centre.

- 1. Teaching Assistant
- 2. Honorarium for the English Proof-Reading (Suggested honorarium is Rs.500/-paper).

1.7. Expected / Intended Outcome

RBS Centre is expected to produce the following outcomes:

- 1. Research will be given extra importance and time which will increase the output
- 2. Studies and Research Council will be helpful in managing and ensuring quality of MS/MPhil thesis.
- 3. Each thesis student will identify the journal for publishing his work and submit the research paper to the journal and submit the evidence of submission along his thesis.
- 4. There will be emphasis on Applied Research and targets
- 5. Targets will be set for all the PhD faculty/PHD scholars which will be aligned with their Performance evaluation report.
- 6. Industry and consultancy projects will be given importance and dedicated team will work to get industry projects
- 7. Final Year Project for BS A& F will be facilitated by the team. They will arrange projects for BBA students.
- 8. Maintain the record of plagiarism of all thesis submitted to the departments at school level
- 9. Facilitate the faculty and students to find out quality and recognized journal as per the area of topic of research
- 10. Industry academia liaison will be improved and will involve the members in curriculum revision or other applied areas.
- 11. indigenous material will be developed to be included in courses
- 12. Citation record at central level will be compiled.

1.8. Implementing Strategy

Some of the committees are already been established but working in isolation therefore, it is recommended to bring all these activities under one umbrella to be facilitated and coordinated in more synchronized manner.

1.9. Recommendations

The Centre is recommended to be launched from Fall 2021

Composition: Studies and Research Council of BBS KC

Chairman: Principal BBS KC

Members:

1. HoD Management Studies
2. HoD Business Studies
3. HoD Maritime Studies
4. PGP Coordinators
5. MBA Thesis Coordinator
6. NBEAC Coordinator
7. Weekend / Evening Program Coordinators
8. Morning Program Coordinators
9. Student Grooming Program Coordinator
10. Member from National University
11. Member from International University

Secretary: Dr. Isma Zaighum

(Composition shall be reviewed as and when required under the Chairman's guidelines).

Terms of Reference of BBS KC Studies and Research Council

1. Monitor and ensure appointment of supervisors and advisory committee panels for PhD student.
2. Monitor and ensure conduct of research including thesis write up and projects as per BU policy parameters.
3. Evaluate progress of PhD and MPhil / MS / MBA students and ensure adherence to BU policy parameters.
4. Implement the decisions of the ACM, HERC and BoG Board on all matters relating to academic standards, examinations and research;
5. Ensure feedback of the implemented measures on research and academic matters to the Pro-rectors academic and research.
6. Process the changes in syllabi proposed by the Departmental Board of Studies and present them to the Faculty Board of Studies and Academic Council.
7. SRC shall meet at least twice a year. The quorum for a meeting of the FRC shall be half of the core members, a fraction being counted as one.
8. SRC shall maintain minutes of its meetings and forward copies to DG Campus, Pro-rector (Academics) Pro-rector (RIC), Dean MS and Director Academics.
9. Undertake any other research related responsibility assigned by the Head of the Committee

Bahria Business School Karachi Campus

Notification

Constitution of Committee for Applied Research

Reference: BU HR Policy on Distribution of Faculty Working Hours and Department Board of Studies Meeting of 8th April, 2021.

Composition

1. Convener: Dr. Sayma Zia (PBBS, KC)
2. Coordinator: Dr. M. Mutasim Billah Tufail
3. Members: Dr. Samina Riaz, Dr. Shazia, Mr. Essa Khan, Mr. Asif Rehman.

Terms of Reference

1. To develop the applied research plan and get it approved by the Convener.
2. To execute the applied research plan in time.
3. To develop liaison between industry and Bahria Business School to get applied research projects.
4. Develop a list of current applied areas and send it to the thesis/PGP coordinators for execution.

Conduct of Study

1. Task assignment by the convener.
2. Coordination of work by the coordinator.
3. Data / information collection by the members.
4. Submission of progress report on fortnightly basis to the convener
5. Write-up draft / preparing presentation by the coordinator.
6. Progress meeting on fortnightly basis under coordinator till completion.

Dr. Sayma Zia

Signature: _____

Designation: PBBS, KC

Date: _____

Distribution: DGKC, DKC, Cluster Heads, Coordinators, Dean MS

Bahria Business School Karachi Campus

Notification

**Constitution of Committee for Industry Projects
(Industrial liaison, Research & Commercialization)**

Reference: BU HR Policy on Distribution of Faculty Working Hours and Department Board of Studies Meeting of 8th April, 2021.

Composition

1. Convener: Dr. Sayma Zia (PBBS, KC)
2. Coordinator: Dr. Mutasim Billah Tufail
3. Members: Dr. Amir Feroz Shamsi, Dr. Naveed R. Khan, Mr. M Ali Sheikh.

Terms of Reference:

1. To develop the plan and get it approved by the Convener.
2. To execute the applied plan in time.
3. To develop liaison between industry and Bahria Business School to get projects.
4. Develop a list of current applied areas for execution.

Conduct of Study

1. Task assignment by the convener.
2. Coordination of work by the coordinator.
3. Data / information collection by the members.
4. Submission of progress report on fortnightly basis to the convener
5. Write-up draft / preparing presentation by the coordinator.
6. Progress meeting on fortnightly basis under coordinator till completion.

Dr. Sayma Zia

Signature: _____

Designation: (PBBS, KC)

Date: _____

Distribution: DGKC, DKC, Cluster Heads, Coordinators, Dean MS

**Bahria Business School Karachi Campus
Notification
Constitution of Committee for Final Year Project**

Reference: BU HR Policy on Distribution of Faculty Working Hours and Department Board of Studies Meeting of 8th April, 2021.

Composition

1. Convener: Dr. Sayma Zia (PBBS, KC)
2. Coordinator: Mr. Shoaib Waseem
3. Members: Dr. Mubshir, Dr. Shakeel, Mr. Muhamamid Faisal, Ms. Maawra Salam.

Terms of Reference:

1. To develop the applied research plan and get it approved by the Convener.
2. To execute the applied research plan in time.
3. To develop liaison between industry and Bahria Business School to get applied research projects.
4. Develop a list of current applied areas and send it to the thesis/PGP coordinators for execution.

Conduct of Study

1. Task assignment by the convener.
2. Coordination of work by the coordinator.
3. Data / information collection by the members.
4. Submission of progress report on fortnightly basis to the convener
5. Write-up draft / preparing presentation by the coordinator.
6. Progress meeting on fortnightly basis under coordinator till completion.

Dr. Sayma Zia

Signature: _____

Designation: PBBS, KC

Date: _____

Distribution: DGKC, DKC, Cluster Heads, Coordinators, Dean MS

**Bahria Business School Karachi Campus
Notification
Constitution of Committee for Ethical Review**

Reference: BU HR Policy on Distribution of Faculty Working Hours and Department Board of Studies Meeting of 5th April, 2021.

Composition

1. Convener: Dr. Sayma Zia (PBBS, KC)
2. Coordinator: Mr. Ahsan Rizvi
3. Members: Ms. Javeria Naveed, Ms. Munazza, Ms. Hadiqa Riaz.

Terms of Reference

1. To analyze plagiarism cases as decided at the department level.
2. To put forward workable recommendations as per HEC and BU rules.
3. To report serious case to higher authorities as per HEC guidelines.

Conduct of Study

1. Task assignment by the convener.
2. Coordination of work by the coordinator.
3. Convening of meeting and write-up under coordination of Committee Coordinator.

Dr. Sayma Zia

Signature: _____

Designation: PBBS,KC

Date: _____

Distribution: DGKC, DKC, Cluster Heads, Coordinators, Dean MS

**Bahria Business School Karachi Campus
Notification
Constitution of Committee for Thesis Quality Assurance**

Reference: BU HR Policy on Distribution of Faculty Working Hours and Department Board of Studies Meeting of 8th April, 2021.

Composition

1. Convener: Dr. Sayma Zia (PBBS,KC)
2. Coordinator: Dr. Rao Rashid
3. Members:, Dr. Amir Feroz Shamsi, Dr. Isma, Dr. Asma. Dr. Shazia

Terms of Reference:

1. To propose a policy to ensure the quality of thesis get it approved by the Convener.
2. To execute the plan in time.
3. To propose the policy for plagiarism.
4. Develop a list of research areas and send it to the thesis/PGP coordinators for execution.

Conduct of Study

1. Task assignment by the convener.
2. Coordination of work by the coordinator.
3. Data / information collection by the members.
4. Submission of progress report on fortnightly basis to the convener
5. Write-up draft / preparing presentation by the coordinator.
6. Progress meeting on fortnightly basis under coordinator till completion.

Dr. Sayma Zia

Signature: _____

Designation: PBBS,KC

Date: _____

Distribution: DGKC, DKC, Cluster Heads, Coordinators, Dean MS

**Bahria Business School Karachi Campus
Notification
Constitution of Committee for Corporate Advisory**

Reference: BU HR Policy on Distribution of Faculty Working Hours and Department Board of Studies Meeting dated 8th April, 2021.

Composition

1. Convener: Dr. Sayma Zia (PBBS,KC)
2. Coordinator: Ms. Insiya
3. Members: Dr. Adnan Butt, Ms. Hina Aamir, Mr. M. Usman

Terms of Reference:

1. To develop the plan for making CAC meetings meaningful and get it approved by the Convener.
2. To execute the plan in time.
3. To develop liaison between industry and Bahria Business School.
4. Develop a list of industry professionals.

Conduct of Study

1. Task assignment by the convener.
2. Coordination of work by the coordinator.
3. Data / information collection by the members.
4. Submission of progress report on fortnightly basis to the convener
5. Write-up draft / preparing presentation by the coordinator.
6. Progress meeting on fortnightly basis under coordinator till completion.

Professor Dr. Sayma Zia

Signature: _____

Designation: PBBS,KC

Date: _____

Distribution: DGKC, DKC, Cluster Heads, Coordinators, Dean MS

**Bahria Business School Karachi Campus
Notification
Constitution of Committee for Training and Development**

Reference: BU HR Policy on Distribution of Faculty Working Hours and Department Board of Studies Meeting of Dated 8th April, 2021.

Composition

1. Convener: Dr. Sayma Zia (PBBS,KC)
2. Coordinator: Dr. Adnan
3. Members: Dr. Isma, Dr. Rao Muhammad Rashid, Dr. Shakeel, Dr. Mubashir

Terms of Reference:

1. To conduct effective training and development session
2. To update it on monthly basis

Conduct of Study

1. Task assignment by the convener.
2. Coordination of work by the coordinator.
3. Data / information collection by the members for training.
4. Progress meeting on fortnightly basis under coordinator till completion.

Dr. Sayma Zia

Signature: _____

Designation: PBBS,KC

Date: _____

Distribution: DGKC, DKC, Cluster Heads, Coordinators, Dean MS

FIGURE 1 RESEARCH & BUSINESS SOLUTION CENTER (RBSC) AREAS AND MAIN ACTIVITIES

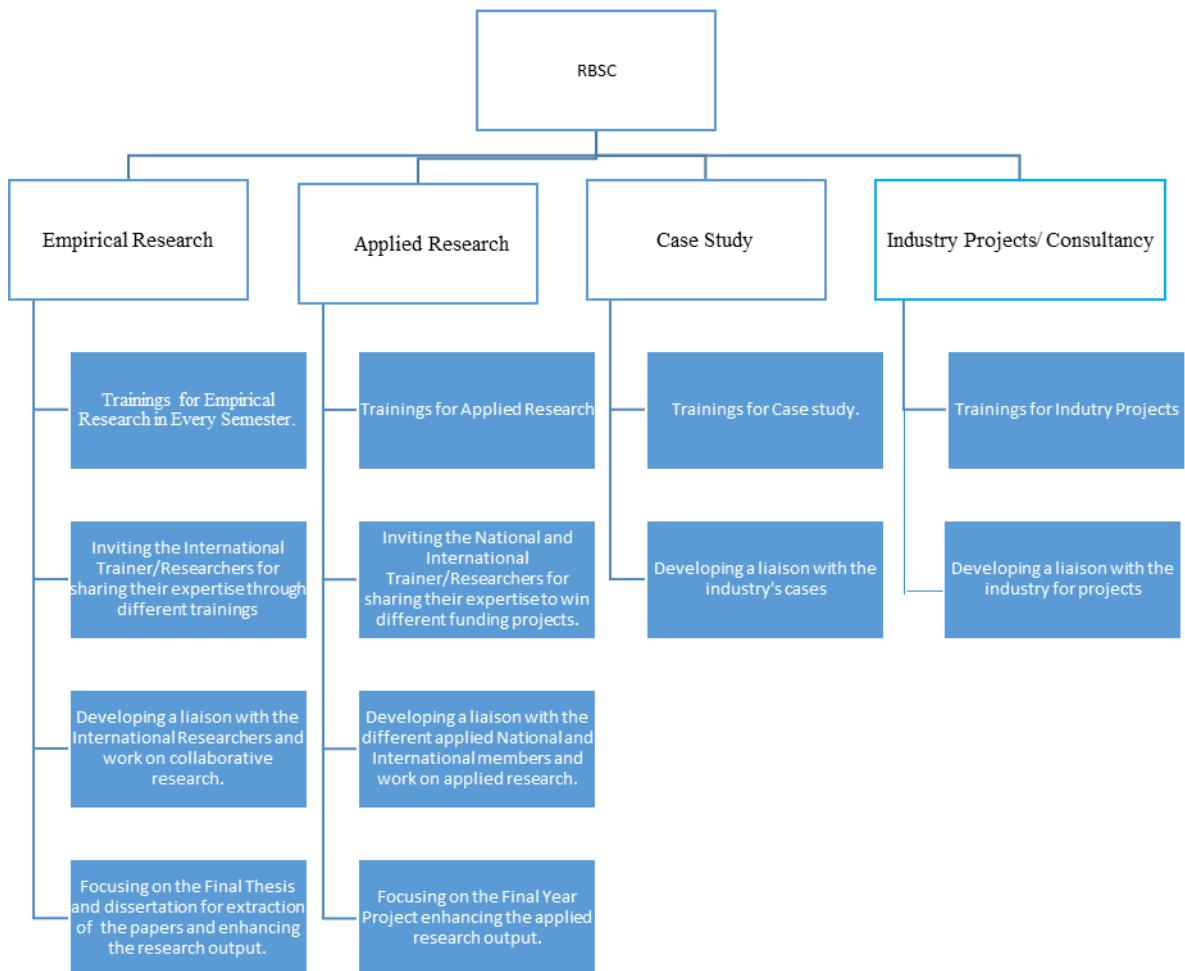
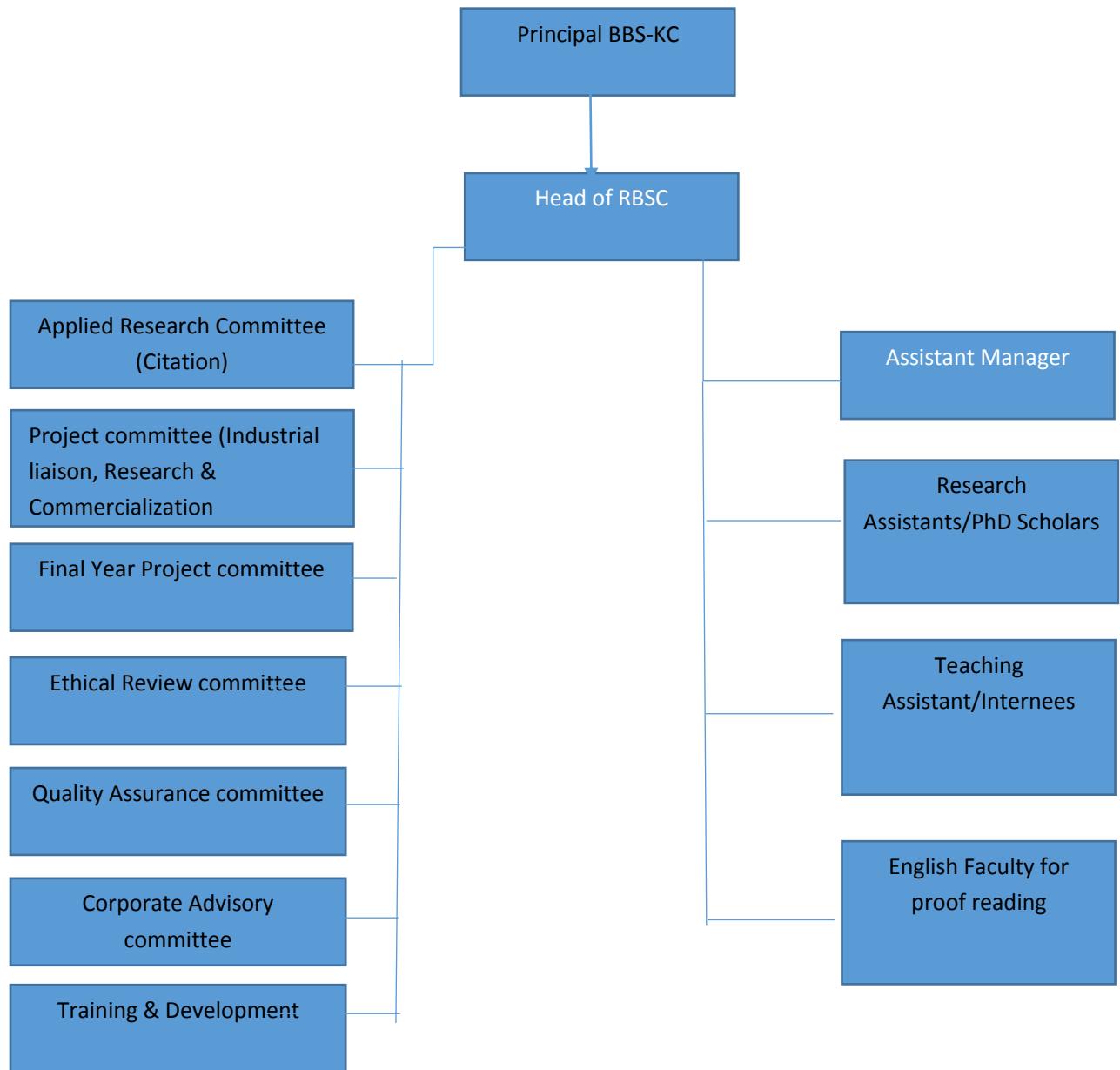


FIGURE 2 RESEARCH & BUSINESS SOLUTION CENTER (RBSC) ORGANOGRAM AND RESOURCES



Appendage 41(3804)

**MBBS AND BDS STUDENTS RETAKE EXAMINATION POLICY AND PROCEDURE FOR REMOVAL FROM
THE PROGRAM - BAHRIA UNIVERSITY, ISLAMABAD**

POLICY STATEMENT

(Reference: PMC Medical and Dental Undergraduate Education (Admissions, Curriculum and Conduct) Regulations 2021)

1. University will frame its own regulations for allowing failed students to retake professional examinations and such regulations will be publically notified and made available to the students.
2. A student retaking the exam will not be required to pay to the college tuition fee in addition to the fee paid for the given year. A retake exam fee will be charged by the university.
3. A student who fails to qualify a professional exam maybe offered a retake opportunity in accordance with the rules of the affiliating university subject to;
 - a. The student having qualified the retake and on rejoining their academic class shall be capable of completing the minimum study hours as prescribed under approved PMC curriculum.
 - b. If a student fails the retake offered and is detained and permitted by the university to repeat the academic year, the corresponding vacant seat occurring due to the repeating student shall remain vacant and not be filled through transfer of another student or any other means.
 - c. At all times the total strength of students in the college shall not exceed the gross total seats allocated for all applicable academic years of the program.

4. The college will notify the university (BUHO) and the BUHO will notify the Authority of any student having left or been removed from a program within fifteen days. The student registration with the Authority will stand cancelled on receipt of the information.

PROCEDURE

5. Maximum of FOUR chances, availed or un-availed, will be allowed to a student to clear any professional examination.
6. The student, upon request, may be allowed to repeat a year after having failed in a retake of the professional exam. The detained student will be required to pay to the college tuition fee in addition to the retake exam fee for the subject in which he/she desires to repeat.
7. Only retake exam fee will be paid by the students who do not desire to repeat the year in that particular subject.
8. The vacant seat of the detained student will not be filled.
9. Any MBBS or BDS student who fails to clear any professional examination in four chances, availed or un-availed, will not be eligible for continuation of medical and dental studies of MBBS and BDS in the subsequent professional examinations and will be removed from the program.
10. The Principal of the concerned college will forward the complete case of such students to BUHO (HS Dte) for the approval of the Competent Authority. After approval, college will be directed to remove the student after necessary clearance, under intimation to BUHO. Registrar will further notify the Authority (PMC) regarding the student having been removed from a program within fifteen days. The student registration with the Authority will stand cancelled on receipt of such information from the university.
11. This policy and procedure shall be effective with immediate effect for all sessions-2021 and onward.

Appendage 41(4013)

Program Objectives (POs) and Program Learning Outcomes (PLOs)
Department of HSS

Bachelor of Social Sciences (BSS)

Program Objectives (POs)	Program Learning Outcomes (PLOs)
PO 1: To prepare graduates acquire deep understanding and knowledge of International Relations, Development Studies, Anthropology and Sociology as well as the ability to analyze any given situation.	PLO 1: Demonstrate intellectual and analytical skills in the realm of IR, DS, Anthropology and Sociology.
PO 2: To prepare students with sound academic foundation that helps them to question critically, think logically, communicate clearly, act resourcefully, and live ethically.	PLO 2: Apply the gained knowledge and acquired skills into various practical domains.
PO 3: To inculcate an understanding of essential concepts and theories of related disciplines enabling the students to draw evidence-based conclusions.	PLO 3: Conduct high impact research on the diverse global, regional and national social, political, cultural and economic development.
PO 4: Impart diverse skills to our graduates to work at the leading national and international organizations, think tanks, and government offices for implementing result-oriented policy solutions.	PLO 4: Plan and execute result-oriented strategies to address the most pressing contemporary socio-economic and political challenges.
PO 5: To prepare students to apply theoretical knowledge to identify lacunae in the policy implementation and suggest cutting-edge solutions to improve socio-economic indicators in the country.	PLO 5: Students are able to monitor and evaluate existing policy interventions.

BS Public Health

Program Objectives	Program Learning Outcomes
The objectives of this program are:	After the completion of the degree graduates will be able to:
PO 1: To gain substantive knowledge in the field of public health and an ability to apply disciplinary principles theories, methods and approaches	PLO 1: To devise appropriate strategies for tackling the emerging public health issues
PO 2: To develop, administer and evaluate health policies and programs	PLO 2: To demonstrate their skills in policy formation and communication of health information to a wide range of audiences for preparedness about health emergencies and public disasters

PO 3: To prepare students to engage in research related to public health issues	PLO 3: to conduct quality research in relevant field to solve public health issues and contribute into the community health focusing on sustainable development approach
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BS Media Studies

Program Objectives POs	Program Learning Outcomes PLOs After completion of the degree, scholars will be
PO1 – To inculcate refined knowledge of Media practices supported by theoretical knowledge in specialised fields of media for successful career.	PLO1: Able to inculcate sufficient knowledge of Media Theories and industry to equip media studies students with relevant knowledge for successful careers in their fields of specialization.
PO2 - To develop analytical skills and abilities to investigate, analyse, monitor and assess the content as vigilant media managers.	PLO 2: Able to sharpen the critical thinking of media studies students to evaluate as well as monitor the situation through creative and innovative skills. PLO3: Able to develop intellectual and analytical skills for identifying and resolving the issues as media managers.
PO3 – To sharpen the communication and presentation skills of students using technology to meet international standards.	PLO4: Enable students to effectively communicate and advocate their viewpoint. PLO5: Able to demonstrate the ability to communicate effectively in writing and presenting thorough various forms of media technologies.
PO4 – Enable students to effectively practice Media Ethics to play socially responsible role in the society.	PLO6: Trained to develop socially responsible individuals and respect for culture and understanding ethics differences in their communicative media practices as part of corporate social responsibility.
PO5 - To train students in soft and hard skills for competing in the media industry by finding solutions in a timely, efficient and creative manner.	PLO7: Able to provide technological as well as efficient communication skills that provide problem solving abilities and instil professional personality traits in students.
PO6 - To equip students with media research skills from brainstorming, observing and integrating new information, theorizing and research writing in a conducive research environment.	PLO 8: Able to work in the media research environment and apply statistical knowledge for producing research theses and articles as per international standards.
PO7 - To sharpen entrepreneurial skills by writing, developing, producing, directing, displaying media content in a professional manner to add into socio-economic development of the country.	PLO9: Able to understand media industry's professional and managerial knowledge while bridging the gap between academia and industry linkages for media and socio-economic development. PLO10: Able to equip with professional environment for enhancing entrepreneurial skills through practical projects as per the market needs and demands.

BS TV Broadcasting & Digital Media

Program Objectives (POs)	Program Learning Outcomes (PLOs) After completion of the degree, students will be
PO 1: To provide students with advanced knowledge & critical awareness regarding, concepts and theoretical approaches in the study of television production & Digital Media.	PLO 1: able to understand all types of visual and digital communication and their theoretical approaches of TV Broadcasting & Digital Media.
PO 2: To develop an understanding of the history, structures and current practices of the television industry & Digital Media, including the primary genres and the critical skills to present analysis and evaluation in written, spoken and visual forms.	PLO2: able to understand historic evolution and developing the required skill set to produce various genres of TV and digital media including news, documentaries, dramas, music videos, interviews, talk shows, and educational programs etc.
PO 3: To enable students to explore and reflect on the practical implications of working in television broadcasting and digital media as well as enabling them to build an understanding of appropriate methodologies for further research in television studies.	PLO 3: Equipped with the requisite skills of all major aspects of TV and Digital video production such as direction, set design, cinematography and editing. PLO 4: Able to have digital media expertise such as digital media analytics, digital storytelling, Vlogging and web designing etc.
PO 4: To equip students with the technical as well as methodological expertise to understand the dynamics of digital and social media technologies in the current times. In order to create and build career opportunities in digital media spectrum.	PLO 5: Able to create and disseminate all kinds of digital media content. PLO 6: Skilled in their entrepreneurial abilities and become practically self-sufficient in terms of their career choices in TV Broadcasting & Digital Media domains.
PO 5: Enable students to effectively practice Electronic and Digital Media Ethics to play socially responsible role in the society.	PLO 7: able to develop socially responsible behaviours with respect to social norms and culture and practice these values in their professional roles.

BS English

POs	PLOs
PO 1: To assist students, cognize fundamental concepts of linguistics & literature and to introduce them to courses from diverse fields to promote trans disciplinary thinking.	PLO 1: to demonstrate the conventions of diverse textual genres (e.g. the non-fiction essay, poetry, autobiography, novel, memoir, films, plays, editorials and so forth) in their own work and to make world a better place. PLO 2: to employ the literary and rhetorical methods and strategies in reading and writing of texts. PLO 3: to build relationship between language and society in order to provide solutions to the social issues.
PO 2 : To provide the lens of modern theories for a broad appreciation of	PLO 4: To apply modern theories in contrast with models with the social and behavioral sciences

global literature and intriguing aspects of human knowledge and behavior.	
PO 3: To nurture a culture of research-based learning environment with an emphasis on novel research into both theoretical and applied linguistic issues in context.	PLO 5: to excel in research, textual criticism, analytical skills and pedagogical methods. PLO 6: to apply field-specific critical and theoretical methods of literary analysis to produce aesthetic, historical and cultural assessments of literary texts. PLO 7: To design and implement a research project focused on a scholarly question in linguistics, thoughtfully collecting, analyzing and interpreting primary data.
PO 4: To enable students to acquire the skills needed to bring a momentous professional impact to the fields of Linguistics & Human Sciences.	PLO 8: to enable students to improve their writing skills, presentation and public speaking skills and apply these professionally outside the classroom to become life-long learners.
PO 5: To enable students to effectively practice moral and ethical values to play socially responsible role in the society.	PLO 9: to assist in developing their employability skills with effective use of moral and ethical values in the real world.

Bahria University Law School

LLB 5-Year Program Objectives

1. Producing Law graduates, competent lawyers, judges and legislators.
2. Encouraging students to be good advocates, researchers and teachers in the fields of Law and Jurisprudence.
3. Equipping students with skills and knowledge of National, Trans-national and International Law.
4. Preparing leadership in the field of Law, imbued with ethical values, for the current and future generations.

Program Learning Outcomes

After completion of degree, students will be able to:

1. Identify, formulate, and apply legal rules and principles onto practical situations.
2. Critically evaluate the practical consequences of various legal rules and to formulate policy arguments through reasoning.
3. Write articulately in a wide range of legal issues for practical and academic domains.
4. Apply their legal thoughts and advocacy skills in a coherent and effective manner.

LLM 2-Year Program Objectives

1. Producing LL.M graduates and prospective research scholars with specialized and in-depth knowledge of different branches of Law.
2. Creating and developing legal research intellect.
3. Inculcating analytical and critical thinking amongst scholars.
4. Preparing leadership in the field of Law, imbued with ethical values, for the current and future generations.

Program Learning Outcomes

After completion of degree, students will be able to:

1. Identify practical consequences of various legal rules and to formulate advanced policy arguments through reasoning.
2. Construct and critically evaluate legal arguments.

3. Articulate their thoughts in a coherent and effective manner.
4. Understand the nexus between practical aspects of legal profession and academia.

LLM (International and Maritime Law) Program Objectives

1. Producing LL.M graduates and prospective research scholars with specialized and in-depth knowledge of International and Maritime Law.
2. Creating and developing legal research intellect in ocean trade and governance alongside marine environment.
3. Inculcating analytical and critical thinking amongst scholars.
4. Preparing leadership in the field of Maritime Law, imbued with ethical values, for the current and future generations.

Program Learning Outcomes

After completion of degree, students will be able to:

1. Identify practical consequences of various legal rules and to formulate advanced policy arguments through reasoning in International and Maritime Law.
2. Articulate their thoughts in a coherent and effective manner.
3. Apply and litigate International and Maritime Law in multiple jurisdictions.
4. Understand the nexus between practical aspects of legal profession and academia.

Department of Islamic Studies

MS Islamic Studies

Programme Objectives (POs)

1. Developing such courses that will provide the accurate and valuable information about Islam and life.
2. Attaining maximum benefit in Islam and life from Quran, Sunnah and global human experiences.
3. Inculcating Islamic philosophy, principles and teachings as a part of practical life and providing guidance regarding knowledge and conduct to societies.
4. Clarifying misconceptions regarding Islam by critically and objectively analysing and bringing forward the true picture of Islam.
5. Analysing worldwide religions, civilizations and cultures, bringing harmony among Islam and other religions, civilizations and cultures by identifying the commonalities.

Programme Learning Outcomes (PLOs)

1. Students would realize the importance of Islam in their daily life and would be able to implement it.
2. Students will learn the role of Islam in different spheres of life.
3. Students will be able to analyse the issues of Islamic Sharia and they would be able to suggest the solutions appropriately.
4. Students will be able to produce scholarly research and they would be able to respond to the Modern Western objections on Islam.

MS (IR) – International Relations

POs (Program Objectives)	PLOs (Program Learning Outcomes)
PO1: To instill an understanding of fundamental principles and theories of international relations.	After the successful completion of the degree, Scholars will be able to; PLO1: Apply the theoretical and conceptual tools to global issues realizing the paradigm shifts in the policies.
PO2: To foster an understanding of current political issues and their impact upon the contemporary political environment.	PLO2: Analyze and evaluate the dominant views, core controversies and the logic behind regional and global systemic changes.
PO3: To develop an exciting and conducive learning environment for quality research and other related learning activities, including seminars, debates and guest lectures.	PLO3: Formulate creative ideas through conducting original research on the significant international issues.

MS Applied Anthropology

Program Objectives	Program Learning Outcomes
The objectives of this program are:	After the completion of the degree graduates will be able to:
PO 1: To develop an extensive knowledge of theoretical frameworks and the subsequent critical positions in anthropology.	PLO 1: Demonstrate critical and analytical skills to engage with a range of socio-cultural and political contexts
PO 2: To provide better and holistic understanding of societal and cultural processes through various sub-disciplines of anthropology.	PLO 2: Employ a cross-cultural and holistic approach to socio-cultural, economic, political, and religious issues.
PO 3: To inculcate skills and knowledge to design, develop and undertake individual ethnographic research projects with human participants in different socio-cultural milieus of Pakistan.	PLO 3: Analyze, assess and implement ethical practices in human research and professional contexts within and outside academia PLO 4: Assess, prioritize, and strategically apply anthropological skills and knowledge in diverse professional settings.

MS Media Studies

Program Objectives POs	Program Learning Outcomes PLOs After completion of the degree, scholars will be able to
PO 1: To prepare scholars analyze the core theoretical approaches to media studies.	PLO 1: Apply key research debates and acquired skill sets while working with Pakistan's leading media organizations, Public relation firms and think tanks.
PO 2: To inculcate a deeper understanding of various theoretical disposition within the critical scholarship	PLO 2: Conduct robust research on the diverse media issues such as media, society, public and narrative building.

of media studies	
PO 3: To prepare scholars to engage in interdisciplinary research related to complex issues within the sphere of media.	PLO 3: Relate interlinked social science disciplines by conducting meaningful research explaining the intersection of these disciplines.
PO 4: To produce refined and skilled media researchers and practitioners as per international standards.	PLO 4: equipped with expertise in media studies research as well as required professional techniques.

Ph.D. (IR) – International Relations

POs (Program Objectives)	PLOs (Program Learning Outcomes)
	After the successful completion of the degree, Scholars will be able to;
PO1: To provide Scholars with a comprehensive understanding of a broader perspective and theoretical foundations of international relations.	PLO1: Analyze contemporary and future international issues and be able to offer innovative solutions for global peace, harmony, and cooperation.
PO2: To produce broadly educated and well-trained Scholars to promote original contributions to research.	PLO2: Evaluate and synthesize information from diverse and reliable sources, to uncover the roots of common perceptions and practices and to come up with policy proposals.
PO3: To acquaint scholars with disciplinary norms and standards, issues related to ethical practices in research, professional and public engagement.	PLO3: Assess the underlying issues in the philosophy of science and social scientific inquiry.

PhD Media Studies

Program Objectives POs	Program Learning Outcomes PLOs After completion of the degree, scholars will be able to
PO 1: To impart state of the art education in media studies to research scholars to prepare them for professional and leadership positions.	PLO 1: Find avenues to a career in academia, research institutes, and media and communication sector
PO 2: To provide intensive trainings in research to equip scholars with excellent research and analytical skills to tackle emerging challenges.	PLO 2: Produce innovative and quality research work to tackle most imminent media and social issues.
PO 3: To enable PhD scholars with better and more comprehensive understanding of the practical issues in media sphere in Pakistan and global media industry.	PLO 3: Comprehend and present policy guidelines pertaining to media related issues.

PhD (Law)

Program Objectives

1. Discovering, creating, and contributing original knowledge in the fields of Law and Jurisprudence.
2. Tackling various challenges identified in legal research methodologies.
3. Responding critically to emerging issues in domestic and global legal environment.
4. Comparing and contrasting indigenous and international research in various fields of Law and Jurisprudence.

Program Learning Outcomes

After completion of the doctoral degree, researchers will be able to:

1. Write an advanced literature review, particularly to indicate research niche(s) in the already published work.
2. Apply appropriate legal research skills for framing sound theoretical, conceptual and empirical frameworks.
3. Identify and comprehend relevant research methodologies and legal research methods applicable to the research problem.
4. Provide researched based opinion to the executive, legislature and judiciary.

Appendage 41(4016)**LAUNCH OF NEW PROGRAM – MASTER OF SCIENCE IN GOVERNMENT AND PUBLIC POLICY - BUIC**

A. ACADEMIC DETAILS	
1	Faculty/Department: Department of Humanities and Social Sciences, Bahria University, Islamabad Campus (BUIC)
2	Name of the Program: Master of SCIENCE (MS) in Government and Public Policy (GPP)
3	Mission of the Program: To equip the scholars with relevant tools and skills to undertake academic research and teaching in the field of Public Policy
4	Objectives of the Program The core objective of MS program is to contribute to bringing forward a new generation of scholars equipped with profound knowledge of discipline with an ability to advance scholarship in areas of their specialization. In particular: <ol style="list-style-type: none"> 1. Students will be encouraged to develop a critical understanding of major debates, theories, and strategic interventions and of the skills to analyze the issues, and to design and assess interventions aimed at tackling these issues. 2. An essential part of this process is to develop skills in research methodology, which will be applied in a thesis prepared as a requirement for the master's degree. 3. The two-year MS in Government and Public Policy will provide them with a rigorous and critical introduction to public policy as a process of managed and unmanaged change in the societies and institutions of the global South. The Program is an excellent preparation for a career in public policy or practice or for further study in the field.
5	Outcomes of the Program A thorough understanding about classical and recent theoretical knowledge in the areas of Public Policy and cross cutting disciplines. <ul style="list-style-type: none"> • Ability to draft projects documents, to be able to work in project implementation team as well as to successfully monitor and evaluate and eventually to determine the success and failures of development Interventions. • To be able to understand the research philosophy along with methodology sophistication and familiarity with academic writing process
6	Rationale for the Program It will add diversity to the programs being conducted at Islamabad Campus of Bahria University. Islamabad is the hub of government offices, donor agencies, NGOs, think tanks and international missions and hence there is continuous need of trained human resource in the field of Public Policy. Bahria University have successfully run the Development Studies Program at undergraduate program that means we already have a strong foundation of students who intend to opt for public program at Bahria University. Given

	<p>the demand of Program PIDE have even started morning and evening batches of Government & Public Policy program and still the demand is unmet. The start of MS program in GPP will fulfill the existing gap in the discipline. The department has a faculty member who would be completing his PhD in Public Policy from Oregon State University within a year. However, we will need another one in Public Policy which fulfills the HEC/BU requirements to start a new MS program.</p>
7	<p>Brief Description of the Program</p> <p>Public organizations today – and those organizations that interact with them – are faced with vast amounts of information and competing opinions with different calls to urgent action. The economists will advise whether a policy proposal idea is efficient; the lawyers whether it is permitted; the financiers whether it is affordable and the philosophers whether it is right. But as a mid-level or senior-level policymakers need to understand and navigate between these different opinions in order to make ‘good’ policy. This is what we call the craft of government. With political polarization becoming the defining issue of our time there is a pressing need to develop a more precise understanding of the complex incentives and limitations that shape the policy behavior of modern governments. In this course we develop an in-depth understanding of what public policy is and why we sometimes justify government action to solve social problems and other times do not. We learn each step of the policy process and evaluate the characteristics of effective and ineffective policies. We also examine the environments in which poorly designed public policies may have created unexpected and negative outcomes such as inequality or political capture. This course explores many of the paradoxes inherent in public policy by focusing on the controversial topics that animate today's most meaningful public debates such as healthcare police reform gun ownership homelessness and education.</p> <p>Government and Public Policy: An insight into program</p> <p>Introduction to Public Policy covers a wide range of topics, from the norms and values informing democratic policymaking to the basics of cost-benefit and other tools of policy analysis. Though emphases will differ based on instructor strengths, all sections will address the institutional arrangements for making public policy decisions, the role of various actors-including nonprofit and private-sector professionals-in shaping policy outcomes, and the fundamentals (and limits) of analytic approaches to public policy. The MPP begins with a carefully planned program of activities during the induction period which introduces policy making and advice on how to derive the greatest benefit from the MPP experience. The curriculum for the rest of the course is delivered via a series of lectures, seminars, case studies and workshops across three terms, and the summer project which is an opportunity to apply knowledge and skills learned through the program in a public policy context.</p> <p>Policy challenges are becoming more complex every day and public leaders need to be able to use expertise from different specialist fields to find innovative solutions. For this reason, the curriculum integrates insights and approaches from a diverse range of academic disciplines and also includes modules delivered by leading policy practitioners.</p> <p>The current curriculum includes the following compulsory modules:</p> <ol style="list-style-type: none"> 1. Introduction to Public Policy

	<p>2. Public Policy and Institutions 3. Political Economy of Public Policy 4. Advance Research Methods and Techniques</p> <p>Students can also personalize their learning to meet professional needs by choosing from a number of options as well as deepen their professional and practical skills through modules such as negotiation, communications, private finance, and entrepreneurship. Students will also get to further sharpen their skills and exposure to real world policy challenges through a 6–8-week summer internship. It is expected that MPP students will be fully committed to their studies and take responsibility for their active participation in all aspects of the program.</p> <p>Alongside teaching, which can include lectures, case studies, workshops, and seminars, students are encouraged to learn from each other, for example by forming study groups and arranging student-led talks and events. Students will also be expected to undertake some self-directed study, including required and supplementary readings and case studies. The students will be offered course work worth 24 credit hours followed by a dissertation worth 6 credit hours.</p>
8	Duration: Minimum 2 Years (4 Semesters)
9	Venue(s): On Site/Off Site/Both On & Off Site (<i>Tick one; if Off Site, give details</i>) Department of Humanities and Social Sciences, Bahria University, Islamabad Campus, Shangrila Road Islamabad.
10	Program Scheduling Format: Evening Bi-Semester
11	Proposed Date of Commencement: Fall 2022
12	Mode of Study/Examination: Semester System
13	Additional Faculty Member(s) Required: (<i>Indicate if there is a requirement for additional faculty members, fulltime/visiting, along with qualifications.</i>). 2 VFM (holding PhDs in relevant disciplines)
14	Additional Skilled-Worker(s) Required: (<i>Indicate if there is a requirement for additional Skilled Staff, fulltime/part-time, along with their qualifications/skill sets.</i>) Nil
15	Additional Classroom(s) required: (<i>The requirement is to include the number of classrooms and their capacities.</i>) One classroom with a capacity of 10-15 students
16	Additional Requirement for Laboratories: (<i>The requirement is to include the number of laboratories, their equipment and their capacities.</i>) Nil
17	Additional Requirement for Books, Subscriptions, Memberships to Online Research Sites/ Repositories: <ol style="list-style-type: none"> Access to the most relevant Public Policy Journals. Recommended books that are mentioned in the course roadmap
18	Minimum Entry Level: 16 years of education from HEC recognized educational universities / institutes, students.
19	Admission Criteria: As per HEC/BU Policy
20	Additional/Different Examination Requirement (<i>Indicate if there will be any examination requirement, additional to or different from the</i>)

	<i>BU Academic Rules or Examination Policy in vogue).</i> As per BU Policy
21	Number of Admissions Expected for First Intake: 10-12 students
22	Number of Admissions Planned/Expected for Subsequent Intakes: 10 % increase every semester
23	Referred by: (delete which is inapplicable) DBOS: held on 29 th July 2021
24	Complete Plan of Studies, inclusive of complete Roadmap: (Attach as Annex 'A') Attached
25	Course Outlines, Descriptions, Pre-Requisites & Readings (Compulsory & Recommended) (Attach as Annex 'B') Attached

B. FINANCIAL DETAILS	
1	Source of Funding: BU: Fully
2	Degree Duration: <u>Annual or Semester System:</u> Semester: Minimum 4 semesters (2 years) Total Number of Credit Hours: 30
3	Expected fee to be charged based on Cost & Benefits Analysis: (show working) Fee rate per credit hour: Rs. 4685
4	Expected Number of students for 1st & 2nd Intakes: 12-15 students
5	Expected Earning from first two Intakes (B5): (Show working) a. $96220 \times 12 \text{ (1}^{\text{st}} \text{ intake - Semester 1)} + 61,220 \times 12 \text{ (1}^{\text{st}} \text{ intake - Semester 2)} = 9,62,200 + 6,12,200 = 1.574400 \text{ million}$ b. $96220 \times 15 \text{ (2}^{\text{nd}} \text{ intake - Semester 1)} + 61,220 \times 15 \text{ (2}^{\text{nd}} \text{ intake - Semester 2)} = 11,54,640 + 7,34,640 = 1.889280 \text{ million}$ Total: 1.574400 + 1.889280 = 3.436720 million
7	Total Estimated Salaries of all Additional Human Resources per annum (B7): (Show working) Salary of first VFM (PhD) = $2300 \times 96 = 220,800 / \text{annum}$ Salary of second VFM (PhD): $2300 \times 96 = 220,800 / \text{annum}$ Total Salaries: 441,600
8	Cost of Additional Laboratory Equipment/Tools (B8): (show working) Nil
9	Cost of Additional Classrooms (B9): (Include furniture, technical aids etc) Nil
10	Cost of Additional Books, Subscription & Memberships to on-line Sites/Repositories (B10): (show details) 0.5 million/annum
11	Off-Site rental Expenses and Cost of other Fixtures (B11): (Show details) Nil
12	Miscellaneous Expenses required for Starting the Program (B12): - Advertisement: - Printing & Stationery: - Admin Cost: - Total: 0.5 million
13	Annual Recurring Expenditures in Subsequent Years (B13): - Salaries: - Rentals:

	<ul style="list-style-type: none"> - Subscriptions/Memberships: - Advertisements: - Printing & Stationery: - Admin Cost
14	Total Cost of the Program (B14): [Add B (7) to B (12)] $B (7) + B (12) = 441600 + 0.5 \text{ million} = 941,600$
15	Net Cost of the Program (B15): [Subtract B (1) from B (14)] $B (14) - B (1) = 941,600 - 0 = 941,600$
16	Net Earnings in First Year (B16): [Subtract B (15) from B (5)] $B (5) - B (15) = 3.436720 \text{ million} - 941,600 = 2.495120 \text{ million}$
17	Projected Annual Gross Earning in Subsequent Years (B 17): (<i>show details & working; add 10% towards all expenses in subsequent years.</i>) 3.780392 million (incremental)
18	Projected Annual Net Earning in Subsequent Years: [Subtract B (14) from B (17)] $B (17) - B (13) = 3.780392 \text{ million} - 441600 = 3.338792 \text{ Million}$

Launch of New Program – Bachelor of Science in Mathematics at BH3S-KC

A. ACADEMIC DETAILS	
1	Faculty/Department: Department of Humanities and Social Sciences, Bahria University, Karachi Campus (BUKC)
2	Name of the Programme: Bachelor of Science (BS) in Mathematics
3	Mission of the Programme: BS Mathematics helps students to be highly numerate with critical thinking, equipped with research-based inquiry and professional approach to seek creative careers in applied sciences.
4	Objectives of the Programme: <ul style="list-style-type: none"> • To acquire mathematical knowledge that will provide the students with a strong foundation for further study and for a career in the domain of applied sciences. • To develop fundamental mathematical skills and the ability for independent mathematical learning, reasoning and critical thinking. • To be familiar with research techniques and know how to apply the mathematical ideas with clarity and coherence. • To use computational tools for solving real-world problems by applying the concept of mathematical modeling.
5	Outcomes of the Programme: Upon completion of the BS Mathematics program, Students will be able to: <ul style="list-style-type: none"> • Identify, formulate, research literature and analyze mathematical models governing laws of applied sciences. • Conduct investigation into complex systems of differential equations using research based knowledge and research methods including analysis and interpretation of data and synthesis of information to provide valid conclusion. • Apply reasoning knowledge to access societal, health, safety, legal, cultural and economic issues and the consequent responsibilities relevant to their professions. • Understand impact of mathematical solutions in societal and environmental contexts and demonstrate knowledge and need for sustainable development. • Demonstrate knowledge and understanding of applied mathematics and statistics and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
6	Rationale for the Programme: A degree in Mathematics is a professional pathway for those interested in solutions and solving real-world problems. It's an important discipline to study because many roles require a basic or advanced understanding of mathematical concepts.
7	Brief Description of the Programme: This program includes brief description about the basic as well as advanced and applied courses of Mathematics. In order to develop strong base of physical sciences, courses of physics, economics, Computer Science, Engineering and research related are also included in it. These courses will provide strong base to apply mathematics in different fields. The BS Mathematics assists students to enhance their quantitative skills which are highly valued as a mathematician. This degree prepares students for a career in the public and private sectors. The graduates can pursue for further studies, or in work finance, consultancy, advertising,

	management, banking, marketing, accountancy, commerce, education, research and IT.
8	Duration: 4 Years (8 Semesters)
9	Venue(s): On Site/Off Site/Both On & Off Site (<i>Tick one; if Off Site, give details</i>) Department of Humanities and Social Sciences, Bahria University, Karachi Campus
10	Programme Scheduling Format: Twice a year
11	Proposed Date of Commencement: Fall 2022
12	Mode of Study/Examination: Semester System
13	Additional Faculty Member(s) Required: (<i>Indicate if there is a requirement for additional faculty members, fulltime/visiting, along with qualifications.</i>) Existing Permanent Faculty will be sufficient to start the program along with few visiting faculty members. Later on more faculty members will be required.
14	Additional Skilled-Worker(s) Required: (<i>Indicate if there is a requirement for additional Skilled Staff, fulltime/part-time, along with their qualifications/skill sets.</i>) Nil
15	Additional Classroom(s) required: (<i>The requirement is to include the number of classrooms and their capacities.</i>) <ul style="list-style-type: none"> • Classrooms in Sir Syed block are available. • No additional Classroom is required till 2nd semester.
16	Additional Requirement for Laboratories: (<i>The requirement is to include the number of laboratories, their equipment and their capacities.</i>) Labs are available in the campus on sharing bases.
17	Additional Requirement for Books, Subscriptions, Memberships to Online Research Sites/ Repositories: BUKC library may fulfill the initial requirements.
18	Minimum Entry Level: The candidates seeking admission must secure at least 50% marks in aggregate in F.Sc. / ICS / DAE / General Science with major subject Mathematics. OR Any other examination of Foreign University/ institution/ Examining Body, equivalent to intermediate with Mathematics, Equivalence and percentage of Marks will be determined by IBCC
19	Admission Criteria: As per HEC/BU Policy
20	Additional/Different Examination Requirement (<i>Indicate if there will be any examination requirement, additional to or different from the BU Academic Rules or Examination Policy in vogue.</i>) As per BU Policy
21	Number of Admissions Expected for First Intake: 20 students
22	Number of Admissions Planned/Expected for Subsequent Intakes: 25-35 students in total are expected in each subsequent semester
23	Referred by: HOD, Department of Humanities and Social Sciences, Bahria University, Karachi Campus (BUKC)
24	Complete Plan of Studies, inclusive of complete Roadmap: (<i>Attach as Annex 'A'</i>) Attached
25	Course Outlines, Descriptions, Pre-Requisites & Readings (Compulsory & Recommended) (<i>Attach as Annex 'B'</i>) Attached

B. FINANCIAL DETAILS																																											
1	Source of Funding: BU: Fully																																										
2	Degree Duration: Annual or Semester System: Semester: Minimum 8 semesters (4 years) Total Number of Credit Hours: 126																																										
3	Expected fee to be charged based on Cost & Benefits Analysis: (show working) <ul style="list-style-type: none"> • Tuition fee per Semester :Rs. 70,000/- • Admission fees & other charges at the time of admission: Rs. 40,000/- • Total fees at the time of admission : Rs. 1,10,000/- 																																										
4	Expected Number of students for 1st & 2nd Intakes: 20 students each																																										
5	Expected Earning from first two Intakes (B5): (Show working) $1,10,000 \times 20 \text{ (1}^{\text{st}} \text{ intake)} + 1,10,000 \times 20 \text{ (2}^{\text{nd}} \text{ intake)} = 2.2 \text{ Million} + 2.2 \text{ Million} = 4.4 \text{ Million}$																																										
6	Expected Earnings for the Next Four Years (B6): (show working) <ul style="list-style-type: none"> • Tuition fee per Semester: Rs. 70,000/- • Admission fees & other charges at the time of admission: Rs. 40,000/- • Total fees at the time of admission : Rs. 1,10,000/- <table border="1"> <thead> <tr> <th><u>Semester</u></th><th><u>Students</u></th><th><u>Cumulative Students</u></th><th><u>Earnings</u></th></tr> </thead> <tbody> <tr> <td>Fall 2022</td><td>20</td><td>20</td><td>2,200,000/-</td></tr> <tr> <td>Spring 2023</td><td>20</td><td>40</td><td>3,600,000/-</td></tr> <tr> <td>Fall 2023</td><td>25</td><td>65</td><td>5,550,000/-</td></tr> <tr> <td>Spring 2024</td><td>25</td><td>90</td><td>7,300,000/-</td></tr> <tr> <td>Fall 2024</td><td>30</td><td>120</td><td>9,600,000/-</td></tr> <tr> <td>Spring 2025</td><td>30</td><td>150</td><td>11,700,000/-</td></tr> <tr> <td>Fall 2025</td><td>35</td><td>185</td><td>14,350,000/-</td></tr> <tr> <td>Spring 2026</td><td>35</td><td>220</td><td>16,800,000/-</td></tr> <tr> <td colspan="3">Total Projected Earning</td><td>71,100,000/- 71.1 million</td></tr> </tbody> </table>			<u>Semester</u>	<u>Students</u>	<u>Cumulative Students</u>	<u>Earnings</u>	Fall 2022	20	20	2,200,000/-	Spring 2023	20	40	3,600,000/-	Fall 2023	25	65	5,550,000/-	Spring 2024	25	90	7,300,000/-	Fall 2024	30	120	9,600,000/-	Spring 2025	30	150	11,700,000/-	Fall 2025	35	185	14,350,000/-	Spring 2026	35	220	16,800,000/-	Total Projected Earning			71,100,000/- 71.1 million
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7	Total Estimated Salaries of all Additional Human Resources per annum (B7): (Show working)																														
	<table border="1"> <thead> <tr> <th><u>Semester</u></th><th><u>No. of courses</u></th><th><u>Salaries per semester</u></th></tr> </thead> <tbody> <tr> <td>Fall 2022</td><td>6</td><td>1,500,000</td></tr> <tr> <td>Spring 2023</td><td>12</td><td>2,850,000</td></tr> <tr> <td>Fall 2023</td><td>17</td><td>3,540,000</td></tr> <tr> <td>Spring 2024</td><td>22</td><td>4,050,000</td></tr> <tr> <td>Fall 2024</td><td>27</td><td>4,500,000</td></tr> <tr> <td>Spring 2025</td><td>32</td><td>5,130,000</td></tr> <tr> <td>Fall 2025</td><td>37</td><td>5,640,000</td></tr> <tr> <td>Spring 2026</td><td>42</td><td>6,090,000</td></tr> <tr> <td colspan="2">Total expected salaries</td><td>33,300,000 33.3 million</td></tr> </tbody> </table>	<u>Semester</u>	<u>No. of courses</u>	<u>Salaries per semester</u>	Fall 2022	6	1,500,000	Spring 2023	12	2,850,000	Fall 2023	17	3,540,000	Spring 2024	22	4,050,000	Fall 2024	27	4,500,000	Spring 2025	32	5,130,000	Fall 2025	37	5,640,000	Spring 2026	42	6,090,000	Total expected salaries		33,300,000 33.3 million
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10	Cost of Additional Books, Subscription & Memberships to on-line Sites/Repositories (B10): (show details) 0.3 million/annum																														
11	Off-Site rental Expenses and Cost of other Fixtures (B11): (Show details) Nil																														
12	Miscellaneous Expenses required for Starting the Program (B12): <ul style="list-style-type: none"> - Advertisement: Rs 50,000/= - Printing & Stationery: Rs 10,000/= - Admin Cost: Rs 100,000/= - Any other: Rs 100,000/= Total: 0.260 million																														
13	Annual Recurring Expenditures in Subsequent Years (B13): <table border="1"> <thead> <tr> <th><u>Year</u></th><th><u>Expenses</u></th></tr> </thead> <tbody> <tr> <td>1</td><td>4.35 million</td></tr> <tr> <td>2</td><td>7.59 million</td></tr> <tr> <td>3</td><td>9.63 million</td></tr> <tr> <td>4</td><td>11.73 million</td></tr> </tbody> </table>	<u>Year</u>	<u>Expenses</u>	1	4.35 million	2	7.59 million	3	9.63 million	4	11.73 million																				
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15	Net Cost of the Programme (B15): [Subtract B(1) from B(14)] 33.86 million																														
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17	<p>Projected Annual Gross Earning in Subsequent Years (B 17): <i>(show details & working; add 10% towards all expenses in subsequent years.)</i></p> <table border="1"> <thead> <tr> <th><u>year</u></th><th><u>No. of expected students</u></th><th><u>Gross earnings</u></th></tr> </thead> <tbody> <tr> <td>1</td><td>40</td><td>5.8 million</td></tr> <tr> <td>2</td><td>50</td><td>12.85 million</td></tr> <tr> <td>3</td><td>60</td><td>21.3 million</td></tr> <tr> <td>4</td><td>70</td><td>31.15 million</td></tr> </tbody> </table> <p>The amount would depend upon number of students</p>	<u>year</u>	<u>No. of expected students</u>	<u>Gross earnings</u>	1	40	5.8 million	2	50	12.85 million	3	60	21.3 million	4	70	31.15 million					
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BAHRIA UNIVERSITY ISLAMABAD

ISLAMABAD CAMPUS

Bachelor of Science in Television Broadcasting and Digital Media*

DRAFT
N.Siddi
7/3/22

Student's Name : MAHNOOR SHAFQAT
 Father's Name : SHAFQAT MAHMOOD ABBASI
 Date Of Birth : 22 December 1999
 CNIC/ Passport No : 37405-4734854-8

Result Intimation

Registration No : 52148
 Enrollment No : 01-153192-012
 Date of Admission : 09 September 2019
 Mode of Study : Regular
 Remarks : -

Credits Transferred **					
MTB 102	Intro to Media				3
PAK 101	Pakistan Studies				2

Fall Semester 2019

Course Code	Title	Grade	Grade Point	Cr. Hrs	Prod.
ENG 111	Functional English-I	B	3	3	9
MTB 101	Computer Skill for Media	C	2	3	6
MTB 103	Journalistic Language	D+	1.33	3	3.99
MTB 104	Mass Media in Pakistan	B-	2.67	3	8.01
		GPA :	2.25	CGPA :	2.25

Fall Semester 2020

Course Code	Title	Grade	Grade Point	Cr. Hrs	Prod.
ENG 114	Communication Skills (English-III)	B-	2.67	3	8.01
MED 206	Current Affairs	A-	3.67	3	11.01
MED 448	Intercultural Communication	B+	3.33	3	9.99
MTB 201	Media Law & Ethics	B	3	3	9
MTB 202	Theories of Mass Communication-I	C	2	3	6
MTB 203	Development Support Communication	D+	1.33	3	9
		GPA :	2.67	CGPA :	2.73

Fall Semester 2021

Course Code	Title	Grade	Grade Point	Cr. Hrs	Prod.
MTB 301	TV Script Writing	C	2	3	6
MTB 304	Television Lighting System	B	3	3	9
MTB 305	Data Journalism	B	3	3	9
MTB 313	Graphic Designing & Visual Communication	B-	2.67	3	8.01
MTB 317	Videography	B+	3.33	3	9.99
MTB 414	Film & Cinematography	B	3	3	9
		GPA :	2.63	CGPA :	2.61

Spring Semester 2020

Course Code	Title	Grade	Grade Point	Cr. Hrs	Prod.
ENG 113	English-II(Writing & Presentation Skills)	B+	3.33	3	9.99
ISL 103	Islamic Studies (Ethics)	C-	1.67	2	3.34
MAT 205	Statistics	A-	3.67	3	11.01
MTB 105	Online Journalism	B+	3.33	3	9.99
MTB 106	Introduction to Digital Media	B-	2.67	3	8.01
MTB 107	News Writing & Reporting	A-	3.67	3	11.01
		GPA :	3.14	CGPA :	2.77

Spring Semester 2021

Course Code	Title	Grade	Grade Point	Cr. Hrs	Prod.
MED 437	2D/3D Animation	B-	2.67	3	8.01
MED 455	Media Management & Marketing	B-	2.67	3	8.01
MTB 212	Theories of Mass Communications - II	D	1	3	3
MTB 213	Introduction to Digital Gaming	C	2	3	6
MTB 214	Cyber Psychology	C+	2.33	3	6.99
MTB 215	Digital Marketing & Public Relations (PR)	C-	1.67	3	5.01
		GPA :	2.05	CGPA :	2.54

Thesis/Internship/CSP

Course Code	Title	Grade	Grade Point	Cr. Hrs	Prod.
MTB 430	Internship Completed on 04 January 2022	B+	3.33	2	6.66
MTB 450	Practical Learning (80 hours) Completed on 04 January 2022			0	

Overall Percentage : 68.59 GPA : 3.33 CGPA : 2.62

85 Credit hours Completed.

Program Status: Incomplete

**5 Credits hours transferred from Previous Academic Program

* The Program consists of 132 Credit Hours, duration 4 years.

Time bar effective from 9 September 2025

Grade 'W' and 'I' indicates status and not to be considered as grades

Print Date : 07 March 2022

Note: 1. Errors & omissions exempted
 2. Discrepancies if any, are to be notified within 7 days of issue of this document.
 3. This is a computer generated report and does not need any signature. Original will be issued later. University reserves the right to correct any inadvertent error.

Appendage 41(4021)

**PROGRAM MISSION, PROGRAM OBJECTIVES AND PROGRAM OUTCOMES OF FACULTY OF
PROFESSIONAL PSYCHOLOGY ACADEMIC PROGRAMMES (IPP, BUIC & BULC)**

BS (Psychology)

Program Mission. To develop theoretical knowledge, and basic skills for contributing positively toward individual and societal growth.

Program Objectives	Program Outcomes
<ol style="list-style-type: none"> 1. To develop a thorough understanding of psychology including theory, practice, and professional ethics 2. To develop an understanding of basic skills related to psychological research. 3. To learn skills necessary for contributing positively toward self-growth and community development. 	<ol style="list-style-type: none"> 1. To be able to apply theoretical and practical concepts of psychology in applied settings under supervision. 2. To be able to assist in psychological research. 3. To apply acquired skills for personal growth and effective community development practices.

Program Learning Outcomes (PLOs)

- a. **PLO 1:** Knowledge of Psychology: An ability to use psychological theories, principles, and/or domain specializations along with other related areas for developing a better understanding of psychology.
- b. **PLO 2:** Psychological Investigation: An ability to investigate psychological and social problems through designing, conducting and interpreting psychological assessments to derive conclusions.
- c. **PLO 3:** Problem Analysis and Solutions: An ability to identify, conceptualize, and analyze psychological problems and synthesize solutions for psychological issues including therapeutic plans, to meet specific needs.
- d. **PLO 4:** Psychologists and Society: An ability to review and report psychological health and socio-cultural issues contributing towards professional psychological practices.
- e. **PLO 5:** Ethics in Psychology: Apply and follow ethical guidelines in psychological practice to fulfil professional responsibilities.
- f. **PLO 6:** Individual and Teamwork: An ability to work effectively, as an individual or in a team, in varied settings.
- g. **PLO 7:** Communication: An ability to communicate effectively, verbally as well as in writing, to comprehend and write psychological reports and make effective presentations.
- h. **PLO 8:** Research Thesis/ Project Management: An ability to utilize psychological theories and practices in managing outcome based research, while maintaining originality.

MS (Clinical Psychological / MPhil (Professional Psychology)

Program Mission. To provide opportunities for the development of relevant knowledge and skills needed in supervised practice and psychological research.

Program Objectives	Program Outcomes
<ol style="list-style-type: none"> 1. To enable the enhancement of relevant knowledge through immersion in coursework. 2. To develop specific technical skills through internships and practical field based applications. 3. To conduct psychological research according to internationally approved standards. 	<ol style="list-style-type: none"> 1. To work in professional settings by applying experiential knowledge. 2. To work as professional psychologists under supervisor utilizing technical skills for the benefit of individuals and groups. 3. To be able to conduct psychological research and contribute in the growth and development of field based knowledge.

PhD Professional Psychology / Clinical Psychology

Program Mission. To provide candidates with academic opportunities for the development of specialized skills in professional practice and psychological research.

Program Objectives	Program Outcomes
<ol style="list-style-type: none"> 1. To develop professional consultative skills through immersion in intensive coursework, internship and field placement. 2. To develop specialized skills related to psychological research according to internationally approved standards. 	<ol style="list-style-type: none"> 1. To be able to work independently in specialized domains providing professional services for individual growth and societal welfare. 2. To be able to contribute in the field of applied research and its application in relevant domains.

REVISED VISION AND MISSION OF IPP AND PROGRAMME OBJECTIVES & PROGRAMME LEARNING OUTCOMES OF PP PROGRAMS OFFERED AT IPP, BUIC AND BULC

1. **IPP Vision.** To become an internationally recognized institute by achieving excellence in Professional Psychology that contributes towards the development of society.
2. **IPP/ Dept of PP Mission.** To positively contribute towards psychological well-being of the society by achieving excellence in academics through creative thinking, applied research and professional practices supported through linkages with industry and international community.

RATIFICATION OF MISSION OF HEALTH SCIENCES PROGRAMMES INCLUDING MBBS, BDS, DPT, MLT AND BSN

a. Medical College Mission Statement

To produce medical professionals who are humane, ethical and competent physicians and researchers by ensuring excellence in medical education, applied research and practices, in a collegiate environment supported through national and international linkages, to improve the health of community and society.

b. Dental College Mission Statement

To produce competent and skilled dental professionals and researchers by ensuring excellence in dental education, applied research and practices, in a collegiate environment supported thorough national and international linkages, to exhibit highest principles of professional humanism towards community and society.

c. DPT Mission Statement

To pursue academic excellence by preparing competent professionals through provision of patient centric, evidence-based physical therapy education, in a collegiate environment, at par with national and international standards to improve physical health and well-being of the society.

d. MLT Mission Statement

To prepare laboratory professionals equipped with knowledge, skills, and innovative research expertise, attained in a collegiate environment supported through national and international linkages, for provision of high quality services in the health care system.

e. BS Nursing Mission Statement

To prepare compassionate nursing professionals equipped with knowledge, skills and innovative research expertise for holistic patient care of international standards by partnering with healthcare disciplines.

Organogram of BU Health Sciences Campus (Karachi) with addition of
BU College of Allied Health Sciences



Infra Structure Details at this Building

1) Facilities Available

	Item	Quantity
1.	Dedicated Class Rooms	4 (30 capacity)
2.	Anatomy lab	1 (shared)
3.	Biochemistry lab	1 (shared)
4.	Physiology Lab	1 (shared)
5.	Pathology Lab	1 (shared)
6.	PNS Shifa Lab	1(shared)
7.	MDRL	1
8.	Skill Lab	1(shared)
9.	Computer Lab	1 (shared)
10.	Common facilities (Girls common room)	(shared)
11.	Faculty rooms	3
12.	Library	1 (shared)

2) Dedicated Faculty Available

	Name of Faculty	Designation
1.	Assoc. Prof. Dr. Mehreen Lateef	HOD, Associate Professor
2.	Ms. Shafaq Mehmood	Sr. Lecturer
3.	Ms. Humaira Ghouri	Lecturer
4.	Mr. M. Fahad	Lecturer
5.	Ms. Hiba Saleem	Lecturer
6.	Ms. Tooba Hussain	Lab Technician
7.	Mr. M. Raza	Lab Technician

3) Shared Faculty Available

	Name of Faculty	Department of Pathology
1.	Surg Cdre. Dr. Muhammad Iqbal	Associate Professor, PNS Shifa Hospital
2.	Surg. Cdr. Luqman Satti	Assistant Professor, PNS Shifa Hospital
3.	Surg. Cdr. Dr. Nighat Jamal	Assistant Professor, PNS Shifa Hospital
4.	Dr. Yumna Shahid	Lecturer, Department of Pathology
5.	Dr. Ayesha Mehwish	Assistant Professor, Department of Pathology
6.	Dr. M. Faraz	Assistant Professor, Department of Biochemistry
7.	Dr. Ambreen Kalam	Lecturer, Department of Physiology
8.	Dr. Insia Fatima	Lecturer, IPP
9.	Dr. Afsheen	Sr. Lecturer, Department of Physiology
10.	Ms. Uzma	Lecturer, English
11.	Mr. Mehran	Lecturer, Pak Studies
12.	Ms. Najmus Sehr	Lecturer, Islamiat

4) Internship and Clinical rotations

- Department of Pathology, PNS Shifa Hospital as main teaching hospital
- Rahila Research & Reference Lab (Pvt) Ltd
- Jinnah Postgraduate Medical Center (JPMC)

Approved Space And Infrastructure Facilities For Another Phase In Allied Health Complex Building At PNS Shifa

S. no	Medical Technology Program	Quantity (25 student capacity)	Total Space* (sq. ft)
1.	Medical Lab Technology	2	600
2.	Surgical Technology	2	600
3.	Radiology & Imaging Technology	2	600
4.	Ophthalmology Technology	2	600
5.	Respiratory & Critical Care Technology/Anaesthesia Technology	2	600
6.	Perfusion/Cardiac Sciences	2	600
7.	Renal/ Dialysis Technology	2	600
		1 (100 student capacity)	1200
		Class Room Area	9600 sq ft
S. no	Medical Technology	Labs	Total Space* (sq. ft)
1.	Medical Lab Technology	1	625
2.	Surgical Technology	1	625
3.	Radiology & Imaging Technology	1	625
4.	Ophthalmology Technology	1	625
5.	Respiratory & Critical Care Technology/Anaesthesia Technology	1	625
6.	Perfusion/Cardiac Sciences	1	625
7	Renal/ Dialysis Technology	1	625
		Total Space	4375/-

Specification	Quantity	Space (sq. ft)
Director/HOD Room	1	300
PA room	1	200
Faculty rooms/staff	7	1500
Conference Room	1	1250
Computer Lab	1	750
Library Section	1	700
GCR/Prayer area	1	100
Pantry	1	100
Examination/Admin office	1	300
Record room/store	1	200
Total		5400 sq. ft

Summary of Total Space in Allied Health Complex Building at PNS Shifa

Specification	Space (sq-ft)
Class Room/ Lecture Hall	9600
Labs	4375
Common Facilities and Faculty Room	5400
Total	19375 sq-ft approx

Phase Wise Methodology

1. The first phase of establishment of BU College of Allied Health Sciences was successfully completed by launching BS-MLT program in 2018 with the successful induction of four batches after getting approval in 31st ACM meeting.
2. The second phase of construction of proposed building of BU college of Allied Health Sciences as a part of ALLIED HEALTH COMPLEX is in process in PNS Shifa, for which working paper related to Infra structure was approved in 41st BOG meeting and will be constructed in third stage. It is based on five to six major degree programs related to various medical technologies, including Surgical Technology Radiology & Imaging, Ophthalmology, Respiratory & Critical Care Technology/Anesthesia Technology, Perfusion/Cardiac Sciences, Renal/ Dialysis Technology and Biotechnology.
3. These allied health sciences degree programs will be started in Allied Health Complex Building at PNS Shifa, master plan of which was approved in 41st BOG meeting. However, these programs can be added in a sequential manner subject to the space availability before construction and completion of allied health complex building in PNS Shifa. For this purpose, one most popular degree program of BS-Biotechnology can be launched in Fall 2022 after shifting of dental college in the medical college building depending upon the space.
4. Proposals of the BS degree Programs to be started in new building in phase 2, already presented in several meetings with Rector and Pro-Rector HS, space for which is already approved as a part of 41st BOG meeting as construction of ALLIED HEALTH COMPLEX at PNS SHIFA.

PHD - NEW PROGRAMME PROPOSAL HEALTH SCIENCES CAMPUS

A. ACADEMIC DETAILS	
1	Faculty/Department: Bahria University Health Sciences Campus (BUHS)
2	Title of the Program: (to be printed on Degree/Transcript): Doctor of Philosophy in Health Sciences (Specialization name)
3	<p>Mission of the Program: Aligned with Vision of BU & Mission of BUHS</p> <p>Vision of Bahria University: To become an internationally recognized university that contributes towards development of nation through excellence in education and research</p> <p>Mission of Bahria University Health Sciences Campus: To produce medical professionals who are humane, ethical and competent physicians and researchers by ensuring excellence in medical education, applied research and practices in a collegiate environment supported through national and international linkages to improve the health of community and society.</p> <p>Mission of PhD Program in Health Sciences: To produce humane, ethical and competent researchers specialized in basic and applied health sciences by achieving excellence in innovative research & national and international collaborations for improving the health of community</p>
4	<p>Objectives of the Program:</p> <p>Cognitive Domain: In the fields of Anatomy, Physiology, Biochemistry, Pathology-Histopathology, Pathology-Microbiology, Pharmacology and Public health</p> <ul style="list-style-type: none"> a. Contribute to scientific understanding by carrying out cutting edge research in the respective field by original publication, presentation and collaborations with academia and industry b. Comprehend theoretical and experimental knowledge and be able to critically reflect on its applied aspects c. Evaluate and analyse existing and novel ideas for systematic insight <p>Psychomotor Domain: In the fields of Anatomy, Physiology, Biochemistry, Pathology-Histopathology, Pathology-Microbiology, Pharmacology and Public health Develop technical expertise and creative skills applicable to the domains Acquire expertise in database utilization of various search engines to design, analyze the research and make significant contribution of knowledge and its application Acquaint with communication skills to explain, critically review and present the original research at national and international forums</p> <p>1. Affective Domain: In the fields of Anatomy, Physiology, Biochemistry, Pathology-Histopathology, Pathology-Microbiology, Pharmacology and Public health</p> <ul style="list-style-type: none"> a. Practice intellectual independence in research endeavours with dedication b. Create and initiate innovative thought provoking ideas c. Self-reflect with full responsibility and accountability for personal inputs and outcomes

	d. Exercise confidence in planning, execution and management of original research project																
5	<p>Outcomes of the Program:</p> <p>The program is committed to produce PhD scholar able to demonstrate:</p> <ol style="list-style-type: none"> 1. attributes of the subject related speciality 2. credibility as committed and dedicated scientific researcher 3. open mindedness and intellectual curiosity to learn 4. effective educator qualities with professionalism 5. time and project management 6. skills of self- management and reflection 7. collaboration with academia and industry with leadership skills 8. approach of critical thinking for analysis and problem solving 9. commitment and dedication to quality team work 10. command of written & oral communication skills 																
6	<p>Rationale for the Program:</p> <ol style="list-style-type: none"> a) To prepare PhD qualified scholars for health education institutions particularly in areas of basic health science in the domain of teaching and research in specializations of Anatomy, Physiology, Biochemistry, Pathology-Histopathology, Pathology-Microbiology, Pharmacology and Public health b) To promote faculty development in basic health sciences education and provide opportunity for junior medical and dental faculty to enhance their professional career as a teacher, researcher and effective collaborator with academia and industry c) To encourage faculty retention in basic health sciences d) To provide opportunities for career building as independent scientists and good research oriented teachers e) To produce scholars for participating in development and formulation of national health policies 																
7	<p>Brief Description of the Program:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2">SCHEME OF STUDY</th> </tr> </thead> <tbody> <tr> <td>Degree title</td><td>Doctor of Philosophy in Health Sciences (Specialization name)</td></tr> <tr> <td>Campus</td><td>Bahria University Health Sciences, Campus, Karachi</td></tr> <tr> <td>Specializations</td><td>Anatomy, Physiology, Biochemistry, Pathology-Microbiology & Pathology-Histopathology, Pharmacology, Public health</td></tr> <tr> <td>Course duration</td><td>Minimum duration 3 years and Maximum duration 6 years</td></tr> <tr> <td>Type of study</td><td>Regular Full time Program</td></tr> <tr> <td>Study system</td><td>Semesters system 16 weeks of teaching + 2 week examinations 2 Regular semesters for coursework (1 year) 4 semesters for research work</td></tr> <tr> <td>Total credit hours</td><td> Credit Hours of Course Work = 18 PhD dissertation Credit Hours = 36 Total Credit Hours = 54 Specialization Elective Courses = 9 CH • 3rd, 4th, 5th, 6th Semesters, Research Dissertation = 36 CH </td></tr> </tbody> </table>	SCHEME OF STUDY		Degree title	Doctor of Philosophy in Health Sciences (Specialization name)	Campus	Bahria University Health Sciences, Campus, Karachi	Specializations	Anatomy, Physiology, Biochemistry, Pathology-Microbiology & Pathology-Histopathology, Pharmacology, Public health	Course duration	Minimum duration 3 years and Maximum duration 6 years	Type of study	Regular Full time Program	Study system	Semesters system 16 weeks of teaching + 2 week examinations 2 Regular semesters for coursework (1 year) 4 semesters for research work	Total credit hours	Credit Hours of Course Work = 18 PhD dissertation Credit Hours = 36 Total Credit Hours = 54 Specialization Elective Courses = 9 CH • 3 rd , 4 th , 5 th , 6 th Semesters, Research Dissertation = 36 CH
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	Course load per semester Teaching institution Degree awarding institution	9 Credit Hours Bahria University Health Sciences Campus, Karachi Bahria University Islamabad
<p>The aim of Doctor of Philosophy in Health Sciences at Bahria University Health Sciences campus is to train the scholars in a way that they shall have comprehensive understanding of the general principles of the program, in addition to specific expertise in their particular area of specialization after completion of the degree. They will build-up upon their knowledge of master program enabling to think critically about advances and emerging trends in specific areas of their respective specialization subject. They will be able to formulate and design, as well as carry out and interpret insights into fields at molecular, genomics, proteomics and bioinformatics horizons. Their findings will be authenticated by publications to enhance the ranking of university. They are expected to show capacity for continuing significant contributions in their respective specialized fields and to conduct independent research.</p> <p>The program is regular and full time with minimum duration of three years and maximum duration of six years. It has a total of fifty-four credit hour allocation and has been designed as per the guidelines of HEC. The program comprises of coursework of one-year duration with two regular semesters. Each semester will have nine credit hours of course load with a total of 18 credit hour in year one. All courses have been developed and will be assessed as per Bahria University guidelines aligned with HEC grading system policy. The scholar will acquire an advanced level of understanding of the content through core and elective courses. The program has three core courses irrespective of the specialization. These are MED 801 (Laboratory Research Techniques), MED 802 (Biostatistics & Epidemiology) and MED 803 (Health Policy and Systems Research). The student will choose two out of three core courses. There are four elective courses of respective specialization to be selected by the candidate out of eight available courses with the exception of Public Health specialization where students will take up four elective courses out of seven total courses. After completing the coursework with minimum CGPA 3.0/4.0, the scholar will have to pass the written comprehensive examination in the first week of August. The scholar then has to defend the research proposal successfully to start the research work, lasting for two years that is four regular semesters with allocation of thirty-six credit hour. Thesis Internal defense will be conducted with open presentation defense by the scholar followed by closed viva evaluation by the examiners. Publication of at least one original research paper is mandatory as per HEC guidelines in "X" category journal prior to thesis defense examination. After successful internal defense, the thesis will be submitted for evaluation by two foreign experts of the relevant field from HERC approved list of foreign evaluators. Upon successful foreign evaluators report, the student will take the final thesis defense exam. It will be conducted by a panel of three examiners (one internal & two external) drawn from the FRC approved list. The defense will be open to all but viva voce will be conducted as closed session by the panel of examiners. Successful defense of thesis will make the candidate eligible for award of PhD degree.</p>		
8	Duration: 3-6 years	
9	Venue(s): On Site/Off Site/Both On & Off Site (Tick one; if Off Site, give details)	
	On site	

10	Program Scheduling Format: Morning/Evening/Weekend (<i>tick one</i>) Morning Semester/Annual/ (<i>tick one</i>) Semester (With Annual intake in Fall)												
11	Proposed Date of Commencement: Tentatively from Fall 2022 depending upon the NOC from HEC												
12	Mode of Study/Examination: As per HEC semester based programs guidelines [Interactive lectures, Lab / wards (where applicable), critical review, assignments, presentations, quizzes, mid-term & final semester exam in each semester, comprehensive exam]												
13	Additional Faculty Member(s) Required: (<i>Indicate if there is a requirement for additional faculty members, fulltime/visiting, along with qualifications.</i>) Total 02 PhD faculty members 1.Full time PhD faculty 01 (Biostatistics & Epidemiology) 2.Visiting PhD faculty 01 (Molecular Biology with mandatory Lab expertise)												
14	Additional Skilled-Worker(s) Required: (<i>Indicate if there is a requirement for additional Skilled Staff, fulltime/part-time, along with their qualifications/skill sets.</i>) Nil												
15	Additional Classroom(s) required: (<i>The requirement is to include the number of classrooms and their capacities.</i>) Yes A. 01 classroom cum seminar room for Postgraduate department with sitting capacity of 100 students including MPhil, FCPS Residents and PhD. B. Individual sitting place / stations / cubicle for PhD scholars is also required.												
16	Additional Requirement for Laboratories: (<i>The requirement is to include the number of laboratories, their equipment and their capacities.</i>) Nil currently as common program. However individual requirement may be generated by the department concern separately, if any.												
17	Additional Requirement for Books, Subscriptions, Memberships to Online Research Sites/ Repositories: YES. Addition of book titles & journals required as per HEC criteria.												
18	Minimum Qualification for Admission: MPhil in relevant specialization. Eligibility criteria page # 15 PhD, Rules 2017. <table border="1"> <thead> <tr> <th colspan="2">ADMISSION ELIGIBILITY CRITERIA</th> </tr> <tr> <th>Requirement</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>Academic Qualification</td> <td>MPhil /equivalent degree from HEC-recognized university having 17.5/18 years of education and a minimum CGPA of 3.00/4.00 (semester system) or 60% marks (only where CGPA is not given/available) in relevant field of Anatomy, Physiology, Biochemistry, Pathology-Histopathology, Pathology-Microbiology, Pharmacology and Public health. The only exception to the 17.5/18 years of education rule shall be a letter from the HEC authorizing a candidate with less than 17.5/18 years of education in unambiguous terms for admission into a PhD programme.</td> </tr> <tr> <td>Attestation</td> <td>HEC's attestation on the candidate's local degrees and cumulative transcript (on the back of the original degrees and transcript).</td> </tr> <tr> <td>Equivalency</td> <td>HEC's equivalency certificate for the candidate's foreign degrees.</td> </tr> <tr> <td>Aptitude Test</td> <td>NTS-GAT (Subject Test), or GRE (Subject Test), passed with minimum 60% marks, or BU Admission Test (70% passing marks). Result be submitted at</td> </tr> </tbody> </table>	ADMISSION ELIGIBILITY CRITERIA		Requirement	Description	Academic Qualification	MPhil /equivalent degree from HEC-recognized university having 17.5/18 years of education and a minimum CGPA of 3.00/4.00 (semester system) or 60% marks (only where CGPA is not given/available) in relevant field of Anatomy, Physiology, Biochemistry, Pathology-Histopathology, Pathology-Microbiology, Pharmacology and Public health. The only exception to the 17.5/18 years of education rule shall be a letter from the HEC authorizing a candidate with less than 17.5/18 years of education in unambiguous terms for admission into a PhD programme.	Attestation	HEC's attestation on the candidate's local degrees and cumulative transcript (on the back of the original degrees and transcript).	Equivalency	HEC's equivalency certificate for the candidate's foreign degrees.	Aptitude Test	NTS-GAT (Subject Test), or GRE (Subject Test), passed with minimum 60% marks, or BU Admission Test (70% passing marks). Result be submitted at
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	the time of application.
	Statement of Purpose A statement of purpose (Maximum 2,000 words) to be evaluated by the Admission Committee.
19	Admission Eligibility Criteria: (to be aligned with accreditation/regulatory bodies) Aligned with BU & HEC
20	Additional/Different Examination Requirement <i>(Indicate if there will be any examination requirement, additional to or different from the BU Academic Rules or Examination Policy in vogue).</i> Nil
21	Number of Admissions Expected for First Intake: A total of 10 students in first intake that is 02 per specialization where 02 PhD faculty is present and 01 per specialization where 01 PhD faculty is present. Anatomy (02), Physiology (02), Biochemistry (02), Pharmacology (02), Pathology (01), Public Health (01) candidates.
22	Number of Admissions Planned/Expected for Subsequent Intakes: 2 nd intake same as the first intake then as per HEC criteria for supervision by PhD supervisors provided all requirements of HEC are met.
23	Referred by: <i>(delete which is inapplicable)</i> FBOS: <i>(Indicate the FBOS meeting reference and Item No)</i> BU-DHS – (FBoSoHS) / Held on 9 th March 2022 vide letter no. PS.BUMDC.FBOS-7/2022/133, dated 1 st March 2022
24	Complete Plan of Studies, inclusive of complete Roadmap: <i>(Attach as Annex 'A')</i> (see enclosed)
25	Course Outlines, Descriptions, Pre-Requisites & Readings <i>(Attach as Annex 'A')</i> (see enclosed)

B.FINANCIAL DETAILS	
1	Source of Funding: <ul style="list-style-type: none"> BU: Fully/Partially: Fully Public Sector (B1): Fully/Partially (<i>provide complete details; attach MOU, agreement etc.</i>) NIL NNGO (B1): Fully/Partially (<i>provide complete details; attach MOU, agreement etc.</i>) INGO (B1): Fully/Partially (<i>provide complete details; attach MOU, agreement etc.</i>) UN/IGO (B1): Fully/Partially (<i>provide complete details; attach MOU, agreement etc.</i>)
2	Degree Duration: 3-6 years Annual or Semester System: Semester Annual Number of Years: 3-6 years Semester: Number of Semester: 6 Total Number of Credit Hours: 54
3	Expected fee to be charged based on Cost & Benefits Analysis: (<i>show working</i>) Per annum fee: 1 st semester = 242,000 + 2 nd semester = 142,000 = 384,000 × 10 candidates = 3,840,000 Fee rate per credit hour: 15000/- in Fall 2022
4	Expected Number of students for 1st& 2nd Intakes: 10 in 1 st intake & 10 in 2 nd intake then as per HEC criteria for supervision by PhD supervisors
5	Expected Earning from first three Intakes (1st 3 years) (B5): (<i>Show working</i>) 1 st Intake (01 candidate for 6 semester) = 952,000 (1 st semester 242,000+ 2 nd 142,000 + 3 rd 142,000 + 4 th Semester 142,000 + 5 th 142,000 + 6 th 142,000) × 10 candidates= 9,520,000 2 nd Intake (01 candidate for 6 semester) = 952,000 (1 st semester 242,000+ 2 nd 142,000 + 3 rd 142,000 + 4 th Semester 142,000 + 5 th 142,000 + 6 th 142,000) × 10 candidates= 9,520,000 3 rd Intake (01 candidate for 6 semester) = 952,000 (1 st semester 242,000+ 2 nd 142,000 + 3 rd 142,000 + 4 th Semester 142,000 + 5 th 142,000 + 6 th 142,000) × 10 candidates= 9,520,000 1 st Intake + 2 nd Intake + 3 rd Intake = 9,520,000 + 9,520,000 + 9,520,000 = 28,560,000
6	Expected Earnings for the Next Five Years (B6): (<i>show working</i>) 9,520,000 × 5 = 47,600,000 (5% tuition fee increase in every year is not included) Total income of next 05 Batches: 47,600,000 (with 10 candidates per year)
7	Total Estimated Salaries of all Additional Human Resources per annum (B7): (<i>Show working</i>) faculty and staff Honorarium to PhD faculty @ 4000 /- per contact hour (i) Core courses= 6 CH (counted once) = 2 × 48 = 96 classes = 96 × 4000=384,000 (ii) 12 CH Elective per specialization in 04 courses = 4 × 48= 192 classes per specialization (counted 7 times)= 192 × 7=1344 = 4,000 × 1344=5,376,000 (i)+(ii)= 384,000+5,376,000= 5,760,000 roundup to 5,800,000 (58 lac)
8	Cost of Additional Laboratory Equipment/Tools (B8): (<i>show working</i>) NIL
9	Cost of Additional Classrooms (B9): (<i>Include furniture, technical aids etc</i>) 01 Classroom cum seminar room for Postgraduate department to cater students of MPhil, FCPS Residency and PhD program Complete computer set system= 65,000 Multimedia with Installation & Multimedia screen = 195,000 Office Table= 10,500

	Revolving Table= 12,500 Dice= 18,000 Presenter newA28w= 50,000 Student chair 100= 650,000 Computer table= 11,500 MIC system with installment= 20,000 Wire board etc.= 5,000 Total amount = 1,037,500
10	Cost of Additional Books, Subscription & Memberships to on-line Sites/Repositories (B10): (show details) 6,000,000 (1,000,000 for each specialty) initially then as per required by specialties , if any
11	Off-Site rental Expenses and Cost of other Fixtures: (Show details) <i>Nil</i>
12	Miscellaneous Expenses required for Starting the Program: -- -- <ul style="list-style-type: none"> - Advertisement: 60,000 - Printing & Stationery = 60,000 - Admin Cost = Nil - Any other = 10,000 Total =130,000 per batch
13	Annual Recurring Expenditures in Subsequent Years: Salaries: Honorarium= 1 st Batch= 5,800,000 <ul style="list-style-type: none"> - Rentals: -- - Subscriptions/Memberships: Nil - Advertisements: 60000 - Printing & Stationery: 50,000 - Admin Cost - Any other –10,000 Total Expenditure: 5,920,000 Total: 10% recurring = 6,512,000+7,163,200+7,879,520+8,667,472= 30,222,192+5,920,000= 36,142,192
14	Total Cost of the Program (B14): [Add B(7) to B(12)] 5,800,000 + 130,000= 5,930,000 in Batch-1
15	Net Cost of the Program (B15): [Subtract B (1) from B(14)] 5,930,000 - Zero= 5,930,000
16	Net Earnings in First 2 Years (B16: [Subtract B(15) from B(5)] 28,560,000-5,930,000= 22,630,000
17	Projected Annual Gross Earning in Subsequent Years (B 17): Batch-2= 9,520,000+ Batch-3= 9,520,000+Batch-4=9,520,000+Batch-5=9,520,000+ Batch-6 =9,520,000 Total earning of 05 Batches: 47,600,000
18	Projected Annual Net Earning in Subsequent Years: [Subtract B (13) from B (17)] 47,600,000 – 36,142,192= 11,457,808 (approximate 11.5 M, annual earnings of 5 batches)

ROADMAP - PHD HEALTH SCIENCES

Duration:

1. Minimum Duration: 3 years (6 Semesters)
2. Maximum Duration: 6 years (12 Semesters)

PhD Course Work	18 Credit Hours - Core Courses: 6 credit hours - Elective Courses: 12 credit hours
PhD Dissertation	36 Credit Hours (THS 900)
Total Credit Hours	54 Credit Hours

Semester -1

Sr.No.	Course Code	Course Title	Credit hours	Theory	Practical
1	MED 801	Laboratory Research Techniques	3(2+1)	2	1
2	MED 802	Biostatistics and Epidemiology	3+0	3	0
3	MED 803	Health Policy and Systems Research	3+0	3	0
4	XXXXXXX	Elective-I	3+0	3	0
5	MED 804	Journal Club -I	No credit hour	0	0
6	MED 806	Teaching Internship-I	No credit hour	0	0
Total Credit Hours				9	

* Student will choose any two out of three MED Courses

Semester -2

Sr.No.	Course Code	Course Title	Credit hours	Theory	Practical
7	XXXXXXX	Elective-II	3+0	3	0
8	XXXXXXX	Elective-III	3+0	3	0
9	XXXXXXX	Elective-IV	3+0	3	0
10	MED 805	Journal Club -II	No credit hour	0	0
11	MED 807	Teaching Internship-II	No credit hour	0	0
Total Credit Hours				9	

COMPREHENSIVE EXAM**Semester -3**

Sr.No.	Course Code	Course Title	Credit hours
12	THS 900	PhD Dissertation	9

Semester -4

Sr.No.	Course Code	Course Title	Credit hours
13	THS 900	PhD Dissertation	9

Semester -5

Sr.No.	Course Code	Course Title	Credit hours
14	THS 900	PhD Dissertation	9

Semester -6

Sr.No.	Course Code	Course Title	Credit hours
15	THS 900	PhD Dissertation	9

MED CORE COURSE LIST

Sr.No.	Course Code	Course Title	Credit hours	Theory	Practical
1	MED 801	Laboratory Research Techniques	3(2+1)	2	1
2	MED 802	Biostatistics and Epidemiology	3+0	3	0
3	MED 803	Health Policy and Systems Research	3+0	3	0

* Student will choose any two out of three MED Courses

DETAILED COURSE OUTLINES - CORE COURSE

Course Code	MED 801
Credit hour	3(2 +1)
Course Title	Laboratory Research Techniques
Pre-Requisite	Basic concepts of research laboratory techniques in health sciences
Course Objectives	<ol style="list-style-type: none"> 1. Describe the principles of laboratory research techniques, commonly used in health sciences 2. Describe the principles of laboratory reagent preparation 3. Describe the procedural steps of spectroscopic, immunological, histopathology, chromatographic, cell culture etc. laboratory techniques used in health sciences research. 4. Describe the skills (real-time PCR, Westerns, cell analysis, sequencing, reporter gene analysis, DNA and RNA purification, cDNA synthesis and proteomic gel analysis etc.) for teaching, training and research purpose 5. Describe safe laboratory working place guidelines 6. Understand the guidelines of Office of the Gene Technology Regulator (OGTR) 7. Describe ways of analysing data generated from various laboratory techniques/ equipment 8. Describe formulation of projects based on laboratory techniques
Course Outcome	<p>At the end of the course, the students will be able to:</p> <ol style="list-style-type: none"> 1. Comprehend principles of laboratory research techniques commonly used in the field of biomedical/ health sciences 2. Utilize the principles in the preparation of laboratory reagents 3. Demonstrate procedural steps of spectroscopic, immunological, histopathology, chromatographic, cell culture etc. techniques 4. Apply the skills of laboratory techniques for teaching, training and research 5. Participate in technology platforms 6. Develop safe laboratory working practice 7. Describe the guidelines of Office of the Gene Technology Regulator (OGTR) 8. Critically analyse and interpret data generated from various laboratory techniques/ equipment 9. Formulate projects based on laboratory research techniques
Course Contents	The course will provide the detailed understanding of principles, opportunity to develop skills and application of essential laboratory research techniques such as cell culture technique, Microscopic Techniques, Molecular biology techniques, Spectroscopy and its types, extraction of biomolecules and sample storage, Blotting Techniques, Recombinant DNA technology and PCR, Proteomics and protein analysis, Gene expression, DNA sequencing applications and Genetic manipulation, Cytological techniques, Immunological techniques, Histopathology Techniques, Chromatography Techniques. It will also encompass the guidelines of safe laboratory working place and Office of the Gene Technology Regulator (OGTR)
Recommended Text Books	<ol style="list-style-type: none"> 1. Jardine, Richard James. Advanced laboratory testing in research and practice: the 2nd Bishop Lecture. Geotechnical Research 1, no. 1 (2014): 2-

	<p>31.</p> <ol style="list-style-type: none"> 2. Olaniyan, mathew folaranmi. Laboratory instrumentation and techniques. 3. Haven, Mary C., Gregory A. Tetrault, and Jerald R. Schenken, eds. <i>Laboratory Instrumentation</i>. John Wiley & Sons, 1994.
Recommended Reference Books	<ol style="list-style-type: none"> 1. Masoodi, Khalid Z., Sameena Maqbool Lone, and Rovidha Saba Rasool. <i>Advanced Methods in Molecular Biology and Biotechnology: A Practical Lab Manual</i>. Academic Press, 2020. 2. Dey, Pranab. <i>Basic and advanced laboratory techniques in histopathology and cytology</i>. Springer Singapore, 2018. 3. Carson, Sue, Heather B. Miller, Melissa C. Srougi, and D. Scott Witherow. <i>Molecular biology techniques: a classroom laboratory manual</i>. Academic Press, 2019. 4. Nigam, Arti. <i>Lab manual in biochemistry, immunology and biotechnology</i>. Tata McGraw-Hill Education, 2007. 5. Moore, David S., ed. <i>Handbook of Spectroscopy</i>. Vol. 1. John Wiley & Sons, 2014.
Web and other resources	<p><u>Website:</u></p> <ol style="list-style-type: none"> 1. https://www.sciencedirect.com/topics/engineering/chromatographic-technique 2. https://www.sciencedirect.com/book/9780125839907/molecular-biology-techniques 3. https://www.leicabiosystems.com/knowledge-pathway/an-introduction-to-specimen-processing <p><u>Journals:</u></p> <ol style="list-style-type: none"> 1. Annals of Clinical and Laboratory Research 2. Advanced Techniques in Biology & Medicine 3. Applied spectroscopic Reviews <p><u>Others:</u></p> <ol style="list-style-type: none"> 1. George, A. <i>Principles of Proteomics</i>. (2013). 2. Scott, Raymond PW. <i>Techniques and practice of chromatography</i>. CRC Press, 2020.

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 2 CH	Outcome
1	Introduction to essential laboratory research techniques	2 hours	<ul style="list-style-type: none"> • Comprehend different research laboratory techniques
2	Cell culture techniques	2 hours	<ul style="list-style-type: none"> • Comprehend concepts of cell biology related to manipulation of cells in culture • Describe the specific skills used for cell culture techniques • Understand the applications of cell/tissue culture in modern laboratory settings

3	Microscopic Techniques	2 hours	<ul style="list-style-type: none"> • Identify the principle components of a light microscope • Differentiate between different types of light microscopy
4	Gel Electrophoresis	2 hours	<ul style="list-style-type: none"> • Understand the types of electrophoresis gels and their uses • Describe the process of running, visualizing and interpretation of agarose gel
5	Spectroscopic Techniques	2 hours	<ul style="list-style-type: none"> • Comprehend the basic concepts and methods of spectroscopy
6	UV, Infrared, NMR and Mass Spectroscopy	2 hours	<ul style="list-style-type: none"> • Describe the UV, Infrared, NMR and Mass Spectroscopy and its applications
7	Techniques for storage and extraction of biomolecules	2 hours	<ul style="list-style-type: none"> • Understand the protocols and processes for collection, processing and storage of biological samples
8	Blotting Techniques	2 hours	<ul style="list-style-type: none"> • Understand principles of Southern, Western and Northern blotting • Identify various biomolecules such as DNA, mRNA, & protein during different stages of gene expression
9	Mid-Term Exam		
10	Recombinant DNA technology and PCR	2 hours	<ul style="list-style-type: none"> • Describe recombinant DNA technology, its scope, tools and applications
11	Proteomics and protein analysis	2 hours	<ul style="list-style-type: none"> • Understand the structure of sequencing and proteomic data • Analyse data for annotation, quantification and statistical analysis of gene and protein expression generated from computational tools
12	Gene expression, DNA sequencing applications and Genetic manipulation	2 hours	<ul style="list-style-type: none"> • Identify genetic mutations, cloning & expression profiling
13	Cytological techniques	2 hours	<ul style="list-style-type: none"> • Apply cytological techniques on different types of samples • Recognize morphological patterns of normality and differentiate them from pathological ones
14	Immunology and its related techniques	2 hours	<ul style="list-style-type: none"> • Describe method used to determine antigen antibody reaction & analyte estimation
15	ELISA technique	2 hours	<ul style="list-style-type: none"> • Describe principles of different types of ELISA technique and applications
16	Histopathology and Immunohistochemistry	2 hours	<ul style="list-style-type: none"> • Describe the normal appearance and structure of different tissues and

	Techniques		<ul style="list-style-type: none"> organs in histological preparations Understand the basic principle of Immunohistochemistry technique and its application
17	Chromatographic techniques	2 hours	<ul style="list-style-type: none"> Describe the principles and techniques of chromatography , its types and applications
18	Final-Term Exam		

18 Week Lab Plan

Week #	Lecture Topic	Duration 1 CH	Outcome
1	Overview of instruments, essential for laboratory research techniques	3 hours	<ul style="list-style-type: none"> Identify instruments used in laboratory for research techniques
2	Cell culture techniques	3 hours	<ul style="list-style-type: none"> Demonstrate the specific skills used for tissue culture techniques Perform supportive or episodic tasks relevant to cell culture, including preparation and evaluation of media, cryopreservation and recovery, and assessment of cell growth/health
3.	Microscopic Techniques	3 hours	<ul style="list-style-type: none"> Demonstrate the routine staining procedures to visualize under light microscope
4	Gel Electrophoresis	3 hours	<ul style="list-style-type: none"> Perform the process of electrophoresis Analyse the results of DNA electrophoresis
5	Spectroscopic Techniques	3 hours	<ul style="list-style-type: none"> Demonstrate use of spectroscopic methods for qualitative and quantitative analyses
6	UV, Infrared, NMR and Mass Spectroscopy	3 hours	<ul style="list-style-type: none"> Demonstrate the working of different types of spectrophotometers
7	Techniques for storage and extraction of biomolecules	3 hours	<ul style="list-style-type: none"> Describe the role of reagents in the extraction of the purest biomolecule along with its significance Explain the proper storage condition for long term molecule's use
8	Blotting Techniques	3 hours	<ul style="list-style-type: none"> Use various types of Blotting techniques to measure protein levels
9	Mid-Term Exam		
10	Recombinant DNA	3 hours	<ul style="list-style-type: none"> Isolate nucleic acid (plasmid, DNA &

	technology and PCR		<p>RNA), quantification and its purity</p> <ul style="list-style-type: none"> • Demonstrate the function of DNA ligase • Use various types of vectors • Construct a recombinant genomic DNA library
11	Proteomics and protein analysis	3 hours	<ul style="list-style-type: none"> • Convert primary data into information that can be used for further biological interpretation. (RNAseq data quantification and differential expression analysis), protein identification and quantification • Use software tools to analyse sequencing and proteomic data (Search GUI, Peptide Shaker, MaxQuant etc.)
12	Gene expression, DNA sequencing applications and Genetic manipulation	3 hours	<ul style="list-style-type: none"> • Demonstrate DNA sequencing, cloning & gene expression
13	Cytological techniques	3 hours	<ul style="list-style-type: none"> • Explain the methods of preparing for cytological investigations
14	Immunology and its related techniques	3 hours	<ul style="list-style-type: none"> • Demonstrate the immunological technique used in research laboratory
15	Types of ELISA and its applications	3 hours	<ul style="list-style-type: none"> • Perform quantitative analysis of biomolecule in serum by ELISA based kit
16	Histopathology and Immunohistochemistry Techniques	3 hours	<ul style="list-style-type: none"> • Identify cell types and tissues in histological preparations • Perform H and E routine stain, • Perform Immunohistochemistry of pathological tissue sample
17	Chromatographic techniques	3 hours	<ul style="list-style-type: none"> • Demonstrate the working of High performance liquid chromatography
18	Final- Term Exam		

CORE COURSE

Course Code	MED 802
Credit Hour	3+0
Course Title	Epidemiology & Biostatistics
Pre-Requisite	Students should be familiar with basic epidemiology and biostatistics and statistical software like SPSS, Stata, or SAS
Course Objective	<ol style="list-style-type: none"> 1. Provision of basic understanding required to design and conduct epidemiological studies 2. Inculcation of basic knowledge required to critique epidemiological studies 3. Develop a scientific thinking process
Course Outcome	<p>Upon completion of this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Apply epidemiological theories and methods in their research thesis and to develop a scientific thinking process 2. Recognize and analyze the most important threats to validity: confounding, selection, and information bias and assess effect modification 3. Design and conduct epidemiologic studies and apply criteria for causal inference 4. Understand and apply advanced statistical techniques in epidemiological studies
Course Contents	This course is designed to advance the application of epidemiological and biostatistical knowledge of the students. Thus the course includes the challenges and issues related to the designs of the epidemiological studies. Similarly, it includes higher-level statistical applications such as survival analysis and longitudinal analysis.
Recommended Text Books	Rothman KJ, Greenland S, Lash TL. Modern Epidemiology 3rd Ed. Philadelphia: Lippincott Williams & Wilkins, 2008.
Recommended Reference Books	<ol style="list-style-type: none"> 1. Szklo M, Nieto FJ. Epidemiology: Beyond the Basics (2nd edition). Sudbury, MA: Jones and Bartlett, 2007. 2. Ian Dohoo, Wayne Martin, Henrik Styrhn. Veterinary Epidemiologic Research (2nd edition). University of Prince Edward Island, 2010. 3. Kleinbaum DG, Kupper LL, Morgenstern H. Epidemiologic Research: Principles and Quantitative Methods. John Wiley & Sons, Inc. 1983 4. Gordis Epidemiology, 6th Edition by David D Celentano, ScD, MHS and Moyses Szklo, MD 5. Rothman K, Greenland S, Lash T. (2008) Modern Epidemiology (3rd edition). Philadelphia: Lippincott-Raven. 6. Hosmer DW (2004), Lemeshow S. Applied Logistic Regression (2nd edition). New York: John Wiley & Sons 7. Hosmer DW (2008), Lemeshow S. Applied Survival Analysis. New York: John Wiley & Sons 8. Polgar Colton, T. 2000. Statistics in Medicine. Little Brown and Co. Boston. 4th Ed. 9. Dawson, B. & Trapp, R.G. 2001. Basic and Clinical Biostatistics. 3rd Edition Prentice-Hall International Inc. 10. Geoffrey, R. & David, L. S. 2000. Biostatistics: The Bare Essentials, Second

	Edition
Web and other resources	<p><u>Websites:</u></p> <ul style="list-style-type: none"> - https://academic.oup.com/biostatistics <p><u>Journals:</u></p> <ul style="list-style-type: none"> - Biostatistics 306. Log-linear models: poisson regression. Chan YH. Singapore Med J. 2005 Aug;46(8):377-85; quiz 386. - Biostatistics 301. Repeated measurement analysis. Chan YH. Singapore Med J. 2004 Aug;45(8):354-68; quiz 369. <p><u>Others:</u></p> <p>Journal of Epidemiology & Community Health https://jech.bmjjournals.org/content/76/1?current-issue=y</p>

18 Weeks Lecture Plan:

Week #	Lecture Topic	Duration 3 CH	Outcome
1	Review of epidemiology	3 hours	Apply general epidemiologic principles in research
2	Causal inference	3 hours	Practice the disease causation approaches
3	Causal Diagrams: Directed Acyclic Graphs (DAGs)	3 hours	Guide in applying encoding researcher a prior assumption about the relationships between and among variables in causal structures
4	Study Designs	3 hours	Apply epidemiologic designs relevant to various research studies
5	Cross-sectional studies; design, conduct, issues and analysis	3 hours	Identify and address the challenges of using the selected study design
6	Case-control studies; design, conduct, issues and analysis	3 hours	
7	Cohort studies; design, conduct, issues and analysis	3 hours	
8	Controlled trials; design, conduct, issues and analysis	3 hours	
9	Mid-Term Exam		
10	Validity in Epidemiologic studies	3 hours	Comprehend conceptual application while conducting research
11	Analysis of the paired data	3 hours	Analyze paired, repeated, and matched variables - Normality - Paired t-test
12	Analysis of variance (ANOVA)	3 hours	Apply the F-criterion and comparison of variances - 1-way ANOVA - Generalizations of ANOVA
13	Randomization and randomization based analysis	3 hours	Conduct randomized experiment - Survey sampling and resampling
14	Advanced statistical analysis I: Survival analysis	3 hours	Comprehend <ul style="list-style-type: none"> - Common terms - Cox regression analysis

			- Tree-structure model
15	Advanced statistical analysis II: Longitudinal analysis	3 hours	Apply repeated measures of ANOVA and multivariate ANOVA
16	Systematic review and meta-analysis	3 hours	Utilize combining and analyzing data from different studies conducted on similar research topics
17	The basic Bayesian statistics	3 hours	Practice Bayesian probability - Likelihood - Prior and posterior - Empirical Bayes models - Bayesian information criterion - Maximum a posterior estimation
18	Final-Term Exam		

CORE COURSE

Course Code	MED 803
Course Title	Health Policy and Systems Research
Credit Hour	3+0
Pre-Requisite	Students should be familiar with health systems and how evidence is used to inform policy-making
Course Objective	<ol style="list-style-type: none"> 1. Describe global perspective on health policy and systems research (HPSR) 2. Comprehend the key characteristics of health policy, health systems, and the contribution to research 3. Understand the core building blocks of health care systems, modes of operation, implications of different approaches to system design for access, quality, and broader outcomes 4. Outline the equity impacts of different design features and ways to conduct health systems research 5. Design monitoring and evaluation frameworks to assess the performance of health programs (within a health systems context)
Course Outcome	<p>By the end of this course, the students are expected to:</p> <ol style="list-style-type: none"> 1. Define a 'health policy & system' concept and its core objectives, elements, and functions. 2. Understand the debates around boundaries of a health policy & system, and major theories and research approaches related to their understanding. 3. Assess the role of different health policies & health care system configurations in promoting good health, access to services, equity, and economic and wider social outcomes 4. Critically appraise and apply key concepts and approaches to health policy & systems evaluation and performance measurement, the role of policy actors, and global influences on health systems 5. Be able to apply a health policy & systems approach to significant health challenges in a range of different contexts
Course Contents	Health systems and related health system approach to major health challenges globally as well as specific to Pakistan.
Recommended Reference Books	<ol style="list-style-type: none"> 1. Gilson (ed), Lucy Health policy and systems research: a methodology reader World Health Organization, 2012 2. Buse, Kent.; Mays, Nicholas.; Walt, Gillian. Making health policy 2nd ed.: Maidenhead: Open University Press, 2012. - 222 p. ISBN:978-0-335-24634-2 3. Leiyu Shi. Health Services Research Methods. 2nd Ed; Delman Cengage Learning, 2008. 4. Yazbeck SA, Peter DH. Health Policy Research in South Asia: Building capacity for reforms. Health, Nutrition and Population Series. World Bank, Geneva: 2003. 5. Alliance for Health Policy and Systems Research. Strengthening Health Systems: the role and promise of policy and systems research. Global Forum for Health Research 2005. RPC-EIP, WHO, CH 1211 Geneva: 2004. 6. World Health Report. <i>Health systems: Improving performances</i>. Geneva: 2000.

	7. World Bank. World Development Report 1993. <i>Investing in Health</i> . Washington DC: 1993
Web and other resources	<p><u>Websites:</u></p> <ul style="list-style-type: none"> • https://www.who.int/alliance-hpsr/alliancehpsr_reader.pdf • https://ahpsr.who.int/what-we-do/what-is-health-policy-and-systems-research-(hpsr) <p><u>Journals:</u></p> <p>BMC-Health Research Policy and systems Others Health System and Policy Research https://www.hsprj.com/#:~:text=Health%20Systems%20and%20Policy%20Research%20(ISSN%3A%202254%2D9137),for%20exchanging%20of%20ideas%2Fviews.</p>

18 Weeks Lecture Plan: Health Policy and Systems Research

Week #	Lecture Topic	Duration 3 CH	Outcome
1.	What is HSPR? The health policy framework: context, content, process, and actors	3 hours	Describe the major theories and frameworks for health policy and systems analysis and how these can be applied in different contexts
2.	The role of health policy and systems research in global health The WHO framework for analyzing health systems	3 hours	Identify and adopt theories and frameworks in health systems to study specific problems within their context
3.	Universal coverage as a key health system goal.	3 hours	Demonstrate the skill required to participate in health systems research and development work.
4.	Pluralistic health systems: what challenges for regulation? The role of the private/voluntary sector in health systems- models of engagement	3 hours	Discuss the public-private partnership arrangements, including various issues and challenges
5.	Globalization: panacea or poison for public health?	3 hours	Describe the issues and challenges in the backdrop of some advantages of globalization specially related to public health research and practice
6.	Systems thinking and what it means for health systems. Leadership and governance: coordination, regulation, accountability. Policy - process and power; Service delivery	3 hours	Describe the development of health policies through the interrelationship of context, content, process, and actors
7.	Health policy and financing	3 hours	Analyze different types of health systems and connected policy implications, including the role of

			the state for the public and private sector; and role of financing
8.	Power & Policy Process the Research-Policy Nexus in Health Policy	3 hours	Comprehend the various components of policy interaction and influence on each other
9.	Mid-Term Exam		
10.	Agenda setting & Policy formulation	3 hours	Apply the theoretical concepts for developing a policy
11.	Policy implementation	3 hours	Identify the translation of policy into the implementation process
12.	Health Policy Analysis in theory and practice	3 hours	Apply policy analysis dynamics and measure applications
13.	Health Policy & Systems Research: Theoretical concepts on various research methodologies	3 hours	Distinguish between policy and systems research and traditional epidemiological research
14.	Barriers and facilitators for implementation of system changes in healthcare	3 hours	Make critical assessments of health systems, taking into account relevant scientific, social and equity aspects, and demonstrate an awareness of ethical aspects of research and development work;
15.	Health system and policy research and evaluation:	3 hours	Identify research and evaluation designs, as well as quantitative and qualitative methods,
16.	Research and evaluation designs, quantitative and qualitative methods,	3 hours	appropriate for specific health policy and systems
17.	Synthesizing and communicating research evidence	3 hours	Understand the communication of evidence and its impact on policy-making and systems
18.	Final-Term Exam		

MED 804 & 805 [Essential –No credit hour]**JOURNAL CLUB: SEMESTER 1& 2****Objectives:**

1. Describe resources for collection of literature
2. Describe the ways to prepare presentation on a given topic
3. Critically analyze the published papers with strengths and limitations
4. Prepare comprehensive lecture from available resources **OR**
5. Produce write up of report on literature review comprising of 5-6 articles on the topic presented

Learning Outcome:

Upon completion of Journal Club etc. the students will be able to:

1. Collect information from the available resources

2. Prepare a presentation on a given topic
3. Work as active productive member of the research journal club
4. Deliver a lecture and manage a question-answer session **OR**
5. Submit report on literature review of 5-6 articles on the topic presented

Course Outline:

Critical review of the published paper(s) of choice and elaborating in detail the findings described on semester basis in the research journal club as presentation, critical thinking on the provided research literature, delivery of lecture, report writing

Recommended Activity:

1. Compulsory Journal Club presentation per semester

Resources:

1. Internet
2. Libraries
3. Peer Advice

Assessment: By proforma of Department of Medical Education (DME) based on Likert scale.
Assessment will be mentioned on the transcript

MED 806 & 807 [Essential –No credit hour]

TEACHING INTERNSHIP: SEMESTER 1 & 2

Objectives:

1. Understand class management and control
2. Know the principles of effective teaching
3. Develop teaching skills and strategies

Learning Outcome:

Upon completion of teaching internship, the students will be able to:

1. Manage and control the undergraduate & postgraduate class
2. Apply the principles of effective teaching in the class
3. Professional grooming of the teaching skills

Course Outline:

Working and duties, academic and administerial tasks performed by the student in the respective department and institution as faculty member including taking up of interactive lectures of undergraduates & postgraduates (MPhil) students apart from, case based sessions, problem based learning sessions, demonstrations, mentoring of undergraduate students etc. Development of questions (BCQs & SEQs) & cases, participation in the assessment process of the undergraduates & postgraduates (MPhil) students

Resources:

1. Internet

2. Libraries
3. Peer Advice
4. Students feedback

Assessment: Marking by respective HOD based on performance of the assigned task(s) throughout the semester as unsatisfactory (<60), satisfactory (60-72), good (73-85), excellent (86-98). Assessment will be mentioned on the transcript.

ANATOMY

ELECTIVE COURSE LIST – ANATOMY

Sr.No.	Course Code	Course Title	Credit Hours	Theory	Practical
1	ANA 830	Human Histology	3(2+1)	2	1
2	ANA 831	Human Embryology	3(2+1)	2	1
3	ANA 832	Neurosciences and Anatomy of Head & Neck Region	3(2+1)	2	1
4	ANA 833	Human Urinary and Genital System	3(2+1)	2	1
5	ANA 834	Human Alimentary Tract	3(2+1)	2	1
6	ANA 835	Human Respiratory System	3(2+1)	2	1
7	ANA 836	Anatomy of Human Heart and Blood Vessels	3(2+1)	2	1
8	ANA 837	Anatomy of Human Skeletal and Muscular System	3(2+1)	2	1

DETAILED COURSE OUTLINES - ELECTIVE COURSE - ANATOMY

Course Code	ANA 830
Credit Hours	3 (2+1)
Course Title	Human Histology
Pre- Requisite	Students are required to have prior knowledge of human anatomy and biomedical sciences
Course Objective	<p>By the end of the course the student will be able to</p> <ol style="list-style-type: none"> 1. Describe the process of tissue preservation for light microscopy and immune-techniques 2. Explain Tissue processing for electron microscopy 3. Explain the process of Frozen tissue techniques 4. Explain the process of different types of tissue staining for light microscopy 5. Describe the structure of cell including cell membrane, organelles, functions, molecules of cells acting as enzymes for cell growth and cell division and cell cycle, and factors affecting the cell cycle and cell death/apoptosis under light microscope as well as electron microscope 6. Describe the microscopic and ultramicroscopic structure, function and clinical importance of epithelial tissues, junctional complex 7. Explain the microscopic and ultramicroscopic structure, function and clinical importance of different types of connective tissues 8. Explain the microscopic and ultramicroscopic structure, function and clinical importance of types of cartilage and types of bone, factors affecting growth and development of bone& cartilage and bone repairmen 9. Describe the microscopic and ultramicroscopic structure, function and clinical importance of the three types of muscle tissues , factors affecting muscle injury and regeneration 10. Discuss the microscopic and ultramicroscopic features of blood and lymph vessels with their clinical significance 11. Describe the microscopic and ultramicroscopic structure of lymphatic tissue with their functional and clinical significance 12. Describe the microscopic and ultramicroscopic features of gastrointestinal tract, functional and clinical aspects 13. Describe the microscopic and ultramicroscopic features of respiratory system (conducting and respiratory parts) with their functional and clinical correlation 14. Define cytogenetic and its role in human diseases 15. Perform the molecular biology techniques and its applications 16. Explain the Immunohistochemistry, Immunocytochemistry, Fluorescent immunostaining and Fluorescent in-situ hybridization (FISH) and application 17. Explain the role of nano-techniques in medicine 18. Explain the technique of tissue culture and its applications 19. Understand the significant role of microscopic anatomy in accurate diagnosis and monitoring of disease progression
Course Outcome	Upon completion of course the students will be able to: - Provide knowledge of the microscopic structure and function of cells, human tissues and tissue regeneration mechanisms (histogenesis).
Course Contents	Cell biology (Advanced /Ultrastructure)

	<p>Microscopic/ Ultramicroscopic structure of cell including cell organelles , functions, molecules of cells acting as enzymes for cell growth and cell division and cell cycle, factors affecting the cell cycle and death of cells</p> <p>Basic tissue (Advanced /Ultrastructure)</p> <p>Types of basic tissues epithelial tissue, connective tissue, muscle tissue, and nervous tissue, their microscopic / ultramicroscopic structure and function</p> <p>Organ systems (Advanced & clinically oriented) structure of organs comprising systems with special reference to</p> <p>Immune system (Advanced / Ultrastructure)</p> <p>The immune system includes vast network of many types of cells, organs, proteins, and tissues, role in body defense, mechanism involve in identification of self from non-self-tissue</p> <p>Immune system disorders including abnormally low activity or over activity of the immune system, molecular or cellular basis of autoimmune diseases and immune deficiency diseases vulnerability of body to infections.</p> <p>Nano-Histology</p> <p>Nanomaterials can occur naturally, A nanoparticle is a small particle ranges between 1 to 100 nano-materials in size, can exhibit significantly different physical and chemical properties to their larger material counterparts. Most nanoparticles are made up of only a few hundred atoms.</p> <p>Tissue techniques</p> <p>Tissue processing for light microscopy (Paraffin embedding)</p> <p>Tissue processing for electron microscopy</p> <p>Frozen tissue techniques (Cryostats)</p> <p>Tissue staining for light microscopy</p> <p>Cytogenetics, molecular biology techniques Immunohistochemistry; Immunocytochemistry; Fluorescent immunostaining; Immunoblotting; Western blotting; Southern blotting</p> <p>Fluorescent insituhybridization (FISH) and tissue culture</p>
Recommended Text Books	<p>Latest editions of:</p> <ol style="list-style-type: none"> 1. Histology: A Text and Atlas: With Correlated Cell and Molecular Biology by Dr. Wojciech Pawlina MD FAAA), Michael H. Ross PhD 2. Junqueira's Basic Histology Text & Atlas Anthony L Mescher McGraw-Hill 3. Suvarna SK, Layton C, Bancroft JD. Bancroft's Theory and Practice of Histological Techniques.
Recommended Reference Books	<ol style="list-style-type: none"> 1. Gartner LP. Color Atlas and Text of Histology. Walters Kluwer 2. Understanding Nanomedicine. An Introductory Textbook By Rob Burgess 1st Edition Copyright Year 2012
Web and other resources	<p><u>Websites:</u></p> <p>Histology-world www.histology-world.com/</p> <p><u>Journals:</u></p> <p>Journal of Morphology and Anatomy</p> <p>Journal of Advanced Microscopy Research</p> <p><u>Others:</u></p> <p>Microscopy Research and Technique - Wiley Online Library</p> <p>Microscopic Structure Research in Animals</p>

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 2 CH	Outcome
1	Light & ultra-structure of cell including cell membrane, surface molecules and cytoplasmic organelles	2 hours	Explain cell structure at light and electron microscopic level
2	Light & electron Microscopic features of different types of epithelial tissues; Cell junctional complex & Surface modifications of epithelial cells with clinical aspects	2 hours	Describe microscopic features of epithelia, with their surface modifications & junctional complexes
3	Light & electron Microscopic features of different types of Connective tissues with clinical correlates	2 hours	Describe microscopic features of connective tissue
4	Light & electron Microscopic features of different types of cartilage & bone with clinical correlates	2 hours	Explain microscopic features of cartilage & bone
5	Light & electron Microscopic features of skeletal, cardiac and smooth muscles, Neuromuscular junctional complex	2 hours	Explain microscopic features of muscles
6	Light & electron Microscopic features of cardiovascular system with clinical aspects	2 hours	Describe microscopic features of blood vessels
7	Light & electron Microscopic features of Lymphatic system parts and common problems	2 hours	Describe microscopic features of MALT, BALT & lymphoid organs
8	Light & electron Microscopic features of structures associated with oral cavity including tongue & glands associated clinical significance	2 hours	Describe microscopic features of tongue and digestive glands
9	Mid-Term Exam		
10	Light & electron Microscopic features of gastrointestinal tract with clinical correlates	2 hours	Explain microscopic features of GIT
11	Light & electron Microscopic features of upper respiratory tract with clinical correlates	2 hours	Discuss microscopic features of upper respiratory passages
12	Light & electron Microscopic features of lower respiratory tract with clinical correlates	2 hours	Discuss microscopic features of lower respiratory passages
13	Techniques for cytogenetic analysis	2 hours	Explain cytogenetics techniques
14	Immunohistochemistry,	2 hours	Differentiate between

	Immunocytochemistry, Fluorescent immunostaining		Immunohistochemistry, Immunocytochemistry, Fluorescent immunostaining
15	Molecular Biology techniques	2 hours	Understand molecular biology techniques
16	Fluorescent in-situ-hybridization (FISH)	2 hours	Explain Fluorescent in-situ-hybridization technique
17	Nanotechnology use in histology and diagnostic approach	2 hours	Explain uses of nanotechnology
18	Final-Term Exam		

18 Weeks Lab Plan

Week #	Practical Lab. Topic	Duration 1 CH	Outcome
1	Perform tissue processing on the given tissue sample; Sectioning of paraffin-embedded tissue sample	3 hours	Perform tissue processing and sectioning of tissue block
2	Perform routine Haematoxylin and Eosin staining of the given tissue slide	3 hours	Perform staining of given tissue slides
3	Histological analysis of different types of epithelial tissue	3 hours	Identify microscopic features of epithelial tissues
4	Histological analysis of types of connective tissue including adipose tissues	3 hours	Identify microscopic features of connective tissue
5	Histological analysis of types of Cartilaginous and Bony tissue	3 hours	Identify microscopic features of cartilage & bone
6	Histological analysis of types of muscles	3 hours	Identify microscopic features of types of muscles
7	Histological analysis of types of blood vessels (arteries & veins)	3 hours	Identify microscopic features of arteries & veins
8	Histological analysis of various types of lymphatic tissue , lymphatic vessels	3 hours	Identify microscopic features of lymphoid organs
9	Mid-Term Exam		
10	Histological analysis of structures associated with oral cavity including tongue & salivary glands associated	3 hours	Identify microscopic features of tongue & glands related with GIT
11	Histological analysis of structures / parts of gastrointestinal tract (esophagus to anal canal)	3 hours	Identify microscopic features of gastrointestinal tract
12	Histological analysis of parts of respiratory system (trachea, bronchial tree and lung)	3 hours	Identify microscopic features of respiratory tract
13	Description of tissue processing for electron microscopy; Frozen section techniques	3 hours	Perform block making for electron microscope & frozen section techniques

14	Techniques involved in Cytogenetics	3 hours	Perform cytogenetic technique
15	Immunohistochemistry, Immunocytochemistry, Fluorescent immunostaining	3 hours	Perform immune-techniques
16	Immunoblotting techniques; Fluorescent in-situ-hybridization (FISH)	3 hours	Perform molecular biology techniques
17	Revision of cellular and ultracellular histological techniques	3 hours	Identify histology slides
18	Final - Term Exam		

Course Code	ANA 831
Credit Hours	3(2+1)
Course Title	Human Embryology
Pre-Requisite	Knowledge of gross and microscopic structure of male and female reproductive organs, mitosis and meiosis, cell cycle, gametogenesis, and ovarian and uterine cycles
Course Objective	<p>At the end of the course student will be able to:</p> <ol style="list-style-type: none"> 1. Describe the type, process and merits of Fertilization in mammals 2. Explain drug induced pregnancy, and In- vitro-fertilization techniques 3. Describe the events of second week of development& genes involved in the event 4. Explain comparative gastrulation 5. Describe the events taking place during third week of development with genetic regulation 6. Discuss different stages of embryonic development with influence of genes and environmental factors 7. Understand the developmental basis of vestigial structures preset in human body 8. Discuss the factors (genetic and environmental, including Rh factor) that affects embryogenesis, leading to teratogenesis, & methods to treat or prevent them. 9. Discuss mechanisms that lead to malformations associated with each organ system. 10. Discuss Ultrastructure of the normal human placenta and compare types of placenta and different fetal membranes with clinical and research application 11. Understand the fetal stages of development of human embryo and compare them with different stages of swine fetus 12. Explain the process of twin formation and ectopic pregnancy 13. Understand how the stem cells are manipulated to differentiate into specific type of cells e.g. heart cells 14. Discuss the role of genes and hormones in human development 15. Describe major developmental events associated with cardiovascular system with congenital malformations 16. Describe major developmental events associated with respiratory system with congenital malformations 17. Describe major developmental events associated with gastrointestinal

	<p>system with congenital malformations</p> <p>18. Describe major developmental events associated with muscular system with congenital malformations</p> <p>19. Describe major developmental events associated with skeletal system with congenital malformations</p>
Course Outcome	<p>Upon completion of course the students will be able to:</p> <ol style="list-style-type: none"> 1. Describe the scientific basis for mechanisms related to both normal and abnormal development 2. Provide a logical basis for understanding the overall organization of human body 3. Identify the major developmental events associated with each organ system of the human body 4. Discuss mechanisms that lead to malformations associated with each organ system.
Course Contents	<p>Introduction to embryology with reference to comparative embryology</p> <p>Fertilization; normal process and infertility & drug induced pregnancy/ In vitro-fertilization</p> <p>Zygote formation, stages of development; embryonic & fetal periods</p> <p>Development of Twins/ Identical twins</p> <p>Stem cells (embryonic/ fetal / perinatal and adult) their use in regenerative medicine i.e procedure that manipulate the immature cells to specialized into specific type of cells such as heart muscle cells, blood cells or nerve cells. The specialized cells can then be implanted into a person</p> <p>4th week of development /organogenesis with reference to</p> <p>Teratogens and Congenital Anomalies/ Birth Defect</p> <ul style="list-style-type: none"> - Morphological and/or functional anomaly - Result of an abnormal prenatal development - Presented at birth <p>Congenital vs Acquired / Chromosomal, Genetic & Environmental (Nutrition & Drugs) teratogenesis / teratogens / teratology (Physical, chemical or biological)</p> <p>Pregnancy including ectopic pregnancy & Rh incompatibility</p> <p>Placenta: normal gross and microscopic (Light and Electron)structure of human placenta, types of mammalian placenta, placental abnormalities (Low-lying placentas and placenta previa; Abnormally invasive placentas; Clinical implications ; advanced Research aspects</p>
Recommended Text Books	<p>(Latest Edition of all below mentioned books should be preferred)</p> <ol style="list-style-type: none"> 1. The Developing Human — Clinically Oriented Embryology Keith Moore, T. V. N. Persaud, Mark Torchia. Philadelphia, USA, W.B. Saunders and Company. 2. Larsen's Human Embryology (Schoenwolf, Larsen's Human Embryology) 5th Edition by Gary C. Schoenwolf PhD, Steven B. Bleyl MD PhD , Philip R. Brauer PhD , Philippa H. Francis-West PhD 3. Langman's Medical Embryology by Dr. T.W. Sadler PhD LWW North American Edition. Philadelphia, USA, Lippincott Williams & Wilkins. 4. Developmental Anatomy by Arey
Recommended Reference Books	Essentials of Stem Cell Biology Robert Lanza and Anthony Atala
Web and other	Websites:

resources	<p>https://embryology.med.unsw.edu.au/</p> <p>https://sites.temple.edu/embryology/recommended-embryology-website/</p> <p><u>Journal:</u></p> <p>Journal of Embryology & Developmental Biology</p> <p>Journal of Embryology & Stem Cell Research (JES) Publons</p> <p>Embryology Open Access Pub</p> <p>Edorium Journal of Anatomy and Embryology</p> <p>Development, Growth and Differentiation</p> <p>International Journal of Developmental Biology</p> <p><u>Others:</u></p> <p>Birth Defects Research Part A: Clinical and Molecular Teratology</p> <p>Birth Defects Research Part B: Developmental and Reproductive Toxicology</p>
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18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 2 CH	Outcome
1	Fertilization, cleavage & implantation (normal and abnormal), in vitro-fertilization (IVF) techniques, ethical issues	2 hours	Discuss events of first week of development with IVF techniques
2	Events occurring during second week of development (Dynamic changes in gene expression)	2 hours	Describe events of second week of development
3	From blastocyst to gastrula, gene regulatory networks , comparative approach, formation of notochord, neurulation, and other events of third week of development	2 hours	Discuss comparative gastrulation & other events of third week of development
4	Different stages of embryonic development with vestigial structures as an evidence for evolution	2 hours	Discuss stages of embryonic development & name vestigial remnants
5	Comparative placentation, development & ultrastructure of human placenta with foetal membranes. Recent advances in research on the human placenta	2 hours	Discuss comparative Placentation, development of placenta & fetal membranes
6	Fetal stages of development in humans and compare them with different swine fetal stages	2 hours	Explain fetal stages of human development and compare them with swine fetal stages
7	Causes and types of twin pregnancy , role of genes in fraternal twins , sites of ectopic pregnancy, Role of Rh factor in pregnancy	2 hours	Discuss twin & ectopic pregnancy and Rh factor
8	Discuss Teratogenesis, with emphasis on environmental teratogens	2 hours	Discuss Teratogenesis
9	Mid-Term Exam		

10	Stem cells, their differentiation and growth, their use in regenerative medicine	2 hours	Discuss stem cell differentiation
11	Role of genes and hormones in human development	2 hours	Discuss role of hormones & genes in development
12	Early development of heart & differentiation of heart chambers with associated congenital malformations	2 hours	Describe development of heart chambers with associated anomalies
13	Development of venous & arterial systems; fetal & neonatal circulation with associated congenital malformations	2 hours	Discuss development of venous & arterial systems, and fetal & neonatal circulation with related congenital anomalies
14	Development of respiratory system with associated congenital malformations	2 hours	Describe development of respiratory system with anomalies
15	Development of foregut, midgut and hindgut with associated congenital malformations	2 hours	Discuss development of GIT with congenital anomalies
16	Development of muscular and skeletal systems with associated congenital malformations	2 hours	Discuss development of musculoskeletal systems with congenital anomalies
17	Embryonic stem cell, somatic cell and cloning	2 hours	Explain concept of stem cell & cloning
18	Final-Term Exam		

18 Weeks Lab Plan

Week #	Practical Topics	Duration 1 CH	Outcome
1	Formation & observation of Chick Embryo slides of 24 hours	3 hours	Prepare and identify chick embryo slides of 24 hours
2	Formation & observation of Chick Embryo slides of 48 hours	3 hours	Prepare and identify chick embryo slides of 48 hours
3	Formation & observation of Chick Embryo slides of 72 hours	3 hours	Prepare and identify chick embryo slides of 72 hours
4	Developmental anatomy of 6-mm swine embryo	3 hours	Identify structures seen on 6-mm swine embryo slide
5	Stages of oogenesis and fertilization, and structures formed during second & third week of human development on Human embryology models	3 hours	Identify structures of first, second & third week of development on human embryology plates
6	Parts of human placenta on the given model; types of twins on the embryology models	3 hours	Identify parts of placenta, and types of twins
7	Events occurring at different months of fetal development	3 hours	Identify stages of development

8	Developmental anatomy of 10-mm swine embryo	3 hours	Identify structures seen on 10-mm swine embryo slide
9	Mid-Term Exam		
10	Developmental anatomy of 18-mm swine embryo	3 hours	Identify structures seen on 18-mm swine embryo slide
11	Observe the process of stem cell differentiation	3 hours	Explain process of stem cell differentiation
12	Developmental anatomy of 35-mm swine embryo	3 hours	Identify structures seen on 18-mm swine embryo slide
13	Comparison of human & swine CVS system	3 hours	Identify and compare human & swine CVS development
14	Study of heart tube, differentiation of heart chambers, sinus venosus, embryonic veins and aortic arches on heart models	3 hours	Identify structures of heart development on given models
15	Comparison of human & swine gastrointestinal system	3 hours	Identify and compare human & swine GIT development
16	Lab based study the stages of somatic cell division (mitosis) on plant model (hands on practice); development of Basic techniques in animal cell culture (video based)	3 hours	Identify stages of somatic cell division on a plant model
17	Comparative embryonic development across species including developmental stages of mammalian embryo(swine embryo) with birds (chick embryo) on slides	3 hours	Identify and compare the stages of development of swine and chick embryo slides
18	Final-Term Exam		

Course Code	ANA 832
Credit Hours	3 (2+1)
Course Title	Neurosciences and Anatomy of Head & Neck Region
Pre- Requisite	<p>Topography of Head and Neck</p> <p>Gross structure of the bones of skull, mandible & hyoid</p> <p>General organization of brain and spinal cord</p>
Course Objective	<p>By the end of the course the student will be able to</p> <ol style="list-style-type: none"> 1.Explain the ultrastructure of neurons, glial cells, peripheral nerve & ganglia with functional significance 2. Obtain a basic understanding of the techniques used to investigate morphology and connections of neurons to provide the basis for further research into the nervous system. 3. Explain the gross and microscopic structure of spinal cord & vertebral column along with cross sections of spinal cord at different levels their connections & clinical correlates 4. Describe the neuronal pathways for ascending & descending tracts their connections and functional deficits 5. Explain the gross and microscopic structure and cross sections of parts of brain stem neuronal pathways, connections , functions, structural and functional deficits 6. Discuss the gross & microscopic structure of cerebellum, its connections, clinical examinations and functional significances researches and explain its role as an associative centre for higher cognitive and emotional functions even in the developing brain 7. Describe the Cytoarchitectural and functional organization of diencephalon, hippocampal formation, Reticular activating system and limbic system and structural and functional deficits / disorders 8. Describe the gross and microscopic structure of different parts of basal nuclei their connections and functional significance, clinical examinations according to associated disorders 9. Describe the gross and microscopic structural organization of meninges (spinal & cranial), dural venous sinuses and ventricular system production and circulation of CSF with clinical correlations 10. Identify the cytoarchitecture of cerebral cortex types of cortices, important sulci and gyri on a human brain specimen with reference to cortical areas, white matter and functional significance 11. Explain the cranial nerves (CN), nuclei, neuronal pathways , area of supply, functions, structural and functional deficits and examination of all CN with clinical correlations 12. Differentiate between the somatic and autonomic nervous system their structural organization with clinical correlatons 13. Understand and explain the vasculature of central nervous system and to be able to deduce the risk of Intracranial "Arteriovenous Malformation Rupture "due to venous drainage Impairment 14. Describe the molecular basis of CNS development and associated malformations 15. Explain the functional anatomy of sensorimotor system and higher brain

	<p>centres control of language, emotions, memory and behaviour etc,</p> <p>16. Describe the structure and function of the musculoskeletal structures associated with the skull, face, pharynx, larynx, oral cavity, and cervical region, along with the neurovascular supply of head and neck</p> <p>17. Explain the gross structure of nose, eye and ear with clinical correlations</p> <p>18. Describe the structural organization of temporomandibular joint (TMJ)with reference to movement and identify the cause, sign and symptoms of disorders of TM joint</p> <p>19. Describe the development of skull, cervical vertebrae, pharyngeal apparatus, face, eye and ear and role of genes.</p> <p>20. Correlate the brain, spinal cord and various structures of head and neck with X-ray, CT and MRI scan</p> <p>21. Identify the structures related to dissected brain and head & neck on human cadaver</p>
Course Outcome	<p>Upon completion of course the students will be able to:</p> <ul style="list-style-type: none"> • Understand the functional anatomy of the nervous system in humans and other animals. • Identify major neuroanatomical structures in wet specimens and images and describe their functional significance. • Explain functional consequences of a lesion to a neuroanatomical structure/pathway or a haemorrhage in a particular blood vessel. • Identify the natural defence mechanisms and protection of the human nervous system. • Apply knowledge of the development and evolution of the nervous system to carry out intra- and inter-species nervous system comparisons. • Describe the processes of injury, repair and plasticity in the nervous system. • Analyze the role of anatomical dysfunction in the emergence and maintenance of major neurological and neuropsychiatric disorders.
Course Contents	<p>Advanced Cellular, Molecular Neurobiology including membrane structure and function, ion channel and neurotransmitter receptor structure and function, synaptic plasticity, sensory transduction.</p> <p>Advanced developmental neurobiology including embryonic and post-embryonic development of vertebrate / primate nervous systems Neural Tube Formation; Neural Tube Defects;</p> <p>Systems Neurobiology: Brain Vesicles developing into Brain; Brain stem; cerebellum and Spinal Cord; Expansion of the Cerebral Cortex ; neuronal pathways;</p> <p>Cerebral Palsy and other developmental disorders</p> <p>Molecular Mechanisms underlying Sensory-Motor Circuits and their contribution to disease pathogenesis.</p> <p>Neuroanatomical basis of Brain and Behavior with special context to neuropsychiatric disease and disability, including mental disorders, behavior changes following human brain injury and disease, and mental sub normality</p> <p>Cognitive Neuroscience: The neurological basis of cognition, including perception, attention, memory, language, motor control, executive control, and emotion.</p> <p>Neurological basis of Learning and Memory: different types of memory;</p>

	<p>Localization of memory in different regions of the brain; how does memory work? Involvement of genes and proteins; how can a memory last for a lifetime?</p> <p>Neuroscience of special senses spanning the entire neural pathway from Special sense organ to cortical processing of sensory signals</p> <p>Neurobiology of Aging and Aging-Related Disorders: A complex process of all vertebrate organisms influenced by systemic, genetic, and environmental factors</p> <p>Molecular Basis of Neurologic Disease</p> <p>Blood supply with emphasis to stroke</p> <p>Head & Neck</p> <p>The skull (cranium), the skeletal structure of the head supporting the face and forming a protective cavity for the brain.</p> <p>Features of articulated skull and Cranial fossae,</p> <p>Le Fort Fractures, a group of midface fracture patterns classified into 3 types: Le Fort I, II, and III. Le Fort fractures represent 10%–20% of all facial fractures and can be caused by any significant blunt trauma to the face, most commonly from motor vehicle accidents.</p> <p>Types of Intracranial Hemorrhage:</p> <ul style="list-style-type: none"> • Epidural hemorrhage (EDH) is an event characterized by bleeding into the epidural space between the dural layers of the meninges and the skull. • Subdural hemorrhage (SDH) is bleeding into the space between the dural and arachnoid meningeal layers surrounding the brain. • Subarachnoid hemorrhage (SAH) is a type of cerebrovascular accident (stroke) resulting from intracranial hemorrhage into the subarachnoid space between the arachnoid and the pia mater layers of the meninges surrounding the brain. • Oral cavity , and associated structures; <p>Special sensory organs and the cranial nerves</p> <p>The Orbit, eye ball and Extraocular Muscles, Optic nerve, Visual system Oral cavity, tongue, muscles of mastication Temporomandibular joint; Muscles of facial expression, Parotid and other salivary glands; Vagus, facial, glossopharyngeal, hypoglossal nerves; Parasympathetic ganglia; Cervical ganglia. Dural venous sinuses; Remaining cranial nerves; Vertebral column.</p> <p>Nose; Paranasal sinuses; Ear Blood supply lymphatic drainage.</p> <p>Cervical region: Cervical vertebrae; Cervical fascia; Triangles of neck; muscles glands and other structures (pharynx, larynx, esophagus and trachea) related to neck</p> <p>Neck pain: one of the most common complaints in the general population. many causes including degenerative disease, trauma, rheumatologic disease, and infections, Musculoskeletal conditions</p> <p>Blood supply , lymphatic drainage</p> <p>Miscellaneous</p>
Recommended Text Books	<ul style="list-style-type: none"> • Carpenter MB. Text book of Neuroanatomy. Baltimore, U.S.A, Williams and Wilkins; • Barr's The Human Nervous System: An Anatomical Viewpoint LWW; latest Ed. by John Kiernan MB, ChB, PhD, DSc, Raj Raja kumar

	<ul style="list-style-type: none"> Moore K.L. Clinically Oriented Anatomy. Baltimore, U.S.A. Lippincott Williams and Wilkins
Recommended Reference Books	<ul style="list-style-type: none"> Principles of Neural Science, Fifth Edition Eric R. Kandel, Edited, James H. Schwartz, The McGraw-Hill Companies, Inc. Neuroscience by Purves Oxford University Press, USA latest edition
Web and other resources	<p><u>Websites:</u> Gray's Anatomy http://www.bartleby.com/107/ Instant Anatomy http://www.instantanatomy.net/</p> <p><u>Journal:</u> Journal of Neuroscience Research</p> <p><u>Others:</u> Brain Research</p>

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 2 CH	Outcome
1	Ultrastructure of neurons, glial cells, peripheral nerve & ganglia. Membrane structure and function, ion channel and neurotransmitter receptor structure and function, synaptic plasticity, sensory transduction.	2 hours	Explain microscopic features of glial cells, peripheral nerve & ganglia with relevant techniques with techniques used to investigate morphology and connections of neurons .
2	Gross structure of spinal cord & vertebral column along with cross sections of spinal cord, & ascending & descending tracts , molecular mechanisms underlying Sensory-Motor Circuits and their contribution to disease pathogenesis	2 hours	Explain gross structure of spinal cord & vertebral column along with cross sections & tracts of spinal cord
3	Gross structure and cross sections of brain stem (medulla, pons & midbrain) with clinical correlates	2 hours	Discuss cross sections of brain stem
4	Gross structure of cerebellum, its connections, clinical correlates role of cerebellum in neurological basis of cognition, including perception, attention, memory, motor control, executive control etc.	2 hours	Discuss gross structure, connections & disorders of cerebellum
5	Structure and functions of different parts of diencephalon, hippocampal formation, Reticular activating system, limbic system and basal nuclei, role in behavior, Learning and Memory: different types of memory; Localization of memory in different regions of the brain; how does memory work? Involvement of genes and proteins; how can a memory last for a lifetime?	2 hours	Explain clinical anatomy of diencephalon, RAS, limbic system and basal nuclei

6	Spinal & cranial meninges, dural venous sinuses and ventricular system with clinical correlates	2 hours	Correlate meninges, dural venous sinuses and ventricular system with clinical disorders
7	Gross structure of human brain specimen with reference to cortical areas, white matter, function in the context of Behavior , cognition, neuropsychiatric disease and disability, including mental disorders, behavior changes following human brain injury and disease, and mental sub normality	2 hours	Identify brain sulci & gyri, along with cortical areas, white matter & their functions
8	Microscopic/Cytoarchitectural features of spinal cord, cerebellum & cerebrum with emphasis on comparative approach. , including perception, attention, memory, language, motor control, executive control, and emotion.	2 hours	Explain microscopic features of spinal cord, cerebellum & cerebrum with comparative approach
9	Mid-Term Exam		
10	Differentiate between the autonomic and somatic nervous system with clinical correlates	2 hours	Explain autonomic nervous system with clinical correlates
11	Nuclei, course, functions, area of supply & branches of cranial nerves with associated clinical correlates	2 hours	Explain the gross anatomy of cranial nerves with associated lesions
12	Arterial supply & venous drainage of spinal cord and brain with associated clinical correlates	2 hours	Describe the blood supply of CNS with clinical correlates
13	Development of human spinal cord, hindbrain, midbrain and forebrain with comparison to embryonic and post-embryonic development of vertebrate / primate nervous systems Neural Tube Formation; Neural Tube Defects; and other associated congenital malformations	2 hours	Describe the development of nervous system with congenital anomalies
14	Structure and function of the musculoskeletal structures associated with the skull, face, pharynx, larynx, oral cavity, and cervical region, along with the neurovascular supply of head and neck	2 hours	Explain the clinical anatomy of the structures associated with skull, face, pharynx, larynx, oral cavity, and cervical region, along with their neurovascular supply
15	Gross structure of nose, eye and ear with clinical correlates	2 hours	Explain structure of nose, eye and ear with clinicals
16	Development of skull, cervical vertebrae, pharyngeal apparatus, face, eye and ear with reference to genetic regulation and associated congenital malformations	2 hours	Explain development of skull, cervical vertebrae, pharyngeal apparatus, face, eye and ear with congenital anomalies
17	Scientific techniques and experimental strategies for neuroscience research	2 hours	Discuss techniques for neuroscience research

18	Final-Term Exam
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18 Weeks Lab Plan

Week #	Practical Topic	Duration 1 CH	Outcome
1	Gross features of skull and TMJ with bony landmarks, foramina, structures passing through these foramina and associated clinical correlates (including Le Fort Fractures)	3 hours	Identify gross features of skull & TMJ, with movements at TMJ & muscles producing them, with clinical correlates
2	Identification of gross features of face, scalp, temporal and infratemporal fossa on prosected human specimen	3 hours	Identify gross features of face, scalp, temporal & infratemporal fossa on human specimen
3	Microscopic features of neurons, glial cells, peripheral nerve & ganglia with relevant techniques	3 hours	Identify microscopic features of neurons, glial cells, peripheral nerve & ganglia
4	Transverse sections of brainstem at the level of Medulla & its circuitry	3 hours	Identify transverse sections of brainstem at level of Medulla
5	Transverse sections of brainstem at the level of Pons& its circuitry	3 hours	Identify transverse sections of brainstem at level of Pons
6	Transverse sections of brainstem at the level of Midbrain& its circuitry	3 hours	Identify transverse sections of brainstem at level of Midbrain
7	Identification of meninges and dural venous sinuses on prosected brain specimen; Clinical examination related to sensory & motor systems, cerebellum and basal nuclei	3 hours	Identify meninges and dural venous sinuses on brain specimen; Perform clinical examination related to sensory & motor systems, cerebellum and basal nuclei
8	Transverse sections of brain at the level of Diencephalon (thalamus & hypothalamus) & circuitry	3 hours	Identify transverse sections of brain at level of Diencephalon
9	Mid-Term Exam		
10	Identification of the sulci and gyri on a human brain specimen, along with cortical areas & white matter	3 hours	Identify gross structure of human brain specimen
11	Transverse sections of brain at the level of basal nuclei & internal capsule	3 hours	Identify transverse sections of brain at level of basal nuclei & internal capsule
12	Study the circle of Willis and	3 hours	Identify circle of Willis and ventricular

	ventricular system on cadaveric brain specimen & models		system on cadaveric brain specimen & models
13	Microscopic features of spinal cord, cerebellar, & cerebral cortex	3 hours	Identify microscopic features of spinal cord, cerebellum & cerebrum
14	Cranial nerve examination I-VI	3 hours	Perform cranial nerve examination I-VI
15	Cranial nerve examination VII-XII	3 hours	Perform cranial nerve examination VII-XII
16	Radiological Anatomy (X-ray, CT and MRI scan) of head and neck region	3 hours	Analyze the radiographs of head and neck region
17	Discussion & Revision of histology slides	3 hours	Identify histological slides
18	Final-Term Exam		

Course Code	ANA 833
Credit Hours	3 (2+1)
Course Title	Human Urinary and Genital System
Pre- Requisite	Knowledge of other anatomy elective courses such as microscopic anatomy (Histology), gross anatomy , neuroanatomy and developmental anatomy, gametogenesis and functional anatomy of pelvis
Course objective	<p>Upon completion of course the students should be able to:</p> <ol style="list-style-type: none"> 1. Describe the gross and microscopic (light and electron) structures of the kidney, ureter, urinary bladder and urethra, functional significance, genetic and environmental regulation 2. Analyze the structure (normal & ultra) and function of nephron, and the structure (normal and ultra) and function of filtration membrane, the Juxtaglomerular apparatus its role in maintenance of blood pressure 3. Discuss the applied anatomy of kidney with reference to vitamin D metabolism, angiotensin II, erythropoietin secretion, acid base balance and regulation of major ions by the kidney etc 4. Explain the process of flow of blood and filtration through the kidney and list some of the solutes filtered, secreted, and reabsorbed in different parts of the nephron and discuss how urine osmolarity is hormonally regulated and provide symptoms of kidney failure 5. Discuss the organization of vascular supply of kidney and explain the role of portal system in the kidney 6. Explain the structural (normal & ultra) functional anatomy of urothelium with special reference to urinary bladder and explain the neurocontrol of urinary bladder with applied aspects (Electrical stimulation for the treatment purpose) 7. Describe the development of urinary system with genetic and environmental signaling pathways, affecting development & associated congenital malformations 8. Discuss the structure, location, support and neurovascular supply of ovary; role of hypothalamic-pituitary-gonadal (HPG) axis in regulation of ovarian cycle,

	<p>ovulation and menstruation</p> <p>9. Correlate the clinical anatomy with the structure, location, support and neurovascular supply of uterus and uterine tube and vagina, paraurethral , vestibular glands, clitoris, labia minora and labia majora</p> <p>10. Describe the gross and microscopic (light & ultra) structure of mammary gland genetic and hormonal regulation with clinical correlation</p> <p>11. Describe the gross and microscopic structure, support, and neurovascular supply of testis, epididymis, vas deferens, prostate, seminal vesicle and ejaculatory duct, scrotum and penis genetic and hormonal regulation with clinical correlation</p> <p>12. Describe the development of gonads, female genital tract, male gonads and genital tract and effect of genetic and environmental factors on the process of development and associated congenital malformations</p>
Course outcome	<p>Upon completion of course the students will be able to:</p> <ol style="list-style-type: none"> 1. Describe the normal anatomy of the urinary system, and histological characteristics of the nephron, and identify the pathological changes in nephrogenic diseases 2. Describe the structure associated with the process of ultrafiltration, and explain the structural and functional changes of these structures leading to disease. 3. Describe the role of the kidney in maintaining acid base balance, and interpret clinical cases of acid base disturbances 4. Describe the structure and relations of the male and female urinary system, and outline the radiological imaging and clinical examination of these structures. 5. Describe common pathological changes in the urinary tract, and their clinical consequences. 6. Discuss the causes and diagnosis of male infertility, and evaluate the clinico-pathological features of cryptorchidism, renal calculi and neoplastic lesions of the urogenital tract. 7. Describe the features, consequences, and management of acute and chronic renal failure.
Course Contents	<p>Gross anatomy of the kidney, ureter, urinary bladder and urethra</p> <p>Light & electron Microscopic anatomy of kidney, ureter, urinary bladder and urethra</p> <p>Structure and function of juxtaglomerular complex/apparatus in the kidney</p> <p>Developmental anatomy of kidney, ureter, urinary bladder and urethra, signaling pathways regulating the development and associated abnormalities</p> <p>Functions of urinary system as:</p> <p>Secretion of Hormonal renin angiotensin aldosterone system (RAAS)</p> <p>Regulation of water, blood pressure and electrolytes (sodium, potassium, etc)</p> <p>Elimination of wastes and toxins from the body</p> <p>Production of hormones involved in red blood cell production</p> <p>Acid-base balance in the blood</p> <p>Metabolism of vitamin D</p> <p>Molecular and genetic basis of kidney diseases as</p> <p>Autosomal Dominant Polycystic Kidney Disease (ADPKD)</p> <p>Autosomal Recessive Polycystic Kidney Disease (ARPKD)</p>

	<p>Hereditary Interstitial Kidney Disease Bartter Syndrome Common pathological changes in the urinary tract, including glomerulonephritis, pyelonephritis, interstitial, tubular and cystic diseases, and prostate enlargement, and their clinical consequences.</p> <p>Factors leading to male infertility, and the clinico-pathological features of cryptorchidism, renal calculi and neoplastic lesions of the urogenital tract.</p> <p>Gross and microscopic anatomy of male reproductive system including Testis with their reproductive function, Leydig cells & function and steroidogenesis, Sertoli cell and their function, germ cell maturation, genetic and HPG axis function, the onset of puberty, Sperm transport-vas deferens, prostate, seminal vesicles etc.</p> <p>Gross and microscopic anatomy of the female reproductive system including the ovaries, fallopian tubes, uterus, cervix, vagina and mammary glands with their functions, genetic and hormonal regulation and clinical correlation</p> <p>Special emphasis on the process of folliculogenesis, hormonal regulation, HPG axis function, steroidogenesis, process of ovulation leading to menstruation, the onset of puberty and menopause.</p>
Recommended Text Books	<p>Latest Edition of all below mentioned books should be preferred</p> <ul style="list-style-type: none"> • Moore K.L. Clinically Oriented Anatomy. Baltimore, U.S.A. Williams and Wilkins: Latest Ed. • Sinnatamby C.S. Lasts Anatomy Regional and Applied London, Churchill Living Stone: Latest Ed. • Junqueira LC, Carneiro J. Basic histology. California, U.S.A, Lange Medical publication • Moore K, Persaud TVN, Torchia M. Clinically Oriented Embryology. Philadelphia, USA, W.B. Saunders and Company • Saddler TW. Langman's Medical Embryology. Philadelphia, USA, Lippincott Williams & Wilkins. • Developmental Anatomy by Arey
Recommended Reference Books	<ul style="list-style-type: none"> • Williams, P.L. Warwick, R. Dyson, M. Bannister, L. H. Gray's anatomy Edinburgh: Churchill Livingstone Latest Ed.
Web and other resources	<p><u>Websites:</u> Gray's Anatomy http://www.bartleby.com/107/ Instant Anatomy http://www.instantanatomy.net/</p> <p><u>Journal:</u> Journal of Anatomy Anatomy and Embryology Urinary tract - Latest research and news Nature</p> <p><u>Others:</u> Anatomia, Histologia, Embryologia</p>

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 2 CH	Outcome
1	Gross structure of kidney, ureter, urinary bladder and urethra with clinical aspects	2 hours	Describe gross anatomy of kidney and urinary tract
2	Light & electron microscopic features of kidney, functional significance. Molecular and genetic basis of kidney diseases including common pathological changes	2 hours	Discuss microscopic anatomy of kidney
3	Light & electron microscopic features of urinary tract , functional significance and molecular and genetic basis of urinary tract diseases including common pathological changes	2 hours	Explain microscopic anatomy of urinary tract
4	Development of kidney, ureter, urinary bladder and urethra, genetic and environmental signaling pathways, affecting development & associated congenital malformations	2 hours	Explain development of urinary system
5	Gross and microscopic (light & ultra) structure of mammary gland genetic and hormonal regulation with clinical correlation	2 hours	Explain functional anatomy of mammary gland
6	Gross structure of ovaries, uterine tubes & uterus with associated clinical correlates and role of HPG-axis in regulation of these structures	2 hours	Discuss functional anatomy of ovaries, uterine tube and uterus
7	Gross anatomy of vagina and associated reproductive glands with clinical significance	2 hours	Explain gross structure of vagina and associated reproductive glands
8	Light & electron microscopic features of ovary and uterine tubes, functions with genetic and hormonal regulation and clinical correlation	2 hours	Explain microscopic features of ovary and uterine tubes
9	Mid-Term Exam		
10	Light & electron microscopic structure of uterus, cervix and vagina associated reproductive glands with genetic and hormonal regulation and clinical correlation	2 hours	Describe microscopic features of uterus, cervix and vagina
11	Gross anatomy of testes, epididymis and scrotum, with functional & clinical significance	2 hours	Discuss gross structure of scrotum, testes and epididymis
12	Gross anatomy of ductus deferens,	2 hours	Explain gross structure of vas

	seminal vesicles, prostate & associated urethral glands with functional & clinical significance		deferens, seminal vesicles, prostate & associated glands
13	Light & electron microscopic structure of testis and epididymis and with functional & clinical significance, regulation (genetic and HPG axis)	2 hours	Explain microscopic features of testis and epididymis
14	Light & electron microscopic structure of vas deferens, seminal vesicles, prostate & associated urethral glands with functional & clinical significance, associate signaling pathways regulation (genetic and HPG axis)	2 hours	Explain microscopic features of vas deferens, seminal vesicles, prostate & associated glands
15	Describe the development of gonads, male & female genital tract with associated signaling pathways and malformations	2 hours	Describe the development of gonads, male and female genital tract
16	Describe the development of external genitalia and descent of gonads with genetic regulation and associated congenital disorders	2 hours	Describe the development of external genitalia and descent of gonads
17	Genetic and environmental factors leading to infertility both in males and females	2 hours	Discuss causes of infertility in males and females
18	Final-Term exam		

18 Weeks Lab Plan

Week #	Practical Topic	Duration 1 CH	Outcome
1	Bony features and foramina of pelvis in relation to urogenital organs	3 hours	Discuss gross features of bony pelvis
2	Dissection of goat & cow kidney	3 hours	Perform dissection of goat & cow kidney
3	Dissection of urinary system on human cadaver	3 hours	Perform cadaveric dissection of urinary system
4	Microscopic anatomy of kidney with clinical correlates	3 hours	Identify microscopic features of kidney
5	Microscopic anatomy of ureter, urinary bladder and urethra with clinical correlates	3 hours	Identify microscopic features of urinary tract
6	Surface anatomy of urinary system	3 hours	Perform surface marking of urinary system
7	Radiological anatomy of urinary system	3 hours	Analyze radiological anatomy of urinary system
8	Perform urinary catheterization in skills lab	3 hours	Perform urinary catheterization in skill lab

9	Mid-Term Exam		
10	Microscopic structure of ovary and uterine tubes with associated clinical correlates	3 hours	Identify microscopic features of ovary & uterine tubes
11	Microscopic structure of uterus and vagina with associated clinical correlates	3 hours	Identify microscopic features of uterus & vagina
12	Revision of histology slides of urinary system	3 hours	Identify microscopic features of urinary system
13	Microscopic structure of testis and epididymis	3 hours	Identify microscopic features of testis and epididymis
14	Microscopic structure of vas deferens, seminal vesicles and prostate with clinical correlates	3 hours	Identify microscopic features of vas deferens, seminal vesicles, and prostate
15	Radiological anatomy of reproductive system with clinical correlates	3 hours	Analyze radiological anatomy of reproductive system
16	Revision of prospected (cadaveric) specimen of human urinary tract and comparison with mammalian kidney	3 hours	Identify and compare gross structure of the human and goat kidney
17	Revision of histology slides of male and female reproductive system	3 hours	Identify histology slides of male and female reproductive system
18	Final-Term exam		

Course Code	ANA 834
Credit Hours	3 (2+1)
Course Title	Human Alimentary Tract
Pre- Requisite	The general topography of Abdomen Skeletal element supporting abdomen Structural components of alimentary tract /GIT
Course Objective	<p>By the end of the course the student will be able to</p> <ol style="list-style-type: none"> 1. Explain the structures of anterior abdominal wall; the surface projection of viscera on the anterior abdominal wall ; differential diagnoses of acute abdomen; Referred pain; Surgical anatomy of incisions and associated hernias. 2. Explain the relationships of the abdominal fascial layers with muscles and serous membrane (peritoneum) reflection of the peritoneum, formation of omenta, mesenteries and the ligaments. 3. Describe and demonstrate the formation and extent of the inguinal canal, its boundaries and contents and inguinal hernias. 4. Describe the gross & microscopic features of oral cavity, structures associated with oral cavity (as Lips, cheeks, tongue, hard and soft palate, salivary glands, oropharynx), oesophagus, stomach, small and large intestine, rectum, anal canal, and spleen with their blood supply, lymphatic drainage and associated clinical problems. Specifically correlate stomach pathology with H. pylori infection 5. Discuss the embryological development of the alimentary tract,

	<p>rotation of gut with genetic regulation and developmental anomalies.</p> <p>6. Describe the gross and microscopic (Light & ultra) structure of liver, gall bladder and pancreas with blood supply, lymphatic drainage, peritoneal ligaments; Correlate the formation & sites of porto-systemic anastomosis with portal hypertension, clinical problems and their frequencies, disease of liver, factors associated with liver transplant</p> <p>7. Demonstrate the biliary and pancreatic duct systems and their major variations and clinical significance</p> <p>8. Explain the structure of posterior abdominal wall, functional significance and clinical relevance</p> <p>9. Identify anatomic structures in radiographic studies including X-ray, CT scans and MRI films</p> <p>10. Identify the structures related to the GIT their anatomical relations and associated blood vessels and nerves while dissecting human cadaver</p> <p>11. Perform the abdominal examination on a simulated subject</p>
Course Outcome	<p>Upon completion of course the students will be able to:</p> <ol style="list-style-type: none"> 1. Integrate all related aspects of gastrointestinal system from basic sciences to clinical 2. Gain appropriate knowledge and skills about normal and abnormal structures and functions of the gastrointestinal system. 3. Correlate pathological conditions, infectious disease and treatment of gastrointestinal diseases with normal anatomy 4. Gain primary knowledge about symptoms and signs related to gastrointestinal disorders.
Course Contents	<ul style="list-style-type: none"> • The course contents will include: Gross feature of anterior abdominal wall/ quadrants • Clinical significance Abdominal examination; differential diagnoses of acute abdomen; Referred pain; Surgical anatomy of incisions • Inguinal hernia; Umbilical hernia; Epigastric hernia; Rectus sheath hematoma • Anatomy of inguinal region, groin hernias. Hydroceles, clinical and surgical application Peritoneum, peritoneal reflexion, peritoneal recesses and fossae. Peritonitis types, Symptoms and Causes • Gross and microscopic features and development of gut: esophagus, stomach, small and large intestine, rectum, anal canal, and spleen, blood supply, lymphatic drainage and clinical significance • Gross and microscopic features and development of liver, gallbladder and pancreas blood supply, lymphatic drainage, portal circulation and porto-systemic anastomosis , liver disease and liver transplant • Correlate the formation & sites of porto-systemic anastomosis with portal hypertension • Role of Gut as a strong immune system, • Gut microbiota: Definition, importance and medical uses • Significant change in the GIT with Ageing • Clinical significance of gut hormones

Recommended Text Books	<p>Recommended Readings:</p> <ul style="list-style-type: none"> • Moore K.L. Clinically Oriented Anatomy. Baltimore, U.S.A. Williams and Wilkins: Latest Ed. • Sinnatamby C.S. Lasts Anatomy Regional and Applied London, Churchill Living Stone: Latest Ed.
Recommended Reference Books	<ul style="list-style-type: none"> • Williams, P.L. Warwick, R. Dyson , M. Bannister, L. H. Gray's anatomy Edinburgh: Churchill Livingstone Latest Ed.
Web and other resources	<p>Websites: Gray's Anatomy http://www.bartleby.com/107/ Instant Anatomy http://www.instantanatomy.net/</p> <p>Journal:</p> <ul style="list-style-type: none"> • Journal of Anatomy • Anatomy and Embryology • Journal of Gastroenterology Research <p>Others:</p> <ul style="list-style-type: none"> • Anatomia, Histologia, Embryologia

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 2 CH	Outcome
1	Gross & microscopic (light and ultra) structure of oral cavity, tongue, and soft palate with associated clinical problems	2hours	Explain gross and microscopic features of upper alimentary canal
2	Gross & microscopic (Light and ultra) structure of salivary glands and oropharynx with associated problems	2 hours	Explain gross & microscopic features of salivary glands
3	Gross structure of anterior abdominal wall & formation of inguinal canal with associate clinical aspects	2 hours	Discuss gross structure of anterior abdominal wall & formation of inguinal canal
4	Peritoneum, attachments, reflections, recesses & fossae with clinical importance	2 hours	Explain attachments of peritoneum
5	Gross & microscopic features of oesophagus & stomach and associated clinical problems, such as GERD & H. pylori infection; esophageal varices	2 hours	Explain functional anatomy of oesophagus and stomach
6	Gross & microscopic structure of liver, gall bladder, & extra hepatic biliary system , portal vein and its tributaries with associated clinical problems and new scientific approach	2 hours	Explain functional anatomy of liver and biliary tract
7	Hepatoportal system , sites & formation of portosystemic anastomosis with portal hypertension and its sequel	2 hours	Explain functional anatomy of portosystemic anastomosis

8	Gross & microscopic features of pancreas & spleen functional significance and clinical relevance	2 hours	Explain functional anatomy of pancreas and spleen
9	Development of oral cavity, oesophagus, stomach, liver, gall bladder, pancreas and spleen with genetic regulation & associated congenital malformations	2 hours	Interpret congenital anomalies in relation to foregut development
10	Mid-Term Exam		
11	Gross & microscopic features of small intestine, caecum & appendix with clinical & surgical significance	2 hours	Explain functional anatomy of small and large intestine
12	Gross & microscopic features of large intestine, rectum & anal canal associated with clinical aspects	2 hours	Explain functional anatomy of large intestine and anal canal
13	Development of midgut with special emphasis on gut rotation and associated genetic role and congenital malformations	2 hours	Interpret congenital anomalies in relation to midgut development
14	Development of hindgut, gene regulation and associated congenital malformations	2 hours	Interpret congenital anomalies in relation to hindgut development
15	Structure of posterior abdominal wall with clinical correlates	2 hours	Explain functional anatomy of posterior abdominal wall
16	Review of functional aspect of Alimentary tract	2 hours	Correlate structure of GIT with disorders
17	Role of gut microbiota in human health, diseases, immunity and obesity	2 hours	Explain effects of gut microbiota
18	Final-Term exam		

18 Weeks Lab Plan

Week #	Practical Topic	Duration 1 CH	Outcome
1	Light & Electron Microscopic features of oral cavity & tongue with clinical correlates	3 hours	Identify microscopic features of tongue
2	Light & Electron Microscopic features of salivary glands ,mode of secretion and clinical aspects	3 hours	Identify microscopic features of salivary glands
3	Dissection of anterolateral abdominal wall and inguinal region on cadaver	3 hours	Perform dissection of anterolateral abdominal wall
4	Dissection of peritoneum, peritoneal recesses and gutters on cadaver	3 hours	Perform dissection of peritoneum
5	Light & Electron Microscopic features of oesophagus with clinical correlates	3 hours	Identify microscopic features of oesophagus

6	Light & Electron Microscopic features of stomach with emphasis on gastritis, gastric ulcers, H.Pylori and gastric carcinoma	3 hours	Identify microscopic features of stomach
7	Light & Electron Microscopic structure of liver and gall bladder with emphasis on fatty liver, hepatitis, carcinoma and gall stones	3 hours	Identify microscopic features of liver and gall bladder
8	Light & Electron Microscopic features of pancreas & spleen with clinical aspects	3 hours	Identify microscopic features of pancreas and spleen
9	Mid-Term Exam		
10	Cadaveric dissection of GIT	3 hours	Perform dissection of GIT
11	Light & Electron Microscopic features of duodenum, jejunum and ileum with clinical aspects	3 hours	Identify microscopic features of small intestine
12	Light & Electron Microscopic features of appendix and large intestine with emphasis on acute appendicitis and other clinical correlation	3 hours	Identify microscopic features of appendix and colon
13	Gross & microscopic (Light & Electron) features of large intestine, rectum & anal canal with clinical correlation	3 hours	Identify microscopic features of rectum and anal canal
14	Abdominal examination on a human subject	3 hours	Perform abdominal examination
15	Surface anatomy of GIT on a human subject	3 hours	Perform surface anatomy of GIT
16	Radiological anatomy of GIT with clinical correlates	3 hours	Analyze radiological anatomy of GIT
17	Revision of histology slides of alimentary tract and associated glands	3 hours	Identify histology slides
18	Final-Term exam		

Course Code	ANA 835
Credit Hours	3 (2+1)
Course Title	Human Respiratory System
Pre-Requisite	Topography of thorax Bones of Axial skeleton
Course Objective	<p>By the end of the course the students will be able to:</p> <ol style="list-style-type: none"> 1. Discuss the Thoracic wall, structure,(bones and joints and content of intercostal spaces) respiratory adaptation to changes in body size, metabolic rate, chest wall abnormalities and their clinical significance 2. Describe Mediastinum, parts, borders ,contents with clinical significance 3. Discuss the gross anatomical features of “muscles of respiration”, muscle plasticity and disorders of respiratory muscles

	<p>4. Describe the anatomy & morphology of nose, nasal cavity, paranasal sinuses, nasopharynx, laryngopharynx, trachea and bronchial tree with their functional significance and disorders</p> <p>5. Describe the anatomical organization of diaphragm as organ of respiration</p> <p>6. Describe the structural and functional organization of lung and its compartments with clinical significance</p> <p>7. Describe the gross anatomical features of pleura, pleural reflections & recesses and their clinical significance</p> <p>8. Explain the light and electron microscopic structure of upper and lower respiratory tract with their clinical significance</p> <p>9. Describe neurovascular supply and lymphatic drainage of thorax and thoracic duct</p> <p>10. Explain the Bronchopulmonary segments, anatomy and clinical importance</p> <p>11. Describe the embryonic development, genetic regulation and congenital malformations of the respiratory system</p> <p>12. Discuss the major functions of the respiratory system with reference to oxygen and carbon dioxide transport into and out of the lungs</p> <p>13. Discuss the voluntary control of respiration with Clinical Relevance</p> <p>14. Discuss the response of respiratory system to exercise</p> <p>15. Discuss the molecular, genetics and genomics of respiratory diseases</p> <p>16. Discuss the role of Lung microbiome, and sleep and circadian biology in respiratory system in health and disease</p>
Course Outcome	<p>Upon completion of course the students will be able to:</p> <p>1. Understand and interpret the gross structure of various parts of the thorax</p> <p>2. Identify the bones, joints, muscles, nerves, viscera and blood vessels in cross sections of the thorax</p> <p>3. Relate the structure of respiratory system with clinical disorders</p> <p>4. Relate the congenital malformations of larynx, trachea, lungs and diaphragm with developmental defects</p> <p>5. Identify the structures of respiratory system on plain radiograph, CT scan and MRI of chest</p>
Course Contents	<p>The course contents will include:</p> <ul style="list-style-type: none"> • Gross anatomical and Light & electron microscopic structure of Nose, nasal cavity, paranasal sinuses with functional and clinical significance • Gross anatomical and Light & electron microscopic structure of Pharynx, larynx, trachea and bronchial tree, bronchopulmonary segments with functional and clinical significance • Thoracic wall , ribs, joints and Intercostal structures and diaphragm • Pleura pleural reflection and pleural cavity and lungs • Blood supply, Lymphatic drainage and innervation • Normal and abnormal development of trachea and lungs involvement of gene and signaling proteins in the process of development • Clinical problems encounter respiratory system as nasal bleed, Common cold, sinusitis, Allergies, Asthma, Bacterial and viral infections. • Molecular, genetics and genomics of respiratory diseases • Role of Lung microbiome, and sleep and circadian biology in respiratory system in health and disease

Recommended Text Books	<ul style="list-style-type: none"> Sinnatamby C.S.Lasts Anatomy Regional and Applied London, Churchill Living Stone: Latest Ed. Moore K.L. Clinically Oriented Anatomy. Baltimore, U.S.A. Williams and Wilkins: Latest Ed. Snell. R.S. Clinical Anatomy for Medical Students. Philadelphia USA Lippincott Williams and Wilkins:Latest Ed.
Recommended Reference Books	<ul style="list-style-type: none"> Williams, P.L. Bannister, L.H. Berry, M.B, Collins, P., Dyson M. Ferguson, M.WJ. Gray's Anatomy
Web and other resources	<p><u>Websites:</u> Gray's Anatomy http://www.bartleby.com/107/ Instant Anatomy http://www.instantanatomy.net/</p> <p><u>Journal:</u></p> <ul style="list-style-type: none"> Journal of Anatomy Journal of Respiration Anatomia, Histologia, Embryologia <p><u>Others:</u></p> <ul style="list-style-type: none"> Respiration and Circulation CHEST

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 2 CH	Outcome
1	Thoracic wall, structure, respiratory adaptation to changes in body size, metabolic rate, chest wall abnormalities and their clinical significance in childhood & adulthood	2 hours	Discuss Bones and joints of thoracic cage and intercostal spaces
2	Mediastinum, parts, borders ,contents with clinical significance	2 hours	Explain the contents of mediastinum
3	Muscles of respiration, Respiratory Muscle Plasticity and Disorders of the Respiratory Muscles	2 hours	Discuss respiratory muscles and diaphragm
4	Nose, nasal cavity, paranasal sinuses nasopharynx their structural and functional significance and disorders	2 hours	Explain gross structure of upper respiratory tract
5	Anatomy and morphology of Larynx, trachea , bronchial tree with functional and clinical significance	2 hours	Discuss gross anatomy of conducting respiratory tract
6	Light and Electron Microscopic features of trachea & bronchial tree with clinical correlates	2 hours	Explain microscopic features of conducting respiratory passages
7	Gross anatomical aspect of pleura, pleural reflections & recesses and their clinical significance	2 hours	Discuss attachments of pleura
8	Structural and functional organization of lung and its	2 hours	Discuss gross structure of lung

	compartments with clinical significance		
9	Mid-Term Exam		
10	Light & Electron Microscopic features of lungs, and role of lung epithelial cells in regulation of immune responses	2 hours	Explain microscopic features of lung
11	Bronchopulmonary segments: Anatomy and clinical importance	2 hours	Interpret functional significance of bronchopulmonary segments
12	Voluntary control of respiration with Clinical Relevance	2 hours	Explain neuronal control of respiration
13	Development, genetic regulation and congenital malformations of nasal cavity, paranasal sinuses, larynx, trachea and bronchial tree	2 hours	Explain development of upper respiratory tract
14	Development , genetic regulation& congenital malformation of pleura, pleural cavity and lungs	2 hours	Explain development of pleural cavity and lung
15	Development genetic regulation & congenital malformation of diaphragm	2 hours	Explain development of diaphragm
16	Molecular, genetics and genomics of respiratory diseases	2 hours	Interpret functional anatomy of respiratory system
17	Role of Lung microbiome, and sleep and circadian biology in respiratory system in health and disease	2 hours	Discuss body adaptation in relation to respiratory system
18	Final-Term exam		

18 Weeks Lab Plan

Week #	Practical Topic	Duration 1 CH	Outcome
1	Bones and joints of thoracic cage and intercostal spaces	3 hours	Identify bones & joints of thoracic cage
2	Gross structure of mediastinum with its divisions and contents	3 hours	Identify gross features of mediastinum
3	Gross anatomical features of muscles of respiration & diaphragm with respiratory movements and clinical	3 hours	Interpret gross structure of thoracic muscles & diaphragm in relation to respiration
4	Demonstration of goat trachea & lung	3 hours	Dissect goat trachea & lung
5	Gross structure of nose, nasal cavity, paranasal sinuses and nasopharynx on models	3 hours	Identify gross features of upper respiratory tract
6	Gross features of larynx, trachea & bronchial tree with clinical correlates on models	3 hours	Identify gross features of conducting respiratory passages

7	Microscopic features of trachea & bronchial tree with clinical correlates	3 hours	Identify microscopic features of conducting respiratory passages
8	Cadaveric dissection of pleural cavity	3 hours	Dissect pleural cavity
9	Mid -Term Exam		
10	Gross features of lung on human cadaver	3 hours	Identify gross features of lung
11	Microscopic features of lung with clinical correlates	3 hours	Identify microscopic features of lung
12	Chest examination related to respiratory system in skills lab	3 hours	Perform chest examination
13	Auscultation of respiratory system in skills lab for normal and added respiratory	3 hours	Auscultate respiratory system
14	Comparative development of lung in pig embryo	3 hours	Explain comparative development of lung
15	Review of functional anatomy of respiratory system	3 hours	Analyze functional anatomy of respiratory system
16	Radiological anatomy of respiratory system with clinical correlates	3 hours	Analyze radiological anatomy of respiratory system
17	Revision and comparison of gross features of human cadaveric lungs and trachea with that of goat	3 hours	Identify histology slides and cadaveric lungs, trachea
18	Final-Term exam		

Course Code	ANA 836
Credit Hours	3 (2+1)
Course Title	Anatomy of Human Heart and Blood Vessels
Pre-Requisite	Topography of thorax Bones of Axial skeleton
Course Objective	<p>By the end of the course the students will be able to:</p> <ol style="list-style-type: none"> 1. Explain Thoracic wall, structures (ribs joints and muscles), chest wall abnormalities and clinical significance 2. Describe mediastinum, its divisions, contents clinical relivances 3. Describe Light & electron microscopic, features of cardiac muscles with functional and clinical significance 4. Describe the gross and microscopic structure of great vessels , functional and clinical significance, application of tissue-engineered vascular graft 5. Describe pericardium (fibrous and serous), pericardial sinuses with clinical correlation 6. Describe the external & internal structure of the heart, heart valves , neurovascular supply, functional and clinical significance 7. Interpret electrocardiogram in relation to blood supply of the heart and heart and blood Vessel disorders 8. Describe the anatomical position and extent of great vessels including aorta, arch of aorta ,branches of aorta, clinical features including aortic aneurysm,

	<p>pulmonary trunk, superior and inferior vena cava, and brachiocephalic vein</p> <p>9. Explain the structure of blood and its component (plasma and blood cells) with functional and clinical significance</p> <p>10. Describe the development of cardiovascular systems with the role of genes and genetic abnormalities and associated congenital malformations</p> <p>11. Describe the Cardiac Conduction System anomalies and sudden cardiac death</p> <p>12. Identify the surface and radiological anatomy of cardiovascular systems</p> <p>13. Identify factors leading to hypertension, and useful approaches in prevention of this condition</p> <p>14. Describe the voluntary neuronal control with reference to brain centers that control heart rate and Identify factors affecting heart rate</p> <p>15. Identify factors involve in chronic cardiovascular disease, such as cardiomyopathies, sleep apnoea, diabetes and hypertension</p> <p>16. Explain effect of exercise on heart rate</p>
Course Outcome	<p>Upon completion of course the students will be able to:</p> <ol style="list-style-type: none"> Understand and interpret the gross structure of various parts of the thorax Identify the bones, joints, muscles, nerves, viscera and blood vessels in cross sections of the thorax Relate the structure of cardiovascular and system with clinical disorders Relate the congenital malformations of heart and blood vessels with developmental defects Identify the structures of CVS on plain radiograph, CT scan and MRI of chest
Course Contents	<p>Thoracic cage, mediastinum and its subdivisions, Pericardium. Anatomy, physiology and pathophysiology of the cardiovascular system.</p> <p>Main emphasis on the light and electron microscopic structure of heart, vessels and cardiac conducting system, embryological development of heart and vessels, genes and transcription factors regulating the process of development, mutational analysis leading to developmental anomalies of the heart and vascular system. Coronary circulations, hemodynamics of the heart and vascular system.</p> <p>Disease processes to challenge genetic modifications known to cause cardiovascular diseases. Role of predisposing factors in relation to ischemic heart disease and heart failure: atherosclerosis, diabetes, hypertension, metabolism, gender, acute myocardial ischemia.</p> <p>Tissue engineering to restore the structure and function of tissues damaged due to injury, aging or disease through the use of cells, biomaterials, and biologically active molecules</p>
Recommended Text Books	<ul style="list-style-type: none"> Sinnatamby C.S.Lasts Anatomy Regional and Applied London, Churchill Living Stone: Latest Ed. Moore K.L. Clinically Oriented Anatomy. Baltimore, U.S.A. Williams and Wilkins: Latest Ed. Williams, P.L. Bannister, L.H. Berry, M.B, Collins, P., Dyson M. Ferguson, M.WJ. Gray's Anatomy London. Churchill living stone: Latest Ed. Guyton AC: Textbook of Physiology Latest Ed. Underwood's Pathology: a Clinical Approach latest Ed.
Recommended Reference Books	Williams, P.L. Bannister, L.H. Berry, M.B, Collins, P., Dyson M. Ferguson, M.WJ. Gray's Anatomy London. Churchill living stone: Latest Ed.

Web and other resources	<p><u>Websites:</u></p> <p>Gray's Anatomy http://www.bartleby.com/107/</p> <p>Instant Anatomy http://www.instantanatomy.net/</p> <p><u>Journal:</u></p> <p>Journal of Anatomy</p> <p>Anatomical record</p> <p><u>Others:</u></p> <p>Circulation AHA/ASA Journals</p>
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18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 2 CH	Outcome
1	Chest/ Thoracic wall, structures (ribs joints and muscles), chest wall abnormalities and clinical significance	2 hours	Explain gross anatomy of bones and joints of thoracic cage
2	Mediastinum, parts, borders ,contents with clinical significance	2 hours	Explain gross structure of mediastinum
3	Light & electron microscopic features of cardiac muscles with functional and clinical significance	2 hours	Explain microscopic features of cardiac muscles
4	Great vessels function, structure, and histology with clinical significance, application of tissue-engineered vascular graft	2 hours	Explain microscopic features of great vessels
5	Structure of the Human Pericardium and clinical significance	2 hours	Explain functional anatomy of pericardium
6	Anatomy of a Human Heart External features	2 hours	Explain functional anatomy of heart
7	Anatomy of a human Heart Internal features	2 hours	Explain functional anatomy of heart
8	Anatomy of human aorta, branches, aortic arch clinical features including aortic aneurysm	2 hours	Explain functional anatomy of aorta
9	Mid-Term Exam		
10	The Great Vessels of the Heart , anatomy of pulmonary trunk, superior and inferior vena cava, and brachiocephalic vein, function, and significance	2 hours	Explain functional anatomy of pulmonary trunk, superior & inferior vena cava & brachiocephalic vein
11	Cardiac conduction system anomalies and sudden cardiac death	2 hours	Explain conduction system of heart
12	Electrocardiography - Heart and Blood Vessel Disorders	2 hours	Interpret electrocardiogram in relation to blood supply of heart
13	An Overview of Blood – Gross and microscopic anatomy , composition and functional & clinical aspects	2 hours	Explain gross & microscopic features of blood

14	Development of heart.& vessels Congenital or acquired heart and vascular defects, caused by genetic and environmental factors including blood flow.	2 hours	Explain development of heart & blood vessels
15	Fetal and neonatal circulation with clinical correlated	2 hours	Discuss fetal & neonatal circulation
16	Developmental anomalies with cardiovascular diseases and predisposing factors (Race, genetic and environmental)	2 hours	Discuss factors leading to cardiovascular congenital anomalies
17	Tissue Engineering Therapy for Cardiovascular Disease (CVD)	2 hours	Discuss aspects of tissue engineering therapy for CVD
18	Final-Term exam		

18 Weeks Lab Plan

Week #	Practical Topic	Duration 1 CH	Outcome
1	Gross features of bones and joints of thoracic cage	3 hours	Identify gross structures of thoracic cage
2	Divisions & contents of Mediastinum on models	3 hours	Identify gross structures of mediastinum
3	Chest examination related to cardiovascular system	3 hours	Perform chest examination related to CVS
4	Microscopic features of cardiac muscles with clinical correlates	3 hours	Identify microscopic features of cardiac muscles
5	Demonstration of dissection of bull's heart	3 hours	Dissect bull's heart
6	Microscopic features of great vessels with clinical correlates	3 hours	Identify microscopic features of great vessels
7	Dissection of pericardium on human cadaver	3 hours	Perform the dissection of pericardium
8	Gross structure of heart with clinical correlates	3 hours	Identify gross structure of heart
9	Mid-Term Exam		
10	Blood pressure using mercury sphygmomanometer	3 hours	Perform BP examination
11	Surface anatomy of heart borders and valves	3 hours	Perform surface anatomy of heart
12	Comparative development of heart in swine embryo	3 hours	Compare heart development with swine embryo
13	Auscultation of heart in skills lab for normal and added heart sounds	3 hours	Auscultate heart sounds
14	Review of functional anatomy of cardiovascular system with special reference to electrocardiogram	3 hours	Interpret functional anatomy of CVS

15	Making of blood smear slide and observation of DLC under light microscope	3 hours	Prepare blood smear slide and count DLC
16	Radiological anatomy of cardiovascular system with clinical correlates	3 hours	Interpret radiological anatomy of CVS
17	Revision & Discussion of histology slides of cardiac muscle and blood vessels, Cadaveric heart	3 hours	Identify histological slides of cadaveric heart and blood vessels
18	Final-Term Exam		

Course Code	ANA 837
Credit hours	3(2+1)
Course Title	Anatomy of Human Skeletal and Muscular System
Pre- Requisite	General outline of bones of axial and appendicular skeleton Gross & microscopic features of skeletal muscles
Course Objective	<p>By the end of the course the student will be able to</p> <ol style="list-style-type: none"> 1. Classify the types of skeletal muscles on the basis of muscle fibre arrangement and on the basis of their functions 2. Explain microscopic (light and electron) features of skeletal muscle, tendon, ligament and aponeurosis 3. Discuss the gross and microscopic structure and functions of bones and cartilages, including cell biology of bone and cartilage cells, their adaption to the mechanical and metabolic environments, regulatory factors and mineral homeostasis with growth and development and bone measurements. 4. Describe the axioappendicular musculature representing as anterior and posterior muscles groups, and their attachments on the girdle bones and limb bones 5. Explain the articulating bones with reference to bone articulation, type, ligaments & movements of the joints of the upper limb (sterno- clavicular, acromioclavicular, shoulder, elbow & wrist joint and joints of hand) 6. Discuss the mammary gland with reference to its location, extent, structure, neurovascular supply and lymphatic drainage and clinical aspects associated with it 7. Discuss the anatomy of back including the spine and back muscles 8. Discuss the axilla region, borders, contents and clinical correlations. 9. Describe formation of brachial plexus, its branches & types of Brachial Plexus Injuries 10. Describe muscles of the arm and forearm (flexors & extensors)and the neurovascular plan with clinical correlations 11. Describe the cubital fossa, boundaries and contents of & anatomical significance 12. Describe the spaces of hand, anatomy and significance, muscles of the hand 13. Describe the pelvis, types of pelvis, bony features and muscular attachment and compare the male and female pelvis. 14. Identify the bones of the lower limb (hip bone, femur, tibia, fibula and bones of the foot) general features and muscle attachments with clinical significance

	<p>15. gluteal region, and compartments of thigh, leg , muscles and neurovascular plan and explain the boundaries and contents of femoral triangle, adductor canal and popliteal fossa with clinical significances</p> <p>16. Explain the articulating bones with reference to bone articulation, type, ligaments & movements of the joints of the lower limb(pelvic girdle, hip, knee, ankle joints, and joints of foot with structural , functional and clinical significance</p> <p>17. Describe formation of lumbosacral plexus, its branches & clinical aspects</p> <p>18. Describe the foot with respect to bony articulation , significance of arches of foot supporting elements, and muscles</p> <p>19. Describe the neurovascular supply of lower limb clinical correlation with myopathy (muscular dystrophies) and regeneration</p> <p>20. Discuss Genetic Regulation of embryological limb development with relation to congenital limb deformity in humans</p> <p>21. Perform surface anatomy of structures within upper & lower limbs</p> <p>22. Explain the radiological aspects of blood vessels, bones and joints of upper and lower limb and back</p>
Course Outcome	<p>Upon completion of course the students will be able to:</p> <ol style="list-style-type: none"> 1. Understand and interpret the gross structure of various parts of the upper and lower limbs 2. Identify the bones, joints, muscles, nerves and blood vessels in cross sections, and X-rays of the upper and lower limbs 3. Identify and correlate the nerve injuries at various levels 4. Relate the structure and lymphatic drainage of mammary gland to the spread of cancer 5. Explain the gross features of back with clinical correlates
Course Contents	<p>Gross and microscopic structure and functions of bones and cartilages, including cell biology of bone / cartilage cells; measurement techniques; adaption to the mechanical and metabolic environments; regulatory factors and mineral homeostasis; and growth and development, ossification and congenital anomalies factors (genetic and environmental) affecting the growth and development of bones and cartilage. Injuries and reparments.</p> <p>Gross and microscopic (light and electron) features of skeletal muscles, tendon, ligament and aponeurosis. Nerve and blood supply clinical correlation with myopathy (muscular dystrophies) and role of stem cells in muscular regeneration</p> <p>Classification of muscles on the basis of arrangement of muscle fibers and on the basis of their functions</p> <p>Injuries, regeneration, disease and aging, problem with movement, pain, stiffness ; congenital anomalies</p>
Recommended Text Books	<p>Latest Edition of all below mentioned books should be referred:</p> <ul style="list-style-type: none"> • Sinnatamby C.S. Last's Anatomy Regional and Applied. London, Churchill Living Stone: Latest Ed. • Standring S. Gray's Anatomy: The Anatomical Basis of Clinical Practice. Elsevier Churchill Living Stone, London. • Moore KL. Clinically Oriented Anatomy. Baltimore, U.S.A. Williams and Wilkins.
Recommended Reference Books	<ul style="list-style-type: none"> • Williams, P.L. Bannister, L.H. Berry, M.B, Collins, P., Dyson M. Ferguson, M.WJ. Gray's Anatomy London. Churchill living stone: Latest Ed.

Web and other resources	<p><u>Websites:</u></p> <p>Gray's Anatomy http://www.bartleby.com/107/</p> <p>Instant Anatomy http://www.instantanatomy.net/</p> <p><u>Journal:</u></p> <ol style="list-style-type: none"> 1. Journal of Anatomy 2. Anatomy Research International 3. Surgical & Radiological Anatomy 4. Translational Research in Anatomy <p><u>Others:</u></p> <p>Anatomical record</p>
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18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 2 CH	Outcome
1	Microscopic (light and electron) features of skeletal muscle, tendon, ligament and aponeurosis, factors (genetic and environmental) affecting the growth and development of muscles, clinical correlation with myopathy (muscular dystrophies) and role of stem cell in muscular regeneration	2 hours	Explain microscopic features of skeletal muscle, tendon, ligament & aponeurosis
2	Gross and microscopic structure and functions of cartilage, with cell biology, adaption to the mechanical and metabolic environments; regulatory factors and mineral homeostasis, ossification and congenital anomalies, factors (genetic and environmental) affecting the growth and development of bones and cartilage. Injuries and repairment	2 hours	Explain gross & microscopic anatomy of cartilage & bone
3	Axioappendicular musculature (anterior and posterior muscles groups) Axilla , boundaries contents with clinical correlation	2 hours	Explain functional anatomy of anterior & posterior axio-appendicular muscles & axilla
4	Muscles of the arm and forearm (flexor and extensor compartments) nerve supply and clinical aspects	2 hours	Explain functional anatomy of flexor & extensor compartments of arm and forearm
5	Neurovascular supply of upper limb with applied aspects	2 hours	Discuss neurovascular supply of upper limb
6	Joints of upper limb with functional and clinical significance	2 hours	Explain joints of upper limb
7	Boundaries and contents of cubital fossa & anatomical snuff box; spaces and functional importance of hand	2 hours	Explain functional anatomy of cubital fossa, anatomical snuff box and hand
8	Gross structure of vertebral column & muscles of back with clinical correlates	2 hours	Explain functional anatomy of vertebral column and back

9	Mid-Term Exam		
10	Gross features of bones of hipbone, femur, tibia, fibular & bones of feet	2 hours	Explain gross features of lower limb bones
11	Gross structure of gluteal region and compartments of thigh	2 hours	Discuss functional anatomy of gluteal region & thigh
12	Anterior, lateral and posterior compartments of leg & joints of lower limb	2 hours	Discuss functional anatomy of compartments of leg
13	Lumbosacral plexus Neurovascular supply of lower limb with clinical aspects	2 hours	Discuss formation & branches of Lumbosacral plexus
14	Boundaries and contents of femoral triangle, adductor canal and popliteal fossa	2 hours	Discuss functional anatomy of femoral triangle, adductor canal & popliteal fossa
15	Foot with its clinical correlates; Development of limbs	2 hours	Explain functional anatomy of foot
16	Revision and discussion of muscles and bones	2 hours	Identify bones and muscles attachment in upper and lower limbs
17	Molecular mechanism and factors affecting the process of regeneration of nerves associated with muscles	2 hours	Explain process of regeneration of nerves associated with muscles
18	Final-Term Exam		

18 Weeks Lab Plan

Week #	Practical Topic	Duration 1 CH	Outcome
1	Bony features & muscle attachment on clavicle, scapula, humerus, radius and ulna	3 hours	Explain functional anatomy of upper limb bones
2	Microscopic features of skeletal muscle, tendon and aponeurosis	3 hours	Identify microscopic features of skeletal muscle and tendon
3	Microscopic features of different types of cartilage and compact and spongy bone	3 hours	Identify microscopic features of cartilage and bone
4	Bones and muscle attachment of hand – model study	3 hours	Explain functional anatomy of hand
5	Cadaveric dissection of anterior and posterior compartment of arm and forearm, with measurements of dry bones	3 hours	Dissect anterior and posterior compartments of arm and forearm with dry bone measurements
6	Cadaveric dissection and cataloging of nerves and vessels of upper limb	3 hours	Dissect and catalogue nerves & vessels of upper limb
7	Radiological anatomy of upper limb	3 hours	Analyze radiological anatomy of upper limb
8	Surface marking of upper limb nerves and vessels	3 hours	Perform surface marking of upper limb structures

9	Mid-Term Exam		
10	Bony features & muscle attachments on hipbone and femur– model study	3 hours	Identify gross features of hipbone and femur
11	Bony features & muscle attachment on tibia & fibula	3 hours	Identify gross features of tibia and fibula
12	Cadaveric dissection of anterior, posterior and medial compartments of thigh	3hours	Perform dissection of thigh
13	Cadaveric dissection of anterior, posterior and lateral compartments of leg	3 hours	Perform dissection of leg
14	Cadaveric dissection and cataloging of nerves and vessels of lower limb	3hours	Dissect and catalogue nerves and vessels of lower limb
15	Surface anatomy of lower limb with clinical correlates	3 hours	Perform surface anatomy of lower limb
16	Radiological anatomy of lower limb with clinical correlates	3hours	Analyze radiological anatomy of lower limb
17	Revision of histology slides	3 hours	Identify histology slides
18	Final-Term Exam		

PHARMACOLOGY

ELECTIVE COURSE LIST - PHARMACOLOGY

Sr.No.	Course Code	Course Title	Credit hours	Theory	Practical
1	PHM 821	Pharmacokinetics & Clinical Pharmacology Concepts	3(2+1)	2	1
2	PHM 822	Molecular Pharmacology	3+0	3	0
3	PHM 823	Clinical Neuro and Psycho Pharmacology	3(1+2)	1	2
4	PHM 824	Clinically Oriented Cardiovascular and Renal Pharmacology	3(1+2)	1	2
5	PHM 825	Pharmacotherapy of microbes, malignancies & cutaneous diseases	3+0	3	0
6	PHM 826	Gastroenterology & Hormonal Pharmacology	3+0	3	0
7	PHM 827	Pulmonary Pharmacology and Peptides	3+0	3	0
8	PHM 828	Haemopoietic and Musculoskeletal Pharmacology	3+0	3	0

DETAILED COURSE OUTLINE - ELECTIVE COURSE LIST - PHARMACOLOGY

Course Code	PHM 821
Credit Hour	3(2+1)
Course Title	Pharmacokinetics & Clinical Pharmacology Concepts
Pre-Requisite	Basic knowledge of Pharmacokinetics and drug development
Course Objective	<ol style="list-style-type: none"> 1. Describe the molecular mechanisms of drug absorption, bioavailability, metabolism and excretion 2. Describe adverse drug reactions and its types 3. Comprehend the process of drug development and approval 4. Describe the concept of clinical trials, Clinical Trial Units (CTU), profile and dynamics of team members of clinical trial unit, basic knowledge for carrying out the clinical trials 5. Understand current legislation/ rules of Pakistan regarding clinical trials and clinical studies 6. Understand the FDA rules and regulations for drug development and regulation of a clinical trial
Course Outcome	Upon completion of course the students will be able to: <ol style="list-style-type: none"> 1. Describe in Pharmacokinetic processes at molecular level 2. Describe the importance of adverse drug reactions 3. Explain the process of drug development and approval 4. Describe the characterization of clinical trial unit, team members, rules & regulation for CTU in Pakistan, FDA guidelines
Course Contents	Molecular mechanisms of absorption, distribution, metabolism and elimination of drugs, mechanism of drug absorption, physiochemical, biological and pharmaceutical factors affecting drug absorption through GIT, Drug disposition, Protein and tissue binding, Bioavailability, bioequivalence, metabolism, Pharmacokinetic characterization of drugs, linear and nonlinear pharmacokinetics. Drug development, definition of Clinical trial, types of clinical trial, registration of a clinical trial, regulation of clinical trial, clinical trial unit setting, biasness and how to minimize the biasness, Current rules and regulations in Pakistan related to drug research, FDA rules to regulate clinical research, interpretation of results of a clinical trial and its extrapolation.
Recommended Text Books	<ol style="list-style-type: none"> 1. Basic & Clinical Pharmacology by Katzung et al. Latest Ed. 2. Rang & Dale's Pharmacology by H.P. Rang, M.M. Dale, R.J. Flower. Latest Ed. 3. Lippincott's Illustrated Reviews: Pharmacology by Richard A Harvey, Pamela C. Champe, Richard Finkel, and Luigi X. Cubeddu. Latest Ed.
Recommended Reference Books	<ol style="list-style-type: none"> 1. Basis of Pharmacology by Goodman & Gillman Latest Ed. 2. Physicochemical Principles of Pharmacy, Sixth Edition Alexander T. Florence and David Attwood Pharmaceutical press 3. Pharmaceutical Dissolution Testing Jennifer Dressman and Johannes Kramer Taylor and Francis. Latest Ed.
Web and other resources	<u>Websites</u> Drugs.com DrugBank Medicines A-Z Medicines Information – SPC & PILS

	<p>RxList</p> <p>BindingDB</p> <p>IUPHAR/BPS Guide to Pharmacology</p> <p>PharmGKB</p> <p>Society of Toxicology webinars</p> <p>ToxTutor</p> <p>The Drug Development Process</p> <p>Journals</p> <ol style="list-style-type: none"> 1. Acta Pharmacologica Sinica 2. The American Journal of Medicine 3. Journal of Clinical Pharmacology 4. Biomedicine and Pharmacotherapy 5. European Journal of Pharmacology 6. Teaching and Learning in Medicine 7. British Journals of Clinical Pharmacology 8. Pharmacology, Biochemistry and Behaviour 9. European Journal of Clinical Pharmacology 10. Canadian Journal of Physiology & Pharmacology <p>Others</p> <ol style="list-style-type: none"> 1. Clinical and Experimental Pharmacology and Physiology The manuals of Drug Laws 2. SROs on the websites of Drug Regulatory Authority of Pakistan /PMC /NIH/ DRAP- Ministry of Health / Pharmacy Council of Pakistan. 3. Molecular similarity in drug design by PM Dean
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18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 2 CH	Outcome
1	Molecular mechanism of drug absorption	2 hours	Comprehend the principle of drug absorption & molecular mechanisms involved
2	Drug disposition, protein and tissue binding	2 hours	Comprehend the principle of drug deposition, protein and tissue binding& molecular mechanisms involved
3	Molecular mechanism of drug bioavailability	2 hours	Comprehend the principle of drug bioavailability & molecular mechanisms involved
4	Molecular mechanism of drug metabolism	2 hours	Comprehend the principle of drug metabolism & molecular mechanisms involved
5	Molecular mechanism of drug excretion	2 hours	Comprehend the principle of drug excretion & molecular mechanisms involved
6	Adverse drug reactions and its types	2 hours	Assess adverse drug reactions and its types
7	Analysis of adverse drug reactions with tools	2 hours	Describe Analysis of adverse reactions with digital and literature tools
8	Management of adverse drug reactions	2 hours	Prescribe management of adverse drug reactions

9	Mid-Term Exam		
10	Drug development and approval overview	2 hours	Encompass drug development and approval
11	Drug design and structure activity relationship	2 hours	Describe design of a drug and propose structure activity relationship
12	Determination of safety, efficacy and toxicity of drugs	2 hours	Describe safety, efficacy and toxicity of drugs
13	Drug formulation studies	2 hours	Encompass drug formulation studies
14	Clinical trials, Phases and importance	2 hours	Describe the formulation of clinical trial of any phase
15	Clinical trial unit and composition	2 hours	Comprehend Clinical trial unit and composition
16	FDA rules and regulations for clinical trials, interpretation of results of a clinical trial	2 hours	Apply FDA rules and regulations for conducting clinical trials, propose interpretation of clinical trial results
17	Rules and regulations in Pakistan regarding clinical trials and clinical studies	2 hours	Apply rules and regulations of Pakistan for regulation of clinical trial studies
18	Final- Term Exam		

18 Weeks Lab Plan

Week #	Lab. Topic	Duration 1CH	Outcome
1	Preparation of solutions relevant to animal tissue experimentation	3 hours	Prepare relevant solutions for normal activity of animal issues
2	Three point assay of histamine on rat/ guinea pig ileum	3 hours	Perform qualitative & quantitative analysis of functional activity of a target
3	Four point assay of histamine on rat/ guinea pig ileum	3 hours	
4	Four point assay of oxytocin on rat uterus	3 hours	
5	Effect of cholinergic and adrenergic drugs on rat uterus	3 hours	Analyzed and interpret ecbolic and tocolytic effects of drugs
6	Comparing effect of drug, water and saline on the urine output in albino mice/rat	3hours	Evaluate the effects of diuretics on mice / rat
7	Effect of furosemide and indomethacin on urine output in mice/rat	3 hours	Evaluate the effect of different group of drugs on urine output in comparison to a diuretic agent in mice/rat
8	Effect of furosemide and morphine on urine output in mice/rat	3 hours	
9	Mid-Term Exam		
10	Effect of local anesthetic agent through intradermal route in guinea pig/ rat	3 hours	Evaluate the effect of local anesthetic drug through different routes
11	Effect of local anesthetic on eye of	3 hours	

	guinea pig / Rabbit		
12	Evaluation of drug-drug interaction in rabbit	3 hours	Evaluate the importance of drug-drug interactions in rabbit
13	Evaluation of drug interaction between morphine and alcohol in rabbit	3 hours	
14	Effect of acetylcholine & epinephrine on rectus abdominus muscle in mice/rat	3hours	Assess the effect of drugs on skeletal muscle in mice /rat
15	Estimation of ED50 and LD50 of stelazine using mice/rat	3hours	Evaluate effective & lethal dose for calculation of therapeutic index in mice / rat
16	Graded dose response of histamine on guinea pig / rat illium	3hours	Record graded dose response curve
17	Discussion & Revision of experiments	3hours	Comprehend the labs. With knowledge & interpretation
18	Final- Term Exam		

Course Code	PHM 822
Credit Hour	3+0
Course Title	Molecular Pharmacology
Pre-Requisite	Basic knowledge of Drug metabolism and Pharmacogenetics
Course Objective	<ol style="list-style-type: none"> 1. Outline various receptor-ligand (drug) interaction models 2. Interpret the genetic variations leading to changes in drug metabolism among the group of metabolizers 3. Comprehend epigenetic mechanisms governing expression of different genes 4. Identify drugs that act through epigenetic mechanism 5. Review different types of enzymatic reactions exploitable by drug intervention 6. Evaluate the changes in enzymes activity under various conditions 7. Compare DNA damages due to different toxins &/or drugs 8. Evaluate and characterize anticancer mechanism of drugs
Course Outcome	<p>Upon completion of course the students will be able to:</p> <ol style="list-style-type: none"> 1. Describe receptor-ligand (drug) interactions 2. Recognize genetic variations affecting drug metabolism 3. Comprehend epigenetic mechanisms governing gene expression and drugs utilizing these mechanisms 4. Describe enzymatic reactions affected by disease and drug intervention 5. Identify DNA damages due to different toxins and or drugs
Course Contents	<p>I. Genomic Regulation of Drug Actions</p> <ol style="list-style-type: none"> A. Introduction to pharmacogenetics and personalized medicine B. Genetic basis of drug response and roles of single nucleotide polymorphisms, copy number variation, tandem repeat polymorphisms; gene insertion and deletion; gene duplications; alternative splicing & their effects on drug C. Drug metabolism affected by polymorphisms in Cytochrome P450 isoforms <p>II. Drugs Acting through Epigenetic Mechanisms</p> <ol style="list-style-type: none"> A. Fundamentals of epigenetics

	<ul style="list-style-type: none"> B. Examples of drugs acting through epigenetic mechanisms III. Signal Transduction and Modulation <ul style="list-style-type: none"> A. Types of secondary messengers B. Types of receptors & regulation of inter and intra cellular signalling IV. Molecular Pharmacology of Enzymes <ul style="list-style-type: none"> A. Types of enzymes on the basis of their mechanism of action B. Effects of different drugs on enzyme function V. Pharmacology of Transcription and Translation <ul style="list-style-type: none"> A. Different types of post-transcriptional and translational modifications. B. Induction and inhibition of gene expression C. Intervention at post-translational levels by modulating protein kinases and phosphatases VI. Regenerative Medicine and Gene therapy <ul style="list-style-type: none"> A. Stems cells, their classification and features B. Stem cell-based drugs C. Cell therapy and regenerative medicine D. Gene therapy protocols and role in treatment of monogenic disorders VII. Mitochondrial Medicine <ul style="list-style-type: none"> A. Principles of mitochondrial homeostasis B. Drugs targeting mitochondrial channels and metabolism
Recommended Text Books	<ol style="list-style-type: none"> 1. Basic & Clinical Pharmacology by Katzung et al. Latest Ed. 2. Rang & Dale's Pharmacology by H.P. Rang, M.M. Dale, R.J. Flower. Latest Ed. 3. Lippincott's Illustrated Reviews: Pharmacology by Richard A Harvey, Pamela C. Champe, Richard Finkel, and Luigi X. Cubeddu. Latest Ed.
Recommended Reference Books	<ol style="list-style-type: none"> 1. Basis of Pharmacology by Goodman & Gillman Latest Ed. 2. Clementi, Francesco, and Guido Fumagalli, eds. General and Molecular Pharmacology: Principles of Drug Action. John Wiley & Sons, 2015
Web and other resources	<p><u>Websites:</u></p> <p>Drugs.com</p> <p>Medicines Information – SPC & PILS</p> <p>IUPHAR/BPS Guide to Pharmacology</p> <p><u>Journals:</u></p> <ol style="list-style-type: none"> 1. The Annals of Pharmacotherapy 2. Basic Clinical Pharmacology 3. Biomedical Pharmacotherapy 4. Journal of Clinical Pharmacology 5. British Journal of Clinical Pharmacology 6. Journal of Pharmaceutical and Biomedical Analysis 7. Pharmacogenomics 8. Pharmacogenetics and Genomics 9. Pharmacological Research 10. Pharmacology & Therapeutics 11. Trends in Pharmacological Sciences <p><u>Others:</u></p> <ol style="list-style-type: none"> 1. Molecular Pharmacology: From DNA to Drug Discovery by John Dickenson, Fiona Freeman, Chris Lloyd Mills and Christian Thode 2. Molecular Analysis and Genome Discovery by Ralph Rapley and Stuart Harbron 3. High Throughput Screening: Methods and Protocols (Methods in Molecular

	Biology) (Methods in Molecular Biology). by William P. Janzen
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18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 3 CH	Outcome
1	Pharmaco-genetics and personalized medicine	3hours	Describe Pharmaco-genetics and personalized medicine
2	Polymorphisms, gene insertion, deletion, duplications, alternative splicing & their effects on drugs	3hours	Comprehend polymorphisms & their effects on drug actions
3	Fundamentals of epigenetics	3hours	Recognize fundamentals of epigenetics
4	Drugs acting through epigenetic mechanisms	3hours	Identify drugs acting through epigenetic mechanisms
5	Types of secondary messengers, receptors, regulation of inter and intracellular signalling mechanisms	3hours	Explain secondary messengers and signal transduction mechanisms
6	Types of enzymes as per mechanism of action	3hours	Recognize the mechanism of action of enzymes
7	Effects of drugs on enzyme functions	3hours	Comprehend effects of drugs on enzyme functions
8	Post-transcriptional and translational modifications	3hours	Describe post-transcriptional and translational modifications
9	Mid-Term Exam		
10	Induction and inhibition of gene expression	3hours	Infer induction and inhibition of gene expression
11	Intervention at post-translational levels by modulating protein kinases and phosphatases	3hours	Describe post-translational intervention by proteins
12	Stems cells, their classification and features	3hours	Recognize stems cells, their classification and features
13	Stem cell-based drugs	3hours	Identify stem cell-based drugs
14	Cell therapy and regenerative medicine	3hours	Describe cell therapy and regenerative medicine
15	Gene therapy protocols and role in treatment of monogenic disorders	3hours	Advocate gene therapy protocols and role in treatment of monogenic disorders
16	Principles of mitochondrial homeostasis	3hours	Comprehend principles of mitochondrial homeostasis
17	Drugs targeting mitochondrial channels and metabolism	3hours	Identify drugs targeting mitochondrial channels and metabolism
18	Final- Term Exam		

Course Code	PHM 823
Credit Hour	3(1+2)
Course Title	Clinical Neuro and Psycho Pharmacology
Pre-requisite	Basic knowledge of drugs acting on central nervous system
Course Objective	<ol style="list-style-type: none"> 1. Describe molecular basis of neurological diseases 2. Describe the molecular pharmacology of Benzodiazepines 3. Describe the molecular pharmacology of Barbiturates 4. Describe the molecular pharmacology of anti-seizure drugs 5. Describe the molecular pharmacology of intravenous anaesthetics 6. Describe the molecular pharmacology of inhalational anaesthetics 7. Describe the molecular pharmacology of local anaesthetics 8. Describe the molecular pharmacology of centrally acting and directly acting muscle relaxants 9. Describe the molecular pharmacology of CNS stimulant drugs 10. Describe the molecular pharmacology of drugs of abuse 11. Describe the molecular pharmacology of alcohol and treatment of alcoholism 12. Describe the molecular pharmacology of anti-Parkinsonian drugs 13. Describe the molecular pharmacology of psychotropic drugs 14. Describe the molecular pharmacology of antidepressant drugs 15. Describe the molecular pharmacology of Lithium
Course Outcome	<p>Upon completion of course the students will be able to:</p> <ol style="list-style-type: none"> 1. Describe neurotransmission in central nervous system and alteration caused by diseases and drugs 2. Comprehend advances in pharmacology of anxiolytics, hypnotics, general and local anaesthetics, anti-epileptics, muscle relaxants, psychotropics, anti-mania, antidepressant and drugs of abuse 3. Comprehend the use of drugs acting on central nervous system diseases in clinical set up 4. Comprehend wave pattern and interpretation of EEG, MRI, CT-scan etc.
Course Contents	Neuro-humoral transmission and CNS, sedatives and hypnotics, anesthetic agents, drugs of abuse, alcohol, drugs used in treatment of epilepsy, Parkinson's disease, psychiatric diseases, depression, schizophrenia, treatment in comatose, diagnostic tools
Recommended Text Books	<ol style="list-style-type: none"> 1. Basic & Clinical Pharmacology by Katzung et al. Latest Ed. 2. Rang & Dale's Pharmacology by H.P. Rang, M.M. Dale, R.J. Flower. Latest Ed. 3. Lippincott's Illustrated Reviews: Pharmacology by Richard A Harvey, Pamela C. Champe, Richard Finkel, and Luigi X. Cubeddu. Latest Ed.
Recommended Reference Books	<ol style="list-style-type: none"> 1. Basis of Pharmacology by Goodman & Gillman Latest Ed. 2. Currents Medical Diagnosis and Treatment Latest Ed. 3. Harrison's Principles of Internal Medicine Latest Ed.
Web and other resources	<p><u>Websites</u></p> <p>Drugs.com</p> <p>Medicines Information – SPC & PILS</p> <p>IUPHAR/BPS Guide to Pharmacology</p> <p><u>Journals</u></p> <ol style="list-style-type: none"> 1. The Annals of Pharmacotherapy 2. Basic Clinical Pharmacology

	<p>3. Biochemical Pharmacology 4. Biomedical Pharmacotherapy 5. British Journal of Pharmacology 6. British Medical Journal 7. Journal of Clinical Pharmacology 8. European Journal of Pharmacology 9. British Journals of Clinical Pharmacology 10. Molecular Pharmaceutics 11. Pharmacology Reviews 12. Pharmacology & Therapeutics 13. Trends in Pharmacological Sciences</p> <p><u>Others</u></p> <p>1. Molecular Pharmacology: From DNA to Drug Discovery by John Dickenson, Fiona Freeman, Chris Lloyd Mills and Christian Thode</p>
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18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 1CH	Outcome
1	Molecular basis of neurological diseases	1hour	Comprehend the emerging trends in the pharmacological advances of sedatives , hypnotics , general anesthetics, local anesthetics, centrally acting & directly acting muscle relaxants
2	Molecular pharmacology of Benzodiazepines	1hour	
3	Molecular pharmacology of Barbiturates	1hour	
4	Molecular pharmacology of Anti-seizure drugs	1hour	
5	Molecular pharmacology of Intravenous general anesthetics	1hour	
6	Molecular pharmacology of Inhalational anesthetics	1hour	
7	Molecular pharmacology of Local anesthetics	1hour	
8	Molecular pharmacology Centrally & Directly acting Muscle Relaxants	1hour	
9	Mid-Term Exam		
10	Molecular pharmacology CNS stimulants	1hour	Comprehend the importance and application of emerging trends in the pharmacological advances of CNS stimulants, drugs of abuse, alcohol, antiparkinsonian, antipsychotics, antidepressants and lithium
11	Molecular pharmacology of Drugs of abuse	1hour	
12	Molecular pharmacology of Alcohol & Alcoholism treatment	1hour	
13	Molecular pharmacology of Anti-parkinsonian drugs	1hour	
14	Molecular pharmacology of anti-psychotic drugs-1 st generation	1hour	
15	Molecular pharmacology of Antipsychotic drugs-2 nd generation	1hour	
16	Molecular pharmacology of Antidepressant drugs- TCAs & MAOIs	1hour	

17	Molecular pharmacology of Antidepressant drugs- Other groups and Lithium	1hour	
18	Final- Term Exam		

18 Weeks Clinical Ward Rotation Plan:

Week #	Rotation Topic	Duration 2 CH	Outcome
1	Drugs prescribed in adult epileptic patients Drugs prescribed in adult patients of psychosis	3 hours 3 hours	Comprehend the drugs prescribed by physicians in epileptic & psychosis patients
2	Drugs prescribed in pediatric epileptic patients Drugs prescribed in adult patients of anxiety	3 hours 3 hours	Comprehend the drugs prescribed by physicians in pediatric epileptics & adult patients with anxiety
3	Drugs prescribed in epileptic patients with comorbid Drugs prescribed in adult patients of depression	3 hours 3 hours	Comprehend the drugs prescribed by physicians in epileptics with comorbid& adult patients with depression
4	Potential drug- drug interactions of antiepileptic & comorbid drugs Drugs prescribed in psychiatric patients with comorbid	3 hours 3 hours	Identify the drug-drug interactions in epileptic patients with comorbid Comprehend drugs prescribed by physicians in psychiatrics with comorbid
5	Wave pattern in EEG, interpretation in focal epilepsy Potential drug- drug interactions of psychotropic & comorbid drugs	3 hours 3 hours	Interpretation of EEG in focal epilepsy Identify the drug-drug interactions in psychiatric patients with comorbid
6	Wave pattern in EEG, interpretation in generalized epilepsy Drugs prescribed in pediatric patients with ADHD	3 hours 3 hours	Interpretation of EEG in generalized epilepsy Comprehend drugs prescribed in ADHD by physicians
7	Adverse effects of anti-epileptics Adverse effects of psychotropics	3 hours 3 hours	Identify the adverse effects of antiepileptics & psychotropics
8	Drugs prescribed in stroke patients Drugs prescribed in eating disorder	3 hours 3 hours	Comprehend drugs prescribed in stroke & eating disorders
9	Mid-Term Exam		
10	Interpretation of MRI & CT-scan in stroke patients Drugs prescribed in Obsessive compulsive disorders (OCD)	3 hours 3 hours	Interpret MRI & CT-scan in stroke patients Comprehend drugs prescribed in Obsessive compulsives
11	Drugs prescribed in chronic neuropathic pain Drugs prescribed in post-traumatic stress disorder (PTSD)& other stress reactions	3 hours 3 hours	Comprehend drugs prescribed in chronic neuropathic pain, post-traumatic stress disorder& other stress reactions
12	Drugs prescribed in Alzheimer's Drug treatment in alcoholism	3 hours 3 hours	Comprehend drugs prescribed in alcoholism & Alzheimer's

13	Rehabilitative treatment in alcoholism/drug addiction Diagnostic and screening standard questionnaire for anxiety / depression	3 hours 3 hours	Comprehend drugs prescribed in alcohol rehabilitation& drug addiction Identify anxiety / depression diagnostic & screening questionnaire tool
14	Rehabilitative treatment in cases of drugs of abuse Psychometric tests by psychologists	3 hours 3 hours	Comprehend drugs used in abusive drug`s rehabilitation Identify Psychometric tests
15	Drug treatment in geriatric depression Childhood psychiatric disorders & their pharmacology	3 hours 3 hours	Comprehend drugs prescribed in geriatric depression& childhood psychiatric disorders
16	Drug treatment in patients of Parkinson`s disease Drugs used in sleep disorders	3 hours 3 hours	Comprehend drugs prescribed in Parkinson`s disease and sleep disorders
17	Interpretation of Glasgow Coma Scale, drug treatment in comatose patients Drug used in somatoform pain disorders	3hours 3 hours	Interpretation of Glasgow Coma Scale Comprehend drugs prescribed in comatose patients & somatoform pain disorders
18	Final- Term Exam		

Course Code	PHM 824
Credit Hours	3(1+2)
Course Title	Clinically Oriented Cardiovascular and Renal Pharmacology
Pre-Requisite	Basic knowledge of drugs acting on cardiovascular and renal system
Course Objective	<ol style="list-style-type: none"> 1. Describe the emerging trends in the pharmacokinetics, pharmacodynamics, clinical uses, contraindications, adverse effects and toxicity of cholinoreceptor activators 2. Describe the emerging trends in the pharmacokinetics, pharmacodynamics, clinical uses, contraindications, adverse effects and toxicity of cholinoreceptor blockers 3. Describe the emerging trends in the pharmacokinetics, pharmacodynamics, clinical uses, contraindications, adverse effects and toxicity of adrenoceptor activators 4. Describe the emerging trends in the pharmacokinetics, pharmacodynamics, clinical uses, contraindications, adverse effects and toxicity of adrenoceptor blockers 5. Describe the molecular pharmacology of clinically used antihypertensive drugs 6. Describe the common drug-drug interactions among antihypertensive agents 7. Describe the vasodilator drugs used in angina pectoris 8. Describe the drugs used clinically for treating heart failure 9. Describe drugs used for treating cardiac arrhythmias 10. Describe the pharmacology of hypo-lipid-emic drugs 11. Describe the pharmacology of diuretics 12. Describe drugs used for treating acute and chronic renal failure

	<p>13. Describe drugs used for treating benign prostatic hypertrophy 14. Describe the steps and interpretation of ECG, ETT, angiography, echocardiography and enzyme level reports in cardiac diseases</p>
Course Outcome	<p>Upon completion of course the students will be able to:</p> <ol style="list-style-type: none"> 1. Describe the Pharmacology of cholinergic and adrenergic agonists and antagonists 2. Comprehend the emerging trends in the pharmacokinetic and pharmacodynamic knowledge of drugs used for treatment of cardiovascular and renal diseases and complications 3. Comprehend the toxicities of drugs acting on cardiovascular and renal systems 4. Comprehend the use of drugs acting on cardiovascular and renal system diseases in clinical set up 5. Comprehend the steps and interpretation of ECG, ETT, angiography, echocardiography and enzyme level reports in cardiac diseases
Course Contents	Cholinergic and adrenergic receptor agonists and antagonists, their role in treating diseases, antihypertensive drugs, cardiac glycosides, treatment of cardiac failure, anti-anginal drugs, anti-arrhythmic drugs, lipid lowering drugs, diuretics, treatment of acute and chronic kidney disease, drug treatment of benign prostatic hypertrophy, toxicities caused by drugs, ECG, ETT, angiography, echocardiography, enzyme levels
Recommended Text Books	<ol style="list-style-type: none"> 1. Basic & Clinical Pharmacology by Katzung et al. Latest Ed. 2. Rang & Dale's Pharmacology by H.P. Rang, M.M. Dale, R.J. Flower. Latest Ed. 3. Lippincott's Illustrated Reviews: Pharmacology by Richard A Harvey, Pamela C. Champe, Richard Finkel, and Luigi X. Cubeddu. Latest Ed.
Recommended Reference Books	<ol style="list-style-type: none"> 1. Basis of Pharmacology by Goodman & Gillman Latest Ed. 2. Currents Medical Diagnosis and Treatment Latest Ed.
Web and other resources	<p><u>Websites</u> Drugs.com Medicines Information – SPC & PILS IUPHAR/BPS Guide to Pharmacology</p> <p><u>Journals</u></p> <ol style="list-style-type: none"> 1. The Annals of Pharmacotherapy 2. Basic Clinical Pharmacology 3. Biochemical Pharmacology 4. Biomedical Pharmacotherapy 5. British Medical Journal 6. British Journal of Pharmacology 7. Journal of Clinical Pharmacology 8. European Journal of Pharmacology 9. British Journals of Clinical Pharmacology 10. Pharmacology & Therapeutic <p><u>Others</u></p> <ol style="list-style-type: none"> 1. Harrison's Principles of Internal Medicine Latest Ed.

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 1 CH	Outcome
1	Direct acting cholinceptor activators	1hour	Comprehend the emerging trends of cholinceptor activators and blocker drugs
2	Indirect acting cholinceptor activators	1hour	
3	Cholinceptor blockers	1hour	
4	Adrenoceptor activators	1hour	Comprehend the emerging trends of adrenoceptor activators & blocker drugs
5	Adrenoceptor Alpha blockers	1hour	
6	Adrenoceptor Beta blockers	1hour	
7	Anti-hypertensive drugs	1hour	Comprehend emerging trends of antihypertensive drugs
8	Drug treatment of angina pectoris	1hour	Comprehend emerging trends of antianginal drugs
9	Mid-Term Exam		
10	Drug treatment of Cardiac failure	1hour	Comprehend emerging trends of drugs used in cardiac failure
11	Drug treatment of Arrhythmias- Class 1 & 2 drugs	1hour	Comprehend emerging trends of antiarrhythmic drugs
12	Drug treatment of Arrhythmias-Class 3, 4 & miscellaneous drugs	1hour	
13	Pharmacology of Diuretics	1hour	Comprehend emerging trends of diuretics
14	Drug treatment of Hyperlipidemia- Statins, Fibrates	1hour	Comprehend emerging trends of anti-hyperlipidemic drugs
15	Drug treatment of Hyperlipidemia- Niacin & other groups	1hour	
16	Drug treatment of Acute renal failure	1hour	Comprehend emerging trends of drug treatment of ARF
17	Drug treatment of Chronic renal failure	1hour	Comprehend emerging trends of drug treatment of CRF
18	Final- Term Exam		

18 Weeks Clinical Rotation Plan:

Week #	Clinical Rotation Topic	Duration 2 CH	Outcome
1	Drug treatment of hypertension	6 hours	Comprehend drug treatment of Hypertension prescribed by physician
2	Drug treatment of volume overload	6 hours	Comprehend drug treatment of volume overload prescribed by physician
3	Drug-drug interactions among antihypertensive drugs & other comorbid drugs	6 hours	Identify drug-drug interactions among antihypertensive drugs & other comorbid drugs
4	Drug treatment of angina	6 hours	Comprehend drug treatment of Angina prescribed by physician
5	Drug treatment of myocardial	6 hours	Comprehend drug treatment of MI

	infarction		prescribed by physician
6	Drug treatment of arrhythmia	6 hours	Comprehend drug treatment of Arrhythmia prescribed by physician
7	Drug treatment of hyperlipidemia	6 hours	Comprehend drug treatment of Hyperlipidemia prescribed by physician
8	Drug treatment of acute renal failure (ARF)	6 hours	Comprehend drug treatment of ARF prescribed by physician
9	Mid-Term Exam		
10	Drug treatment of chronic renal failure (CRF)	6 hours	Comprehend drug treatment of CRF prescribed by physician
11	Wave pattern & interpretation of ECG in hypertensive patients	6 hours	Comprehend wave pattern and interpretation of ECG report in Hypertensive, Angina, MI, Arrhythmic patients
12	Wave pattern &interpretation of ECG in angina patients	6 hours	
13	Wave pattern &interpretation of ECG in myocardial infarction patients	6 hours	
14	Wave pattern &interpretation of ECG in arrhythmic patients	6 hours	
15	Observation of procedure & interpretation of angiography report	6 hours	Comprehend interpretation of Angiography report
16	Interpretation of cardiac enzyme level, Exercise Tolerance Test (ETT) report	6 hours	Comprehend interpretation of Cardiac enzyme level and ETT report
17	Observation of procedure &interpretation of echocardiography report	6 hours	Comprehend interpretation of Echocardiography report
18	Final- Term Exam		

Course Code	PHM 825
Credit Hours	3+0
Course Title	Pharmacotherapy of microbes, malignancies & cutaneous diseases
Pre-Requisite	Basic knowledge of drugs used to treat bacterial, fungal, parasitic, viral, mycobacterial, helmintic infections Basic knowledge of drugs used to treat skin diseases and various types of cancers
Course Objective	<ol style="list-style-type: none"> 1. Describe molecular pharmacology of Penicillins 2. Describe molecular pharmacology of cephalosporins 3. Describe molecular pharmacology of Carbapenems & Monobactams 4. Describe molecular pharmacology of Vancomycin 5. Describe molecular pharmacology of Tetracyclines 6. Describe molecular pharmacology of Aminoglycosides 7. Describe molecular pharmacology of Macrolides 8. Describe molecular pharmacology of Chloramphenicol 9. Describe molecular pharmacology of Clindamycin 10. Describe molecular pharmacology of Sulfonamides

	<ol style="list-style-type: none"> 11. Describe molecular pharmacology of fluoroquinolones 12. Describe molecular pharmacology of first line anti-tuberculosis drugs 13. Describe molecular pharmacology of 2nd line anti- tuberculosis drugs 14. Describe drug treatment of leprosy 15. Describe molecular pharmacology of antiviral drugs 16. Describe molecular pharmacology of anti-helminthic drugs 17. Describe molecular pharmacology of antifungal drugs 18. Describe drug treatment of malaria 19. Describe drug treatment of amebiasis 20. Describe drug treatment of leishmaniasis and trypanosomiasis 21. Describe mechanism of action and adverse effects of anticancer drugs 22. Describe the mechanism of resistance to anticancer drugs 23. Describe the pharmacology of dermatological drugs
Course Outcome	<p>Upon completion of course the students will be able to:</p> <ol style="list-style-type: none"> 1. Comprehend the advances in principles of pharmacotherapy 2. Describe the advances in the pharmacology of antibacterial, antiviral, antifungal, anti- protozoal, anti-helminthic, anti-leishmaniasis, anti-trypanosomiasis, anticancer, dermatological drugs
Course Contents	General principles of pharmacotherapy, penicillin, cephalosporin, carbapenam, monobactam, vancomycin, clindamycin, macrolides, sulphonamides, trimethoprim, co-trimoxazole, , tetracycline, chloramphenicol, aminoglycosides, quinolones, anti-tuberculosis, antileprosy, antimalarial, antifungal, anti-amoebic , anti -viral, anthelmintic, antiprotozoal, anticancer and dermatological drugs.
Recommended Text Books	<ol style="list-style-type: none"> 1. Basic & Clinical Pharmacology by Katzung et al. Latest Ed. 2. Rang & Dale's Pharmacology by H.P. Rang, M.M. Dale, R.J. Flower. Latest Ed. 3. Lippincott's Illustrated Reviews: Pharmacology by Richard A Harvey, Pamela C. Champe, Richard Finkel, and Luigi X. Cubeddu. Latest Ed.
Recommended Reference Books	<ol style="list-style-type: none"> 1. Basis of Pharmacology by Goodman & Gillman Latest Ed. 2. Currents Medical Diagnosis and Treatment Latest Ed.
Web and other resources	<p><u>Websites</u></p> <p>Drugs.com</p> <p>Medicines Information – SPC & PILS</p> <p>IUPHAR/BPS Guide to Pharmacology</p> <p><u>Journals</u></p> <ol style="list-style-type: none"> 1. The Annals of Pharmacotherapy 2. Basic Clinical Pharmacology 3. Biomedical Pharmacotherapy 4. British Medical Journal 5. British Journal of Pharmacology 6. Journal of Clinical Pharmacology 7. European Journal of Pharmacology 8. British Journals of Clinical Pharmacology 9. Pharmacological Research 10. Pharmacology Reviews 11. Pharmacology & Therapeutics 12. Trends in Pharmacological Sciences <p><u>Others</u></p>

	1. Harrison's Principles of Internal Medicine Latest Ed.
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18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 3 CH	Outcome
1	Describe molecular pharmacology of Penicillins	3 hours	Comprehend emerging trends of Penicillins, Cephalosporins, Carbapenems, Vancomycin, Aminoglycosides, Chloramphenicol, Sulfonamides, Fluoroquinolones Anti-leishmaniasis drugs, 1 st line Anti-tuberculosis drugs
2	Describe molecular pharmacology of Cephalosporins	3 hours	
3	Describe molecular pharmacology of Carbapenems, Monobactems, Vancomycin	3 hours	
4	Describe molecular pharmacology of Tetracyclines & Aminoglycosides	3 hours	
5	Describe molecular pharmacology of Macrolides & Chloramphenicol	3 hours	
6	Describe molecular pharmacology of Clindamycin & Sulfonamides	3 hours	
7	Describe molecular pharmacology of Fluoroquinolones & Anti-leishmaniasis drugs	3 hours	
8	Describe molecular pharmacology of 1 st line Anti-tuberculosis drugs	3 hours	
9	Mid-Term Exam		
10	Describe molecular pharmacology of 2 nd line Anti-tuberculosis drugs and dermatological drugs	3 hours	Comprehend emerging trends in 2 nd line Anti-tuberculosis, Dermatological, Anti-leprosy, Anti-amebic, Antifungal, Antiviral, Anti-protozoal, Anti-helmintics, Anti-trypanosomiasis, Anticancer drugs
11	Describe Anti-leprosy drugs & Anti-amebic drugs	3 hours	
12	Describe molecular pharmacology of Antiviral drugs	3 hours	
13	Describe molecular pharmacology of Antifungal drugs	3 hours	
14	Describe Anti-protozoal drugs	3 hours	
15	Describe Anti-helmintics & Anti-trypanosomiasis drugs	3 hours	
16	Describe Anticancer drugs- Mechanisms	3 hours	
17	Describe Anticancer drugs-Regimes	3 hours	
18	Final- Term Exam		

Course Code	PHM 826
Credit Hours	3+0
Course Title	Gastroenterology and Hormonal Pharmacology
Pre-Requisite	Basic knowledge of drugs acting on gastrointestinal tract and endocrine system
Course Objective	<ol style="list-style-type: none"> 1. Describe emerging trends in pharmacology of drugs used to reduce and neutralize gastric acid 2. Describe the pharmacology of anti-emetic drugs 3. Describe pharmacology of drugs that alter motility of GI tract 4. Describe emerging trends in pharmacology of drugs used to treat inflammatory bowel disease 5. Describe drugs causing pancreatitis and cholestasis as adverse effect 6. Describe the drugs causing hepatotoxicity 7. Outline the considerations for prescribing drugs in hepatic impairment 8. Describe drug treatment of diarrhoea and constipation 9. Describe the emerging trends of drugs affecting growth hormone functions 10. Describe the drugs affecting prolactin secretion 11. Describe the effects of drugs on the hypothalamic-pituitary-adrenal axis 12. Describe the pharmacology of corticosteroids 13. Describe the drugs acting on hormones of anterior and posterior pituitary gland 14. Describe the drugs used for treating Hypo- and hyper-thyroidism and the drugs affecting thyroid hormones 15. Demarcate drugs affecting estrogens, progesterone, testosterone and other gonadal hormones 16. Describe the clinical uses of female and male sex hormones 17. Describe the drug treatment of diabetes mellitus Type 1 18. Describe the drug treatment of diabetes mellitus Type 2 19. Describe the drug treatment of obesity 20. Describe the drug treatment of infertility
Course Outcome	<p>Upon completion of course the students will be able to:</p> <ol style="list-style-type: none"> 1. Describe emerging trends in the drug treatment of common ailments related to Gastrointestinal tract 2. Describe emerging trends in the drug treatment of common ailments related to Endocrine system 3. Describe iatrogenic problems of hepatotoxicity, hepatic failure, pancreatitis, cholestasis, production and secretion of hormones 4. Describe the clinical uses of female and male sex hormones
Course Contents	Drug treatment of peptic ulcer, GERD emesis, inflammatory bowel disease, cholestasis, pancreatitis, hepatic failure, type 1 & 2 Diabetes mellitus, thyroid diseases, obesity, diarrhea, constipation, infertility, iatrogenic effects of drugs on somatotropic, pituitary, hypothalamic and adrenal cortex hormones, advances in composition of contraceptives and administration of Hormone-replacement therapy
Recommended Text Books	<ol style="list-style-type: none"> 1. Basic & Clinical Pharmacology by Katzung et al. Latest Ed. 2. Rang & Dale's Pharmacology by H.P. Rang, M.M. Dale, R.J. Flower. Latest Ed. 3. Lippincott's Illustrated Reviews: Pharmacology by Richard A Harvey, Pamela C. Champe, Richard Finkel, and Luigi X. Cubeddu. Latest Ed.

Recommended Reference Books	<ol style="list-style-type: none"> 1. Basis of Pharmacology by Goodman & Gillman Latest Ed. 2. Currents Medical Diagnosis and Treatment Latest Ed.
Web and other resources	<p><u>Websites</u></p> <p>Drugs.com</p> <p>Medicines Information – SPC & PILS</p> <p>UPHAR/BPS Guide to Pharmacology</p> <p><u>Journals</u></p> <ol style="list-style-type: none"> 1. The Annals of Pharmacotherapy 2. Basic Clinical Pharmacology 3. Biomedical Pharmacotherapy 2. British Medical Journal 3. British Journal of Pharmacology 4. Journal of Clinical Pharmacology 5. European Journal of Pharmacology 6. British Journals of Clinical Pharmacology 7. Pharmacological Research 8. Pharmacology Reviews 9. Pharmacology & Therapeutics 10. Trends in Pharmacological Sciences <p><u>Others</u></p> <ol style="list-style-type: none"> 1. Harrison's Principles of Internal Medicine Latest Ed.

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 3 CH	Outcome
1	Drug treatment of Peptic ulcer	3 hours	Comprehend emerging trends in the drug treatment of peptic ulcer, GERD, Emesis, IBD, Cholestasis, Pancreatitis, Hepatic failure, Diarrhea, Constipation
2	Drug treatment of GERD	3 hours	
3	Drug treatment of emesis	3 hours	
4	Drug treatment of Inflammatory bowel disease	3 hours	
5	Treatment of drug induced Cholestasis	3 hours	
6	Treatment of drug induced Pancreatitis	3 hours	
7	Treatment of drug induced Hepatic failure	3 hours	
8	Drug treatment of Diarrhea & Constipation	3 hours	
9	Mid-Term Exam		
10	Drug treatment of Type-1 Diabetes mellitus	3 hours	Comprehend emerging trends in the treatment of Diabetes, Obesity, alterations in hypothalamo-
11	Drug treatment of Type-2 Diabetes mellitus	3 hours	
12	Drug treatment of Obesity	3 hours	
13	Drugs affecting somatotropic, pituitary, hypothalamic hormone	3 hours	

	secretions		
14	Pharmacology of Corticosteroids	3 hours	pituitary-adrenal axis, thyroid diseases, infertility
15	Drugs affecting thyroid function	3 hours	
16	Drug treatment of Infertility, clinical uses of female & male sex hormones	3 hours	Comprehend indications for use of contraceptives & HRT with adverse effects
17	Composition, strategies of Contraceptive agents, Hormone-replacement therapy (HRT) & their adverse effects	3 hours	
18	Final- Term Exam		

Course Code	PHM 827
Credit Hours	3+0
Course Title	Pulmonary Pharmacology and peptides
Pre-Requisite	Basic knowledge of drugs acting on respiratory system and pharmacology of peptides
Course Objective	<ol style="list-style-type: none"> 1. Describe use of glucocorticoids in respiratory diseases 2. Describe drugs used in treatment of Asthma 3. Describe drugs used in treatment of cough& COPD 4. Describe the therapeutic role of eicosanoids 5. Describe the therapeutic role of Calcitonin gene related peptides 6. Describe the therapeutic role of Substance P 7. Describe the therapeutic role of TNF α and β 8. Describe the therapeutic role of EDRF and Vasopressin 9. Describe the therapeutic role of Oxytocin and Nerve growth factor (NGF) 10. Describe the therapeutic role of IGF, IGF2 and Endothelins 11. Describe the therapeutic role of VIP, Propio Melanocortin Peptide (POMC) 12. Describe the therapeutic role of Neurotensin 13. Describe the therapeutic role of Neuropeptide Y 14. Describe the therapeutic role of Kinins
Course Outcome	<p>Upon completion of course the students will be able to:</p> <ol style="list-style-type: none"> 1. Comprehend the knowledge of drugs used for treatment of diseases of respiratory systems 2. Comprehend the knowledge of eicosanoids, vasoactive and neuroactive peptides
Course Contents	Pharmacological knowledge and application of histamine, bradykinin, 5-hydroxy-tryptamine, ergot alkaloids and their antagonists, eicosanoids, prostaglandins, drugs used in the treatment of bronchial asthma, COPD, expectorants, mucolytics, antitussives, vasoactive peptides, neuroactive peptides
Recommended Text Books	<ol style="list-style-type: none"> 1. Basic & Clinical Pharmacology by Katzung et al. Latest Ed. 2. Rang & Dale's Pharmacology by H.P. Rang, M.M. Dale, R.J. Flower. Latest Ed. 3. Lippincott's Illustrated Reviews: Pharmacology by Richard A Harvey, Pamela C. Champe, Richard Finkel, and Luigi X. Cubeddu. Latest Ed.
Recommended Reference	<ol style="list-style-type: none"> 1. Basis of Pharmacology by Goodman & Gillman Latest Ed. 2. Currents Medical Diagnosis and Treatment Latest Ed.

Books	
Web and other resources	<p><u>Websites</u></p> <p>Drugs.com</p> <p><u>Medicines Information – SPC & PILS</u></p> <p><u>IUPHAR/BPS Guide to Pharmacology</u></p> <p><u>Journals</u></p> <ol style="list-style-type: none"> 1. The Annals of Pharmacotherapy 2. Basic Clinical Pharmacology 3. Biomedical Pharmacotherapy 4. British Medical Journal 5. British Journal of Pharmacology 6. Journal of Clinical Pharmacology 7. European Journal of Pharmacology 8. British Journal of Clinical Pharmacology 9. Pharmacological Research 10. Pharmacology Reviews 11. Pharmacology & Therapeutics 12. Trends in Pharmacological Sciences <p><u>Others</u></p> <ol style="list-style-type: none"> 1. Harrison's Principles of Internal Medicine Latest Ed.

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 3 CH	Outcome
1	Describe use of glucocorticoids in respiratory diseases	3 hours	Comprehend the emerging trends of drugs used for the treatment of respiratory diseases
2	Describe drugs used in treatment of Asthma	3 hours	
3	Describe drugs used in treatment of cough & COPD	3 hours	
4	Describe the therapeutic role of eicosanoids	3 hours	
5	Describe the therapeutic role of Calcitonin gene related peptides	3 hours	Comprehend the therapeutic role of Eicosanoids, Calcitonin gene related peptide, Substance P, TNF α and β , EDHF and Vasopressin
6	Describe the therapeutic role of Substance P	3 hours	
7	Describe the therapeutic role of TNF α and β	3 hours	
8	Describe the therapeutic role of EDHF and Vasopressin	3 hours	
9	Mid-Term Exam		
10	Describe the therapeutic role of Oxytocin	3 hours	Comprehend the therapeutic role of IGF1, IGF2
11	Describe the therapeutic role of Nerve growth factor (NGF)	3 hours	
12	Describe the therapeutic role of IGF1, IGF2	3 hours	

13	Describe the therapeutic role of Endothelins	3 hours	Oxytocin, Nerve growth factor, IGF, IGF2,
14	Describe the therapeutic role of VIP, Propio Melanocortin Peptide (POMC)	3 hours	Endothelins, VIP, Propio Melanocortin Peptide, Neuropeptid Y, Kinins
15	Describe the therapeutic role of Neurotensin	3 hours	
16	Describe therapeutic role of Neuropeptide Y	3 hours	
17	Describe therapeutic role of Kinins	3 hours	
18	Final- Term Exam		

Course Code	PHM 828
Credit Hours	3+0
Course Title	Haemopeiotic and Musculoskeletal Pharmacology
Pre-Requisite	Basic knowledge of drugs acting on blood, muscles and joints
Course Objective	<ol style="list-style-type: none"> 1. Describe the pharmacology of oral anticoagulants 2. Describe the pharmacology of parenteral anticoagulants 3. Describe the pharmacology of coagulants and thrombolytic drugs 4. Describe the pharmacology of anti-platelet drugs 5. Describe the pharmacology of hematinic drugs 6. Describe pharmacokinetics and dynamics of NSAIDS 7. Describe drug treatment of rheumatoid arthritis 8. Describe drug treatment of osteo- arthritis & gout 9. Describe pharmacology of immunosuppressant drugs 10. Describe pharmacology of immuno-modulator drugs 11. Describe pharmacokinetics and pharmacodynamics of glucocorticoids in relieving pain 12. Describe pharmacology of opioid analgesic drugs 13. Describe pharmacology of opioid antagonists 14. Describe pharmacology of skeletal muscle relaxants 15. Describe pharmacology of drugs acting on bone mineral metabolism
Course Outcome	<p>Upon completion of course the students will be able to:</p> <ol style="list-style-type: none"> 1. Comprehend the drug treatment of anemia, rheumatoid arthritis, osteoarthritis, gout 2. Comprehend drugs acting as coagulants, anticoagulants, thrombolytics, platelet aggregation inhibitors, analgesics, skeletal muscle relaxants, immunosuppressants, immunomodulators 3. Comprehend drugs acting on bone mineral metabolism
Course Contents	Oral and parenteral anticoagulants, coagulants, thrombolytics, anti-platelet drugs, hematinics, analgesics, drug treatment of rheumatoid arthritis, osteoarthritis , gout, immunosuppressants, immuno-modulators, glucocorticoids, skeletal muscle relaxants, drugs affecting bone mineral metabolism
Recommended	1. Basic & Clinical Pharmacology by Katzung et al. Latest Ed.

Text Books	2. Rang & Dale's Pharmacology by H.P. Rang, M.M. Dale, R.J. Flower. Latest Ed. 3. Lippincott's Illustrated Reviews: Pharmacology by Richard A Harvey, Pamela C. Champe, Richard Finkel, and Luigi X. Cubeddu. Latest Ed.
Recommended Reference Books	1. Basis of Pharmacology by Goodman & Gillman Latest Ed. 2. Currents Medical Diagnosis and Treatment Latest Ed.
Web and other resources	<p><u>Websites</u> Drugs.com Medicines Information – SPC & PILS IUPHAR/BPS Guide to Pharmacology</p> <p><u>Journals</u></p> <ol style="list-style-type: none"> 1. The Annals of Pharmacotherapy 2. Basic Clinical Pharmacology 3. Biomedical Pharmacotherapy 4. British Medical Journal 5. Journal of Clinical Pharmacology 6. European Journal of Pharmacology 7. British Journals of Clinical Pharmacology 8. Pharmacological Research 9. Pharmacology & Therapeutics 10. Trends in Pharmacological Sciences <p><u>Others</u></p> <ol style="list-style-type: none"> 1. Harrison's Principles of Internal Medicine Latest Ed.

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 3 CH	Outcome
1	Describe the pharmacology of oral anticoagulants	3hours	Comprehend use of anticoagulants, coagulants, thrombolytics, antiplatelets, hematinics, NSAIDs, drug treatment of Rheumatoid arthritis, osteoarthritis, gout
2	Describe the pharmacology of parenteral anticoagulants	3hours	
3	Describe the pharmacology of coagulants and thrombolytic drugs	3hours	
4	Describe the pharmacology of anti-platelet drugs	3hours	
5	Describe emerging trends and importance of hematinic drugs	3hours	
6	Describe pharmacokinetics and dynamics of NSAIDS	3hours	
7	Describe drug treatment of rheumatoid arthritis	3hours	
8	Describe drug treatment of osteo-arthritis & gout	3hours	
9	Mid-Term Exam		
10	Describe pharmacology of	3hours	

	immunosuppressant drugs		Comprehend use of immuno-suppressant, immuno-modulator, glucocorticoids, opioid analgesics and antagonists, skeletal muscle relaxants, drugs acting on bone mineral metabolism
11	Describe pharmacology of immuno-modulator drugs	3hours	
12	Describe pharmacokinetics and pharmacodynamics of glucocorticoids in relieving pain	3hours	
13	Describe pharmacology of opioid analgesic drugs	3hours	
14	Describe pharmacology of opioid antagonists	3hours	
15	Describe pharmacology of skeletal muscle relaxants	3hours	
16	Describe pharmacology of drugs acting on bone mineral metabolism - Bisphosphonates	3hours	
17	Describe pharmacology of drugs acting on bone mineral metabolism- SERMs, Calcitonin, Parathyroid agents	3hours	
18	Final- Term Exam		

PUBLIC HEALTH

ELECTIVES COURSE LIST - PUBLIC HEALTH

Sr.No.	Course Code	Course Title	Credit Hours	Theory	Practical
1	PBH 802	Strategic Planning in Health Sector of Developing Countries	3+0	3	0
2	PBH 803	Ethics and Public Health: Theory & Practice	3+0	3	0
3	PBH 804	Disease Control (Communicable & non-Communicable) approaches: Historical evolution & advancement	3+0	3	0
4	PBH 805	Monitoring and Evaluation of Health Programs	3+0	3	0
5	PBH 806	Qualitative Research Methods in Public Health	3+0	3	0
6	PBH 807	Community Development & stakeholders' engagement	3+0	3	0
7	PBH 808	Public Health Leadership and systems thinking	3+0	3	0

DETAILED COURSE OUTLINE - ELECTIVE COURSES - PUBLIC HEALTH

Course Code	PBH 802
Credit Hour	3+0
Course Title	Strategic Planning in Health Sector of Developing Countries
Pre-Requisite	Basic understanding of health sector in developing countries and the need for strategic planning
Course Objective	<p>1. Inculcate the knowledge and skills for developing the strategic plan for any level or institution or project</p>
Course Outcome	<p>By the end of this course, students are expected to</p> <ol style="list-style-type: none"> 1. Apply the concepts, principles, and processes for undertaking a strategic planning exercise. 2. Develop skills of utilizing various tools commonly used in the planning process. 3. Utilize the logical framework approach, for planning, managing and monitoring a project or program. 4. Critically analyze various strategic plans in the health sector of Pakistan. 5. Discuss the issues and challenges associated with strategic plans and planning processes. 6. Analyze various experiences in the developing countries in the context of strategic planning & implementation in health sector
Course Contents	The course content included topics pertinent to strategic planning, the planning cycle, situation analysis to health project and evaluation
Recommended Text Books	<ol style="list-style-type: none"> 1. Health Sector Planning in Developing Countries- Martin S. Feldstein 2. Strategic Health Plans: guidelines for developing countries, August 2002 Funded by European Commission
Recommended Reference Books	<ol style="list-style-type: none"> 1. Strategic Planning handbook and manager's implementation tools; Southern University at New Orleans 2. A planning framework for public health practice. National public health partnership 3. Guidelines for conducting a stakeholder's analysis. Health reform tool series
Web and other resources	<p><u>Website:</u></p> <ul style="list-style-type: none"> - https://apps.who.int/iris/bitstream/handle/10665/250221/9789241549745-chapter5-eng.pdf;sequence=17 <p><u>Journals:</u></p> <ul style="list-style-type: none"> - Journal of operations and strategic planning https://journals.sagepub.com/home/osp <p><u>Other:</u></p> <ul style="list-style-type: none"> - Various articles and other printed materials to be shared by the Course Coordinator - Strategic plans of all the provinces of Pakistan (latest) - Health Policy and Planning https://academic.oup.com/heapol

18 Weeks Lecture Plan:

Week #	Lecture Topic	Duration 3 CH	Outcome
1.	What is Strategic Planning? - Introduction to the course, processes and assignments	3 hours	Understand the need for strategic planning, the process of defining the values and dealing with the conflicts
2.	Basic concepts and introduction to strategic planning	3 hours	
3	What values underpin strategic planning? - Process of defining values - Dealing with conflicts	3 hours	
4	Health Planning cycle	3 hours	Concepts of the cycle in rational planning Steps in planning
5	How should a strategic plan relate to the strategic health plan	3 hours	
6	Planning environment: An overview of the context	3 hours	Comprehend the mission, vision, values & principles—what & how of it Understanding the context
7	Situation analysis of the health sector - Phases of planning-situation analysis - Analytics & Planning Phases - How to conduct a situation analysis	3 hours	Understand the context and situation analysis of the health sector
8	Analysis phase 1—approaches and tools	3 hours	Conduct and use Stakeholders' analysis and other tools such as SWOT analysis
9	Mid-Term Exam		
10	Analysis Phase 2- Approaches & tools spider diagram, PEST and gap analysis etc. Internal & external assessment	3 hours	Conduct and use Stakeholders' analysis and other tools such as SWOT analysis
11	Analysis Phase –problem analysis	3 hours	Understand how to develop and use problem tree and conduct problem analysis
12	Planning Phase: Framework	3 hours	Comprehend LFA and different phases of planning phase
13	Planning- Indicators, risks & assumptions - Define & develop indicators and means of verification - Risk analysis & its management	3 hours	Identify to develop indicators and conduct risk analysis
14	Planning for monitoring: Process & approaches Converting planning framework into monitoring framework	3 hours	Describe the importance of monitoring the project and risk

15	Planning for resources & management - Preparing resources & cost schedules - Sources of resources & resource planning - Adjusting management & organization	3 hours	assessment
16	Tools & techniques for planning & consensus building	3 hours	Understand the importance of group dynamics, brainstorming, nominal group process, Delphi technique etc.
17	Priority-setting for national health policies, strategies and plans Leadership roles in planning	3 hours	Describe the importance of roles & management and the qualities required for a leader for planning Understand the application of priority measures for finalizing the policies and strategies.
18	Final-Term Exam		

Course Code	PBH 803
Credit Hour	3+0
Course Title	Ethics and Public Health: Theory & Practice
Pre-Requisite	Basic knowledge of ethics in public health and its importance
Course Objective	1. Describe the values and principles that animate public health 2. Describe application of ethical principles to resolve or clarify difficult issues in public health practice and policy
Course Outcome	By the end of the course, the students are expected to: 1. Articulate the values and principles that distinguish public health from medical care and public health ethics from bioethics. 2. Describe different ethical theories relevant to public health. 3. Identify and analyze the ethical arguments for and against public health interventions. 4. Practice applying ethical frameworks to be used for resolving resource allocation challenges, with particular attention to the process and outcomes of priority-setting. 5. Articulate and apply ethical frameworks for balancing the interests of the individual with community health. 6. Communicate justifications for public health decisions that are based on ethical concepts and principles. 7. Identify current issues in public health practice and policy that have ethical or moral relevance.
Course Contents	Importance of ethics and its role in public health, ethics in conducting research, addressing of ethical issues while conducting research
Recommended Text Books	1. Kass, N. E. (2001). An Ethics Framework for Public Health. American Journal of Public Health, 91(11), 1776-82

	2. Baum, N. M., Gollust, S. E., Goold, S. D., & Jacobson, P. D. (2007). Looking Ahead: Addressing Ethical Challenges in Public Health Practice.
Recommended Reference Books	1. Journal of Law, Medicine and Ethics, 35(4), 657-667, 513. "Public Health Code of Ethics," Principles of the Ethical Practice of Public Health, Public Health Leadership Society (2002).
Web and other resources	<p><u>Websites:</u></p> <ul style="list-style-type: none"> - World Health Organization (WHO). Guidelines on Ethical Issues in Public Health Surveillance. 2017. Available at: http://www.who.int/ethics/publications/public-healthsurveillance/en/ - United Nations. Universal Declaration of Human Rights. 1948. Available online at: http://www.un.org/Overview/rights.html - United Nations. Declaration of Alma Ata. 1978. Available online at:http://www.who.int/publications/almaata_declaration_en.pdf?ua=1 <p><u>Journals:</u></p> <ul style="list-style-type: none"> - Adler and Stewart (2009). Reducing Obesity: Motivating Action While Not Blaming the Victim. Milbank Quarterly, 87, 49-70. - Bayer, R. (2008). Stigma and the Ethics of Public Health: Not Can We But Should We. Social Science & Medicine, 67(3), 463-472. - Burris S. (2008). Stigma, Ethics, and Policy: A Commentary on Bayer's "Stigma and the Ethics of Public Health: Now Can We But Should We", Social Science and Medicine 67: 473-47 <p><u>Other:</u></p> <p>Public Health Ethics by CDC https://www.cdc.gov/os/integrity/phethics/index.htm</p>

18 Weeks Lecture plan:

Week #	Lecture Topic	Duration 3 CH	Outcome
1.	Introduction to Public Health Ethics	3 hours	Understand the principles that distinguish public health from medical care and public health ethics from bioethics
2.	Philosophical and Historical Foundations of Public Health Ethics	3 hours	
3.	Theories of Justice and Distribution of Public Health Resources	3hours	Identify the importance of Ethical theories relevant to public health Identify and analyze the ethical arguments for and against public health interventions
4.	Priority-Setting and Resource Allocation at the Macro Level	3 hours	
5.	Priority-Setting and resource allocation at the micro Level	3 hours	Practice applying ethical frameworks to be used for resolving resource allocation challenges, with particular attention to the process and outcomes of priority-setting
6.	Global Health and Human Rights	3 hours	
7.	Ethics and Health Promotion	3 hours	
8.	Ethical challenges in infectious disease control	3 hours	

9.	Mid-Term Exam		
10.	Public health laws and legal challenges in infectious disease control	3 hours	Comprehend public health laws and legal challenges in infectious disease control
11.	Research ethics in resource-limited settings	3 hours	
12.	Ethical issues in clinical trial design (e.g. placebo-controlled trials)	3 hours	
13.	Ethical issues in the informed consent	3 hours	Communicate justifications for public health decisions that are based on ethical concepts and principles.
14.	Ethical issues for clinical research in public health emergencies	3 hours	Identify current issues in public health practice and policy that have ethical or moral relevance.
15.	Research capacity strengthening	3 hours	
16.	Good participatory practice guidelines and stakeholder engagement	3 hours	
17.	Operationalizing ethics (e.g., in-practice ethics	3 hours	
18.	Final-Term Exam		

Course Code	PBH 804
Credit Hour	3+0
Course Title	Disease Control (Communicable & non-Communicable) approaches: Historical evolution & advancement
Pre-Requisite	Must have basic knowledge of communicable and non -communicable diseases
Course Objective	<ol style="list-style-type: none"> 1. Describe the overview of epidemiology, risk factors, etiology, and public health importance of major non-communicable diseases. 2. Describe the social determinants and physiological risk factors of the most common non-communicable diseases. 3. Describe the methods for measuring the burden of non-communicable disease, review approaches to program and service development to modify risk factors 4. Analyse the implications for health services and policy development
Course Outcome	<p>By the end of the course, the students are expected to:</p> <ol style="list-style-type: none"> 1. Define the scope of non-communicable diseases epidemiology and appreciate the changing importance of non-communicable diseases as a major public health burden in different parts of the world 2. Describe the epidemiology, trends, and burden of major non-communicable diseases 3. Calculate prevalence, incidence, and mortality and apply definitions of DALY and QALY to describe the burden of main non-communicable diseases 4. Measure and analyze main determinants of non-communicable diseases 5. Understand the impact of social determinants and behavioural factors on non-communicable diseases
Course Contents	Communicable and non-communicable disease and surveillance. Using surveillance data and using QALYS and DALYS.
Recommend	Oxford Textbook of Global Public Health (6 ed.) Edited by: Roger Detels Martin

ed Text Books	Gulliford, Quarraisha Abdool Karim, and Chorh Chuan Tan
Recommended Reference Books	<p>Part I. Non-Communicable Diseases Harris RE. Epidemiology of Chronic Disease. Global Perspectives Jones & Bartlett Learning, Burlington MA, 2013</p> <p>Part II. Infectious Diseases Global Disease Elimination and Eradication as Public Health</p>
Web and other resources	<p><u>Websites:</u></p> <ul style="list-style-type: none"> - https://health-policy-systems.biomedcentral.com/articles/10.1186/1478-4505-2-7 - Strategies www.cdc.gov/epo/mmwr/pdf/other/mm48su01.pdf - Center for Global Development (The Case Studies) www.cgdev.org/section/initiatives/_active/millionsaved/studeis/ <p><u>Journals:</u></p> <p>International Journal of Infectious diseases https://www.scimagojr.com/journalsearch.php?q=22380&tip=sid</p> <p>International journal of chronic diseases https://www.hindawi.com/journals/ijcd/?utm_source=google&utm_medium=cpc&utm_campaign=HDW_MRKT_GBL_SUB_ADWO_PA1_DYNA_JOUR_X&gclid=Cj0KCQiAwqCOBhCdARIsAEPyW9lb9T01b3Uqp5GPADCPNppPZX3TIjbz_dBSvzdvQJ2Zd24w7e7lrNUaAkHnEALw_wcB</p> <p><u>Others:</u></p> <p>Disease control priorities in developing countries –World Bank https://openknowledge.worldbank.org/handle/10986/7242</p>

18 Weeks Lecture Plan:

Week #	Lecture Topic	Duration 3 CH	Outcome
1.	Introduction to Epidemiology of Non-communicable (NCDs) diseases	3 hours	Understand the epidemiology of NCDs, risk factors, burden, and types Comprehend the measures of burden of disease
2.	Introduction to NCDs	3 hours	
3.	Epidemiologic Transition	3 hours	
4.	NCDs Risk Factors	3 hours	
5.	Epidemiology of NCDs and Global Burden of Diseases	3 hours	
6.	Measures of Burden for Non Communicable diseases	3 hours	
7.	Introduction to Communicable diseases	3 hours	
8.	Comparison between communicable and NCDs	3 hours	
9.	Mid-Term Exam		
10.	Prevention and control of non-communicable diseases	3 hours	Calculate prevalence, incidence, and mortality
11.	Communicable Disease control	3 hours	Apply definitions of DALY and QALY to describe the burden of main non-communicable diseases
12.	Uses of Public Health Surveillance Systems	3 hours	Measure and analyze the main
13.	NCDs Surveillance Systems and	3 hours	

	Indicators		
14.	NCDs Surveillance As a Function of Monitoring and Evaluation	3 hours	determinants of non-communicable diseases Understand the impact of social determinants and behavioural factors on non-communicable diseases
15.	Analysis and interpretation of Surveillance Data	3 hours	Describe analysis and interpretation of Surveillance Data, burden of disease
16.	Health promotion for non-communicable diseases	3 hours	DALYS and QALYS
17.	The burden of disease DALYS and QALYS	3 hours	
18.	Final-Term Exam		

Course Code	PBH 805
Credit Hour	3+0
Course Title	Monitoring and Evaluation of Health Programs
Pre-Requisite	Students should have basic concept of monitoring and evaluation and why it is important for program/projects
Course Objective	Update the knowledge and skills in basics program monitoring and evaluation in the context to health
Course Outcome	By the end of the course, the students are expected to: 1. Identify why M&E is essential for program management. 2. Learn the basic purposes and scope of M&E 3. Differentiate between monitoring functions and evaluation functions 4. Describe the functions of an M&E plan 5. Identify the main components of an M&E plan 6. Identify and differentiate between conceptual frameworks, results frameworks and logic models 7. Identify types of data sources 8. Describe how information can be used for decision-making.
Course Contents	Monitoring and evaluation of health programs and their importance. Use of monitoring and evaluation tools. Data source and resource allocation
Recommended Text Books	1. Frankel N & Gage A (2007). M&E Fundamentals: A Self-Guided Minicourse. U.S. Agency for International Development (USAID) 2. Family Health International (FHI) (2011). Core Module1: Monitoring HIV/AIDS Programs: A Facilitator's Training Guide. USAID Resource for Prevention, Care and Treatment. 3. International Federation of Red Cross and Red Crescent Societies (2002). Handbook for Monitoring and Evaluation. 1st edition. Switzerland
Recommended Reference Books	1. School of Geography and Environment (2014). A Step by Step Guide to Monitoring and Evaluation. Higher Education Innovation Fund at the University of Oxford. Retrieved from: http://www.geog.ox.ac.uk/research/technologies/projects/monitoringandevaluation.html).
Web and other resources	<u>Websites:</u> Measure Evaluation: https://www.measureevaluation.org/resources/publications https://www.measureevaluation.org/resources/training https://www.k4health.org/toolkits/measuring-success <u>Journals:</u>

	Evaluation & Program Planning https://www.sciencedirect.com/journal/evaluation-and-program-planning Other: https://openknowledge.worldbank.org/handle/10986/7242
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18 Weeks Lecture Plan:

Week #	Lecture Topic	Duration 3 CH	Outcome
1.	Overview of Monitoring and Evaluation of Health Program and Services	3 hours	Understand the essentiality of Monitoring and Evaluation of Health programs for management Identify the basic purposes and scope of Monitoring
2.	Monitoring of Health Programs and Services	3 hours	
3.	Purpose of Monitoring Process Levels of Monitoring	3 hours	Conceptualize the understanding and application of various dimensions of monitoring
4.	Overview of Evaluation of Health Programs and Services	3 hours	Differentiate between monitoring functions and evaluation functions Describe the functions of a Monitoring and Evaluation plan Identify the main components of a Monitoring and Evaluation plan
5.	Uses of Evaluation	3 hours	
6.	Drawback to Evaluation	3 hours	
7.	Types of Evaluation Formative/impact	3 hours	
8.	Conducting Monitoring and Evaluation	3 hours	
9.	Mid-term Exam		
10.	Principles of Effective Monitoring and Evaluation	3 hours	Understand the principles of Effective Monitoring and Evaluation
11.	Tools of Monitoring and Evaluation	3 hours	Apply some tools for monitoring
12.	Resources for Monitoring and Evaluation	3 hours	Identify the resources required for monitoring and evaluation
13.	Monitoring and Evaluation Frameworks	3 hours	Identify and differentiate between conceptual frameworks, results frameworks and logic models Describe the frameworks used for M&E planning
14.	Steps in Developing Appropriate Indicators for a Project/Program	3 hours	Identify criteria for the selection of indicators
15.	Types of Indicators and their Importance	3 hours	Identify types of data sources describe how indicators are linked to frameworks
16.	Characteristics of Indicators and challenges for selecting the indicators	3 hours	Describe the information used for decision-making
17.	Data Sources in Monitoring and evaluation	3 hours	Apply data sources in Monitoring and Evaluation

18.	Final-Term Exam
Course Code	PBH 806
Credit Hour	3+0
Course Title	Qualitative Research Methods in Public Health
Pre-Requisite	Students should know different types of research methods
Course Objective	<p>1. Describe the method of conducting health research using a qualitative approach.</p> <p>2. Describe the main components of research methodology, including types of qualitative research, data collection techniques, analyzing and reporting, research design, proposal writing, and plan of analysis</p>
Course Outcome	<p>By the end of the course, the students are expected to:</p> <ol style="list-style-type: none"> 1. Discuss the methodological position of a qualitative approach 2. Understand the process and steps in qualitative research 3. Demonstrate the qualitative data collection technique and data analyze 4. Plan and write a qualitative project.
Course Contents	Qualitative methods and types. Skills of qualitative research, sampling, use analysis, and drawing results. Different types of qualitative research methods
Recommended Text Books	<p>1. Becker, H.S and Geer, B. (1971) "Participation Observation and Interviewing: A Comparison", in Filstead, W.J (ed.). Qualitative Methodology: First Hand Involvement with the Social World, Chicago: Markham Pub. Co, 133-142</p>
Recommended Reference Books	<p>1. Becker, H.S. (1971) "Whose Side Are We On?", in Filstead, W.J. (ed.), Qualitative Methodology: Firsthand Involvement with the Social World, Chicago: Markham Pub. Co., 15-25</p> <p>2. Becker, H.S. (1971) Sociological Work, London: Alien Lane</p> <p>3. Becker, H.S. and Geer, B. (1969) "Participation and Interview: A Rejoinder" in McCall, G.J. and Simmons, J.L. (eds.). Issues in Participant Observation, Mass.: Addison & Wesley Pub., 338-341.</p> <p>4. Berg, B. L. (2006). (6th edition). Qualitative Research for the Social Sciences. Massachusetts, USA: Allyn & Bacon.</p> <p>5. Blumer, H. (1969) Symbolic Interactionism: Perspective and Method, New Jersey, Englewood Cliff: Prentice Hall</p> <p>6. Bryman, A. (1988) Quantity and Quality in Social Research, London: Unwin</p> <p>7. Burgess, R.G. (1984) In the Field: An Introduction to Field Research, London: Alien & Unwin</p> <p>8. Burgess, R.G. (ed.), (1982) Field Research: A Sourcebook and Field Manual, London: George Alien & Unwin</p> <p>9. Denzin, N. K. & Lincoln, Y. (2005). (3rd edition). The sage handbook of qualitative research. London: Sage.</p>
Web and other resources	<u>Websites:</u> https://scholar.google.com.pk/scholar?q=qualitative+research+methods&hl=en&as_sdt=0&as_vis=1&oi=scholart <u>Journals:</u> <ul style="list-style-type: none"> - Bulmer, M. (1979) "Concepts in the Analysis of Qualitative Data", Sociological Review, 27, 4, 651-677 - Others: Burgess, R.G. (1982) "The Unstructured Interview as a Conversation", in Burgess, R.G. (ed.), Field Research: Source Book and Field Manual, London: Alien & Unwin, 107-110

18 Weeks Lecture Plan:

Week #	Lecture Topic	Duration 3 CH	Outcome
1.	Introduction, course briefing- What is qualitative research? Research Paradigm. – Ontology & epistemology.	3 hours	
2.	Selecting topic priorities in qualitative research & Proposal writing	3 hours	Discuss the methodological position of a qualitative approach
3.	Scientific vs. non-scientific statement of facts and Journal critique Evaluating scientific evidence in qualitative research generalization/induction/deduction/ type and ways of triangulation/ value and ethics Literature review	3 hours	Understand the process and steps in qualitative research
4.	Skills in qualitative research (Communication-probing & paraphrasing; understanding body language; controlling & encouraging respondent's participation)	3 hours	
5.	Managing the passive respondents – the how	3 hours	Develop the profile of non-respondents and apply the skills to involve them
6.	Research design: Case study/series; ethnography; phenomenology/ grounded theory	3 hours	Understand different types of qualitative methods
7.	Research design: Case study/series; ethnography; phenomenology/ grounded theory	3 hours	Developing the skill for conducting the research
8.	Research methodology –Sampling, sampling size, saturation point, sampling strategy	3 hours	
9.	Mid-Term Exam		
10.	Fieldwork issues	3 hours	Understand the fieldwork issues
11.	Data Collecting Technique I - In-depth interview In-depth interview - Hands-on	3 hours	
12.	Data Collecting technique II- Focus Group Discussion (FGD) FGD - Hands-on	3 hours	Demonstrate the qualitative data collection technique, data analysis plan and write up of a qualitative project
13.	Data Collecting Technique III – Observation & Experts group Observation & experts groups technique –Hands-on	3 hours	
14.	Data Collecting Technique IV- Nominal Group Technique (NGT) Nominal Group Technique- Hands-on.	3 hours	
15.	Analysis technique and transcribing – indexing/ categorizing/ theme development	3 hours	

16.	Mixing method-qualitative and quantitative methods in research Practical issues in mix-method	3 hours	
17.	Managing qualitative data- I (during fieldwork) Managing qualitative data- II (after fieldwork) - report writing	3 hours	
18.	Final-Term Exam		

Course Code	PBH 807
Credit Hour	3+0
Course Title	Community Development & stakeholders' engagement
Pre-Requisite	Students should have Knowledge on different types of stakeholders and their role in community development
Course Objective	<ol style="list-style-type: none"> 1. Describe the process of community development and stakeholder engagement an integral part of quality improvement (QI) initiatives 2. Describe the approaches to make stakeholder engagement comprehensive for community development
Course Outcome	<p>By the end of the course the students are expected to:</p> <ol style="list-style-type: none"> 1. Design a stakeholder engagement process and develop a stakeholder engagement plan 2. Undertake comprehensive stakeholder mapping and analysis 3. Better understand an array of engagement methods and their appropriate use 4. Evaluate the quality of stakeholder engagement processes 5. Understand the role and practice of facilitation in implementing engagement 6. Understand the pros and cons of different stakeholder methodologies and clarify which tools and approaches are suitable for particular circumstances 7. The development of a broad, step-by-step approach to designing and implementing high-impact community development programs 8. Develop tools to analyze and assess the effectiveness of stakeholder engagement programs
Course Contents	Different types of stakeholders and their engagement for community development. Issues and challenges and decision making
Recommended Text Books	An Introduction to Community Development 2nd Edition Edited By <u>Rhonda Phillips; Robert Pittman</u> . Copyright Year 2015
Recommended Reference Books	1. Stakeholder engagement: A road map towards meaningful engagement." Neil Jeffery (2009)
Web and other resources	<p><u>Website:</u> https://www.msh.org/sites/default/files/2015_08_msh_engaging_stakeholders_health_systems_strengthening.pdf</p> <p><u>Journals:</u> Journal of Community Development Society https://www.comm-dev.org/professional-development/cds-journal</p> <p><u>Other:</u> community participation health systems development</p>

	https://www.cambridge.org/core/books/achieving-personcentred-health-systems/community-participation-in-health-systems-development/047EBAEFD9672109E323DEC4694D4E10
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18 Weeks Lecture Plan:

Week #	Lecture Topic	Duration 3 CH	Outcome
1.	What is community and stakeholders' engagement	3 hours	Design stakeholder engagement process and develop a stakeholder engagement plan
2.	Purpose of community and stakeholders' engagement	3 hours	Understand the development of a broad, step-by-step approach to designing and implementing high-impact community development programs
3.	Principles of community and stakeholders engagement	3 hours	
4.	Objectives of community and Stakeholder engagement	3 hours	
5.	Engagement for the 2030 Agenda	3 hours	
6.	Common challenges	3 hours	
7.	Quality Engagement	3 hours	
8.	Planning engagement strategy	3 hours	
9.	Mid-Term Exam		
10.	Defining project life cycle	3 hours	Understand the project cycle
11.	Stakeholder mapping	3 hours	Develop tools to analyze and assess the effectiveness of stakeholder engagement programs
12.	Development of management plan	3 hours	
13.	Roles and responsibilities	3 hours	
14.	Stakeholder analysis and initial engagement	3 hours	
15.	Measuring impact and learning from results	3 hours	
16.	How stakeholder engagement improves community development	3 hours	
17.	Development, monitoring and evaluation	3 hours	
18.	Final-Term Exam		

Course Code	PBH 808
Credit Hour	3+0
Course Title	Public Health Leadership and Systems Thinking
Pre-Requisite	Students should have knowledge on public health and health systems
Course Objective	<ol style="list-style-type: none"> 1. Describe the leadership models and theories, the core principles of public health leadership, and the application of systems thinking to public health 2. Describe to create strategies and solutions that efficiently utilize public health and healthcare resources 3. Comprehend the descriptive and prescriptive systems, focusing on the application of these processes to current public health issues and challenges

	at the organizational and community levels
Course Outcome	<p>By the end of this course the students are expected to:</p> <ol style="list-style-type: none"> 1. Give a satisfactory description of public health leadership and systems thinking 2. Define and describe essential concepts, principles, and systems perspectives in public health leadership
Course Contents	The key contents including introduction to public health leadership and its importance. Context and forms of leadership. Issue and challenges and system thinking
Recommended Text Books	1. Burke RE, Friedman LH. Essentials of Management and Leadership in Public health. Jones & Bartlett Publishers; 1st Ed. 2010.
Recommended Reference Books	1. Alliance for Health Systems and Policy research. Systems thinking for Health Systems Strengthening. Eds: Don de Savigny, Taghreed Adam. World Health Organization, Geneva: 2009.
Web and other resources	<p><u>Websites:</u> https://www.who.int/alliance-hpsr/alliancehpsr_overview_fr_eng.pdf</p> <p><u>Journal:</u> Journal of health care leadership. https://www.dovepress.com/journal-of-healthcare-leadership-journal#</p> <p><u>Others:</u> steward leadership https://www.amazon.com/Steward-Leadership-Becoming-effective-breaking-ebook/dp/B08RGNGLZ7</p>

18 Weeks Lecture Plan:

Week #	Lecture Topic	Duration 3 CH	Outcome
1.	Introduction to the public health leadership	3 hours	Describe the public health leadership and systems thinking
2.	An introduction to fundamental concepts of Leadership in public health	3 hours	
3.	A context about the health systems	3 hours	
4.	Leading Public Health Organizations frameworks of Leadership	3 hours	Describe essential concepts, principles, and systems perspectives in public health leadership
5.	Environmental analysis by public health managers	3 hours	
6.	Development of capacity and abilities in leadership	3 hours	
7.	Develop skills in teamwork and organizational performance	3 hours	
8.	Development of a plan and implementation of programs in the community.	3 hours	Develop a plan and implement programs in the community
9.	Mid-Term Exam		
10.	Decision making	3 hours	Understand decision making and community development

11.	The skills necessary for advocacy and communication	3 hours	Understand the importance of advocacy and communication and skills needed
12.	WHO Health System Framework; Systems Thinking	3 hours	Understand the importance of leadership in public health
13.	Styles of leadership	3 hours	
14.	Roles of Manager as Leaders	3 hours	
15.	Challenges for Health managers	3 hours	
16.	Leading a team: Functions and methodology	3 hours	
17.	Leading a team: Challenges Stress and Time management Conflict management	3 hours	
18.	Final-Term Exam		

PATHOLOGY-MICROBIOLOGY

ELECTIVE COURSE LIST - PATHOLOGY –MICROBIOLOGY

Sr.No.	Course Code	Course Title	Credit hours	Theory	Practical
1	PAT 840	Diagnostic Microbiology	3(1+2)	1	2
2	PAT 841	Immunological basis of diseases	3(1+2)	1	2
3	PAT 842	Microscopy and Staining Techniques	3(1+2)	1	2
4	PAT 843	Medical Parasitology	3(1+2)	1	2
5	PAT 844	Medical Mycology	3(1+2)	1	2
6	PAT 845	Clinical Virology	3(1+2)	1	2
7	PAT 846	Infection Control	3(1+2)	1	2
8	PAT 847	Serology	3(1+2)	1	2

DETAILED COURSE OUTLINE - ELECTIVE COURSES -PATHOLOGY- MICROBIOLOGY

Course Code	PAT 840
Credit hours	3(1+2)
Course Title	Diagnostic Microbiology
Pre-Requisite	Medical Microbiology
Course Objective	<ol style="list-style-type: none"> 1. Describe the utilization of laboratory services with minimum resources. 2. Describe the type and preparation of culture media. 3. Describe the various biochemical tests and serology procedures. 4. Describe interpretation of tests for different infection causing pathogens
Course Outcome	Upon successful completion of the course, the students will be able to: Understand utilization of laboratory services with minimum resources, identify and interpret the role of different diagnostic tests of infectious diseases.
Course Contents	<p>Microbiological laboratory services with minimum resources. Collection, labeling, preservation, transportation and dispatching of microbiological aspects. Preparation and interpretation of culture media. Biochemical tests and serology procedures and interpretations of tests to make diagnosis of staphylococcus and streptococcus infections. Biochemical tests and serology procedures and interpretations of tests to make diagnosis of neisseria infections. Procedures and interpretations of tests to make diagnosis of spore-forming gram-positive rods (bacillus clostridium) and non-spore-forming gram-positive rods (corynebacterium diphtheria and listeria monocytogenes). Procedures and interpretations of tests to make diagnosis of pathogens both within & outside the enteric tract (escherichia and salmonella) and pathogens primarily within the enteric tract (shigella, vibrio, campylobacter and helicobacter). procedures and interpretations of biochemical and serological tests to make diagnosis of pathogens outside the enteric tract (klebsiella-enterobacter-serratia group, proteus-providencia-morganella group, pseudomonas bacteroides & prevotella). Procedures and interpretations of biochemical and serology tests to make diagnosis of bacteria related to respiratory tract (haemophilus, bordetella and legionella). Procedures and interpretations of tests to make diagnosis of zoonotic organisms (brucella, francisella yersinia, pasteurella and bartonella). procedures and interpretations of tests to make diagnosis of treponema (treponema pallidum and nonvenereal treponematoses) Borrelia (Borrelia burgdorferi, Borrelia recurrentis & Borrelia hermsii) Leptospira and Other Spirochetes.</p> <p>Interpretations of tests of Mycobacterium tuberculosis, Atypical Mycobacteria and Mycobacterium leprae. Procedures and interpretations of tests to make diagnosis of Actinomycetes and Mycoplasma species.</p> <p>Interpretations of tests to make diagnosis of Rickettsiae and Chlamydiae infections</p>
Recommended Text Books	<ol style="list-style-type: none"> 1. District laboratory practice in tropical countries by Monica Cheesbrough 2. Review of Medical Microbiology and Immunology by Warren Levinson
Recommended Reference Books	<ol style="list-style-type: none"> 1. Greenwood D, Slack R, Peutherer J. Medical microbiology – Guide to microbial infections: pathogenesis, immunity, laboratory diagnosis and control, 16th edition, 2002. Churchill Livingstone, Elsevier.

	2. Collins CH, Lyne PM, Grange JM. Collins & Lyne's Microbiological methods. 8th edition 2004. Arnold publishers.
Web and other resources	<p><u>Websites:</u></p> <ol style="list-style-type: none"> 1. American Society of Clinical Investigation 2. Microbiology: nature.com 3. Labmedicineblog.com <p><u>Journals:</u></p> <ol style="list-style-type: none"> 1. Journal of Clinical Microbiology 2. Journal of Infectious Diseases <p><u>Others:</u></p> <p>Webber R. Communicable disease epidemiology and control: A global perspective, 2nd edition, 2005. CABI Publishing</p>

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 1CH	Outcome
1	Use of microbiological laboratory services with minimum resources and proper disposal of microbiology sample	1 hour	Utilize Microbiological laboratory services with minimum resources. Practice the proper disposal of microbiology sample.
2	Preparation and interpretation of Culture Mediums	1 hour	Describe the preparation and interpretation of culture media.
3	Principles of biochemical tests, serology procedures and interpretations for diagnosis of Gram positive cocci (Staphylococcus)	1 hour	Understand principles of biochemical tests, serology procedures and interpretations for diagnosis of Staphylococcus and Streptococcus infections
4	Principles of biochemical tests, serology procedures and interpretations for diagnosis of Gram positive cocci (Streptococcus)	1 hour	
5	Principles of biochemical tests, serology procedures and diagnostic interpretation for Gram negative cocci (Neisseria gonorrhoeae)	1 hour	Understand principles of biochemical tests, serology procedures and interpretations for diagnosis of Neisseria infections.
6	Principles of biochemical tests, serology procedures and diagnostic interpretation for Gram negative cocci (Neisseria meningitidis)	1 hour	
7	Principles of biochemical tests, serology procedures and diagnostic interpretation for Gram positive bacilli (spore-forming gram-positive rods)	1 hour	Understand the Procedures and interpret the tests to make diagnosis of spore-forming gram-positive rods and non-spore-forming gram-positive rods
8	Principles of biochemical tests serology procedures and diagnostic interpretation for Gram positive bacilli (non-spore-forming gram-	1 hour	

	positive rods)		
9	Mid-Term Exam		
10	Procedures and interpretation of tests for diagnosing Gram negative bacilli (enteric tract pathogens)	1 hour	Understand Procedures and interpret the tests to make diagnosis of pathogens both within & outside the enteric tract and pathogens primarily within the enteric tract
11	Procedures and interpretation of tests for diagnosing Gram negative bacilli (pathogens outside the enteric tract)	1 hour	Understand Procedures and interpret the biochemical and serological tests to diagnose the pathogens outside the enteric tract.
12	Procedures and interpretation of tests for diagnosing Gram negative bacilli (respiratory tract)	1 hour	Understand Procedures and interpret biochemical and serology tests to make diagnosis of bacteria related to respiratory tract.
13	Procedures and interpretation of tests for diagnosing Gram negative bacilli (Zoonotic)	1 hour	Understand Procedures and interpret tests to make diagnosis of Zoonotic Organisms.
14	Procedures and interpretation of tests for diagnosing Treponema, Borrelia, Leptospira, Spirochetes	1 hour	Understand the Procedures and interpret tests to make diagnosis of Treponema, Borrelia, Leptospira and other Spirochetes
15	Procedures and interpretation of tests for diagnosing Mycobacterium	1 hour	Describe the Interpretation tests of Mycobacterium tuberculosis, Atypical Mycobacteria and Mycobacterium leprae
16	Procedures and interpretation of tests for diagnosing Actinomycetes and Mycoplasma species	1 hour	Understand the Procedures and interpret tests to make diagnosis of Actinomycetes and Mycoplasma species
17	Procedures and interpretation of tests for diagnosing Rickettsiae and Chlamydiae infections	1 hour	Describe the interpretation tests to make diagnosis of Rickettsiae and Chlamydiae infections
18	Final-Term Exam		

18 Weeks Lab Plan

Week #	Lab Topic	Duration 2CH	Outcome
1	Laboratory services	6 hours	Demonstrate general rules of conduct in the laboratory and use of equipment.
2	Equipment	6 hours	
3	Collection, transport and storage of sample	6 hours	Collect, transport, store and dispose the specimen.
4	Disposal of sample	6 hours	
5	Blood Cultures	6 hours	Perform blood culture procedure and Interpret growth on blood samples
6	Throat Cultures	6 hours	Perform and Interpret growth cultures of

			samples collected from throat
7	Sputum Cultures	6 hours	Perform and Interpret microbial growth on culture media from sputum sample
8	Spinal Fluid Cultures	6 hours	Perform and Interpret microbial growth on culture media from Spinal Fluid sample
9	Mid-Term Exam		
10	Stool Cultures	6 hours	Perform and Interpret microbial growth on culture media from Stool sample
11	Urine Cultures	6 hours	Perform and Interpret microbial growth on culture media from urine sample
12	Genital Tract Cultures	6 hours	Perform and Interpret microbial growth on culture media, collected from Genital tract samples
13	Wound & Abscess Cultures	6 hours	Perform and Interpret microbial growth on culture media, collected from the Wound & Abscess site
14	Immunologic Methods-1 (Organism with Known Antiserum)	6 hours	Identify an organism with known Antiserum and Serum Antibodies with known Antigens.
15	Immunologic Methods-2 (Serum Antibodies with Known Antigens)	6 hours	
16	Nucleic Acid-Based Methods	6 hours	Identify an organism with Nucleic Acid-Based Methods and their serology.
17	Serology of organisms	6 hours	
18	Final-Term Exam		

Course Code	PAT 841
Credit hours	3(1+2)
Course Title	Immunological basis of diseases
Pre-Requisite	Medical Microbiology
Course Objective	<ol style="list-style-type: none"> 1. Describe advance concepts of Immunology & Disorders of the Immune System 2. Explain Immune system and its components 3. Discuss various immune system disorders, their causes and mechanisms 4. Describe structure and function of antigen and antibodies 5. Illustrate allergy and immunodeficiency
Course Outcome	Upon successful completion of the course, the students will be able to: Understand basis of immunity and cells and organs involved in acquired immunity, the role of antibodies and induction of antibody response to antigens and the role of vaccines in controlling diseases
Course Contents	Chronological development and scope of immunology. Immunity and immune responses: Definitions and types (specific and non-specific). Humoral and cellular immunity. Details of Complement system. Cells and tissues of immune system. The antigens: structure (simple and complex molecules, proteins and polysaccharides) and immunogenicity. Tissue antigens: the Allo- and heterophile antigens. The ABO and Rh blood group systems, their chemical basis, inheritance & clinical significance. Immunoglobulin: structure and function; classes,

	<p>subclasses, types and subtypes; immunoglobulin genetics. Immune response to an antigen. Introduction to antigen-antibody reactions: methods for detecting antigens and antibodies (agglutination, precipitation, complement fixation, EIA, etc.). Introduction to HLA & MHC and its role in immune response, disease and its significance in tissue transplantation. Immune-regulation and tolerance. Introduction to Cancer immunology. Introduction to immunopathology: hypersensitivity reactions, autoimmune diseases and immune-deficiencies. Immunization (methods of immunization, vaccines and adjuvants). Parameter of complete blood count, Differential leucocyte count, Erythrocyte sedimentation Rate and Reticulocyte count along with their relevant significance to different diseases. Blood grouping techniques. Different cross matching methods and indications (e.g., electronic, immediate-spin, anti-globulin). Policies/process in selection of a blood donor and blood donation procedure. Coagulation techniques with coagulopathies. Principles of apheresis technology, including centrifugation, filtration and immune-adsorption. Diagnosis of Haemoglobinopathies. Technique of bone marrow aspiration, its indication, contraindication, significance and complication. Purpose and techniques of compatibility testing and Auto-transfusion. Types of Blood transfusion reactions (hemolytic and non-hemolytic), clinical manifestations, pathophysiology and complications. Immunization (methods of immunization, vaccines and adjuvants)</p>
Recommended Text Books	<ol style="list-style-type: none"> 1. District laboratory practice in tropical countries by Monica Cheesbrough 2. Review of Medical Microbiology and Immunology by Warren Levinson
Recommended Reference Books	<ol style="list-style-type: none"> 1. Lewis SM, Bain BJ, Bates I. Practical haematology, 9th edition, 2001. Churchill Livingstone, Elsevier. 2. Greenwood D, Slack R, Peutherer J. Medical microbiology – Guide to microbial infections: pathogenesis, immunity, laboratory diagnosis and control, 16th edition, 2002. Churchill Livingstone, Elsevier. 3. Collins CH, Lyne PM, Grange JM. Collins & Lyne's Microbiological methods. 8th edition 2004. Arnold publishers. 4. Webber R. Communicable disease epidemiology and control: A global perspective, 2nd edition, 2005. CABI Publishing
Web and other resources	<p><u>Websites:</u></p> <ol style="list-style-type: none"> 1. American Society of Clinical Investigation 2. Microbiology: nature.com 3. Labmedicineblog.com <p><u>Journals:</u></p> <ol style="list-style-type: none"> 1. Nature Reviews Immunology 2. Cellular Immunology 3. Clinical and Experimental Immunology 4. Nature Reviews Microbiology <p><u>Others:</u></p> <ol style="list-style-type: none"> 1. Chen, E. R. and Kasturi, S. 2006. Deja Review: Microbiology and Immunology, McGraw-Hill Companies, N.Y. 2. Van Emon, V. M. 2006. Immunoassay and Other Bioanalytical Techniques, CRC Press, F.L... 3. Abbas, A. K., Lichtman, A. H. and Pillai, S. 2007. Cellular and Molecular Immunology, Elsevier Health Sciences, N.Y

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 1CH	Outcome
1	Overview of immunology and immune system	1 hour	Chronological development and scope of immunology. Immunity and immune responses: types (specific and non-specific). Humoral and cellular immunity
2	Complement system and Cells or tissues of immune system	1 hour	Understand the complement system and Cells or tissues of immune system.
3	Blood complete picture and their significance	1 hour	Understand the parameters of complete blood count and their significance with relevance to different diseases.
4	Antigens and immunogenicity	1 hour	Understand the antigens: structure (simple and complex molecules, proteins and polysaccharides) and immunogenicity.
5	Chemical basis, inheritance & clinical significance Blood group (ABO & Rh)	1 hour	Understand the Tissue antigens: the Allo- and heterophile antigens, and ABO and Rh blood group systems, their chemical basis, inheritance & clinical significance
6	Structure and function; classes, subclasses, types and subtypes; immunoglobulin genetics.	1 hour	Understand the Immunoglobulin: structure and function; classes, subclasses, types and subtypes; immunoglobulin genetics.
7	Policies/process in selection of a blood donor and blood donation procedure	1 hour	Understand the Policies/process in selection of a blood donor and blood donation procedure.
8	Methods and indications different cross matching and screening tests, their methods and its significance	1 hour	Understand the Different cross matching methods and indications (e.g., electronic, immediate-spin, antiglobulin) and donor Blood screening tests, their methods and its significance.
9	Mid-Term Exam		
10	Methods for detecting Antigen-antibody reactions	1 hour	Understand methods for detecting antigens and antibodies (agglutination, precipitation, complement fixation, EIA, etc.).
11	Immune-regulation and tolerance	1 hour	Understand the HLA & MHC and its role in immune response, disease and its significance in tissue transplantation and the Immune-regulation and tolerance.
12	Concepts of Cancer immunology	1 hour	Understand the concepts of Cancer immunology
13	Immunopathology and its significance	1 hour	Understand the immunopathology: hypersensitivity reactions, autoimmune diseases and immune-deficiencies.
14	Bone marrow aspiration	1 hour	Understand the technique of bone

	technique		marrow aspiration, its indication, contraindication, significance and complication.
15	Compatibility testing techniques	1 hour	Understand the Purpose and techniques of compatibility testing and Auto-transfusion.
16	Transfusion reactions pathophysiology	1 hour	Understand the types of Blood transfusion reactions (hemolytic and non-hemolytic), clinical manifestations, pathophysiology and complications.
17	Immunization and vaccines	1 hour	Understand the Immunization (methods of immunization, vaccines and adjuvants)
18	Final-Term Exam		

18 Weeks Lab Plan

Week #	Lab Topic	Duration 2CH	Outcome
1	Personal Protective measures	6 hours	Identify the personal protective safety measures.
2	Sample collection	6 hours	Demonstrate the sample collection procedures for haematology
3	Blood complete picture	6 hours	Perform the technique of complete blood count and differential WBC count on slide
4	Differential leucocyte count	6 hours	
5	Blood grouping (ABO & Rh)	6 hours	Perform the method of Blood grouping and Blood cross matching
6	Agglutination test (Widal test)	6 hours	Perform the Agglutination test (Widal test)
7	Immuno-diagnostic Methods	6 hours	Perform the Immuno-diagnostic Methods
8	Precipitation tests	6 hours	Perform the Precipitation tests
9	Mid-Term Exam		
10	Gel diffusion test	6 hours	Perform Gel diffusion test
11	Blood components preparation	6 hours	Demonstrate the preparation of Blood components
12	ICT Test	6 hours	Perform the ICT Test
13	Erythrocyte sedimentation Rate	6 hours	Perform the procedure of ESR
14	Haemoglobinopathies	6 hours	Interpret the Diagnostic studies for Haemoglobinopathies
15	Bone marrow aspiration	6 hours	Perform the procedure of bone marrow aspiration and trephine biopsy
16	Slide preparation and special	6 hours	Demonstrate the slide preparation and

	staining techniques for Bone marrow aspiration		special staining techniques of bone marrow aspiration Diagnose the bone marrow morphology on microscopy.
17	Reticulocyte stain preparation	6 hours	Perform the reticulocyte stain preparation and procedure
18	Final Term Exam		

Course Code	PAT 842
Credit hours	3(1+2)
Course Title	Microscopy and Staining Techniques
Pre-Requisite	Medical Microbiology
Course Objective	1. Describe advance concepts of Microscopy and principles of microscopic techniques. 2. Discuss different staining techniques, their principles and significance.
Course Outcome	Upon successful completion of the course, the students will be able to: Understand different microscopy techniques and variables used in microscopy and different staining techniques, their principles and significance.
Course Contents	Introduction to advanced microscopy, mechanisms involved in different microscopy techniques and the basic principles of advanced microscopy. Use of advanced microscopes including, microscope care, slide preparation and operating procedures of fluorescent microscopy, con-focal microscopy, flow cytometry and electron microscopy. Will also study the role of microscopy in basic medical research and diagnostics. The students will also learn standard operating procedures and data interpretation using specific software for these microscopes. Different Staining Techniques, their principles and significance.
Recommended Text Books	1. District laboratory practice in tropical countries by Monica Cheesbrough 2. Review of Medical Microbiology and Immunology by Warren Levinson
Recommended Reference Books	1. Greenwood D, Slack R, Peutherer J. Medical microbiology – Guide to microbial infections: pathogenesis, immunity, laboratory diagnosis and control, 16th edition, 2002. Churchill Livingstone, Elsevier. 2. Bradbury, S. (1968) The Microscope, past and present. Pergamon Press. 3. Turner, G. L'E. (1980) Essays on the history of the microscope. Senecio Publishing
Web and other resources	<u>Websites:</u> 1. American Society of Clinical Investigation 2. Microbiology: nature.com 3. Labmedicineblog.com <u>Journals:</u> 1.Journal of microscopy 2.Oxford journal of microscopy 3.Journal of microscopy and microanalysis 4.Journal of advanced microscopy research 5.Fluorescent microscopy journal 6.Journal of electron microscopy <u>Others:</u>

	1. Rost, F. W. D. (1991). Quantitative fluorescence microscopy. C. U. P. 2. Sanderson, J. B. (1994) Biological microtechnique. RMS Handbook No. 28. Bios press.
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18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 1CH	Outcome
1	Microscopical techniques used in microbiology	1 hour	Understand the microscopical techniques used in microbiology.
2	Different Types and parts of Microscope with their significance	1 hour	Explore Different Types of Microscope in detail along with its uses and parts of microscope and their functions.
3	Variables in microscopy	1 hour	Understand the variables used in microscopy. Quality control, care and maintenance of microscope.
4	Principles of optics and their application	1 hour	Understand the principles of optics that are applied in different microscopes and micrometry.
5	Smear preparation technique	1 hour	Understand the preparation and fixation of smear.
6	Staining-precautions	1 hour	Understand the precautions while staining smear.
7	Staining technique-procedures	1 hour	Understand different staining procedures used on tissue sections
8	Gram staining	1 hour	Understand the method of Gram technique and its significance
9	Mid-Term Exam		
10	Ziehl-Neelsen technique	1 hour	Understand the procedure of Ziehl-Neelsen technique.
11	Auramine-phenol technique	1 hour	Understand the principles of Auramine-phenol technique
12	Methylene blue technique	1 hour	Understand the method of Methylene blue technique
13	Wayson's bipolar staining	1 hour	Understand the method of Wayson's bipolar staining
14	Albert staining of volutin granules	1 hour	Understand Albert staining of volutin granules
15	Giemsa technique	1 hour	Understand the procedure and interpretation of Giemsa technique.
16	Acridine orange technique	1 hour	Elaborate the principles of Acridine orange technique.
17	Magnification of microscope's field	1 hour	Understand the magnification of microscope's field
18	Final Term Exam		

18 Weeks Lab Plan

Week #	Lab Topic	Duration 2CH	Outcome
1	Microscope-Types of microscope	6 hours	Identify different types of microscope in detail along with its uses
2	Microscope- Parts of microscope	6 hours	Identify the parts of microscope and their functions.
3	Slide preparation -precautions and steps	6 hours	Demonstrate the SOPs of microbiology laboratory while slide preparation.
4	Slide preparation - performance	6 hours	Perform smear making, fixation of smear (bacterial and fungal), and procedure of slide preparation with staining.
5	Slide preparation- Slide preparation with staining	6 hours	Perform different staining procedures are used on tissue sections.
6	Simple staining	6 hours	Perform the method of Gram technique and its significance.
7	Gram staining - performance	6 hours	
8	Gram staining- gram stained slides observation under microscope	6 hours	
9	Mid-Term Exam		
10	Ziehl-Neelsen technique	6 hours	Perform the procedure of Ziehl-Neelsen technique.
11	Auramine-phenol technique	6 hours	Perform the Auramine-phenol technique.
12	Methylene blue technique	6 hours	Perform the method of Methylene blue technique.
13	Wayson's bipolar staining	6 hours	Perform the method of Wayson's bipolar staining.
14	Albert staining	6 hours	Perform the Albert staining of volutin granules.
15	Giemsa technique-performance steps	6 hours	Perform the procedure and interpret the Giemsa technique in various infections.
16	Giemsa technique- interpretation of results	6 hours	
17	Acridine orange technique	6 hours	Demonstrate the Acridine orange technique.
18	Final Term Exam		

Course Code	PAT 843
Credit hours	3(1+2)
Course Title	Medical Parasitology
Pre-Requisite	Medical Microbiology
Course Objective	<ol style="list-style-type: none"> 1. Advance concepts of medical parasitology and molecular mechanism in spread of disease. 2. Parasitic pathogenesis 3. Laboratory diagnosis and interpretation of tests for different infection causing parasites.
Course Outcome	Upon successful completion of the course, the students will be able to: Understand the pathogenesis, immunity, epidemiology, clinical manifestations and diagnostic procedures of parasites.
Course Contents	Principles of medical parasitology including molecular mechanism involved in cellular physiology, growth, spread and disease causation. The molecular mechanism involved in maintenance of normal flora of body organs and parasitic pathogenesis and molecular mechanism of developing resistance. The course will also include the molecular methods in diagnosis of parasitic diseases, their pathogenesis in normal and immune-compromised host. The course will also include the development of anti-helminthic drugs and vaccines against different diseases. Parasitic interaction with their human host will be studied at molecular level including their genetic makeup and their genetic association with the development of resistance to the available therapies. The course will also include molecular mechanism involved in different systematic manifestations of parasitic infections and their association with the community and any outbreaks.
Recommended Text Books	<ol style="list-style-type: none"> 1. District laboratory practice in tropical countries by Monica Cheesbrough 2. Review of Medical Microbiology and Immunology by Warren Levinson
Recommended Reference Books	<ol style="list-style-type: none"> 1. Greenwood D, Slack R, Peutherer J. Medical microbiology – Guide to microbial infections: pathogenesis, immunity, laboratory diagnosis and control, 16th edition, 2002. Churchill Livingstone, Elsevier. 2. Collins CH, Lyne PM, Grange JM. Collins & Lyne's Microbiological methods. 8th edition 2004. Arnold publishers. 3. Webber R. Communicable disease epidemiology and control: A global perspective, 2nd edition, 2005. CABI Publishing
Web and other resources	<p><u>Websites:</u></p> <ol style="list-style-type: none"> 1. American Society of Clinical Investigation 2. Microbiology: nature.com 3. Labmedicineblog.com <p><u>Journals:</u></p> <ol style="list-style-type: none"> 1. Nature Reviews Microbiology 2. Archives and Microbiology 3. Cellular Microbiology 4. Critical Reviews in Microbiology 5. Journal of Molecular Microbiology and Biotechnology 6. Journal of Clinical Microbiology <p><u>Others:</u></p> <ol style="list-style-type: none"> 1. Webber R. Communicable disease epidemiology and control: A global perspective, 2nd edition, 2005. CABI Publishing

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 1CH	Outcome
1	Overview of Parasitology (classification of parasites)	1 hour	Understand the classification of parasites and techniques used for laboratory diagnosis of parasitic diseases.
2	Overview of Parasitology (laboratory diagnosis)	1 hour	
3	Parasitic pathogenesis and its molecular mechanism	1 hour	Understand the molecular mechanism involved in maintenance of normal flora of body organs and parasitic pathogenesis
4	Protozoa (flagellates) (Giardia, Trichomonas)	1 hour	Elaborate the relevant features and laboratory diagnosis and interpret protozoa, Flagellates
5	Protozoa (flagellates) (Trypanosoma, Leishmania)	1 hour	
6	Ciliates	1 hour	Elaborate the relevant features, laboratory diagnosis and interpret protozoa, Ciliates
7	Coccidia	1 hour	Elaborate the relevant features and laboratory diagnosis and interpret protozoa, Coccidia
8	Microsporidia	1 hour	Elaborate the relevant features, laboratory diagnosis and interpret protozoa, Single-celled organisms, Microsporidia
9	Mid-Term Exam		
10	Trematodes (Flukes)	1 hour	Elaborate the relevant features, laboratory diagnosis and interpret helminthes, Trematodes
11	Cestodes (Tapeworms) (Taenia)	1 hour	Elaborate the relevant features, laboratory diagnosis and interpret helminthes, Cestodes
12	Cestodes (Tapeworms) (Echinococcus, Diphyllobothrium)	1 hour	
13	Nematodes (Ascaris, Enterobius)	1 hour	Elaborate the relevant features, laboratory diagnosis and interpret Helminthes, Nematodes
14	Nematodes (Trichuris, Strongyloides, Ancylostoma, Necator, Filarial)	1 hour	
15	Nematodes (other tissue nematodes)	1 hour	
16	Standard anti-parasitic therapy	1 hour	Correlate anti-parasitic therapy with the signs and symptoms of disease.
17	Specific human and non-human parasitic diseases	1 hour	Assemble literature review on current topic in specific human and non-human parasitic diseases
18	Final Term Exam		

18 Weeks Lab Plan

Week #	Lab Topic	Duration 2CH	Outcome
1	Laboratory diagnosis of parasitic infections	6 hours	Identify the instruments used for laboratory diagnosis of parasitic infections.
2	Sample Collection and processing procedure	6 hours	Demonstrate the collection and processing of clinical samples
3	Immunology techniques	6 hours	Demonstrate the Immunology and molecular techniques used in
4	Molecular techniques	6 hours	laboratory for the diagnosis of different parasites.
5	Flagellates	6 hours	Demonstrate the detection and diagnosis of Flagellates.
6	Ciliates	6 hours	Perform the detection and diagnosis of Ciliates.
7	Plasmodium	6 hours	Demonstrate the detection and diagnosis of plasmodium in blood
8	ICT method	6 hours	
9	Mid-Term Exam		
10	Detection of Helminthes-1	6 hours	Demonstrate the detection and diagnosis with interpretation of Helminthes
11	Detection of Helminthes-2	6 hours	
12	Staining methods	6 hours	Perform different Staining methods
13	Stool examination	6 hours	Examine stool, urine and blood samples for the diagnosis of different parasitic infections and direct visualization in microscope.
14	Urine examination	6 hours	
15	Blood examination	6 hours	
16	Indirect hem-agglutination test	6 hours	Perform Indirect hem-agglutination test.
17	Discussion and Revision of practical	6 hours	
18	Final-Term Exam		

Course Code	PAT 844
Credit hours	3(1+2)
Course Title	Medical Mycology
Pre-Requisite	Medical Microbiology
Course Objective	<p>1. Describe advance concepts of medical Mycology and Molecular mechanism in spread of disease.</p> <p>2. Explain fungal pathogenesis.</p> <p>3. Describe laboratory diagnosis and interpretation of tests for different infection caused by fungi.</p>
Course Outcome	Upon successful completion of the course, the students will be able to: Identify and interpret the role of different diagnostic tests of fungal diseases.
Course Contents	Principles of medical mycology including molecular mechanism involved in cellular physiology, growth, spread and disease causation. The molecular mechanism involved in maintenance of normal flora of body organs and fungal pathogenesis and molecular mechanism of developing resistance. The course will also include the molecular methods in diagnosis of fungal diseases, their pathogenesis in normal and immunocompromised host. The course will also include the development of antifungal drugs and vaccines against different diseases. Fungal interaction with their human host will be studied at molecular level including their genetic makeup and their genetic association with the development of resistance to the available therapies. The course will also include molecular mechanism involved in different systematic manifestations of fungal infections and their association with the community and any outbreaks.
Recommended Text Books	<p>1. District laboratory practice in tropical countries by Monica Cheesbrough</p> <p>2. Review of Medical Microbiology and Immunology by Warren Levinson</p>
Recommended Reference Books	<p>1. Greenwood D, Slack R, Peutherer J. Medical microbiology – Guide to microbial infections: pathogenesis, immunity, laboratory diagnosis and control, 16th edition, 2002. Churchill Livingstone, Elsevier.</p> <p>2. Collins CH, Lyne PM, Grange JM. Collins & Lyne's Microbiological methods. 8th edition 2004. Arnold publishers.</p> <p>3. Webber R. Communicable disease epidemiology and control: A global perspective, 2nd edition, 2005. CABI Publishing</p>
Web and other resources	<u>Websites:</u> <p>1. American Society of Clinical Investigation</p> <p>2. Microbiology: nature.com</p> <p>3. Labmedicineblog.com</p> <u>Journals:</u> <p>1. Nature Reviews Microbiology</p> <p>2. Archives and Microbiology</p> <p>3. Cellular Microbiology</p> <p>4. Critical Reviews in Microbiology</p> <p>5. Journal of Molecular Microbiology and Biotechnology</p> <p>6. Medical Mycology</p> <u>Others:</u> <p>Webber R. Communicable disease epidemiology and control: A global perspective, 2nd edition, 2005. CABI Publishing</p>

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 1CH	Outcome
1	General characteristics of fungi	1 hour	Understand the general characteristics of fungi and discuss details of its structural parts.
2	Classification of fungi and their medical significance	1 hour	Understand the classification of fungi with medical significance.
3	Fungal Toxins & Allergies	1 hour	Understand the molecular mechanism involved in maintenance of normal flora of body organs and fungal pathogenesis
4	Features and laboratory tests of Cutaneous Mycoses (Dermatophytes)	1 hour	Understand the Pathology and laboratory diagnosis of Dermatophytoses, Tinea Versicolor and Tinea Nigra
5	Features and laboratory tests of Cutaneous Mycoses (Tinea)	1 hour	
6	Features and laboratory tests of Subcutaneous Mycoses (Sporotrichosis, Chromomycosis)	1 hour	Understand the Pathology and laboratory diagnosis of Sporotrichosis Chromomycosis Mycetoma
7	Features and laboratory tests of Subcutaneous Mycoses (Mycetoma)	1 hour	
8	Features and laboratory tests of Histoplasma infections	1 hour	Understand the procedures and interpretations of tests to make diagnosis of Histoplasma infections.
9	Mid-Term Exam		
10	Features and laboratory tests of Blastomyces dermatitidis	1 hour	Understand the features and laboratory tests of Blastomyces dermatitidis.
11	Features and laboratory tests of Coccidioides immitis and Paracoccidioides brasiliensis	1 hour	Understand the features and laboratory diagnosis of Coccidioides immitis and Paracoccidioides brasiliensis.
12	Standard Antifungal therapy	1 hour	Understand the standard antifungal drugs and vaccines in correlation with the clinical manifestation of diseases.
13	Features and laboratory tests of Candida albicans infections	1 hour	Understand the procedures and interpretations of tests to make diagnosis of Candida albicans infection.
14	Features and laboratory tests of Cryptococcus neoformans	1 hour	Understand the features and laboratory tests of Cryptococcus neoformans.
15	Features and laboratory tests of Aspergillus species	1 hour	Understand the procedures and interpretations of tests to make diagnosis of Aspergillus species.
16	Features and laboratory tests of Mucormycosis	1 hour	Understand the Fungi that cause mucormycosis.
17	Features and laboratory tests of Pneumocystis jiroveci	1 hour	Understand the methods and interpretations of tests to make diagnosis of Pneumocystis jiroveci.
18	Final-Term Exam		

18 Weeks Lab Plan

Week #	Lab Topic	Duration 2CH	Outcome
1	Laboratory diagnosis of fungal diseases	6 hours	Perform the laboratory diagnosis of fungal diseases
2	Isolation and identification of fungi from: Environment and Clinical samples.	6 hours	Perform the procedure to collect the specimen from environment and patients.
3	Direct microscopic examination-1	6 hours	Interpret microscopic examination of a KOH preparation revealing the presence of fungal structures.
4	Direct microscopic examination-2	6 hours	
5	Culture media- agar preparation	6 hours	Identify and prepare the agar to grow fungi.
6	Culture media- performance	6 hours	
7	Culture of the organism-specimen streaks on agar	6 hours	
8	Culture of the organism - growth of fungus	6 hours	
9	Mid-Term Exam		
10	Anti-fungal activity	6 hours	Determine the anti-fungal susceptibility of (nystatin, actidion, amphotericin B etc.)
11	Significance of edible fungi and their differentiation from poisonous species (Mushrooms)	6 hours	Identify the edible mushroom
12	DNA probe test-1	6 hours	Identify DNA probes to grow fungi in culture at a much earlier stage (i.e., when the colony size is much smaller).
13	DNA probe test-2	6 hours	
14	Disease specific tests	6 hours	Interpret the disease specific tests.
15	Serologic tests-fungal antigens	6 hours	Identify the tests for fungal antigens & antibodies and Latex agglutination test
16	Serologic tests-fungal Antibodies	6 hours	
17	Latex agglutination test	6 hours	
18	Final-Term Exam		

Course Code	PAT 845
Credit hours	3(1+2)
Course Title	Clinical Virology
Pre-Requisite	Medical Microbiology
Course Objective	<ol style="list-style-type: none"> 1. Describe advance concepts of Virology with relevance to disease diagnosis and molecular mechanism in spread and disease causation. 2. Discuss viral life cycle, replication and pathogenesis. 3. Describe laboratory diagnosis and interpretation of tests for viral infection.
Course Outcome	Upon successful completion of the course, the students will be able to: Identify, interpret the role of different diagnostic tests of viral diseases.
Course Contents	Principles of medical virology including molecular mechanism involved in viral life cycle and replication, spread and disease causation. The molecular mechanisms involved in viral pathogenesis and the development resistance. The course will also include the molecular methods in lab diagnosis of different viral diseases, development of antiviral agents and vaccines. The viral diseases spreading from animals to humans will also be studied at molecular level including viral genetic makeup and their genetic association with the development of resistance to the available antibiotics. The course will also include molecular mechanism involved in different systematic viral pathogens and their association with the community i.e. Hepatitis, HIV Aids and other sexually transmitted virus, Cancer causing viruses and other medically important viruses which may cause outbreaks. The course will also include antiviral therapy and antiviral drug development.
Recommended Text Books	<ol style="list-style-type: none"> 1. District laboratory practice in tropical countries by Monica Cheesbrough 2. Review of Medical Microbiology and Immunology by Warren Levinson
Recommended Reference Books	<ol style="list-style-type: none"> 1. Greenwood D, Slack R, Peutherer J. Medical microbiology – Guide to microbial infections: pathogenesis, immunity, laboratory diagnosis and control, 16th edition, 2002. Churchill Livingstone, Elsevier. 2. Collins CH, Lyne PM, Grange JM. Collins & Lyne's Microbiological methods. 8th edition 2004. Arnold publishers. 3. Webber R. Communicable disease epidemiology and control: A global perspective, 2nd edition, 2005. CABI Publishing
Web and other resources	<p><u>Websites:</u></p> <ol style="list-style-type: none"> 1. American Society of Clinical Investigation 2. Microbiology: nature.com 3. Labmedicineblog.com <p><u>Journals:</u></p> <ol style="list-style-type: none"> 1.Advances in Virus Research 2.Journal of virology 3.Nature Reviews Microbiology 4.Archives and Microbiology 5.Cellular Microbiology 6.Critical Reviews in Microbiology 7.Journal of Molecular Microbiology and Biotechnology 8.Journal of Microbiological Methods <p><u>Others:</u></p> <ol style="list-style-type: none"> Webber R. Communicable disease epidemiology and control: A global perspective, 2nd edition, 2005. CABI Publishing

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 1CH	Outcome
1	General characteristics of viruses	1 hour	Understand the Principles of medical virology including molecular mechanism involved in viral life cycle and replication, spread and disease causation.
2	Classification of viruses	1 hour	
3	Viral replicative cycle	1 hour	
4	Diagnosis of the viral diseases	1 hour	
5	Features and laboratory interpretations of Arbovirus	1 hour	Understand the Features and laboratory interpretations of Arbovirus.
6	Features and laboratory interpretations of Hepatitis viruses	1 hour	Classify the features of Hepatitis viruses with its laboratory interpretations.
7	Features and laboratory interpretations of Poliovirus	1 hour	Understand the pathogenesis, clinical features, diagnostic and preventive measures of poliovirus.
8	Features and laboratory interpretations of Human immunodeficiency virus (HIV)	1 hour	Understand the features and Interpret testing techniques Human immunodeficiency virus (HIV) and briefly discuss WHO recommended Strategies.
9	Mid-Term Exam		
10	Features and laboratory interpretations of Herpes viruses	1 hour	Understand the features of Herpes viruses with its laboratory interpretations.
11	Features and laboratory interpretations of Arthomyxovirus	1 hour	Understand the pathogenesis, clinical features, diagnostic and preventive measures of Arthomyxovirus.
12	Features and laboratory interpretations of Paramyxovirus	1 hour	Understand the pathogenesis, clinical features, diagnostic and preventive measures of Paramyxovirus.
13	Features and laboratory interpretations of Toga virus	1 hour	Understand the pathogenesis, clinical features, diagnostic and preventive measures of Toga virus.
14	Features and laboratory interpretations of SARS	1 hour	Understand the pathogenesis, clinical features, diagnostic and preventive measures of SARS
15	Features and laboratory interpretations of Rhabdovirus	1 hour	Understand the pathogenesis, clinical manifestations, diagnostic and preventive measures of Rhabdovirus.
16	Recombinant Viral vaccines	1 hour	Comprehend the basic concepts and mechanisms of Recombinant Viral vaccines Antiviral therapy susceptibility.
17	Antiviral therapy susceptibility	1 hour	
18	Final-Term Exam		

18 Weeks Lab Plan

Week #	Lab Topic	Duration 2CH	Outcome
1	Cell Culture	6 hours	Identify the presence of a virus in a patient's specimen in various cell culture procedures.
2	Complement Fixation-1	6 hours	Identify the presence of a virus in a patient's specimen through complement fixation.
3	Complement Fixation-2	6 hours	
4	Haem-agglutination Inhibition	6 hours	Identify the presence of a virus in a patient's specimen through Hem-agglutination Inhibition.
5	Neutralization	6 hours	Identify the presence of a virus in a patient's specimen through Neutralization.
6	Fluorescent Antibody Assay	6 hours	Identify the presence of a virus in a patient's specimen through Fluorescent Antibody Assay.
7	Radioimmunoassay	6 hours	Identify the presence of a virus in a patient's specimen through Radioimmunoassay and differentiating it from other immunoassays.
8	Immunoassay	6 hours	
9	Mid-Term Exam		
10	Chick embryo inoculation	6 hours	Identify the process of Chick embryo inoculation and presence of a virus in a patient's specimen through ELISA.
11	Enzyme-Linked Immunosorbent Assay (ELISA)	6 hours	
12	Immuno-electron Microscopy	6 hours	Identify the presence of a virus in a patient's specimen through Immuno-electron Microscopy.
13	Microscopic Identification	6 hours	Identify the presence of a virus in a patient's specimen through Microscopy.
14	Serologic Procedures	6 hours	Identify the presence of a virus in a patient's specimen through Serology.
15	Detection of Viral Antigens	6 hours	Identify the presence of a virus in a patient's specimen through Viral Antigen detection.
16	Polymerase chain reaction (PCR)-1	6 hours	Identify the presence of a virus in a patient's various specimens through PCR.
17	Polymerase chain reaction (PCR)-2	6 hours	
18	Final-Term Exam		

Course Code	PAT 846
Credit hours	3(1+2)
Course Title	Infection Control
Pre-Requisite	Medical Microbiology
Course Objective	<ol style="list-style-type: none"> Understand regarding prevention of laboratory associated infections. Elaborate the biological safety techniques, decontamination, recycling, and disposal of laboratory waste. Identify potential hazardous biological materials and the risks associated with them. Describe the bio-risk management program.
Course Outcome	Upon successful completion of the course, the students will be able to: Understand the biological safety techniques, decontamination, recycling, and disposal of laboratory waste and bio-risk management program.
Course Contents	Understand regarding prevention of laboratory associated infections. Classification of infective microorganisms. Techniques of working safely to prevent laboratory related infections. Classify and elaborate Biological safety cabinets. Identify safe laboratory premise and personal safety measures. Identify safe transport of specimens. Demonstrate the responsibility of a laboratory for safe decontamination, recycling, and disposal of laboratory waste. Elaborate methods used to decontaminate and disposal of infectious material in district laboratories. Cleaning and Sterilization of reusable items. Laboratory autoclave technique and its usage. Handling of Incubator, water bath, heat block to minimize infectious spread. Identify the methods, use and care of mixers. Identify the procedure, use and care of different general laboratory-wares. Identify potential hazardous biological materials and the risks associated with them. Select appropriate means to minimize risk and to protect against or prevent exposure. Recognize applicable legal requirements and prepare the necessary documents to obtain authorizations. Understand how to run a bio-risk management program.
Recommended Text Books	<ol style="list-style-type: none"> District laboratory practice in tropical countries by Monica Cheesbrough Review of Medical Microbiology and Immunology by Warren Levinson
Recommended Reference Books	<ol style="list-style-type: none"> Greenwood D, Slack R, Peutherer J. Medical microbiology – Guide to microbial infections: pathogenesis, immunity, laboratory diagnosis and control, 16th edition, 2002. Churchill Livingstone, Elsevier. Collins CH, Lyne PM, Grange JM. Collins & Lyne's Microbiological methods. 8th edition 2004. Arnold publishers. Webber R. Communicable disease epidemiology and control: A global perspective, 2nd edition, 2005. CABI Publishing
Web and other resources	<p><u>Websites:</u></p> <ol style="list-style-type: none"> American Society of Clinical Investigation Centers for Disease Control and Prevention <p><u>Journals:</u></p> <ol style="list-style-type: none"> Journal of Clinical Microbiology Journal of Infectious Diseases <p><u>Others:</u></p> <ol style="list-style-type: none"> Microbiology: nature.com Labmedicineblog.com

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 1CH	Outcome
1	Prevention of laboratory infections-classification of infective microorganisms	1 hour	Understand prevention of laboratory associated infections. Classification of infective microorganisms.
2	Prevention of laboratory infections- Working safely	1 hour	Discuss techniques of working safely to prevent laboratory related infections.
3	Biological safety cabinets	1 hour	Classify and elaborate Biological safety cabinets.
4	Personal safety measures	1 hour	Identify safe laboratory premise and personal safety measures.
5	Safe transportation	1 hour	Identify safe transport of specimens.
6	Disposal of infectious material- Responsibilities	1 hour	Describe the responsibility of a laboratory for safe decontamination, recycling, and disposal of laboratory waste.
7	Disposal of infectious material- Methods	1 hour	Elaborate methods used to decontaminate and disposal of infectious material in district laboratories.
8	Sterilization of reusable items	1 hour	Understand the cleaning and sterilization of reusable items.
9	Mid-Term Exam		
10	Laboratory autoclave technique	1 hour	Understand the Laboratory autoclave technique and its usage.
11	Laboratory wares-1	1 hour	Identify the procedure, use and care of different general laboratory-wares.
12	Laboratory wares-2	1 hour	Understand the handling of Incubator, water bath, heat block to minimize infectious spread.
13	Mixers	1 hour	Identify the methods, use and care of mixers.
14	Hazardous biological materials	1 hour	Identify potential hazardous biological materials and the risks associated with them.
15	Selection of appropriate means to minimize risk and to protect against or prevent exposure.	1 hour	Select appropriate means to minimize risk and to protect against or prevent exposure.
16	Legal requirements and preparation of the necessary documents	1 hour	Recognize applicable legal requirements and prepare the necessary documents to obtain authorizations.
17	Bio-risk management	1 hour	Understand how to run a bio-risk management program.
18	Final Term Exam		

18 Weeks Lab Plan

Week #	Lab Topic	Duration 2CH	Outcome
1	Isolation and screening of microorganism microbial-extracellular metabolites	6 hours	Isolate and screen the microbial extracellular metabolites, enzymes and antimicrobial agents
2	Isolation and screening of microorganism enzymes and antimicrobial agents	6 hours	
3	Citric acid fermentation	6 hours	Perform the process of citric acid fermentation.
4	Fermentation	6 hours	Identify the hazardous environment, chemicals, biological factors and radiations Formulate the field rules and regulation
5	Industrial bio-hazards	6 hours	
6	Components of biosafety environment in lab	6 hours	Identify the components of Biosafety in laboratory Identify the personal Protective measures and equipment used in laboratory
7	Protective measures and equipment	6 hours	
8	Biosafety levels	6 hours	
9	Mid-Term Exam		
10	Isolation of antibiotic resistant bacteria	6 hours	Isolate antibiotic resistant bacteria from environment
11	Laboratory wares-1	6 hours	Demonstrate the handling of Incubator, water bath, heat block to minimize infectious spread. Perform sterilization procedures
12	Laboratory wares-2	6 hours	
13	Sterilization procedures	6 hours	
14	Laboratory autoclave technique	6 hours	Demonstrate the use of laboratory autoclave
15	Collection and safe handling of samples	6 hours	Collect and safely handle the samples for storage or transportation.
16	Enzyme immobilization	6 hours	Isolate the microbial enzymes
17	Industrially important enzymes	6 hours	Identify the steps of production of industrially important enzymes from microbes
18	Final-Term Exam		

Course Code	PAT 847
Course Title	Serology
Pre-Requisite	Medical Microbiology
Course Objective	1. Describe advanced concepts of serology and general Immunology. 2. Describe different techniques of serological tests with their application.
Course Outcome	Upon successful completion of the course, the students will be able to: Explore the advance concepts of serology and different techniques of serological tests with their application.
Course Contents	General Immunology including Innate versus acquired immunity and Antigen versus antibodies. Categorize serological tests; Precipitation tests and their types. Antigen, Properties of Antigen, Types of antigens, Antibodies, Structure of antibodies, Classes of antibodies, Antigen-antibody interaction. List factors which affect antigen-antibody reaction. Method of Agglutination Precipitation (Precipitin). Principles of Radioimmunoassay (RIA). Procedure of Enzyme-Linked Immunosorbent Assay (ELISA). Method of Immunofluorescence (Fluorescent Antibody). Principles of Complement Fixation. Principles of Neutralization Tests. Method of Immune Complexes. Principles of Hem-agglutination Tests. Technique of Antiglobulin (Coombs) Test. Method of Western Blot (Immunoblot). Principles of Fluorescence-Activated Cell Sorting (Flow Cytometry). Application of such tests to relevant cases of disease. Advantages and Disadvantages of different immunological techniques
Recommended Text Books	1. District laboratory practice in tropical countries by Monica Cheesbrough 2. Review of Medical Microbiology and Immunology by Warren Levinson
Recommended Reference Books	1. Greenwood D, Slack R, Peutherer J. Medical microbiology – Guide to microbial infections: pathogenesis, immunity, laboratory diagnosis and control, 16th edition, 2002. Churchill Livingstone, Elsevier. 2. Collins CH, Lyne PM, Grange JM. Collins & Lyne's Microbiological methods. 8th edition 2004. Arnold publishers. 3. Webber R. Communicable disease epidemiology and control: A global perspective, 2nd edition, 2005. CABI Publishing
Web and other resources	<u>Websites:</u> 1. American Society of Clinical Investigation 2. American Society of Immunologists <u>Journals:</u> 1. Journal of Clinical Microbiology 2. Journal of Infectious Diseases <u>Others:</u> 1. Microbiology: nature.com 2. Labmedicineblog.com

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 1CH	Outcome
1	General Immunology	1 hour	Understand the General Immunology including Innate versus acquired immunity and Antigen versus antibodies.
2	Basics of Serological tests	1 hour	Understand the basics of serological tests; Precipitation tests and their types.
3	Antigen-Antibody reaction	1 hour	Understand properties of antigen, types, antibodies, structure of antibodies, classes, antigen-antibody interaction, factors affecting antigen-antibody reaction
4	Principles of Agglutination Precipitation (Precipitin)	1 hour	Understand the method of Agglutination Precipitation (Precipitin).
5	Principles of Radioimmunoassay (RIA)	1 hour	Describe the principles of Radioimmunoassay (RIA).
6	Principles of Enzyme-Linked Immunosorbent Assay (ELISA)	1 hour	Describe the procedure of Enzyme-Linked Immunosorbent Assay (ELISA).
7	Principles of Immunofluorescence (Fluorescent Antibody)	1 hour	Describe the method of Immunofluorescence (Fluorescent Antibody).
8	Principles of Complement Fixation	1 hour	Comprehend the principles of Complement Fixation.
9	Mid-Term Exam		
10	Principles of Neutralization Tests	1 hour	Comprehend the principles of Neutralization Tests.
11	Principles of Immune Complexes	1 hour	Understand the method of Immune Complexes.
12	Principles of Hemagglutination Tests	1 hour	Describe the principles of Hemagglutination Tests.
13	Principles of Antiglobulin (Coombs) Test	1 hour	Understand the technique of Antiglobulin (Coombs) Test.
14	Principles of Western Blot (Immunoblot)	1 hour	Describe the method of Western Blot (Immunoblot).
15	Principles of Fluorescence-Activated Cell Sorting (Flow Cytometry)	1 hour	Describe the principles of Fluorescence-Activated Cell Sorting (Flow Cytometry).
16	Principles of Immunological techniques	1 hour	Understand the application of such tests to relevant cases of disease.
17	Advantages and disadvantages Immunological techniques	1 hour	Understand the advantages and disadvantages of different immunological techniques
18	Final-Term Exam		

18 Weeks Lab Plan

Week #	Lab Topic	Duration 2CH	Outcome
1	Serological tests	6 hours	Perform the serological and precipitation tests.
2	Precipitation tests	6 hours	
3	Antigen-Antibody reaction	6 hours	Interpret the Antigen-antibody interaction.
4	Agglutination Precipitation (Precipitin)	6 hours	Perform the Agglutination Precipitation (Precipitin) test
5	Radioimmunoassay (RIA)	6 hours	Identify the steps of Radioimmunoassay (RIA).
6	Enzyme-Linked Immunosorbent Assay (ELISA)	6 hours	Demonstrate the procedure of Enzyme-Linked Immunosorbent Assay (ELISA).
7	Immunofluorescence (Fluorescent Antibody)	6 hours	Perform the method of Immunofluorescence (Fluorescent Antibody).
8	Complement Fixation	6 hours	Perform the procedure for complement Fixation
9	Mid-Term Exam		
10	Neutralization Tests	6 hours	Perform the Neutralization Tests.
11	Immune Complexes	6 hours	Evaluate the method of Immune Complexes.
12	Haem-agglutination Tests	6 hours	Perform the Haem-agglutination Tests.
13	Antiglobulin (Coombs) Test	6 hours	Perform the technique of Antiglobulin (Coombs) Test.
14	Western Blot (Immunoblot)	6 hours	Demonstrate the method of Western Blot (Immunoblot).
15	Fluorescence-Activated Cell Sorting (Flow Cytometry)	6 hours	Identify the steps of Fluorescence-Activated Cell Sorting (Flow Cytometry).
16	Culture of immune cells	6 hours	Culture the immune cells Perform various methods of Immuno-chromatography
17	Immunochromatography	6 hours	
18	Final-Term Exam		

PATHOLOGY-HISTOPATHOLOGY

ELECTIVE COURSE LIST - PATHOLOGY – HISTOPATHOLOGY

Sr. No.	Course Code	Course Title	Credit hours	Theory	Practical
1	PAT 848	Research oriented Pathology	3(3+0)	3	0
2	PAT 849	Biomarkers in histopathology	3(2+1)	2	1
3	PAT 850	Cancer genetics	3(3+0)	3	0
4	PAT 851	Bioinformatics in Pathology	3(2+1)	2	1
5	PAT 852	Molecular genetics	3(3+0)	3	0
6	PAT 853	Immunological Pathology	3(3+0)	3	0
7	PAT 854	Biosafety	3(2+1)	2	1
8	PAT 855	Molecular Medicine	3(3+0)	3	0

DETAILED COURSE OUTLINES - ELECTIVE COURSES - PATHOLOGY – HISTOPATHOLOGY

Course Code	PAT 848
Credit hours	3(3+0)
Course Title	Research Oriented Pathology
Pre-Requisite	Concepts of general and systemic pathology
Course Objective	<p>1. Comprehend Molecular processes underlying non-neoplastic and neoplastic diseases</p> <p>2. Describe the role of inflammation and immune-mediated mechanisms in disease process</p> <p>3. Discuss the pathogenic mechanisms underlying ischemic heart disease, vascular disorders and tumors with regards to latest advancements in research</p> <p>4. Understand the molecular mechanisms for neoplastic lung diseases and discuss new developments in this field</p> <p>5. Describe the pathogenic mechanisms underlying COPD and other inflammatory lesions of the respiratory tract with respect to latest developments in research</p> <p>6. Explain the mechanisms leading to various inflammatory and non-inflammatory lesions of the gastrointestinal tract and discuss latest developments in this regard</p> <p>7. Discuss latest developments in understanding the role of genetic alterations and molecular mechanisms underlying evolution of benign and malignant tumors of the gastrointestinal tract</p> <p>8. Comprehend the pathogenic basis of inflammatory and neoplastic hepatic diseases and discuss latest research in this regard</p> <p>9. Relate the role of inflammatory and immune mediated mechanisms to the development of inflammatory renal diseases with respect to current advancements in this area</p> <p>10. Understand molecular mechanisms underlying the development of neoplastic lesions of the urinary tract and discuss relevant research advancements</p> <p>11. Discuss current advancements in comprehending pathogenic mechanisms underlying the development of testicular and prostate carcinomas</p> <p>12. Describe the pathogenic mechanism for various non-neoplastic diseases of the female genital tract and discuss the relevant literature</p> <p>13. Elaborate upon the molecular mechanisms underlying development of tumors of the female genital tract with respect to latest research</p> <p>14. Comprehend the molecular mechanisms underlying development of breast carcinomas and discuss various molecular types of breast cancers with respect to the latest research in this regard</p> <p>15. Correlate the development of neoplastic and non-neoplastic lesions of endocrine glands with molecular and immune mediated disease mechanisms and discuss the relevant literature</p> <p>16. Discuss the latest research advancements with regards to the molecular pathogenic mechanisms underlying degenerative and neoplastic lesions of the Central nervous system</p> <p>17. Describe the role of environmental and genetic mechanisms underlying</p>

	<p>tumorous and non-tumorous musculo-skeletal diseases in the light of current research</p> <p>18. Explain the immune mechanisms and genetic alterations underlying the development of inflammatory skin lesions and skin tumors with regards to the current research</p>
Course Outcome	<p>Upon completion of course the students will be able to:</p> <ol style="list-style-type: none"> 1. Discuss the pathogenesis of various diseases of the heart and blood vessels 2. Describe etiology, pathogenesis, histology and clinical features of disorders related to the respiratory system 3. Describe molecular mechanisms of various diseases of the gastro-intestinal and hepato-biliary systems 4. Discuss various lesions pertaining to the urinary tract, female and male genital tract and breast, with regards to their pathogenesis 5. Explain pathophysiological basis and consequences of specific endocrine disorders 6. Describe the pathogenesis of various diseases involving the musculoskeletal system and soft tissues 7. Describe the pathological mechanisms for various CNS and skin diseases
Course Contents	Pathogenesis of diseases related to the urinary tract, male and female genital tract, breast, endocrine organs, cardiovascular system, central nervous system, skin, bones and joints, gastro-intestinal, hepatobiliary and respiratory systems with regards to the current advancements in research
Recommended Text Books	<p>(Latest Edition of all mentioned books should be referred)</p> <ul style="list-style-type: none"> • Cotran RS, Kumar V and Collins T. Robbin's Pathologic Basis of Disease (10th ed.). Philadelphia: W.B. Saunders • Kumar V, Cotran RS, and Robbins SL. Basic Pathology (10th ed.) Philadelphia: W.B. Saunders • Rubin E, Pathology (7th ed.) Philadelphia: Lippincott-Raven
Recommended Reference Books	Molecular pathology. William B. Coleman and Gregory J. Tsongalis. Elsevier 2018
Web and other resources	<p><u>Websites:</u></p> <p>https://pubmed.ncbi.nlm.nih.gov/ https://www.medscape.com/ https://www.bmjjournals.org/ https://www.thelancet.com/ https://journals.lww.com/ajsp/pages/currenttoc.aspx https://www.cell.com/ https://www.nature.com/</p> <p><u>Journals:</u></p> <ol style="list-style-type: none"> 1. American journal of surgical pathology 2. Histopathology 3. Cell 4. Lancet 5. British medical journal <p><u>Others:</u></p> <p>Molecular Pathology in Clinical Practice. Debra G.B. Leonard Springer link 2016</p>

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 3 CH	Outcome
1	Molecular and immunological basis of diseases	3 hours	Describe the molecular and immunological processes underlying disease development
2	Pathogenic mechanisms of cardiovascular disorders	3 hours	Discuss the latest development in understanding the processes leading to diseases of CVS
3	Pathogenesis of neoplastic and non-neoplastic diseases of respiratory system	3 hours	Describe the disease processes for respiratory disorders with regards to the latest literature
4	Pathological processes underlying gastrointestinal pathologies	3 hours	Comprehend disease processes underlying GI disorders with regards to new developments
5	Pathogenesis of various hepatobiliary diseases	3 hours	Discuss the latest developments in understanding disease development for hepatobiliary disorders
6	Pathogenesis of renal diseases	3 hours	Discuss the latest research advancements with regards to the molecular pathogenic mechanisms underlying renal diseases
7	Molecular pathogenesis of tumors of male genital tract	3 hours	Describe the current advancements in comprehending pathogenic mechanisms underlying the development of testicular and prostate carcinomas
8	Pathogenesis of neoplastic and non-neoplastic diseases of female genital tract	3 hours	Comprehend the pathogenic mechanism for various neoplastic and non-neoplastic diseases of the female genital tract and discuss the relevant literature
9	Mid-Term Exam		
10	Molecular pathogenesis of breast carcinomas	3 hours	Comprehend the molecular mechanisms underlying development of breast carcinomas
11	Pathogenesis of diseases of endocrine glands	3 hours	Correlate the clinical features of endocrine disorders with mechanisms underlying disease development
12	Pathological mechanisms underlying degenerative and neoplastic lesions of the Central nervous system	3 hours	Comprehend the pathogenic mechanisms for development of degenerative and neoplastic diseases of CNS
13	Pathogenesis of diseases involving the bones	3 hours	Describe the role of environmental and genetic mechanisms underlying skeletal diseases in the light of current research
14	Pathogenesis of soft tissue tumors and skeletal muscle disorders	3 hours	Discuss the pathogenesis of muscular dystrophies and soft tissue tumors with regards to current advances in research
15	Pathogenesis of inflammatory	3 hours	Discuss the current research pertaining to

	and neoplastic skin lesions		molecular mechanisms underlying various skin diseases
16	Literature discussion: Molecular pathways driving pathogenesis of prevalent diseases-(Breast, colorectal, lung, prostate carcinomas)	3 hours	Discuss recent advances in discerning the molecular pathways involved in the pathogenesis of prevalent diseases in Pakistan
17	Literature discussion: Molecular pathways driving pathogenesis of prevalent diseases- (Autoimmune disorders)	3 hours	Discuss recent advances in discerning the molecular pathways involved in the pathogenesis of prevalent diseases in Pakistan
18	Final-Term Exam		

Course Code	PAT 849
Credit hours	3(2+1)
Course Title	Biomarkers in Histopathology
Pre-Requisite	Concepts of general and systemic pathology
Course Objective	<ol style="list-style-type: none"> 1. Describe various histological and molecular biomarkers 2. Discuss the various techniques for identification of tissue and blood biomarkers 3. Discuss the significance of histological biomarkers in disease diagnosis and prognosis 4. Discuss the significance of histological biomarkers in disease treatment 5. Explain the histopathological techniques for identification of biomarkers 6. Comprehend the role of histological biomarkers in research 7. Describe various molecular markers and their role in early diagnosis of disease 8. Explain various techniques for identification of molecular biomarkers and their clinical applications 9. Discuss the significance of molecular biomarkers in research 10. Describe the principals, processes and applications of selected techniques for detection of biomarkers 11. Perform immune-histochemical techniques for detection of tissue biomarkers 12. Perform PCR and RT-PCR for detection of various molecular biomarkers 13. Interpret the results of various techniques (IHC, FISH, DNA/RNA Sequencing) utilized for detection of biomarkers 14. Apply the knowledge of various biomarkers for diagnostic, prognostic and therapeutic purposes
Course Outcome	<p>After completion of this course the students of PhD program will be able to:</p> <ol style="list-style-type: none"> 1. Enlist important histopathological and molecular biomarkers and their origin 2. Explain the significance of biomarkers in the field of histopathology 3. Describe the pathway of biomarker from discovery to clinical application 4. Discuss the role of biomarkers in research 5. Interpret the histo-morphology of various biomarkers in histopathology 6. Explain the advanced and predictive histopathology (e.g. IHC, FISH, RT-PCR) based on biomarkers 7. Relate biomarkers to clinical outcomes

	<p>8. Explain the relation of biomarkers to organ and organ systems 9. Describe the systemic manifestation of a pathological condition in relation to diagnostic and research biomarkers 10. Interpretation of IHC, FISH and PCR based biomarkers detection 11. Interpret various statistical models related to biomarkers research</p>
Course Contents	Biomarkers and their discovery, validation, clinical application etc. Diagnostic, Prognostic, Predictive biomarkers, Interpretation and application of biomarkers
Recommended Text Books	(Latest Edition of all mentioned books should be referred) <ul style="list-style-type: none"> • Cotran RS, Kumar V and Collins T. Robbin's Pathologic Basis of Disease (10th ed.). Philadelphia: W.B. Saunders • Kumar V, Cotran RS, and Robbins SL. Basic Pathology (10th ed.) Philadelphia: W.B. Saunders • Rubin E, Pathology (7th ed.) Philadelphia: Lippincott-Raven
Recommended Reference Books	Rosai and Ackerman's Surgical Pathology, 11th edition
Web and other resources	<u>Websites:</u> https://pubmed.ncbi.nlm.nih.gov/ https://www.medscape.com/ https://www.bmjjournals.org/ https://www.thelancet.com/ https://journals.lww.com/ajsp/pages/currenttoc.aspx https://www.cell.com/ https://www.nature.com/ <u>Journal:</u> 1. American journal of surgical pathology 2. Oncology 3. Histopathology 4. Cell 5. Lancet oncology <u>Others:</u> Sternberg's Diagnostic Surgical Pathology, 7th edition

18 week lecture plan

Week #	Lecture Topic	Duration 2CH	Outcome
1	Introduction to biomarkers	2 hours	Describe various histological and molecular biomarkers
2	Techniques for detection of biomarkers	2 hours	Discuss the various techniques for identification of tissue and blood biomarkers
3	Diagnostic histological biomarkers for non-neoplastic lesions	2 hours	Discuss the significance of histological biomarkers in disease diagnosis and prognosis
4	Diagnostic histological biomarkers for neoplastic lesions	2 hours	Discuss the significance of histological biomarkers in disease diagnosis and prognosis

5	Tissue markers in disease therapeutics	2 hours	Discuss the significance of histological biomarkers in disease treatment
6	Immunohistochemistry: principles process and applications	2 hours	Describe the principals, processes and applications of selected techniques for detection of biomarkers
7	Identification of histological markers: applications	2 hours	Explain the histopathological techniques for identification of biomarkers and their clinical applications
8	Histological markers in research	2 hours	Comprehend the role of histological biomarkers in research
9	Mid-Term Exam		
10	Diagnostic molecular markers- non-neoplastic lesions	2 hours	Describe various molecular markers and their role in early diagnosis of disease
11	Diagnostic molecular markers- neoplastic lesions	2 hours	Describe various molecular markers and their role in early diagnosis of disease
12	Molecular biomarkers: techniques	2 hours	Explain various techniques for identification of molecular biomarkers and their clinical applications
13	Molecular biomarkers: applications	2 hours	Explain various techniques for identification of molecular biomarkers and their clinical applications
14	Molecular biomarkers and research	2 hours	Discuss the significance of molecular biomarkers in research
16	PCR and RT-PCR principles, process and applications	2 hours	Describe the principals, processes and applications of selected techniques for detection of biomarkers
17	Next generation sequencing techniques: principles, process and applications	2 hours	Describe the principals, processes and applications of selected techniques for detection of biomarkers
18	Final-Term Exam		

18 weeks practical plan

Week #	Lecture Topic	Duration 1 CH	Outcome
1	Tissue fixation and processing	3 hours	Perform tissue fixation and processing of tissue in histopathology
2	Tissue sectioning and staining	3 hours	Perform sectioning of processed tissue and H&E staining
3	Immunohistochemistry	3 hours	Perform immune-histochemical staining and interpret the results
4	Immunohistochemistry	3 hours	Perform immune-histochemical staining and interpret the result
5	In-situ hybridization (FISH)	3 hours	Perform the process of FISH and interpret the results
6	In-situ hybridization (ISH)	3 hours	Perform the process of ISH and interpret the results
7	Polymerase chain reaction:	3 hours	Perform PCR and gel electrophoresis

	process and performance		
8	Polymerase chain reaction: Interpretation of the results	3 hours	Interpret the results of Polymerase chain reaction
9	Mid-Term Exam		
10	RT-PCR: RNA extraction	3 hours	Perform RT-PCR
11	RT-PCR: Interpretation	3 hours	Interpret the results of RT-PCR
12	Next generation sequencing: DNA sequencing	3 hours	Perform the process for DNA sequencing
13	Next generation sequencing: RNA process	3 hours	Perform the process for RNA sequencing
14	Next generation sequencing: data analysis	3 hours	Analyze and interpret NGS data
15	Next generation sequencing: variant calling	3 hours	Analyze and interpret NGS data for identification of actionable variants
16	Comparison of data	3 hours	Compare the analyze the data with available information
17	Revision of practical	3 hours	Discussion & revision of labs.
18	Final-Term Exam		

Course Code	PAT 850
Credit hours	3(3+0)
Course Title	Cancer Genetics
Pre-Requisite	Concepts of general pathology and basic genetics
Course Objective	<ol style="list-style-type: none"> 1. Describe the characteristic features of benign and malignant tumors with regards to their biological behavior and structural alterations 2. Discuss the interaction between genetics and environmental factors in carcinogenesis 3. Comprehend the role of genetic and epigenetic alterations in the pathogenesis of cancer 4. Describe the various pathways and the underlying mechanisms for invasion and metastasis of cancers 5. Elaborate the inflammatory pathways involved in cancer development 6. Discuss the mechanisms for evasion of host defenses by tumors 7. Describe the role of oncogenic viruses, radiation, chemicals and other environmental factors in causing cancer 8. Discuss the genetic predisposition to cancers with regards to the common hereditary cancer syndromes 9. Discuss the role of genetic counselling in cases of familial cancer syndromes 10. Describe the significance of molecular markers in cancer diagnosis, prognosis and therapeutics 11. Discuss the molecular diagnostic techniques of cancer 12. Elaborate upon the advances in cancer therapeutics with special emphasis on gene therapy
Course Outcome	<p>Upon completion, of course the students will be able to:</p> <ol style="list-style-type: none"> 1. Discuss the molecular and cellular events involved in tumor formation, progression and metastasis 2. Understand how genetics contributes to predisposition and progression of

	<p>cancer</p> <ol style="list-style-type: none"> 3. Identify common indications for referring a patient to cancer genetic services 4. Describe the different hereditary cancer syndromes with regards to their inheritance patterns and underlying molecular mechanisms 5. Construct pedigree charts for genetic counseling 6. Discuss advances in cancer diagnosis and cancer therapy
Course Contents	Cellular and molecular events involved in tumor formation, progression and metastasis, hereditary cancer syndromes and pedigree analysis, genetic counseling, specific examples of hereditary cancers, advances in cancer diagnosis and therapeutics with special emphasis on gene expression and gene therapy.
Recommended Text Books	<p>(Latest Edition of all mentioned books should be referred)</p> <ul style="list-style-type: none"> • Cotran RS, Kumar V and Collins T. Robbin's Pathologic Basis of Disease (10th ed.). Philadelphia: W.B. Saunders • Kumar V, Cotran RS, and Robbins SL. Basic Pathology (10th ed.) Philadelphia: W.B. Saunders • Rubin E, Pathology (7th ed.) Philadelphia: Lippincott-Raven
Recommended Reference Books	<ul style="list-style-type: none"> • Molecular pathology. William B. Coleman and Gregory J. Tsongalis. Elsevier 2018 • Douglas Hanahan and Robert A. Weinberg (2011) Hallmarks of cancer, The Next Generation. Cell 144(5):646-674 • Thompson and Thompson. Genetics in Medicine. 7th Ed. Philadelphia, PA • Helen M Kingston. ABC of clinical genetics 3rd Ed. BMJ Books, London • Laura M. Gunder Scott A. Martin. Essentials of Medical Genetics for Health Professionals. Jones & Bartlett Learning Canada
Web and other resources	<p><u>Websites:</u></p> <p>https://pubmed.ncbi.nlm.nih.gov/ https://www.medscape.com/ https://www.bmj.com/ https://www.thelancet.com/ https://journals.lww.com/ajsp/pages/currenttoc.aspx https://www.cell.com/ https://www.nature.com/ http://www.cancer.net/</p> <p><u>Journal:</u></p> <ol style="list-style-type: none"> 1. American journal of surgical pathology 2. Cancer 3. Oncology 4. Histopathology 5. Cell 6. Lancet oncology <p><u>Others:</u></p> <p>Sternberg's Diagnostic Surgical Pathology, 7th edition</p>

18 week lecture plan

Week #	Lecture Topic	Duration 3CH	Outcome
1	Nomenclature of tumors and characteristics of benign and malignant tumors	3 hours	Describe the characteristic features of benign and malignant tumors with regards to their biological behavior and structural alterations
2	Epidemiology of cancer	3 hours	Discuss the interaction between genetics and environmental factors in carcinogenesis
3	Molecular basis of cancer- genetic alterations	3 hours	Comprehend the role of genetic and epigenetic alterations in the pathogenesis of cancer
4	Molecular basis of cancer- epigenetic alterations	3 hours	Comprehend the role of genetic and epigenetic alterations in the pathogenesis of cancer
5	Cancer progression, invasion and metastasis	3 hours	Describe the various pathways and the molecular mechanisms for invasion and metastasis of cancers
6	Inflammation and cancer	3 hours	Elaborate the inflammatory pathways involved in cancer development
7	Tumor immunity	3 hours	Discuss the molecular mechanisms for evasion of host defenses by tumors
8	Microbial and chemical carcinogenesis	3 hours	Describe the role of oncogenic viruses, radiation, chemicals and other environmental factors in causing cancer
9	Mid-term Exam		
10	Genetics of common hereditary cancer syndromes	3 hours	Discuss the genetic predisposition to cancers with regards to the common hereditary cancer syndromes
11	Genetic counselling	3 hours	Discuss the role of genetic counselling in cases of familial cancer syndromes
12	Molecular markers for cancer diagnosis and prognosis	3 hours	Describe the significance of molecular markers in cancer diagnosis, prognosis
13	Molecular markers and precision medicine	3 hours	Describe the significance of molecular markers in cancer therapeutics
14	Molecular techniques for cancer diagnostics-Microarray, FISH, ISH	3 hours	Discuss the molecular diagnostic techniques of cancer
15	Molecular techniques for cancer diagnostics-PCR, RT-PCR, sanger sequencing, NGS	3 hours	Discuss the molecular diagnostic techniques of cancer
16	Gene therapy in cancers	3 hours	Elaborate upon the advances in cancer therapeutics with special emphasis on gene therapy
17	Literature discussion: actionable genetic variants in common cancer	3 hours	Discussion of latest advancement in identifying actionable gene variants in common cancers
18	Final-Term Exam		

Course Code	PAT 851
Credit Hours	3(2+1)
Course Title	Bioinformatics in Pathology
Pre-Requisite	Concepts of Molecular Biology, Biochemistry, general and special pathology and basic computer skills
Course Objective	<ol style="list-style-type: none"> 1. Understand bioinformatics as an inter-disciplinary science and its applications. 2. Comprehend the biological information given in databases 3. Understand links among bioinformatics hubs 4. Differentiate among methods to find bio-similarity 5. Understand the concept and selection criteria for BLAST search 6. Comprehend the difference among different PWA algorithms 7. Comprehend the utility of gene sequences in molecular biology experiments. 8. Comprehend the concept of evolutionary relation, conserved phenotypic characters 9. Understanding the origin of molecular programing that dictates 3D conformation and dynamics and stability 10. Acquire concept of proteins structural and functional features and classification 11. Predict 3D structure and their selection/ preference criteria 12. Analyze high throughput biological data for solution and diagnostics 13. Understand and execute phylogenetic tree construction
Course Outcome	Upon completion of course the student will be able to: <ol style="list-style-type: none"> 1. Comprehend and retrieve the required information from various databases 2. Understand and utilize links among bioinformatics hubs for data comparison and analysis 3. Predict and analyze protein structure and function 4. Analyze high throughput biological data for research purposes
Course Contents	Bioinformatics repositories, tools, browsers and servers: NCBI, Uniprot, GeneCard, PDB, SCOP, CATH, Expasy, EMBL sequence alignment tools. 1D. 2D and 3D structure analyses, sequence alignments, homolog search, finding similarity and identity, Structure (3D) modeling and validation, Sequencing methods, Evolutionary relationship analysis Retrieval and understanding of Biological Data. Application of bioinformatics in research, diagnostics, medicine, and evolution.
Recommended Text Books	Xiong, Essential Bioinformatics The Biostar handbook-Bioinformatics data analysis guide
Recommended Reference Books	Arthur M. Lesk, Introduction to Bioinformatics Oxford University Press. Batiza AF. Bioinformatics, Genomics, and Proteomics: Getting the Big Picture (Biotechnology in the 21st Century). Chelsea House Publishers; 2006. Campbell MA, Heyer LJ. Discovering Genomics, Proteomics and Bioinformatics. Pearson education, 2009 Christianini, N. and Hahn, M. W. Introduction to Computational Genomics: A Case Studies Approach, Cambridge University Press, 2007. UK. Durbin, R., Eddy, S., Krogh, A. and Mitchison, G., Biological Sequence Analysis: Probabilistic models of proteins and nucleic acids, Cambridge University Press, 1998. UK. DW Mount, Bioinformatics: Sequence and Genome Analysis, Second Edition,

	<p>CSHL Press, USA.</p> <p>Introduction to Bioinformatics: A Theoretical and Practical Approach, Humana Press.</p> <p>Jones, N. C. and Pevzner, P. A. An Introduction to Bioinformatics Algorithms, MIT Press, 2004. USA.</p> <p>Pevsner J (2009) Bioinformatics and Functional Genomics. Wiley-Blackwell, Hoboken, NJ, USA.</p> <p>Structural Bioinformatics by Philip E Bourne. 2. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, 3rd Edition, Andreas D. Baxevanis (Editor), B.F. Francis Oullette (Editor), ISBN: 978-0-471-47878-2.</p>
Web and other resources	<p><u>Websites:</u></p> <p>https://www.ncbi.nlm.nih.gov/</p> <p>https://blast.ncbi.nlm.nih.gov/</p> <p>https://usegalaxy.org/</p> <p>https://www.rcsb.org/</p> <p>https://www.uniprot.org/</p> <p>https://www.expasy.org/resources/uniprotkb-swiss-prot</p> <p><u>Journal:</u></p> <p>Bioinformatics</p> <p>Journal of bioinformatics and computational biology</p> <p>Frontiers in Bioinformatics</p> <p><u>Others:</u></p> <p>Xiong, J., Essential Bioinformatics, Cambridge University Press, 2006. UK.</p>

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 2CH	Outcome
1	Introduction to Bioinformatics: Goal, Scope and applications	2 hours	Understand bioinformatics as an inter-disciplinary science and its applications
2	Introduction to Databases, File formats and Nucleotide	2 hours	Comprehend the biological information given in databases
3	Introduction to amino acid sequences and structure data	2 hours	Comprehend the biological information given in databases
4	Genome Browsers	2 hours	Understand links among bioinformatics hubs
5	Integrated Databases	2 hours	Understand links among bioinformatics hubs, find agreement and ways to confirm
6	Concept of sequence alignments: Local, Global, Pairwise, Multiple	2 hours	Differentiate among methods to find bio-similarity
7	Basic Local Alignment Search Tool (BLAST), Flavors, Variables, Analysis and selection of optimal hits	2 hours	Understand the concept and selection criteria for BLAST search

8	Pairwise Sequence Alignment tools and algorithms for DNA and Proteins	2 hours	Comprehend the difference among different PWA algorithms
9	Mid-Term Exam		
10	Concept of Primer and Probes	2 hours	Comprehend the utility of gene sequences in molecular biology experiments.
11	Concept of Multiple sequence alignment (Conserved domains Evolutionary relation, divergence and convergence)	2 hours	Comprehend the concept of evolutionary relation, conserved phenotypic characters.
12	Physicochemical attributes of amino acids: structure, function, stability and their behaviors in lab experiments	2 hours	Understanding the origin of molecular programming that dictates 3D conformation and dynamics and stability
13	3D Structure analysis Concepts: Structural organization and classification of proteins Secondary Databases of Protein 3D Structure Classification	2 hours	Acquire concept of proteins structural and functional features and classification
14	Protein 3D structure prediction: Ab initio, Threading	2 hours	Predict 3D structure and their selection/ preference criteria
15	Protein 3D structure prediction: Homology modeling	2 hours	Predict 3D structure and their selection/ preference criteria
16	Intro to MS and NGS	2 hours	Analyze high throughput biological data for solutions/diagnostics
17	Phylogenetics	2 hours	Understand the method for phylogenetic tree construction
18	Final-Term Exam		

18 week practical plan

Week #	In-silico Lab	Duration 1CH	Outcome
1	Introduction to nucleotide and protein databases	3 hours	Search various nucleotide and protein databases for retrieval of required information
2	NCBI Retrieval of desired information	3 hours	Retrieve required biological information from NCBI database and decipher it
3	Information retrieval and 3D structure visualization (NCBI, GeneCard, Expasy Protein Data Bank)	3 hours	Confirm information retrieved from databases by comparing biological information in different repositories
4	Local & global sequence alignments.	3 hours	Perform in-silico local & global sequence alignments.
5	BLAST (Basic local alignment search tool)	3 hours	Search homologues or similar domains using BLAST
6	Pairwise Sequence Alignment	3 hours	Perform optimal alignment and compare 2

	by employing different algorithms		sequences
7	Primer mapping on target seq. (Reverse/complimentary sequences)	3 hours	Validate the sequences for molecular biology experiments. (Map primer binding site and target region)
8	Multiple sequence alignment by Clustal Omega, Multiple Sequence Comparison by alignment score, Log-Expectation values and scores	3 hours	Search for conserved domains for possible structural and functional homology and evolutionary relationship
9	Mid-Term Exam		
10	IP value, Titration curve, buffer selection, IEF, Determine bonding types and find the suitable distance for various types of bonds to form	3 hours	Determine physical and chemical attributes of amino acids and proteins
11	Use of PAM and BLOSUM for in-silico experiments and result analysis	3 hours	Find out the effect of scoring scheme on similarity search
12	DPA for global and local alignment	3 hours	Perform actual calculations to find optimal global and local alignments
13	PDB Visual analytics on DS & SPDBV CATH vs SCOP	3 hours	Determine proteins 3D structure and analyze structural features, locate functional features and classify domains
14	Homology modeling SWISS model, Modeller (Python script based)	3 hours	Perform template based protein structure designing
15	Ramachandran plot ProSA-web	3 hours	Validate 3D structure of protein and its stability
16	Genome Mapping, Assembly	3 hours	Perform genome mapping for variant analysis
17	Comparison of genomic data	3 hours	Compare the acquired genomic data with available information
18	Final-Term Exam		

Course Code	PAT 852
Credit hours	3(3+0)
Course Title	Molecular Genetics
Pre-Requisite	Basic concepts of human genetics
Course Objective	<ol style="list-style-type: none"> Describe the phases of cell cycle and its regulation Explain the mechanisms of DNA replication and repair, RNA synthesis and processing and protein synthesis Describe the various numerical and structural chromosomal aberrations Describe the various molecular phenomenon governing inheritance and laws of single gene, polygenic and multifactorial inheritance Describe the underlying molecular mechanisms for single gene disorders linked to autosomes, sex chromosomes, and mitochondrial genes

	<p>6. Explain the genetic alterations and their downstream effects involved in disorders with polygenic and multifactorial inheritance</p> <p>7. Understand the role of genetic and environmental factors in multifactorial conditions such as congenital anomalies, diabetes and psychiatric illness and in the development of cancers</p> <p>8. Describe the different abnormal types of hemoglobin, the genetic alterations involved and how their pathophysiologic mechanisms result in clinical disease.</p> <p>9. Define the role of genetic polymorphism in disease development and presentation and the role of molecular genetics in the development of common congenital malformations</p> <p>10. Describe the principles and techniques of prenatal and reproductive screening</p> <p>11. Discuss how to integrate genetic testing options in genetic counseling practice</p>
Course Outcome	<p>Upon the completion of the course the student should be able to</p> <p>1. Explain the role of genetic alterations and environmental factors in the development of monogenic and polygenic disorders</p> <p>2. Describe the various patterns of inheritance for common autosomal and sex linked disorders</p> <p>3. Discuss the significance of prenatal screening and genetic testing and the importance of genetic counseling</p>
Course Contents	Cellular and molecular basis of inheritance transcription, translation, gene expression, regulation, mutations, human chromosomes cell division, monogenic disorders, developmental genetics, patterns of inheritance and population genetics, polygenic and multifactorial inheritance, cancer genetics, genetic factors in common diseases, congenital abnormalities and dysmorphic syndromes, genetic counseling, chromosome disorders, screening for genetic disease, prenatal testing and reproductive genetics.
Recommended Text Books	<p>1. Gardner, R. J. M. and Sutherland, G. R. 1996. Chromosome Abnormalities and Genetic Counseling, Oxford University Press, New York., USA.</p> <p>2. Gerdes, L. I. 2014. Human Genetics. Farmington Hills, Mich: Greenhaven Press.</p> <p>3. Hartwell, L.H., Goldberg, M.L., Fische, J.A.,R. L. Hood and Aquadro, C.F. 2015. Genetics: From genes to genomes. 5th Ed.,McGraw Hill Book co., New York, USA.</p>
Recommended Reference Books	<p>1. Lewis, R. 2017. Human Genetics: Concepts and applications. McGraw-Hill.</p> <p>2. Strachan, T., Goodship, J., & Chinnery, P. F. 2015. Genetics and genomics in medicine. New York, USA: Garland Science/Taylor & Francis Group.</p> <p>3. Wolfe, J. 2016. Genetic testing and gene therapy. New York: Britannica Educational Publishing in association with Rosen Educational Services. Harper's Illustrated Biochemistry Latest Ed.</p> <p>4. M N Chatterjea and Rana shinde Text book of medical biochemistry Latest Ed.</p> <p>5. Victor 1, Davidson and David B Sittna Biochemistry Latest Ed.</p> <p>6. AS Saini Text Book of Biochemistry Latest Ed.</p> <p>7. DM Vasudevan and Streekumaris "Text book of biochemistry Latest Ed.</p>
Web and other resources	<p><u>Website:</u></p> <p>https://onlinelibrary.wiley.com/journal/23249269</p> <p>http://www.freebookcentre.net/medical_text_books_journals/genetics_ebooks_online_texts_download.html</p> <p>https://www.genecards.org/</p> <p><u>Journal:</u></p> <p>Journal of Inherited Metabolic Disease</p>

	Genes and Diseases PLOS Genetics <u>Others:</u> Maria Puiu, "Genetic Disorders". (2013). Rob Elles, "Molecular Diagnosis of Genetic Diseases (Methods in Molecular Medicine) (v. 1) 2nd Edition" (2002).
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18 week lecture plan

Week #	Lecture Topic	Duration 3CH	Outcome
1	Cell Cycle and its regulation	3 hours	Describe the phases of cell cycle and factors regulating it
2	DNA replication and repair	3 hours	Explain the mechanisms of DNA replication and repair
3	Transcription and translation	3 hours	Explain the mechanism for RNA synthesis and processing and protein synthesis
4	Chromosomal aberrations	3 hours	Describe the various numerical and structural chromosomal aberrations
5	Cellular and molecular basis of inheritance	3 hours	Describe the various molecular phenomenon governing inheritance
6	Patterns of Inheritance	3 hours	Explain the laws of for single gene, polygenic and multifactorial inheritance
7	Mendelian Disorders	3 hours	Describe the underlying molecular mechanisms for single gene disorders linked to autosomes, sex chromosomes, and mitochondrial genes
8	Disorders with Polygenic and multifactorial inheritance	3 hours	Explain the genetic alterations and their downstream effects involved in disorders with polygenic and multifactorial inheritance
9	Mid-Term Exam		
10	Genetics of common non-cancerous diseases	3 hours	Understand the role of genetic and environmental factors in multifactorial conditions such as congenital anomalies, diabetes and psychiatric illness
11	Genetics of cancers	3 hours	Comprehend the role of genetic alterations in the development of cancers
12	Hemoglobinopathies	3 hours	Describe the different abnormal types of hemoglobin, the genetic alterations involved and how their pathophysiologic mechanisms result in clinical disease.
13	Developmental genetics	3 hours	Explain the role of genetic mutations in the development of skeletal malformations
14	Genetic polymorphism and Population genetics	3 hours	Define the role of genetic polymorphism in disease development and presentation
15	Genetics and environmental influences in disorders with	3 hours	Analyze and interpret data and graphs related to cell biology, genetics and its

	complex inheritance		malfunction in disease
15	Congenital anomalies and dysmorphic syndromes	3 hours	Comprehend the role of molecular genetics in the development of common congenital malformations
16	Prenatal testing and reproductive genetics	3 hours	Describe the principles and techniques of prenatal and reproductive screening
17	Genetic counseling	3 hours	Construct relevant, targeted and comprehensive personal and family histories and pedigree to facilitate, and integrate genetic testing options in genetic counseling practice
18	Final-Term Exam		

Course Code	PAT 853
Credit hours	3(3+0)
Course Title	Immunological Pathology
Pre-Requisite	Basic concepts of immune system and immune response
Course Objective	<ol style="list-style-type: none"> 1. Comprehend the basic concept of immune response and the role of immune cells and compare the various classes of antibodies 2. Describe the structure and function of the major classes of MHC proteins and their role in immune response 3. Compare various hypersensitivity reactions on the basis of underlying mechanisms and downstream effects 4. Understand the significance of loss of immune tolerance with to autoimmune disorders 5. Comprehend the role of immune response in transplant rejection 6. Explain the genetic alterations and deficiencies underlying immune deficiency disorders 7. Describe the role of HIV in the development of T cell deficiency in AIDS 8. Describe how immune system responds against tumors and the mechanisms developed by tumors to escape immune surveillance 9. Discuss the development of monoclonal antibodies and their role in the treatment of cancers and other pathologies 10. Understand the role of gene therapy in the treatment of autoimmune disorders and immune deficiency states
Course Outcome	<p>Upon successful completion of the course, the student will be able to:</p> <ol style="list-style-type: none"> 1. Comprehend the mechanisms underlying the development of immunological disorders 2. Describe the role of immune cells and MHC molecules in disease development 3. Discuss current advances in the field of immunology and therapeutics of immunological disorders
Course Contents	Cells and tissues of the immune system, Innate and acquired Immunity immune response, cell mediated and humoral immunity, antibodies and hybridomas, MHC and antigen presentation, Isotype switching and affinity maturation, tumor Immunology, Immune escape by tumors,

	Immunotherapeutic Strategies, Transplantation of Autologous, Bone Marrow/Hematopoietic Stem Cells, Clinical Aspects of Organ Transplantation, gene therapy for immunological disorders.
Recommended Text Books	<ol style="list-style-type: none"> 1. Roitt's Essential Immunology (2017). Peter J. Delves, Seamus J. Martin, Dennis R. Burton and Ivan M. Roitt 13th Edition. Wiley-Blackwell. 2. Kuby Immunology, 9th edition. (2019). by Jenni Punt, Sharon Stanford, Patricia P. Jones, Judy Owen 3. Ken Murphy, Paul Travers, Mark Walport. Janeway's Immunobiology – 8th Edition Garland Science Publishers 4. Thomas J Kindt, Richard A Goldsby, Barbara A Osborne, Janis Kuby: Immunology, 6th edition, W.H. Freeman
Recommended Reference Books	<ol style="list-style-type: none"> 1. Peter J. Delves, Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt Roitt: Roitt's Essential Immunology (12th ed. , Blackwell) 2. Abul Abbas, Andrew H. Lichtman, Shiv Pillai. Cellular and Molecular Immunology, 9th edition, 2017. Elsevier Pub Co.
Web and other resources	<p><u>Website:</u> https://www.us.elsevierhealth.com/medical-students/immunology</p> <p><u>Journal:</u> Journal of Immunology Infection and Immunity Molecular Immunology</p> <p><u>Others:</u></p> <ol style="list-style-type: none"> 1. CRC Critical Reviews in Immunology and Human Gene Therapy 2. Gerd R. Burmester, Antonio Pezzutto Color Atlas of Immunology, 2006. Thieme Stuttgart, New York. 3. Annual Review of Immunology, Journal of Immunology 4. European Journal of Immunology, Immunology Today, Advances in Immunology

18 week lecture plan

Week #	Lecture Topic	Duration 3CH	Outcome
1	Cells of immune system and the immune response: introduction	3 hours	Comprehend the basic concept of immune response and the role of immune cells
2	Tissues of the immune system	3 hours	Describe the morphology, development and significance of lymphoid tissue
3	Immunoglobulins: classes, structure, function and class switching	3 hours	Compare the various classes of antibodies on the basis of their structure, function, role in immune response, and comprehend the concept of somatic rearrangement and class switching
4	Major histocompatibility complex and antigen presentation	3 hours	Describe the structure and function of the major classes of MHC proteins and their role in immune response
5	Cell mediated and humoral immunity	3 hours	Discuss the role of T and B cells in immune response and disease

6	Immunologically mediated tissue injury and hypersensitivity reactions	3 hours	Compare various hypersensitivity reactions on the basis of underlying mechanisms and downstream effects
7	Loss of immunological tolerance and autoimmunity	3 hours	Understand the significance of loss of immune tolerance with regards to autoimmune disorders
8	Immunology and organ transplant	3 hours	Comprehend the role of immune response in transplant rejection
9	Mid-Term Exam		
10	Primary and secondary immunodeficiency	3 hours	Explain the genetic alterations and deficiencies underlying immune deficiency disorders
11	HIV infection and AIDS	3 hours	Describe the role of HIV in the development of T cell deficiency in AIDS
12	Tumor immunity: Immune surveillance and escape	3 hours	Describe how immune system responds against tumors and the mechanisms developed by tumors to escape immune surveillance
13	Immune system and cancers	3 hours	Discuss the role of immune system in the initiation and progression of cancers
14	Therapeutic antibodies: Monoclonal antibodies and hybridomas	3 hours	Discuss the development of monoclonal antibodies and their role in the treatment of cancers and other pathologies
15	Gene therapy in immunological disorders	3 hours	Understand the role of gene therapy in the treatment of autoimmune disorders and immune deficiency states
16	MHC and disease susceptibility	3 hours	Discuss the role of MHC and MHC gene polymorphism in the development of diseases
17	Current developments in treating autoimmune disorders	3 hours	Discuss the current literature for advancements in therapy for immunological disorders
18	Final-Term Exam		

Course Code	PAT 854
Credit hours	3(2+1)
Course Title	Biosafety
Pre-Requisite	Basic concepts of Microbiology and Genetics
Course Objective	<ol style="list-style-type: none"> 1. Describe concepts of biosafety and management of biological risks 2. Describe the AMP model and its key components, for bio-risk management 3. Explain the standard operating practices and procedures for protection of laboratory personnel and the community from infection, genetically engineered samples and prevent contamination of the environment 4. Discuss the key concepts of the four biosafety levels for control and

	<p>containment of biological hazards</p> <ol style="list-style-type: none"> 5. Describe institutional and personnel security measure for biosafety 6. Describe the standard SOPs for the use of personal protective equipment 7. Describe the standard procedures for handling the biological waste generated in laboratories for heightened control measures 8. Demonstrate the standard procedures for biosafety management
Course Outcome	Upon successful completion of the course, the students will be able to: Discuss and demonstrate the standard biological safety techniques, decontamination, and disposal of laboratory waste and bio-risk assessment and management of genetically engineered samples
Course Contents	Biosafety and important terminologies, bio-risk management AMP model, Good laboratory work practices, Biosafety levels, Biosecurity, personal protection, decontamination and waste management, safe collection, handling and transport of specimens, genetically engineered samples, autoclaving biological safety cabinets, personal safety measures
Recommended Text Books	<ol style="list-style-type: none"> 1. Biological Safety: Principles and Practices, 5th Edition by Dawn P.Wooley 2. Laboratory Biorisk Management, Biosafety and Biosecurity by Reynolds S. Selerno 3. District laboratory practice in tropical countries by Monica Cheesbrough
Recommended Reference Books	<ol style="list-style-type: none"> 1. Greenwood D, Slack R, Peutherer J. Medical microbiology – Guide to microbial infections: pathogenesis, immunity, laboratory diagnosis and control, 16th edition, 2002. Churchill Livingstone, Elsevier. 2. Collins CH, Lyne PM, Grange JM. Collins & Lyne's Microbiological methods. 8th edition 2004. Arnold publishers. 3. Webber R. Communicable disease epidemiology and control: A global perspective, 2nd edition, 2005. CABI Publishing
Web and other resources	<p><u>Websites:</u></p> <p>https://www.who.int/csr/resources/publications/biosafety/Biosafety7.pdf https://phkh.nhsrk.pk/sites/default/files/2019-06/Biosafety https://www.cdc.gov</p> <p><u>Journals:</u></p> <ol style="list-style-type: none"> 1. Journal of Clinical Microbiology 2. Journal of Infectious Diseases <p><u>Others:</u></p> <ol style="list-style-type: none"> 1. WHO biosafety manual 2. National biosafety guidelines-Pakistan

18 weeks lecture plan

Week #	Lecture Topic	Duration 2CH	Outcome
1	Bio Risk Management: introduction and terminologies	2 hours	Discuss the main concepts of biosafety and management of biological risks
2	AMP (Assessment, Mitigation, Performance) Model: introduction	2 hours	Describe the AMP model and its key components, for bio-risk management
3	Risk assessment: Hazards & threat identification & analysis	2 hours	Describe the factors that contribute to the occurrence of infection, genetically

			engineered samples and other bio-risks
4	Risk assessment: Likelihood & consequences evaluation	2 hours	Discuss the factors that need to be considered in relation to the consequence of an exposure or release
5	Risk mitigation: Elimination & substitution	2 hours	Discuss how to develop a risk control strategy in order to reduce bio-risks and allow the work to proceed safely
6	Risk mitigation: Practices & procedures	2 hours	Describe the procedures for reduction and elimination of bio hazards
7	Performance: Key elements of performance, monitoring protocols, assurance and improvement	2 hours	Discuss the measures to achieve the appropriate level of awareness, training and competency for implementation of risk control measures and safe laboratory operation
8	GLWPs (good laboratory work practices)	2 hours	Explain the standard operating practices and procedures for protection of laboratory personnel and the community from infection and prevent contamination of the environment
9	Mid-Term Exam		
10	Biosafety Levels – introduction	2 hours	Discuss the key concepts of the four biosafety levels for control and containment of biological hazards
11	BSL 1 and 2	2 hours	Describe the practices and procedures for control and containment of pathogens posing a mild or moderate health hazard
12	BSL 3 and 4	2 hours	Describe the practices and procedures for control and containment of pathogens posing a severe/potentially fatal health hazard
13	Biosecurity	2 hours	Describe institutional and personnel security measures designed to prevent the loss, theft, misuse, diversion or intentional release of biological agents being handled in the laboratory and misuse of gene editing tools
14	PPE (personal protective equipment)	2 hours	Describe the standard SOPs for the use of personal protective equipment
16	Waste management	2 hours	Describe the standard procedures for handling the biological waste generated in laboratories for heightened control measures
17	Decontamination	2 hours	<i>Discuss the standard procedures for decontaminating lab instruments, surfaces and environment</i>
18	Final-Term Exam		

18 Weeks practical Plan

Week #	Lecture Topic	Duration 1CH	Outcome
1	Collection and safe handling of samples	3 hours	Demonstrate safe collection and handling of biological and genetically engineered samples for storage or transportation
2	Safe transportation	3 hours	Demonstrate safe transport of biological and genetically engineered specimens
3	Personal safety measures	3 hours	Demonstrate personal safety laboratory measures
4	PPE (personal protective equipment)	3 hours	Demonstrate proper use and care of PPE
5	Sterilization of reusable items	3 hours	Demonstrate cleaning and sterilization of reusable items.
6	Biological safety cabinets: class I and II	3 hours	Demonstrate the proper use of class I and II biological safety cabinets.
7	Maximum containment measures: Biological safety cabinets class III	3 hours	Demonstrate the proper use of class III biological safety cabinet
8	Laboratory autoclave technique	3 hours	Perform autoclaving of lab equipment
9	Mid-Term Exam		
10	Biosecurity risk assessment: identification and evaluation	3 hours	Collect information and assess for risk of breach of biosecurity Assess misuse of gene editing tools
11	Biosecurity risk assessment: risk control strategy	3 hours	Develop a risk control strategy for biosecurity risk and inventory control
12	Containment in Animal Houses	3 hours	Demonstrate standard procedures for handling animals and equipment in order to contain biological hazards
13	Decontamination	3 hours	<i>Demonstrate the standard procedures for decontaminating lab instruments, surfaces and environment</i>
14	Waste management	3 hours	Demonstrate standard practices and procedures for handling and disposing biological and genetically engineered sample waste
15	Biological spill response		Demonstrate procedures and practices for handling, decontaminating and reporting biological spills
16	Legal requirements and selection of the necessary documents	3 hours	Prepare a sample document, satisfying applicable legal requirements, to obtain authorization for biological laboratory.
17	Revision of practicals	3 hours	Discussion and revision of Labs.
18	Final- Term Exam		

Course Code	PAT 855
Credit hours	3(3+0)
Course Title	Molecular Medicine
Pre-Requisite	Basic concepts of human genetics and medicine
Course Objective	<ol style="list-style-type: none"> 1. Discuss the key concepts and terminologies related to molecular medicine, pharmacogenomics, gene and stem cell therapy 2. Discuss the utility of molecular medicine and its fields in clinical settings 3. Describe the role of bioinformatics in information retrieval, drug discovery and development 4. Discuss the various phases and process involved in drug development 5. Describe in detail the types and uses of vectors and the methods utilized in gene therapy 6. Discuss the current achievements and pitfalls with regards to stem cell therapy 7. Discuss the current advances with regards to the role of molecular medicine in cancer therapy and treatment of neurodegenerative diseases
Course Outcome	<p>Upon successful completion of the course, the student will be able to:</p> <ol style="list-style-type: none"> 1. Comprehend the key concepts of stem cell and gene therapy, pharmacogenomics and drug development and their utility in disease therapeutics 2. Discuss current advances and future implications in the field of molecular medicine
Course Contents	Introduction to molecular medicine, important terminologies in molecular medicine, principles and applications of pharmacogenomics, stem cell therapy: procedures and applications, methods and techniques of gene therapy and its applications, drug discovery and development, molecular medicine and treatment of cancer, cell reprogramming and its applications, molecular medicine and treatment of neurodegenerative disorders
Recommended Text Books	<ol style="list-style-type: none"> 1. Molecular medicine: an introduction. Jens Kurrek, Cy Aaron Stein. Wiley-Blackwell 2016 2. Molecular Medicine: Genomics to personalized health care. R.J. Trent. Elsevier 2012
Recommended Reference Books	1. Clinical Molecular Medicine: Principles and Practice. Dhavendra Kumar. Elesvier 2019
Web and other resources	<p><u>Websites:</u></p> <p>https://molmed.biomedcentral.com/ https://www.cell.com/trends/molecular-medicine/home https://www.nature.com/subjects/molecular-medicine</p> <p><u>Journal:</u></p> <p>Molecular medicine Journal of molecular medicine Cell stem cell Nature biotechnology</p> <p><u>Others:</u></p> <p>Principles of Molecular Medicine. J. Larry Jameson</p>

18 week lecture plan

Week #	Lecture Topic	Duration 3CH	Outcome
1	Introduction to molecular medicine	3 hours	Discuss the key concepts and terminologies related to molecular medicine
2	Molecular medicine: clinical application	3 hours	Discuss the utility of molecular medicine in clinical settings
3	Pharmacogenomics: Introduction and terminologies	3 hours	Describe the terminologies and basic concepts of pharmacogenomics
4	Pharmacogenomics: applications	3 hours	Discuss in detail the clinical application of pharmacogenomics approach and the relevant current development
5	Bioinformatics: introduction and drug data bases	3 hours	Compare the various databases for information retrieval
6	Bioinformatics: role in drug development	3 hours	Comprehend the use of bioinformatics in drug discovery and development
7	Drug development: identifying the target	3 hours	Explain the methods for identifying actionable therapeutic targets in proteins
8	Drug development: process	3 hours	Discuss the various phases and process involved in drug development
9	Mid-Term Exam		
10	Gene therapy: approaches and principles	3 hours	Describe in detail the types and uses of vectors and the methods utilized in gene therapy
11	Gene therapy: applications	3 hours	Discuss the clinical applications and current advancements in gene therapy
12	Stem cells: types and applications	3 hours	Compare the various types of stem cells and their utility in therapeutics
13	Stem cells therapy: current advancements	3 hours	Discuss the current achievements and pitfalls with regards to stem cell therapy
14	Cell reprogramming and induced stem cells	3 hours	Describe the principles and procedures involved in adult stem cell reprogramming and utility of induced pluripotent stem cell in disease treatment
15	Molecular medicine and cancer therapy	3 hours	Discuss the current advances with regards to the role of molecular medicine in cancer therapy
16	Molecular medicine and treatment of neurodegenerative diseases	3 hours	Discuss the current advances with regards to the role of molecular medicine in the treatment of neurodegenerative disorders
17	Future of molecular medicine	3 hours	Discuss the future implications and pitfalls related to various fields of molecular medicine
18	Final-Term Exam		

BIOCHEMISTRY

ELECTIVE COURSE LIST – BIOCHEMISTRY

Sr.No.	Course Code	Course Title	Credit hours	Theory	Practica l
1	BIO 852	Medical Biochemistry and Diagnostics	3(2+1)	2	1
2	BIO 853	Nutritional Biochemistry	3+0	3	0
3	BIO 854	Metabolic Pathways	3+0	3	0
4	BIO 855	Applied Enzymology	3+0	3	0
5	BIO 856	Molecular Genetics and Genetics Disorder	3+0	3	0
6	BIO 857	Principles of Immunology	3+0	3	0
7	BIO 858	Medical Biotechnology	3+0	3	0
8	BIO 859	Bioinformatics	3(2+1)	2	1

DETAILED COURSE OUTLINES - ELECTIVE COURSES - BIOCHEMISTRY

Course Code	BIO 852
Credit hour	3(2+1)
Course Title	Medical Biochemistry and Diagnostics
Pre-Requisite	MED 801
Course Objectives	<ol style="list-style-type: none"> 1. Describe the principles of various diagnostic tests performed in clinical Biochemistry laboratory 2. Identify various diagnostic tests 3. Interpret the role of different diagnostics tests 4. Discuss the importance of these tests in the diagnosis of various diseases and disorders.
Course Outcome	Upon successful completion of the course, the student will be able to discuss the basic concepts and principles regarding biochemistry diagnostics with analytical correlation with different diseases.
Course Contents	Procedure and interpretation of hypothalamic and pituitary function, Adrenocortical function tests with their interpretation, Assessment of gonadal functions, Interpretation of thyroid functions, Assessment of liver functions, Assessment of cardiac functions, Evaluation of renal functions, Pancreatic functions and gastrointestinal functions, Body fluid analysis, Circulating tumor markers , Clinical chemistry and geriatric patient, Acid base disorders.
Recommended Text Books	<ol style="list-style-type: none"> 1. Michael LB, Edward PF and Larry ES (2005). Clinical Chemistry. Principles, Procedures, Correlations, Lippincott Williams and Wilkins. 2. Allan G, JM Michael, AC Robert and St. J O'Reilly Denis (2008). Clinical Biochemistry: An Illustrated Colour Text. 4th edition. Churchill livingstone elsevier. 3. Thomas MD (2006). Textbook of Biochemistry with Clinical Correlations. Volume 35, 6th edition, Wiley-Liss, 2006
Recommended Reference Books	<ol style="list-style-type: none"> 1. Thomas MD (2006). Textbook of Biochemistry with Clinical Correlations. Volume 35, 6th edition, Wiley-Liss, 2006 2. Tsisana S (2011). Biological Aspects of Human Health and Well-being. Nova Science Pub Inc.
Web and other resources	<p><u>Website:</u></p> <ol style="list-style-type: none"> 1. https://www.sciencedirect.com/journal/clinical-biochemistry 2. https://www.taylorfrancis.com/books/mono/10.1201/b13295/clinical-biochemistry-metabolic-medicine-martin-andrew-crook 3. https://www.msdvetmanual.com/clinical-pathology-and-procedures/diagnostic-procedures-for-the-private-practice-laboratory/clinical-biochemistry <p><u>Journals:</u></p> <ol style="list-style-type: none"> 1. Annals of Clinical Biochemistry 2. Cell Biochemistry and Function 3. The Open Clinical Biochemistry Journal <p><u>Others:</u></p> <ol style="list-style-type: none"> 1. William J. Marshall, Marta Lapsley, Andrew P. Day, Ruth M. Ayling. "Clinical Biochemistry, Metabolic and clinical aspects". (2014). 2. Martin Andrew Crook, "Clinical Biochemistry and Metabolic Medicine, 8th Edition". (2012).

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 2CH	Outcomes
1	Review of hypothalamic and pituitary function	2 hour	Explain biochemical and functional aspects of hypothalamus and pituitary functions with its clinical disorders
2	Adrenocortical function and their assessment	2 hour	Relate the role of adreno- corticoids in disease progression.
3	Assessment of gonadal function	2 hour	Relate the role of gonadal hormones in disease progression
4	Assessment of thyroid function	2 hour	Relate the biochemical, functional aspects of thyroid gland with diseases.
5	Assessment of cardiac function	2 hour	Discuss the biochemical markers and enzymes used in evaluation of cardiac disease.
6	Assessment of liver function	2 hour	Discuss the biochemical role of liver and its importance and detoxification.
7	Evaluation of renal function	2 hour	Explain details of excretory function of kidneys.
8	Body fluid analysis	2 hour	Interpret the biochemical analysis of amniotic fluid, cerebrospinal fluid, sweat, synovial fluid, serous fluids.
9	Mid-Term Exam		
10	Circulating tumor markers	2 hour	Describe the types of tumor markers and application of tumor markers in disease progression and analysis.
11	Clinical chemistry and geriatric patient	2 hour	Discuss the biochemical changes of aging
12	Electrolytes balance and imbalance – hyper/hyponatremia and hyper/hypokalemia	2 hour	Describe the homeostasis of sodium and potassium
13	Pancreatic and gastrointestinal functions	2 hour	Explain the biochemistry of gastric and pancreatic secretions and their functions
14	Acid base disorders	2 hour	Describe the acid base abnormalities, their diagnosis and management.
15	Disorders of heme metabolism	2 hour	Discuss the hemoglobinopathies.
16	Biochemical aspects of metabolic bone disease	2 hour	Discuss the biochemical aspects of metabolic bones disorders.
17	Regulation of blood glucose	2 hour	Explain the blood glucose homeostasis.
18	Final- Term Exam		

18 Weeks Lab Plan

Week #	Lab Topic	Duration 1 CH	Outcomes
1	Estimation of prolactin	3 hour	Perform and interpret serum prolactin levels by kit and manual method.
2	Estimation of corticosteroids	3 hour	Perform and interpret corticosteroid levels by kit and manual method.
3	Estimation of testosterone, FSH and LH	3 hour	Perform and correlate results of serum testosterone, FSH and LH levels by kit and manual method.
4	Estimation of TSH, T3 and T4	3 hour	Perform and interpret tests for the estimation of serum TSH, T3 and T4 levels by kit and manual method.
5	Troponin test and CK-MB Test Test Serum Myoglobin	3 hour	Demonstrate and interpret tests for serum troponin, CK-MB and myoglobin by kit and manual method.
6	Estimation of Bilirubin (direct and indirect) Alkaline Phosphatase, Albumin and Total Protein	3 hour	Demonstrate and interpret tests for estimation of Bilirubin (direct and indirect) Alkaline Phosphatase, Albumin and Total Protein levels by kit and manual method.
7	Perform the estimation of urea, uric acid, BUN and creatinine	3 hour	Interpret estimation of urea, uric acid, BUN and creatinine by kit and manual method.
8	Analysis of CSF and saliva	3 hour	Perform various tests for analysis of CSF and saliva by kit and manual method.
9	Mid-Term Exam		
10	Estimation of PSA and alpha-fetoprotein	3 hour	Perform and interpret the results of tests for PSA and alpha-fetoprotein by kit and manual method.
11	Estimation of Cholesterol, HDL, LDL and TG in blood	3 hour	Demonstrate and interpret tests for Cholesterol, HDL, LDL and TG in blood by kit and manual method.
12	Estimation of serum sodium and potassium	3 hour	Perform and interpret tests for estimation of serum sodium and potassium by kit and manual method.
13	Estimation of proteases, peptidases, lipases and amylase	3 hour	Perform and interpret tests for Estimation of proteases, peptidases, lipases and amylase by kit and manual method.
14	Analysis of Arterial blood gases	3 hour	Analysis of ABGs to interpret metabolic disorders.
15	Estimation of hemoglobin	3 hour	Perform tests for estimation of hemoglobin.
16	Estimation of calcium and phosphate in blood.	3 hour	Perform and interpret tests for estimation of calcium and phosphate in blood by kit and manual method.
17	Estimation of blood glucose	3 hour	Perform and interpret tests for estimation of blood glucose by kit and manual method.
18	Final-Term Exam		

Course Code	BIO 853
Credit hours	3+0
Course Title	Nutritional Biochemistry
Pre-Requisite	Basic concepts of Nutrition and Food Science
Course Objectives	<ol style="list-style-type: none"> 1. Discuss human nutrition, diet, macronutrients, micronutrients and health. 2. Identify the roles of minerals and vitamins in normal human physiology 3. Plan appropriate therapies for the diseases related to deficiencies of nutrients
Course Outcome	By the end of this course the student should be able to discuss the fundamental concept of nutrients, food constituents in human body with complete understanding of the interactions of biomolecules and deficiency disorder
Course Contents	Food nutrition and diet- BMI, BMR, waist circumference; Balanced diet, glycemic index and glycemic load in food; Diet and Nutrition in pregnancy; Vitamins; Water soluble Vitamins; Micronutrients; Macronutrients; review of classification of amino acids and proteins and their importance in nutrition; Association of digestion and absorption of protein and amino Acids with clinical disorders; Clinical importance, structural properties and function of different forms of carbohydrates; Review of digestion, absorption, and functions of lipids with clinical disorders along with the essential fatty acids and their biomedical importance; Sources, role, importance, and properties of cholesterol; Properties of lipids; Biochemical role of eicosanoids; Lipid per oxidation and its significance
Recommended Text Books	<ol style="list-style-type: none"> 1. Lippincott's Illustrated Reviews: Biochemistry, Champe, P.C., Harvey, R.A. and Ferrier, D.R., 4th or 5th Edition, (2008) or (2011), Lippincott Williams & Wilkins. 2. Nutrition, P. Insel, R. E. Turner and D. Ross, 3rd Edition, (2007), Jones & Bartlett Publishers
Recommended Reference Books	<ol style="list-style-type: none"> 1. Harper's Illustrated Biochemistry Latest Ed. 2. M N Chatterjea and Rana shinde Text book of medical biochemistry Latest Ed. 3. Victor 1, Davidson and David B Sittna Biochemistry Latest Ed. 4. AS Saini Text Book of Biochemistry Latest Ed. 5. K.Sembulingan and DremaSembulingan. Essentials of Medical Physiology Latest Ed.. 6. DM Vasudevan and Streekumaris "Text book of biochemistry Latest Ed. 7. Textbook of Biochemistry Devlin
Web and other resources	<p><u>Website:</u></p> <ol style="list-style-type: none"> 1. https://www.sciencedirect.com/journal/the-journal-of-nutritional-biochemistry 2. https://www.textbooks.com/Catalog/AAO/Nutritional-Biochemistry.php 3. https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/metabolic-pathway <p><u>Journal:</u></p> <ol style="list-style-type: none"> 1. Journal of Nutritional Biochemistry 2. Journal of Food Biochemistry 3. Nutrition and Metabolism <p><u>Others:</u></p> <ol style="list-style-type: none"> 1. Martha H. Stipanuk, "Biochemical, Physiological, and Molecular Aspects of Human Nutrition - 3rd edition". (2013).

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 3CH	Outcomes
1	Food, nutrition and diet in healthy adults and various parameters of assessing nutritional status	3 hour	Comprehend the basic concepts of energy Describe methods used to assess nutritional status
2	Nutritional factors in diet, Balanced diet, glycemic index and glycemic load in food	3 hour	Describe nutritional factors in diet, glycemic index and glycemic load of food and its implications
3	Diet and Nutrition in pregnancy and lactation with emphasis on vitamin deficiencies	3 hour	Discuss Diet and Nutrition in pregnancy and lactation.
4	Vitamins and their role in metabolism	3 hour	Discuss role of vitamins in metabolic pathways and regulations.
5	Importance of Water-soluble Vitamins- Vitamin C, B1, folic acid, thiamine, pyridoxine, riboflavin, nicotinic acid, pantothenic acid, biotin Vit B12	3 hour	Identify the role and deficiency related diseases of water-soluble vitamins.
6	Macro minerals- sodium, potassium, calcium, chloride, phosphate	3 hour	Discuss the sources, absorption, regulation, biochemical function and clinical aspect of macro minerals.
7	Micro minerals- iron, zinc, magnesium, selenium, iodine, copper, manganese.	3 hour	Identify the different sources, absorption, regulation, biochemical function, and clinical aspect of micro minerals.
8	Review of classification, physiochemical properties and importance of proteins and amino acids	3 hour	Review amino acids and proteins on the basis of functions, physical & chemical properties
9	Mid-Term Exam		
10	Structural level of Proteins and their importance in Nutrition	3 hour	Discuss the structural levels of proteins and correlate the structural abnormalities of proteins Relate the importance of proteins in nutrition
11	Association of digestion and absorption of protein and amino Acids with clinical disorders.	3 hour	Discuss Digestion and absorption of protein and amino Acids with clinical disorders
12	Review of classification, structural properties and function of different forms of carbohydrates with their clinical disorders	3 hour	Describe properties and function of carbohydrates and their clinical disorders with emphasis on different Glycosaminoglycan

13	Role of digestion, absorption, and functions of lipids and fatty acids with clinical disorders	3 hour	Describe the digestion, absorption and functions of lipids with clinical disorders
14	Review of sources, role, importance, and properties of cholesterol	3 hour	Describe the sources, properties, and biomedical role of cholesterol and TG and correlate them with development of atherosclerosis
15	Properties of lipids	3 hour	Discuss the various properties of lipids such as saponification and rancidity.
16	Biochemical role of prostaglandins, leucotrienes and thromoxanes	3 hour	Discuss the biochemical role of eicosanoids
17	Lipid per oxidation and its significance	3 hour	Describe the oxidation of lipids and its clinical significance.
18	Final-Term Exam		

Course Code	BIO 854
Credit hours	3+0
Course Title	Metabolic Pathways
Pre-Requisite	Basic concepts of anabolism and catabolism in a body
Course Objectives:	<ol style="list-style-type: none"> 1. Describe the biochemical energy yielding and energy requiring reactions of carbohydrates 2. Describe the biochemical energy yielding and energy requiring reactions of proteins 3. Describe the biochemical energy yielding and energy requiring reactions of lipids
Course Outcome	On successful completion of this course the students should be able to discuss the metabolism and metabolic pathways of carbohydrates, proteins and lipids.
Course Contents	Digestion and absorption of carbohydrate, protein and lipids with their clinical significance; Carbohydrate metabolism (Glycolysis, TCA, Gluconeogenesis, and HMP shunt, uronic acid, fructose, galactose and sorbitol); Glycogen metabolism pathways; Respiratory chain and oxidation phosphorylation ,Uncouplers and inhibitors of oxidative phosphorylation; Fatty acids synthesis; Oxidation of fatty acid -steps, regulation and its clinical disorders; Metabolism of cholesterol and ketone bodies and its clinical disorders; Metabolism of lipoproteins and its clinical disorders; Metabolism and clinical disorders of Eicosanoids; Metabolism of phospholipids and its clinical significance; Synthesis and metabolic pathways of Urea; Individual metabolism and their inherited disorders of amino acids including phenylalanine, tyrosine, methionine, cysteine; Individual metabolism and their inherited disorders of amino acids including cystine, tryptophan, creatine, leucine, valine, isoleucine; Neurotransmitters metabolism and related disorders
Recommended Text Books	<ol style="list-style-type: none"> 1. Fundamentals of Biochemistry, D. Voet, J.G. Voet, C.W. Pratt, (1999) John Wiley & Sons, New York.
Recommended Reference Books	<ol style="list-style-type: none"> 1. Harper's Illustrated Biochemistry Latest Ed. 2. M N Chatterjea and Rana shinde Text book of medical biochemistry Latest Ed. 3. Victor 1, Davidson and David B Sittna Biochemistry Latest Ed.

	<p>4. AS Saini Text Book of Biochemistry Latest Ed.</p> <p>5. K.Sembulingan and DremaSembulingan. Essentials of Medical Physiology Latest Ed.</p> <p>6. DM Vasudevan and Streekumaris "Text book of biochemistry Latest Ed.</p> <p>7. Textbook of biochemistryDevlin</p>
Web and other resources	<p><u>Website:</u></p> <p>1. https://www.imedpub.com/scholarly/metabolic-pathways-journals-articles-ppts-list.php</p> <p>2.https://bio.libretexts.org/Bookshelves/Biochemistry/Book%3A_Biochemistry_Online_(Jakubowski)/10%3A_Metabolic_Pathways</p> <p>3. http://homepage.ufp.pt/pedros/bq/integration.htm</p> <p><u>Journal:</u></p> <p>1. Cell Metabolism</p> <p>2. Cell Systems</p> <p>3. Journal of Cell Biology and Metabolism</p> <p><u>Others:</u></p> <p>1. David Greenberg, Metabolic Pathways, 3rd Edition. (1970).</p> <p>2. Michael Krogh Jensen Jay D. Keasling, Synthetic Metabolic Pathways (2018).</p>

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 3CH	Outcomes
1	Review the digestion and absorption of carbohydrate, protein and lipids with their clinical significance.	3 hour	Describe the digestion and absorption of carbohydrate, protein and lipids with their clinical significance. Identify the mechanism leading to malabsorption
2	Carbohydrate metabolism - Glycolysis, TCA, Gluconeogenesis, and HMP shunt	3 hour	Explain glycolysis, TCA, gluconeogenesis, HMP shunt with their clinical correlation.
3	Carbohydrate Metabolism - uronic acid, fructose, galactose and sorbitol	3 hour	Describe biomedical importance of uronic acid pathway, fructose, galactose and sorbitol metabolism with its clinical significance.
4	Glycogen metabolism pathways and regulation of blood glucose levels	3 hour	Discuss glycogen metabolism and the regulation of blood glucose during well fed state and starvation
5	Review of endergonic and exergonic reactions, Respiratory chain & oxidation phosphorylation	3 hour	Correlate biological oxidation, respiratory chain and oxidation phosphorylation with disorders
6	Uncouplers and inhibitors of oxidative phosphorylation	3 hour	Discuss uncouplers and inhibitors of oxidative phosphorylation
7	Fatty acids synthesis	3 hour	Discuss the steps, regulation, biomedical importance and clinical disorder of fatty acids synthesis
8	Oxidation of fatty acid-steps, regulation and its clinical	3 hour	Describe fatty acid oxidation and correlate it with the clinical disorders

	disorders.		
9	Mid-Term Exam		
10	Metabolism of cholesterol and ketone bodies and its clinical disorders	3 hour	Discuss the regulation of metabolism, biomedical importance and role of cholesterol and ketone bodies
11	Metabolism of lipoproteins and its clinical disorders	3 hour	Describe the metabolism of lipoproteins and correlate with coronary heart disease and atherosclerosis
12	Metabolism and clinical disorders of Eicosanoids	3 hour	Understand the Eicosanoids metabolism and its association with various clinical disorders.
13	Metabolism of phospholipids and its clinical significance	3 hour	Discuss the metabolism of phospholipids and its association with the various clinical disorders
14	Synthesis and metabolic pathways of Urea-Transamination and Deamination	3 hour	Describe various urea pathways and associate them with the various clinical disorders.
15	Individual metabolisms and inherited disorders of amino acids - phenylalanine, tyrosine, methionine, cysteine	3 hour	Discuss the individual metabolisms and inherited disorders of amino acids
16	Individual metabolisms and the inherited disorders of amino acids-cystine, tryptophan, creatine, leucine, valine, isoleucine	3 hour	Discuss the individual metabolism and the inherited disorders of amino acids
17	Metabolism of neurotransmitters and disorders related to Acetylcholine, glutamate, GABA, glycine, serotonin, dopamine	3 hour	Discuss the metabolism, biomedical importance and associated diseases of neurotransmitters.
18	Final -Term Exam		

Course Code	BIO 855
Credit hour	3+0
Course Title	Applied Enzymology
Pre-Requisite	Basic concepts of Enzyme mechanism and its function
Course Outcome	This course will impart theoretical and practical knowledge regarding the nature of enzymes that includes classification, and concept of catalysis and catalytic mechanisms
Course Objectives	Upon successful completion of the course, the student will be able to: 1. Understand the catalytic properties, nature and mechanisms of enzyme action. 2. Understanding in the general and applied areas of enzymology which will enable individual student to undertake independent research work in enzymology and successfully undertake postgraduate study
Course Contents	Enzyme Nomenclature, Steady state enzyme kinetics, Differences between chemical equilibrium and steady state kinetics, Limitation of Michealis-Menten equation (MME), variation in MME with respect to the type of inhibitor, Multisubstrate systems, Enzyme reconstitution, Enzyme assays, Criteria for determining purity of enzymes, Measurement and magnitude of enzyme rate constant, The pH dependence of enzyme catalysis, Regulatory enzymes; regulation of enzyme activity and synthesis, Molecular models for allosterism, Multienzyme complexes, Transient kinetic methods, Detection of intermediate in reactions, Determination of Enzyme-Substrate, Dissociation Constants, Chemistry of enzyme catalysis, Stereochemistry of enzymatic reaction, Active site-directed and enzyme activated irreversible inhibitors, Cooperativity, allosteric interactions and regulation, Mechanisms of action of enzymes, Thermodynamics of enzyme-substrate interactions
Recommended Text Books	1. Advances in Enzymology and Related Areas of Molecular Biology, Alton, M., Vol. 61, (1988), John Wiley & Sons, Inc., New York. 2. Enzyme Kinetics, Segel, I., (1993), John Wiley & Sons, Inc., New York.
Recommended Reference Books	1. David Nelson and Micheal Cox, Leninger Principle of Biochemistry, Fifth edition W.H Freeman &Co., Newyork. 2. Stryer, L, Biochemistry, Fifth edition W. H Freeman & Co., Newyork. 3. Palmer,T and Bonner, P Enzymes: Biochemistry, Biotechnology and Clinical Chemistry Second edition. 4. Alan Fersht, Structure and Mechanism in Protein Science, Second edition W.H Freeman & Co. Newyork
Web and other resources	<u>Website:</u> 1. https://www.sciencedirect.com/topics/medicine-and-dentistry/enzymology 2. https://onlinelibrary.wiley.com/doi/book/10.1002/0471220639 3. https://www.opensciencepublications.com/journal-of-enzymology-and-metabolism/ <u>Journal:</u> 1. Methods in enzymology 2. Advances in Enzymology and Related Areas of Molecular Biology 3. Clinical Chemistry and Enzymology Communications <u>Others:</u> 1. N.S. Punekar, ENZYMES: Catalysis, Kinetics and Mechanisms. (2018). 2. Neil D. Rawlings , Alan John Barrett, Handbook of Proteolytic Enzymes (2005)

18 Week Lecture Plan

Week #	Lecture Topic	Duration 3 CH	Outcomes
1	Concepts of enzymology and enzyme nomenclature	3 hour	Describe the basic enzymatic concepts.
2	Steady state enzyme kinetics	3 hour	Differentiate between equilibrium and steady state kinetics
3	Multi-substrate systems and enzyme reconstitution	3 hour	Discuss the basic structure and functions of enzymes.
4	Regulatory enzymes; regulation of enzyme activity and synthesis	3 hour	Understand the Molecular models for allosterism, multienzyme complexes
5	Transient kinetic methods	3 hour	Discuss Enzyme-Substrate Dissociation Constants
6	Chemistry of enzyme catalysis	3 hour	Describe the catalytic mechanisms employed by most well characterized enzymes.
7	Mechanisms of action of enzymes	3 hour	Describe the mechanisms of enzyme catalysis.
8	Thermodynamics of enzyme-substrate interactions, Binding energy in catalysis	3 hour	Understand the energy profile in chemical reaction and enzyme catalyzed reaction.
9	Mid-Term Exam		
10	Practical kinetics	3 hour	Understand the rate constant and kinetic parameters, different transient kinetic methods
11	Factors affecting enzyme activity	3 hour	Understand the factors affecting enzyme activity
12	Protein engineering	3 hour	Describe the current and future trends of enzyme technology used for commercialization of biotechnological products.
13	Enzyme Assay Techniques	3 hour	Understand the various enzyme assays technique
14	Enzyme purification	3 hour	Compare methods for production, purification, characterization and immobilization of enzymes
15	Thermodynamics of commercially important enzymes	3 hour	Describe important kinetics parameters of commercially important enzymes.
16	Enzyme Technology	3 hour	Understand the basic concepts of enzyme technology, enzymatic biotransformation and innovative application of some specialized enzyme in food, medical, and diagnostic industries.
17	Applications of Enzyme Technology	3 hour	Explain the techniques employed in enzymes engineering and hybridization
18	Final-Term Exams		

Course Code	BIO 856
Credit hour	3+0
Course Title	Molecular Genetics and Disorders
Pre-Requisite	Basic concepts of human genetics and related disorders
Course Outcome	This course will provide information about the molecular basis of genes; the principles of genetic disorders and their diagnosis.
Course Objective	At the end of the course students will be able to 1. Identify the patterns and ways of transmission of genetic disorders. 2. Discuss the importance and limitations of genetic testing, genetic screening and prenatal diagnosis.
Course Contents	The history and impact of genetics in medicine, the cellular and molecular basis of inheritance, transcription, translation, gene expression regulation, Mutations, Human chromosomes and methods of analysis, Cell division, DNA technology and application Mapping and identifying genes for monogenic disorders, Developmental genetics, Patterns of inheritance, Mathematics and population genetics, Polygenic and multifactorial inheritance, Hemoglobin and the hemoglobinopathies, Biochemical genetics, Pharmacogenetics, Immunogenetics, Cancer genetics, Genetic factors in common diseases, Congenital abnormalities and dysmorphic syndromes Genetic counseling, Chromosome disorders, Single-gene disorders, Screening for genetic disease, prenatal testing and reproductive genetics, Risk calculation, Ethical and legal issues in medical genetics.
Recommended Text Books	1. Gardner, R. J. M. and Sutherland, G. R. 1996. Chromosome Abnormalities and Genetic Counseling, Oxford University Press, New York., USA. 2. Gerdes, L. I. 2014. Human Genetics. Farmington Hills, Mich: Greenhaven Press. 3. Hartwell, L.H., Goldberg, M.L., Fischer, J.A., R. L. Hood and Aquadro, C.F. 2015. Genetics: From genes to genomes. 5th Ed., McGraw Hill Book co., New York, USA.
Recommended Reference Books	1. Lewis, R. 2017. Human Genetics: Concepts and applications. McGraw-Hill. 2. Strachan, T., Goodship, J., & Chinnery, P. F. 2015. Genetics and genomics in medicine. New York, USA: Garland Science/Taylor & Francis Group. 3. Wolfe, J. 2016. Genetic testing and gene therapy. New York: Britannica Educational Publishing in association with Rosen Educational Services. Harper's Illustrated Biochemistry Latest Ed. 4. M N Chatterjee and Rana shinde Text book of medical biochemistry Latest Ed. 5. Victor 1, Davidson and David B Sittna Biochemistry Latest Ed. 6. AS Saini Text Book of Biochemistry Latest Ed. 7. DM Vasudevan and Streekumaris "Text book of biochemistry Latest Ed.
Web and other resources	<p><u>Website:</u></p> <ol style="list-style-type: none"> 1. https://onlinelibrary.wiley.com/journal/23249269 2. http://www.freebookcentre.net/medical_text_books_journals/genetics_ebooks_online_texts_download.html 3. https://www.genecards.org/ <p><u>Journal:</u></p> <ol style="list-style-type: none"> 1. Journal of Inherited Metabolic Disease 2. Genes and Diseases 3. PLOS Genetics <p><u>Others:</u></p>

	1. Maria Puiu, "Genetic Disorders". (2013). 2. Rob Elles, "Molecular Diagnosis of Genetic Diseases (Methods in Molecular Medicine) (v. 1) 2nd Edition" (2002).
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18 week Lecture Plan

Week #	Lecture Topic	Duration 3CH	Outcomes
1	History and impact of genetics in medicine	3 hour	Discuss the most significant discoveries and theories through the historical progress on the development of molecular biology
2	Cellular and molecular basis of inheritance	3 hour	Understand the basic principles of Molecular Genetics Explain the mechanisms of DNA replication and repair, RNA synthesis and processing, and protein synthesis.
3	Chromosomes structure and functions	3 hour	Describe the basic structure of chromosome and its function
4	Cell Cycle and its regulation	3 hour	Identify the phases of division of somatic and sex cells.
5	Chromosome and its abnormalities	3 hour	Discuss the chromosomal abnormalities
6	Pattern of Inheritance	3 hour	Describe the principles and laws of inheritance at the cell, individual and population levels
7	Single gene Disorders, Polygenic and multifactorial inheritance	3 hour	Understand the single gene related disorders, polygenic and multifactorial inheritance
8	Biochemical genetics	3 hour	Explain the basis of biochemical genetics
9	Mid-Term Exam		
10	Hemoglobin and the hemoglobinopathies	3 hour	Discuss the pathophysiologic mechanisms resulting in clinical disease.
11	Genetic factors in common diseases	3 hour	Understand the role of genetic factors in health and disease
12	Developmental genetics	3 hour	Discuss basic concepts, principles and methods in developmental biology.
13	Population genetics	3 hour	Describe the principle and analysis of population genetics.
14	Dysmorphic syndromes	3 hour	Explain the Dysmorphic syndromes related to cell biology, genetics and its malfunction
15	Congenital abnormalities and dysmorphic syndromes	3 hour	Describe the causes of congenital disorders.
16	Prenatal testing and reproductive genetics	3 hour	Explain the principles of prenatal screening and reproductive carrier screening.
17	Pedigrees	3 hour	Understand the relevant, targeted and

			comprehensive personal and family histories and pedigrees.
18	Final-Term Exam		

Course Code	BIO 857
Credit Hour	3+0
Course Title	Principles of Immunology
Pre-Requisite	Basic concepts of immune system in a body
Course Outcome	This course will provide basic and advanced knowledge of different mechanisms of the immune system and will introduce the students to the recent advances in immunology
Course Objectives	Upon successful completion of the course, the student will be able to: <ol style="list-style-type: none">1. Explore the basic knowledge of the mechanisms of immune system.2. Describe the concepts about the role of immune system.3. Interpret the provided problems in using immunological techniques for diagnosis of immune disorders.
Course Contents	Introduction, Components of the immune system, Antigens and Pathogens, Innate Immunity and Inflammation, Different types of leukocytes, Recognition and Responses to foreign antigens, Pattern recognition receptors, Innate immune signaling, The complement system, Hybridoma technology, Lymphocyte Development and Diversity, Lymphocyte development, , Differences between B and T lymphocytes, The generation of lymphocyte receptor diversity, T Cell Activation by Antigens, Antigen presentation, T Cell-Dependent B Cell Responses, T Cell activation of B cells, Isotype switching and affinity maturation, Helper T cell functions, The role of helper T cells in disease, Cytotoxic T cell functions, Selection and expansion of cytotoxic T cells, Therapies that target cytotoxic T cell functions, Tumor Immunology, Detection and identification of Tumor Antigens, Immune Escape Mechanisms of Tumor Antigens, basis of Immunodiagnostic Techniques, Transplantation of Autologous, Bone Marrow/Hematopoietic Stem Cells, Clinical Aspects of Organ Transplantation.
Recommended Text Books	<ol style="list-style-type: none">1. Roitt's Essential Immunology (2011). by Peter J. Delves, Seamus J. Martin, Dennis R. Burton and Ivan M. Roitt 12th Edition. Wiley-Blackwell.2. Kuby Immunolgy, 7th edition. (2013). by Jenni Punt, Sharon Stranford, Patricia P. Jones, Judy Owen3. Kindt, Goldsby, Osborne Immunology by Kuby 6th edition WH Freeman Publishers.4. Ken Murphy, Paul Travers, Mark Walport. Janeway's Immunobiology – 8th Edition Garland Science Publishers5. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter. Molecular Biology of the Cell (5th ed. 2008, Garland)6. Thomas J Kindt, Richard A Goldsby, Barbara A Osborne, Janis Kuby: Immunology (2003, Freeman).7. Peter J. Delves, Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt Roitt:

	<p>Roitt's Essential Immunology (12th ed. 2012, Blackwell)</p> <p>8. Abul Abbas, Andrew H. Lichtman, Shiv Pillai. Cellular and Molecular Immunology, 9th edition, 2017. Elsevier Pub Co.</p>
Recommended Reference Books	<p>1. Gerd R. Burmester, Antonio Pezzutto Color Atlas of Immunology, 2006. Thieme Stuttgart, New York.</p> <p>2. Annual Review of Immunology, Journal of Immunology</p> <p>3. European Journal of Immunology, Immunology Today, Advances in Immunology</p> <p>4. CRC Critical Reviews in Immunology and Human Gene Therapy</p>
Web and other resources	<p><u>Web sources</u></p> <p>1. https://www.us.elsevierhealth.com/medical-students/immunology.</p> <p>2. https://www.accessengineeringlibrary.com/content/book/9781260120783/chapter/chapter19</p> <p>3. https://www.genecards.org/</p> <p><u>Journal:</u></p> <p>1. Journal of Immunology</p> <p>2. Infection and Immunity</p> <p>3. Molecular Immunology</p> <p><u>Others:</u></p> <p>1. Jenni Punt; Sharon Stranford; Patricia Jones; Judy Owen, "Kuby Immunology, 18th Edition". (2019).</p> <p>2. Kenneth M. Murphy; Casey Weaver, "Janeway's Immunobiology 9th Edition" (2016).</p>

18 Week Lecture Plan

Week #	Lecture Topic	Duration 3 CH	Outcomes
1	Overview of principles and components of the Immune system	3 hour	Distinguish between innate immunity and acquired immunity .
2	Cells and Organs of Immune System	3 hour	Discuss the Structure and Function of the molecules, cells, and organs involved in Immunity.
3	Antigen Antibody Interaction	3 hour	Describe the basic structure of antigen, immunoglobulin and their interactions
4	Cytokines	3 hour	Discuss the structure, properties and functions of cytokines
5	Hypersensitive reactions	3 hour	Differentiate between the components and mechanism of type I and Type II hypersensitive reactions
6	Hybridomas and monoclonal antibody technology	3 hour	Describe the formation and selection of hybrid cells
7	Antigen processing and presentation	3 hour	Understand the role of antigen presenting cell and define the mechanism
8	T cells activation and its role in disease development.	3 hour	Describe the T cell developmental pathways

9	Mid-Term Exam		
10	Complement activation pathways	3 hour	Differentiate between the classical and alternative pathway involved in complement activation
11	Transplantation Immunology	3 hour	Describe the Clinical Aspects of Organ Transplantation
12	Major histocompatibility complex and its classes	3 hour	Understand General organization and structures of MHC molecules
13	Autoimmune disease in humans	3 hour	Discuss the cellular and molecular basis for autoimmune disease and allergies.
14	Immune systems in AIDS	3 hour	Describe the HIV structure and infectious process and its clinical diagnosis.
15	Immunodeficiency Diseases	3 hour	Classify immunodeficiency diseases with cell mediated and humoral deficiencies.
16	Immune responses to the infectious diseases and tumors	3 hour	Define the immune response against viral, bacterial protozoan diseases and tumors
17	Problems in immunological techniques for diagnosis of disorders	3 hour	Interpret the relevant problems in immunological techniques for diagnosis of disorders
18	Final-Term Exam		

Course Code	BIO 858
Credit Hour	3+0
Course Title	Medical Biotechnology
Pre-Requisite	Basic Concepts of Biotechnology with respect to its application in medical sciences
Course Outcome	This course will provide the students with the fundamental knowledge regarding the various techniques being used in modern bioengineering in order to help them to analyze, design and solve health problems
Course Objectives	After successful completion of course, the students will be able to understand the basic concepts of medical biotechnology and various techniques involved in diagnosis of diseases.
Course Contents	Introduction to the medical biotechnology, Introduction to gene and genome, Human Genome project, Primer Designing, Single nucleotide polymorphism, Principles of cloning DNA in medical biotechnology, General principles and strategies for cloning, Gene cloning techniques for mammalian cells, Molecular biological techniques for rapid diagnosis of diseases, DNA sequencing, Medical biotechnological approach to study various types of diseases (Infectious and Genetic), Tuberculosis, Typhoid, Hepatitis C, Thalassemia, Chromosomal anomalies, Other mutations, Prenatal diagnosis of anemia, Molecular basis for inherited disease , Mapping a genetic disease, Medical Biotechnology Regulations, Ethics and Medical Biotechnology, Biosafety Regulation, Introduction to genetically manipulated organisms (GMOs)
Recommended Text Books	1. Biosafety management. Mitchell, R. 2000.1st ed. Virginia Polytechnic Institute Publication. USA.

	<p>2. Principles of tissue Engineering. Lanza, R.P., Langer, R. and Vacanti, 2000. 2nd Edition. Academic Press, California, USA.</p> <p>3. Genetics: From Genes to Genomes. Hartwell, L.H., Hood, L., Goldberg, M.L., Reynolds, A.E., Silver, L.M. and Veres, R.C. 2008. 3rd edition. McGraw-Hill Companies, Inc. Avenue of Americans, New York.</p> <p>4. Introduction to Genetic Analysis. Griffiths, A. J. F., Wessler, S.R., Lewontin, R.C. and Carroll, S. B. 2008. 9th edition. W.H. Freeman and company, USA, New York. Basic Biotechnology. Ed. Ratledge, C. and Kristiansen, Bjorn. 2006. 3rd edition. Cambridge University Press, New York.</p> <p>5. Principles of Gene Manipulation and Genetics. Primrose, S.B. and Twyman, R. M. 2006. 7th edition. Blackwell Publishing, USA.</p>
Recommended Reference Books	<p>1. Daugherty E, 2012. Biotechnology: Science for the New Millennium. 1st Edition, Revised; Paradigm Publication.</p> <p>2. Smith JE, 2009. Biotechnology. 5th Edition; Cambridge University Press.</p> <p>3. Nicholl TSD, 2004. An Introduction to Genetic Engineering. 2nd Edition; Cambridge University Press, UK.</p> <p>4. Purohit SS, 2005. Biotechnology Fundamentals & Application. 4th Edition; Agro Bios, India.</p> <p>5. Ratledge C and Kristiansen B, 2006. Basic Biotechnology. 2nd Edition;</p>
Web and other resources	<p><u>Website:</u></p> <ol style="list-style-type: none"> 1. https://www.gfmer.ch/Medical_journals/Biotechnology.htm 2. https://www.routledge.com/Biotechnology-in-Medical-Sciences/Khan/p/book/9781138076792 3. https://www.wgu.edu/blog/medical-biotechnology-advancements-ethics1811.html <p><u>Journals:</u></p> <ol style="list-style-type: none"> 1. Biotechnology Journal 2. International Journal of Advances in Medical Biotechnology (IJAMB) 3. Avicenna Journal of Medical Biotechnology (AJMB) <p><u>Others:</u></p> <ol style="list-style-type: none"> 1. Bernard R. Glick, Cheryl L. Patten, T. L. Delovitch, "Medical Biotechnology", (2013). 2. Firdos Alam Khan, "Biotechnology in Medical Sciences" (2014).

18 week Lecture Plan

Week #	Lecture Topic	Duration 3CH	Outcome
1	Overview of Medical Biotechnology	3 hour	Provide basic concept of biotechnology and its branches including medical biotechnology
2	Overview of Genes and Genomes, Gene Mutations	3 hour	Understand assembly of genes into genomes Describe the types and causes of mutation
3	Single Nucleotide Polymorphism & Primer Designing	3 hour	Understand diseases caused by single gene and multiple genes polymorphism and environmental factors Describe the process of primer designing
4	Gene Cloning and Vehicles for Gene Cloning	3 hour	Understand the gene cloning and vehicles for gene cloning

5	Biosensors in clinical diagnosis	3 hour	Describe the application of biosensors in clinical diagnosis
6	DNA Sequencing & Restriction Fragment Length Polymorphism	3 hour	Understand how di-deoxy-nucleotides can be used to obtain DNA sequence information (Sanger sequencing)
7	Types of Plasmids	3 hour	Describe the types of Plasmids and DNA vectors
8	Recombinant DNA Technology and DNA cloning	3 hour	Explain the recombinant DNA technology and DNA cloning
9	Mid-Term Exam		
10	Applications of Recombinant DNA Technology	3 hour	Identify the applications and scope of recombinant DNA technology
11	DNA Fingerprinting and Forensic Analysis	3 hour	Describe the utilization of genetics in a forensic investigation. Explain the utilization of genetic markers typing and DNA profiling by the forensic serology discipline for criminal investigations
12	Human Genetic Disease Conditions	3 hour	Identify the significance of genetic alterations in common diseases
13	Detection and Diagnosis of Human Diseases	3 hour	Discuss the significance of genetic testing in the diagnosis, prevention, and treatment of monogenic and common diseases Perform the most commonly-used molecular diagnostics protocols
14	Genetically engineered protein and peptide agents	3 hour	Describe genetically engineered proteins and peptide agents
15	Biosafety in biotechnology	3 hour	Understand the scope and significance of biosafety in biotechnological process
16	Product planning and development	3 hour	Describe the concepts of product planning and development
17	Ethics and Medical Biotechnology	3 hour	Understand the appropriate ethical frameworks Apply ethical principles in conducting Medical Biotechnology studies
18	Final-Term Exam		

Course Code	BIO 859
Credit Hour	3(2+1)
Course Title	Bioinformatics
Pre-Requisite	Basic concept and knowledge of Biochemistry, Molecular Biology and basic computer knowledge.
Course Objective	<ol style="list-style-type: none"> 1. Describe the principles of bioinformatics 2. Describe the guidelines to work in silico lab 3. Perform the skills to run <i>in silico</i> lab analysis independently. 4. Develop methods and use software tools for understanding biological data
Course Outcome	Students will be able to understand the principles and apply the skills in research projects in respect to sequence analysis and structural analysis
Course Contents	Bioinformatics repositories, tools, browsers and servers. NCBI, Uniprot, Gene Card, PDB, SCOP, CATH, Expasy, EMBL sequence alignment tools. 1D, 2D and 3D structure analyses, sequence alignments, homolog search, finding similarity and identity, Algorithms and approaches: PAM, BLOSUM, Dynamic programming etc. Applications: Drug discovery and validation, antibody development, molecular communication, Structure (3D) modeling and validation, Sequencing methods, Evolutionary relationship analysis, Retrieval and understanding of Biological Data Concepts, Methodology and analysis of Biological information, Application of bioinformatics in research, diagnostics and medicine, and evolution. Employing bioinformatics resources and available information to fill the knowledge gaps and find the solutions to biological problems
Recommended Text Books	<p>Arthur M. Lesk, Introduction to Bioinformatics Oxford University Press.</p> <p>Batiza AF. Bioinformatics, Genomics, and Proteomics: Getting the Big Picture (Biotechnology in the 21st Century). Chelsea House Publishers; 2006.</p> <p>Campbell MA, Heyer LJ. Discovering Genomics, Proteomics and Bioinformatics. Pearson education, 2009</p> <p>Christianini, N. and Hahn, M. W. Introduction to Computational Genomics: A Case Studies Approach, Cambridge University Press, 2007. UK.</p> <p>Durbin, R., Eddy, S., Krogh, A. and Mitchison, G., Biological Sequence Analysis: Probabilistic models of proteins and nucleic acids, Cambridge University Press, 1998. UK.</p>
Recommended Reference Books	<p>DW Mount, Bioinformatics: Sequence and Genome Analysis, Second Edition, CSHL Press, USA.</p> <p>Introduction to Bioinformatics: A Theoretical and Practical Approach, Humana Press.</p> <p>Jones, N. C. and Pevzner, P. A. An Introduction to Bioinformatics Algorithms, MIT Press, 2004. USA.</p> <p>Pevsner J (2009) Bioinformatics and Functional Genomics. Wiley-Blackwell, Hoboken, NJ, USA.</p>
Web and other resources	<p><u>Websites:</u></p> <p>www.ncbi.nlm.nih.gov</p> <p>www.uniprot.org</p> <p>www.expasy.org</p> <p>https://blast.ncbi.nlm.nih.gov/Blast.cgi</p> <p>www.ncbi.nlm.nih.gov > pubmed</p>

	<p>https://www.rcsb.org/ www.cathdb.info http://scop.mrc-lmb.cam.ac.uk/</p> <p><u>Journals:</u> International society for computational Biology PLOS computational biology</p> <p><u>Others:</u> Structural Bioinformatics by Philip E Bourne. 2. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, 3rd Edition, Andreas D. Baxevanis (Editor), B.F. Francis Ouellette (Editor), ISBN: 978-0-471-47878-2. Xiong, J., Essential Bioinformatics, Cambridge University Press, 2006. UK.</p>
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18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 2CH	Outcome
1	Introduction to Bioinformatics Scope of Bioinformatics Review: Concepts of Molecular Biology	2 hour	Explain connection of bioinformatics with other sciences.
2	Databases, File formats, Nucleotide and amino acid sequences and structure data, Comprehend relevant information	2 hour	Describe the explicit biological information in databases
3	Genome Browsers and Integrated Databases Bioinformatics tools and repositories. Primary vs Secondary Databases Structure Database (Protein Data Bank), information retrieval and 3D structure visualization	2 hour	Describe the links among bioinformation hubs, find agreement and ways to cross check the information
4	Concept of sequence alignments: Local, Global, Pairwise, Multiple. Algorithms of Identity matrix and Dot plot and relevance of variables	2 hour	Differentiate among methods to find bio-similarity
5	Basic Local Alignment Search Tool (BLAST), Flavors, Variables, Analysis and selection of optimal hits	2 hour	Elaborate the concept and selection criteria for BLAST search
6	Different algorithms of Pairwise Sequence Alignment tools and algorithms for both DNA and Proteins	2 hour	Differentiate among different PWA algorithms
7	Concept of Primer and Probes Use in PCR Primer mapping on target seq. Concept of Revers, complimentary and Revers- complimentary	2 hour	Comprehend the use of N.A sequences in molecular biology experiments. Importance of reverse/complementarity and use of relevant bioinformatics tool

	sequences		
8	Concept of Multiple sequence alignment Conserved domains Evolutionary relation, divergence and convergence	2 hour	Explain concept of evolutionary relation. Conserved phenotypic characters.
9	Mid-Term Exam		
10	Physicochemical attributes of amino acids which dictates proteins' structure, function, stability and their behaviors in lab experiments	2 hour	Describe the origin of molecular programing that dictates 3D conformation, dynamics and stability
11	Substitution matrices (PAM, BLOSUM)	2 hour	Acquire concept of evolutionary based scoring scheme
12	K-tuple method, Dynamic Programing Algorithm	2 hour	Discuss the robust method to find optimal alignments
13	3D Structure analysis Concepts: Structural organization and classification of proteins Secondary Databases of Protein 3D Structure Classification	2 hour	Discuss the concept of proteins structural and functional features and classification
14	Protein 3D structure prediction: Ab initio, Threading, Homology modeling	2 hour	Explain the alternative strategies to predict 3D structure and their selection/ preference criteria
15	Stability prediction of Protein 3D models by software	2 hour	Explain the set of criteria form protein structural stability
16	Introduction to MS and NGS Introduction to Phylogenetic Introduction to Immuno-informatics	2 hour	Explain troubleshoot basic sequencing errors and introduction to the applications of <i>in silico</i> approaches to find solutions to biological problems
17	Molecular Docking steps, requirements, advantages result analysis Introduction to molecular dynamic simulation Exposure to Computer aided Drug discovery	2 hour	Describe the design of basic protocol to perform <i>in silico</i> interaction between molecules.
18	Final -Term Exam		

18 Weeks Lab Plan

Week #	In silico Lab	Duration 1 CH	Outcome
1	Physicochemical attributes of amino acids	3 hour	Identify the molecular phenomenon that dictate structure function and effect of mutations, evolution/Diversity.
2	NCBI (nucleotide, protein, Gene, ESST, Chromosome) Uniprot, Swissprot, Genebank,	3 hour	

	FASTA, Raw. nucleotide and aminoacid based sequence, structure data acquisition. Retereval of desired information		Retrieve implicit biological information and decipher it
3	Information retrieval and 3D structure visualization NCBI, GeneCard, Expasy Protein Data Bank	3 hour	Confirm the information by finding alignment between biological information in repositories
4	Perform <i>in silico</i> local & global sequence alignments. Experience the effect of variation in parameters on Dot plot	3 hour	Choose the method and select variables to find similarity
5	Procedure of performing BLAST	3 hour	Find out the homologues or similar domains
6	Procedure of performing: Pairwise Sequence Alignment by employing different algorithms	3 hour	Perform the optimal alignment and compare 2 sequences
7	Primer mapping on target seq. Reverse/complimentary sequences	3 hour	Validate the sequences for molecular biology experiments. Map primer binding site. Map target region.
8	Procedure of performing: Multiple sequence alignment by Clustal Omega, Multiple Sequence Comparison by alignment score, Log-Expectation values and scores	3 hour	Perform the procedure to conserve domains for possible structural and functional homology or evolutionary relationship
9	Mid-Term Exam		
10	Procedure of performing: IP value, Titration curve, buffer selection, IEF, Determine bonding types and find the suitable distance for various types of bonds to form	3 hour	Assess the physical and chemical attributes of amino acids and proteins which help them in following topics
11	Use of PAM and BLOSUM for <i>in silico</i> experiments and result analysis	3 hour	Perform the effect of scoring scheme on similarity search
12	Procedure of performing: DPA for global and local alignment	3 hour	Perform actual calculations to find optimal global and local alignments
13	PDB Visual analytics on DS & SPDBV CATH vs SCOP	3 hour	Analyze proteins 3D structure and structural features Locate functional features and classify domains
14	Procedure of performing: Homology modeling SWISS model	3 hour	Demonstrate template based protein structure designing

	Modeller (Python script based)		
15	Ramachandran plot	3 hour	Validate protein 3D structure on the basis of torsion angles
16	ProSA-web	3 hour	Validate the stability of protein 3D structure
17	Procedure of performing: Molecular Docking experiment	3 hour	Assess the inter-molecular interactions between compound(s) and protein (receptor)
18	Final-Term Exam		

PHYSIOLOGY

ELECTIVE COURSE LIST - PHYSIOLOGY

Sr.No .	Course Code	Course Title	Credit hours	Theory	Practica l
1	PHY 861	Cellular & Molecular Basis of Physiology	3+0	3	0
2	PHY 862	Hormonal Physiology	3+0	3	0
3	PHY 863	Laboratory techniques in Physiology	3(1+2)	1	2
4	PHY 864	Physiology of Behaviour & Neurosciences	3+0	3	0
5	PHY 865	Exercise Physiology and Movement Disorders	3+0	3	0
6	PHY 866	Principles of Hematology and immune mechanisms	3+0	3	0
7	PHY 867	Cardio-Vascular Physiology and Hemodynamics	3+0	3	0
8	PHY 868	Pulmonary and Renal Physiology	3+0	3	0

DETAILED COURSE OUTLINE - ELECTIVE COURSE LIST – PHYSIOLOGY

Course Code	PHY 861
Credit hour	3+0
Course Title	Cellular & Molecular Basis of Physiology
Pre-Requisite	Basic knowledge of cellular Mechanisms
Course Objective	<ol style="list-style-type: none"> 1. Develop an understanding of genomic approaches to molecular biology and Protein structure and function 2. Explain signalling pathways 3. Discuss the molecular and chemical basis of membrane structure 4. Describe catalysis and the use of energy by cells 5. Explain chromosomal DNA and its packaging in the chromatin fiber 6. Discuss mechanism of DNA replication and repairs 7. Understand the central dogma for the synthesis of protein 8. Discuss the analysis and techniques of cell culture 9. Explain the principles of membrane transport, transporters and compartmentalization of cells 10. Discuss different cell signalling mechanisms in regulation of gene 11. Discuss significance of cytoskeleton in growth and changes in cellular environment 12. Explain the physiological and molecular basis of apoptosis and cell death
Course Outcome	At the end of this course the student should be able to: <ol style="list-style-type: none"> 1. Understand the molecular and physiological basis of cell membrane and cellular contents 2. Describe the complex mechanisms in replication of DNA and protein synthesis 3. Explain various mechanisms involved in cell remodeling, repair and cell death
Course Contents	This course is designed to explore the molecular mechanisms of cell physiology, gene expression and genome function including the role of chromatin and non-coding RNA, translation, cell cycle and division, and cell signaling. Protein trafficking, secretory pathways, electron transport, cell homeostasis and apoptosis.
Recommended Textbooks	<ol style="list-style-type: none"> 1. Textbook: Molecular Biology of the Cell (6th edition) by Alberts et al. Garland Science.ISBN-13: 978-0815345244 2. The Cell: A Molecular Approach by Geoffrey M. Cooper 3. ISBN-13: 978-0878939640
Recommended Reference Books	Cell and Molecular Biology 7th Edition by <u>Gerald Karp</u> ISBN-13: 978-1118791547
Web and Other Resources	<p>Website: www.garlandscience.com/MBOC6-students https://www.omicsonline.org/cellular-and-molecular-biology.php</p> <p>Journals: Journal of molecular biology Journal of genetics and genomics</p> <p>Others: https://www.siftdesk.org/journal-details/Journal-of-Cellular-and-Molecular-Physiology/58</p>

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 3 CH	Outcome
1	Diversity of Genome	3 hour	Critically discuss the diversity of genomes, the tree of life and genetic Information in eukaryotes
2	Cellular Chemistry and Bioenergetics	3 hour	Explain the chemical components of a cell and describe catalysis and the use of energy by cells
3	Molecular Basis of the Shape, Structure & Function of Proteins	3 hour	Relate the shape and structure of proteins with their functions
4	DNA, Chromosomes, and Genomes	3 hour	Describe the structure and function of DNA, chromosomal DNA and its packaging in the chromatin fiber and relate it with chromatin structure and function
5	DNA Replication, Repair, and Recombination	3 hour	Discuss the maintenance of DNA sequences, replication mechanisms and relate it with DNA repair
6	From DNA to Protein	3 hour	Understand the complex mechanism of DNA to RNA and RNA to protein synthesis
7	Control of Gene Expression	3 hour	Describe the control of transcription by sequence-specific DNA-binding proteins and genes switching on and off.
8	Molecular genetic mechanisms	3 hour	Explain the molecular genetic mechanisms creating and maintaining specialized cell types and mechanisms reinforcing cell memory in animals
9	Mid-Term Exam		
10	Analyzing Cells, Molecules, and Systems	3 hour	Describe isolation of cells, purifying and growth in culture, analysis of proteins and manipulation of DNA.
11	Advanced Membrane Structure	3 hour	Describe the advances in the molecular and chemical basis for membrane structure
12	Molecular Basis of the Membrane Transport and its Electrical Properties	3 hour	Critically discuss the principles of membrane transport, transporters and relate them with the electrical properties of membranes
13	Intracellular Compartments and Protein Sorting	3 hour	Describe the compartmentalization of cells, and its organelles and transportation of molecules between the nucleus, cytosol and mitochondria.
14	Intracellular Membrane Traffic	3 hour	Discuss the molecular mechanisms of membrane transport and the maintenance of compartmental diversity.
15	Molecular Basis of Cell Signaling	3 hour	Describe the signaling through G-protein-coupled receptors, enzyme-coupled receptors and alternative signaling routes in gene regulation.

16	Intracellular Organization and Interaction	3 hour	Describe rearrangement of cell's internal components as they grow, divide, and adapt to changing circumstances
17	Cell Growth and Proliferation, Apoptosis and Senescence	3 hour	Describe the cell cycle control and its phases, excessive or insufficient apoptosis contribution to disease
18	Final-Term Exam		

Course Code	PHY 862
Credit hours	3+0
Course Title	Hormonal Physiology
Pre-Requisite	Basic knowledge of endocrine system
Course Objective	<ol style="list-style-type: none"> 1. Understand the underlying principles of endocrinology at the cellular, biochemical, and physiological level. 2. Describe the advances in contribution of sedentary lifestyle and obesity in the development of metabolic syndrome 3. Describe the etiological factors for development of metabolic syndrome 4. Describe the association of gene expression regulation with metabolic and endocrine regulation in tissues 5. Describe the pathophysiologic mechanisms involved in different hypo and hyper thyroid states 6. Discuss chromosomal aberrations in different endocrine disorders 7. Describe the life-saving action of epinephrine and nor epinephrine in case of emergency states and accidents 8. Explain the role of leptin and ghrelin in regulation of growth hormone secretion 9. Discuss the importance of oxytocin and prolactin as bonding hormones 10. Discuss genetic and environmental factors as basis of various types of diabetes mellitus 11. Describe the role of cortisol and aldosterone in pathogenesis of different types of hypertension 12. Discuss the Importance and causes of polycystic ovarian syndromes in infertility 13. Understand different genetic, and environmental causes of infertility in both males and females 14. Explain the molecular biology of early human embryo and its development in IVF technologies 15. Understand the use IVF technologies 16. Discuss the significance of hormone replacement therapy in menopause in other female reproductive disorders
Course Outcome	<p>Student should be able to:</p> <ol style="list-style-type: none"> 1. Understand the underlying principles of endocrinology at the cellular, biochemical, and physiological level. 2. Describe the role of gene expression and chromosomal aberration in metabolic and endocrine diseases

	3. Explain the Causes of primary and secondary infertility and use of IVF methods as treatment options.
Course Contents	This course focuses on understanding the underlying principles of endocrinology, the mechanisms involved in regulating hormone levels, including thyroid hormones(cretinism, myxedema ,graves' disease Hashimoto thyroiditis), role of endocrine system in integrating metabolic pathways, role of various factors like lipid profile, BMI and adipokines in development of metabolic syndrome ,regulation of gene expression and its association with metabolic and endocrine regulation in different tissues, infertility including causes and risk factors of male and female infertility, ovulation induction, reproductive technologies, assisted conception.
Recommended Textbooks	1. Clinical Endocrinology and Metabolism 1 st Edition By Pauline Camacho ISBN-13: 978-1840761214 2. Williams Textbook of Endocrinology 14th Edition (2019) by Shlomo Melmed ISBN-13: 978-0323555968
Recommended Reference Books	Essential endocrinology and diabetes by Holt, Richard I. G.; Hanley, Neil A. ISBN-13: 978-1405136488 Integrated endocrinology by Laycock, John F. ISBN-13: 978-1405136488
Web and other resources	<u>Websites:</u> Clinical Endocrinology - Wiley Online Library <u>Journals:</u> Journal of endocrinology and reproduction Reproductive biology and endocrinology <u>Others:</u> Greenspan's basic and clinical endocrinology

17 Weeks Lecture Plan

Week #	Lecture Topic	Duration 3CH	Outcome
1	Childhood obesity and physical inactivity as a cause of Metabolic syndrome.	3 hour	Understand the relationship between the Childhood obesity and physical inactivity in metabolic syndrome.
2	Role of adipokines, high BMI and lipid profile in obesity	3 hour	Discuss the role of adipokines, high BMI and lipid profile in pathophysiology of obesity
3	Mechanisms for regulation of gene expression in metabolic diseases and progression	3 hour	Discuss the different mechanisms that regulate gene expression involved in pathogenesis of metabolic syndrome
4	Biological effects of thyroid disorders	3 hour	Understand the effects of thyroid hormones in body metabolism.
5	Chromosomal Aberrations in Endocrine related syndromes	3 hour	Discuss chromosomal aberrations in various endocrine disorders
6	Lifesaving role of adrenal medullary hormones	3 hour	Describe role of catecholamines in regulation of sympatho-adrenal

			activity in emergency
7	Regulation of Growth Hormone: Leptin and Ghrelin	3 hour	Describe the regulation of Growth hormone by Leptin, and ghrelin
8	Oxytocin and Prolactin as bonding hormones	3 hour	Discuss the role of oxytocin and prolactin as bonding hormones in stress
9	Mid-Term Exam		
10	Genetic and acquired factors of Diabetes Mellitus	3 hour	Discuss pathophysiology of different types of diabetes mellitus
11	Role of Adreno- cortical hormones in hypertension.	3 hour	Discuss the role of adrenal cortical hormones in pathogenesis of hypertension.
12	Causes of primary and secondary infertility	3 hour	Describe causative factors responsible for infertility in males and females.
13	Significance of PCOS in causing infertility	3 hour	Discuss various underlying factors and hormones responsible for causing PCOS
14	Methods of Assisted Reproductive Technologies	3 hour	Describe various methods for in-vitro fertilization
15	Outcomes and complications of Assisted reproductive techniques	3 hour	Discuss different outcomes and complications of assisted reproductive techniques
16	Biological & Social Aspects of Infertility and IVF	3 hour	Discuss the social and cultural consequences of infertility and IVF
17	Role of hormone replacement therapy in female endocrine disorders	3hour	Discuss the role of Hormone replacement therapy in various diseases
18	Final -Term Exam		

Course Code	PHY 863
Credit hours	3(1+2)
Course Title	Laboratory techniques in Physiology
Pre-Requisite	Basic knowledge of laboratory techniques in physiology
Course Objective	<ol style="list-style-type: none"> 1. Discuss changes in heart rate, blood pressure cardiac output, stroke volume and ECG during different types of endurance activity 2. Describe the changes in PO₂, PCO₂, respiratory rate, PH of blood and lung volumes and capacities during physical activity 3. Discuss the Significance of electrocardiographic changes in arrhythmias and heart block 4. Discuss different types of echocardiography and their clinical implications 5. Discuss changes in blood pressure with various physical activities and postural changes 6. Explain the role of cardiac efficiency tests in different cardiac disease 7. Explain the role of EEG in active and relaxed states, during sleep and in epilepsy. 8. Discuss the importance of EMG in the diagnosis of different muscle disorders

	<p>9. Describe the assessment of muscle tone, tension, isometric and isotonic contraction and muscle fatigue using different lab techniques</p> <p>10. Understand the pathophysiological basis of hemoglobinopathies</p> <p>11. Discuss the genetic and acquired causes of hemolytic anemias.</p> <p>12. Explain fundamental and biochemical basis of ABO blood group and Rh factor</p> <p>13. Identify and elaborate various molecular techniques for disease diagnosis</p> <p>14. Discuss the pathophysiology of different bleeding disorders</p>
Course Outcome	<p>At the end of this course the student is able to:</p> <ol style="list-style-type: none"> 1. Describe the advanced laboratory techniques in investigation of cardiorespiratory diseases and neuromuscular disorders 2. Perform the skills used in advanced laboratory techniques for investigation of cardiorespiratory diseases and neuromuscular disorders 3. Describe the lab investigations for diagnosis of hematological disorders like anemia and bleeding disorders 4. Perform and interpret various lab investigations for diagnosis of hematological disorders like anemia and bleeding disorders 5. Accomplish modern molecular lab techniques such as DNA extraction method.
Course Contents	This course encompasses cardiorespiratory adaptation to exercise and various modern laboratory procedures for diagnosis of important cardiorespiratory diseases, pathophysiology and diagnostic techniques for detection of hematological disorders including anemias, hemoglobopathies and bleeding disorders, interpretation of EEG and EMG recordings during different types of activities.
Recommended Text Books	<ol style="list-style-type: none"> 1. A text book of Practical physiology by CL Ghai. Latest edition 2. Hoffbrand essential hematology
Recommended Reference Books	<ol style="list-style-type: none"> 1. Mosby's® Diagnostic and Laboratory Test Reference, 15th Edition Kathleen Deska Pagana & Timothy J. Pagana & Theresa Noel Pagana
Web and other resources	<p><u>Websites:</u></p> <ol style="list-style-type: none"> 1. https://www.hhs.k-state.edu/kines/research/cardiorespiratory/ 2. https://www.us.elsevierhealth.com/nursing/lab-and-diagnostic-tests 3. https://physoc.onlinelibrary.wiley.com/toc/1469445x/current <p><u>Journals:</u></p> <ol style="list-style-type: none"> 1. Experimental Physiology: publication of Physiological society 2. Physiological reports; publication of Physiological society <p><u>Others:</u></p> <ol style="list-style-type: none"> 1. Text book of Practical Physiology: GK Pal

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 1 CH	Outcome
1	Cardiovascular adaptation to exercise	1 hour	Discuss endurance training, changes in Cardiovascular physiology during exercise
2	Respiratory adaptation to exercise	1 hour	Discuss, adaptation of respiratory system during exercise
3	Role of electrocardiography in diagnosis of cardiac arrhythmias and	1hour	Describe the different conduction defects and arrhythmias on

	heart block		electrocardiography
4	Principles of Echocardiography	1hour	Describe Doppler echocardiography, Doppler equation
5	Types of Echocardiography	1hour	Describe types of Doppler, spectral Doppler, color Flow Doppler, power Doppler, continuous Wave Doppler and duplex Doppler.
6	Effect of posture, gravity and muscular exercise on blood pressure	1hour	Discuss effect of postural changes and environmental factors on blood pressure
7	Importance of cardiac efficiency tests in various cardiac diseases	1hour	Discuss the role of cardiac efficiency tests(exercise tolerance test in cardiac diseases
8	Changes in EEG waves during various mental activities	1hour	Discuss EEG changes with mental activity and in neurological diseases
9	Mid-Term Exam		
10	Effects of different motor activities on EMG	1hour	Discuss the variations in EMG recording during muscular activity and disorders
11	Muscle tone, tension and types of contractions	1hour	Explain the changes in tone, tensions ,various contractions and fatigue in human muscle
12	Types of hemoglobinopathies	1hour	Discuss qualitative and quantitative defects of hemoglobin chains in types of hemoglobinopathies
13	Biochemical basis of blood group and Rh factor	1hour	Discuss the biochemical basis of ABO blood group and Rhesus factor
14	Molecular basis of disease diagnosis and treatment	1hour	Describe various classes of molecular diagnosis techniques
15	Laboratory investigations in different types of anemia	1hour	Discuss detection of anemia through lab investigations
16	Congenital and acquired causes of hemolytic anemias	1hour	Discuss pathophysiology of hemolytic anemias
17	Bleeding disorder	1hour	Explain underlying causes of different bleeding disorders
18	Final -Term Exam		

18 Weeks Lab Plan

Week #	Lecture Topic	Duration 2 CH	Outcome
1	Assessment of Cardiovascular parameters during exercise	6 hour	Record the changes occurring in cardiovascular parameters during exercise on treadmill.
2	Evaluation of pulmonary function tests during exercise	6 hour	Perform exercise and record changes by power lab and vitalograph
3	Electrocardiogram in normal and diseased conditions	6 hour	Record and interpret ECG for diagnosing different conduction defects and

			arrhythmias
4	Doppler echocardiography	6 hour	Perform Doppler echocardiography and Doppler equation
5	Types of Doppler echocardiography (Spectral ,color, power ,duplex and wave Doppler techniques)	6 hour	Record and Interpret types of Doppler, spectral Doppler, colour Flow Doppler, power Doppler, continuous Wave Doppler and duplex Doppler.
6	Blood pressure in standing, lying down and sitting positions	6 hour	Record and interpret the effects of posture changes on blood pressure
7	Cardiac efficiency tests	6 hour	Record the cardiac efficiency tests
8	EEG changes during various mental activities	6 hour	Record the changes in EEG during various neurological activities
9	Mid-Term Exam		
10	Evaluation of muscle tone, tension and types of contractions	6 hour	Assess the changes in tone tensions, various contractions and fatigue in human muscle
11	EMG recording techniques	6 hour	Record EMG for assessment of variation in motor functions
12	Detection of hemoglobinopathies	6 hour	Perform various techniques for diagnosis of different types of hemoglobinopathies
13	Detection of various blood groups	6 hour	Detect different blood groups
14	Multiple Molecular techniques in various disease conditions	6 hour	Apply various molecular diagnosis techniques for detection of diseases
15	Laboratory investigations in different types of anemia	6 hour	Performance of various blood investigation in the diagnosis of different types of anemias
16	Diagnosis and detection of hemolytic anemias	6 hour	Perform CBC, peripheral blood film, reticulocyte count, LDH, coombs test
17	Investigations of bleeding disorders	6 hour	Interpret lab investigations for diagnosis of bleeding disorders
18	Final-Term Exam		

Course Code	PHY 864
Credit hours	3+0
Course Title	Physiology of Behaviour and Neurosciences
Pre-Requisite	Basic concepts of Neurophysiology & Special Senses
Course Objective	<ol style="list-style-type: none"> 1. Describe the development of behaviour and its biological characteristics over the life span 2. Understand the biological mechanisms that underlie cognition, learning and memory 3. Identify the brain regions involved in the regulation of behaviour and cognition 4. Describe emotions, the brain mechanisms related to emotional states and the effects of deregulation of these systems 5. Understand the applications of behavioural neuroscience for understanding

	<p>human health and disease</p> <ol style="list-style-type: none"> 6. Discuss physiological mechanisms involved in sexual stimulation 7. Explain stress causing and relieving mechanisms. 8. Discuss the role of neurotransmitters in mood changes. 9. Discuss the visual pathways that connect the visual receptive field with retinal ganglion cell pathway.
Course Outcome	<p>At the end of the course student should be able to:</p> <ol style="list-style-type: none"> 1. Explain the molecular, cellular basis of learning and memory. 2. Compare and contrast the ways in which synaptic transmission can be altered in learning and disease. 3. Relate the molecular function of neuronal proteins to their role in synaptic plasticity and animal behaviour. 4. Comprehend effect of genetic and environmental factors on behaviour, stress and emotions.
Course Contents	<p>In this course students will learn how the internal, external environments and biological factors act upon the brain to produce perceptions, control body functions, and generate behavior. This will also include learning and memory, emotions, stress, aggression, and parental nurturing and neurological and neuropsychiatric disorders. Display insight into current research issues and an ability to critically evaluate primary literature in the field of neuroscience.</p>
Recommended Textbooks	<ol style="list-style-type: none"> 1. Principles of Neural Science, Sixth Edition 6th Edition by Eric Kandel, John D. Koester, Sarah H. Mack, Steven Siegelbaum 2. ISBN-13: 978-1259642234 3. Neuroscience: Exploring the Brain, 4th Edition by Mark F. Bear, Barry W. Connors, Michael A. Paradiso (2015) ISBN-13: 978-0781778176
Recommended Reference Books	<p>Behavioral Neuroscience 8th Edition by S. Marc Breedlove, Neil V. Watson ISBN-13: 978-1605356426</p>
Web and other resources	<p><u>Websites:</u> https://www.journals.elsevier.com/neuroscience-and-biobehavioral-reviews</p> <p>Movie: Three Identical Strangers</p> <p><u>Journals:</u></p> <ol style="list-style-type: none"> 1. The Journal of neuroscience 2. Nature reviews neuroscience <p><u>Others:</u></p> <ol style="list-style-type: none"> 1. Encyclopedia of behavioral neuroscience George F.Koob ,Michel Le Moal and Richard Thompson 2. Brain and behavior: Gerald Hough

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 3CH	Outcome
1	Brain Mechanisms of Motivation and Emotional Regulation	3 hour	Discuss the profound effects of motivation and emotions on perception, cognition, and individual behaviors.
2	Evolution and behavior: Genes and individuals	3hour	Explain the influence of genes on behavioral and psychological characteristics
3	Physiological and emotional	3 hour	Discuss underlying mechanisms and emotional

	aspects of pain and analgesia		aspects of pain and analgesia
4	Cell to cell communication and chemical signals	3 hour	Discuss coordination of different functions in tissues to achieve well developed communication system
5	Synaptic transmission and plasticity	3 hour	Describe different types of synaptic transmission at cellular level
6	Genetic factor affecting human behavior	3 hour	Discuss various genetic and environmental factors affecting human behavior
7	Learning & Memory	3 hour	Discuss role of cortical areas in learning and long /short term memory
8	Memory disorders	3 hour	Discuss different types of memory disorders as age advances
9	Mid-Term Exam		
10	Integration of Sensory and Motor Functions	3 hour	Discuss the sensorimotor integration at spinal cord level
11	Neural Degeneration and Regeneration	3 hour	Discuss different aspects of degeneration, regeneration, and adaptation to injury in the nervous system
12	Central Mechanisms of Reward, Punishment and Emotion	3 hour	discuss the role of limbic system and other cortical areas in reward, punishment and emotions
13	Stress & Aggression	3 hour	Discuss the impacts of stress and aggression on our physical and mental health
14	Stress relieving mechanisms	3 hour	Discuss different hormonal and cognitive methods for relieving stress
15	Pathway for visual information	3 hour	Discuss how does information about the visual environment reach the cerebral cortex.
16	Mechanism of Mood Disorders	3 hour	Describe the pathophysiology and neurotransmitters involved in major depressive disorder
17	Neurobiology of Sexual Behavior	3 hour	Discuss the role of neurophysiology, neuroendocrine, and neurochemical systems in modulation of responses to sexual stimulation.
18	Final-Term Exam		

Course Code	PHY 865
Credit hours	3+0
Course Title	Exercise Physiology and Movement Disorders
Pre-Requisite	Concepts of Physiology of Health, Fitness & Exercise
Course Objective	<ol style="list-style-type: none"> 1. Distinguish between acute physiological responses and chronic adaptations to a wide range of exercise conditions. 2. Explain the neural control of physiological responses and adaptations. 3. Demonstrate the use of exercise as a non-invasive means to investigate changes in physiologic systems, organs, tissues, cells, organelles and molecules. 4. Describe health and fitness benefits from different doses and types of physical activity and exercise. 5. Explain the measurement of energy expenditure, its estimation and perform calculation of exercise efficiency. 6. Discuss the training to improve aerobic and anaerobic power. 7. Describe the nutritional influence on training-induced skeletal muscle adaptations
Course Outcome	<p>At the end of this course, the student should be able to:</p> <ol style="list-style-type: none"> 1. Understand the body's response to exercise and its neural control. 2. Explain the acute and chronic adaptations of the body to exercise, with special attention to the heart, skeletal muscle and metabolic system. 3. Describe how nutrition and nutritional supplements can affect the performance 4. Discuss neurologic and genetic movement disorders and role of physiotherapy in alleviating the effects. 5. Discuss how muscular disorders affect individuals and reduces their quality of life and life expectancy.
Course Contents	The course will consist of studies in acute physiological responses and chronic adaptations to a wide range of exercise conditions and their neuronal control.
Recommended Text Books	<ol style="list-style-type: none"> 1. Biomechanics of Movement: The Science of Sports, Robotics, and Rehabilitation 1st Edition by Thomas K. Uchida (Author), Scott L Delp (Author), David Delp (Illustrator) ISBN-13: 978-0262044202 2. Neuromechanics of Human Movement-5th Edition Author: Roger Enoka ISBN: 9781450458801 3. Mechanics of Human Movement by Author: James Watkins ISBN: 978-94-011-7815-0
Recommended Reference Books	<ol style="list-style-type: none"> 1. Benjamin Cummings: Interactive Physiology 10-System Suite. Benjamin-Cummings Publishing Company, Subs of Addison Wesley Longman, Inc. Latest Ed. 2. Cindy L. Stanfield: Principles of Human Physiology. Benjamin Cummings, Latest Ed. 3. Robots and Biological Systems: Towards a New Bionics? Editors: Paolo Dario, Giulio Sandini, Patrick Aebischer ISBN: 978-3-642-58069-7
Web and other resources	<p><u>Websites:</u></p> <p>http://thebiomechanicsinitiative.org/virtual-content/ https://accessphysiotherapy.mhmedical.com/</p> <p><u>Journals:</u></p> <ol style="list-style-type: none"> 1. APS Journals: Heart and Circulatory Physiology 2. APS Journals: Lung Cellular and Molecular Physiology 3. Canadian Journal of Applied Physiology Reviews

	4. European Journal of Applied Physiology 5. Journal of Applied Physiology 6. Pakistan Journal of Physiology <u>Others:</u> West JB: Respiratory Physiology—The essentials Board Review Series Latest Ed
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18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 3CH	Outcome
1	Molecular basis of muscle contraction	3hour	Describe basis of production of movements
2	Metabolic and neuromuscular mechanisms of skeletal muscle adaptation	3 hour	Discuss various mechanisms of skeletal muscle adaptation to reduced physical activity and subsequent recovery.
3	Principles of Bioenergetics	3 hour	Describe the biological energy transformation, cellular chemical reactions and fuels for exercise
4	Factors Affecting Performance	3 hour	Discuss types of fatigue Describe factors limiting anaerobic and aerobic performance
5	Exercise & Environment	3 hour	Discuss various environmental conditions (e.g. altitude, heat, cold and pollution) affect the exercising ability.
6	Exercise and body homeostasis	3 hour	Explain hydrogen ion production during exercise. Describe acid-base regulation during exercise and its importance.
7	Effect of high altitude on Pulmonary function	3 hour	Discuss changes in PO ₂ , PCO ₂ and oxyhemoglobin dissociation curve at high altitude
8	Effects of deep sea diving on cardiorespiratory functions	3 hour	Describe the effect of deep sea diving on the respiratory and cardiac functions. Critically discuss the necessary precautions related to deep sea diving.
9	Mid-Term Exam		
10	Principles for exercise Training	3 hour	Describe the training principles and list the components of a training session.
11	Physiological principles of muscle wasting and disuse atrophy	3 hour	Discuss pathophysiological mechanisms of muscle wasting and atrophy
12	Nutrition & Health	3 hour	Describe nutrients in the body, composition and weight control. Relate the diet with the physical activity and obesity.

13	Role of different vitamins and nutrients in movement disorders	3 hour	Describe the role of vitaminD,B12,biotin, and zinc as causative factors of movement disorders
14	Ergogenic Aids	3 hour	Discuss role of nutritional and drugs supplements on physical performance
15	Movement Disorders	3 hour	Describe the neurological conditions that cause abnormal voluntary or involuntary increased or decreased movements.
16	Genetic Movement Disorder	3 hour	Describe the group of genetically defined diseases characterized by an impaired control of movements.
17	Role of physiotherapy in movement disorders	3 hour	Discuss the importance of different methods of physical therapy in movement disorders
18	Final-Term Exam		

Course Code	PHY 866
Credit hours	3+0
Course Title	Principles of Hematology and Immune Mechanisms
Pre-Requisite	Basic knowledge of blood physiology and immunity
Course Objective	<ol style="list-style-type: none"> 1. Discuss the genesis of blood cells and factors affecting it 2. Explain different types of anemias and polycythemias along with causes and management 3. Discuss genetic and biochemical basis of different ABO blood groups and their significance in individuality 4. Describe the role of Rh antigen in normal life and during pregnancy 5. Discuss the role of different types of WBCs in acute and chronic viral, bacterial and parasitic infections encompassing their predominance 6. Discuss the role of T lymphocytes in various immune mechanisms 7. Discuss various types of immunity (including active, passive, acquired and innate). 8. Discuss role of antigen presenting cells and various mediators in immunity. 9. Describe various types of vaccines (live and attenuated) 10. Discuss intrinsic and extrinsic mechanisms of blood coagulation and role of different clotting factors synthesized in liver 11. Discuss different type of hereditary and acquired bleeding disorders 12. Discuss the clinical significance of blood transfusion 13. Describe the importance of stem cell transplantation in hemolytic disorders 14. Discuss pathophysiology of different autoimmune diseases 15. Discuss underlying immune mechanisms in the development of hypersensitivity and allergic reactions 16. Understand diagnosis of blood diseases 17. Discuss Iron absorption, storage and metabolism, Hereditary hemochromatosis , hemosiderosis and Iron overload
Course outcomes	<p>This course will impart students with an advanced knowledge of:</p> <ol style="list-style-type: none"> 1. The molecular basis of haemoglobinopathies. Discuss genotype-phenotype

	<p>relationship in haemoglobinopathies.</p> <ol style="list-style-type: none"> 2. Currently accepted physiological process of coagulation. 3. Mechanisms of factor deficiencies and Current challenges in bleeding disorders 4. Molecular basis of platelet disorders. Discuss in detail Von Will brand disease. 5. Discuss the molecular basis of blood cell allo-antgens.
Course Contents	genesis of blood cells and their role in different blood diseases, different blood groups and incompatibility, bleeding disorders, various mediators, cytokines and signaling pathways involved in regulation and genetic control of immune responses and disease susceptibility
Recommended Text Books	Exercise Physiology: Energy, Nutrition and Human Performance (6th Ed) McArdle, Katch & Katch (2007) Lippincott, Wilkins & Wilkins ISBN-0781749905, 9780781749909
Recommended Reference Books	<ol style="list-style-type: none"> 1. Post-graduate haematology, Wiley Blackwell, 7th edition (2016) 2. Molecular Hematology, Wiley Blackwell, 3rd edition (2010) 3. Basic and Clinical Pharmacology, A and L Lange, 13th edition (2015) 4. Commonly used drugs in hematologic disorders, Elise Anders and Sucha Nand, Elsevier (2014)
Web and other resources	<p><u>Web:</u> https://www.mdpi.com/journal/ijms/special_issues/immuno_hematology</p> <p><u>Journals:</u></p> <ol style="list-style-type: none"> 1. Blood 2. Haematologica 3. Leukaemia 4. British Journal of Haematology

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 3CH	Outcome
1	Haemopoiesis and its regulation	3 hours	Discuss genesis of blood cells with control factors
2	Pathophysiology of Anemias & polycythemias	3 hours	Basis of different types of anemias with clinical significance.
3	Biochemical and genetic basis of ABO blood grouping	3 hours	Explain Basis of development of different blood groups
4	Molecular basis of Rh incompatibility	3 hours	Discuss the significance of D antigen during blood transfusions
5	Role of WBCs in different immune mechanisms	3 hours	Identify roles of different Leucocytes in different immune mechanisms
6	Role of WBCs in infections	3 hours	Discuss Role of WBCs in different types of infections
7	Components of the immune system and their	3 hours	Discuss different components of immune system and their responses in health and disease

	functions in immune responses		
8	Molecular and cellular bases of immunity	3 hours	Discuss pathophysiology of immune responses
9	Mid-Term Exam		
10	Vaccination and immunization	3 hours	Describe various types of vaccination and immunization and their implementation through various national and international programs
11	Currently accepted physiological process of coagulation	3 hours	Discuss various physiological mechanisms of blood clotting.
12	Role of genetic factors in bleeding disorders	3 hours	Describe the mechanisms of clotting factor deficiencies in congenital bleeding disorders.
13	Pathophysiology of Disseminated intra vascular coagulation	3 hours	Discuss causes of DIC during different type of infections and pregnancy
14	Blood transfusion and stem cell transplantation	3 hours	Acquire basic knowledge of blood transfusion, its importance and transfusion reactions Describe stem cells and discuss their impact on treatment response.
15	Pathophysiology of Autoimmune disease	3 hours	Discuss mechanisms involved in different types of autoimmune diseases of clinical importance
16	Immediate and adaptive types of hypersensitivity of clinical importance	3 hours	Role of cell mediated and antibody mediated defence mechanisms in stimulation of Hypersensitivity and allergy
17	Molecular basis of iron metabolism	3 hours	Discuss molecular basis of iron metabolism and strategies to prevent and treat iron deficiency at individual and population levels.
18	Final-Term Exam		

Course Code	PHY 867
Credit hours	3+0
Course Title	Cardio-Vascular Physiology and Hemodynamics
Pre-Requisite	Basic knowledge of cardiovascular mechanisms
Course Objective	<ol style="list-style-type: none"> 1. Discuss generation of pacemaker potential and cardiac muscle potential. 2. Discuss pathophysiology of various types of heart blocks. 3. Explain the Significance and implantation of cardiac pacemakers. 4. Describe clinical assessment of efficiency of conducting system of heart and Importance of Electrocardiogram in different conduction blocks and cardiac arrhythmias 5. Explain the correlation between the electrical and mechanical events during cardiac cycle 6. Discuss the mechanical basis for generation of normal and abnormal heart sounds 7. Discuss various factors for the control of heart rate, stroke volume and

	<p>cardiac output</p> <ol style="list-style-type: none"> 8. Describe the role of autonomic nervous system in the generation of pacemaker potential and regulation of heart rate 9. Discuss the clinical significance of echocardiography in different cardiac arrhythmias. 10. Discuss how does frank starling law explain the ability of heart to respond to end diastolic volume with an increase in stroke volume 11. Discuss genetic basis of congenital heart diseases and tools for investigating these diseases 12. Describe the control of arterial pressure by the medullary control centers and role of autonomic nervous system in subsequent modulation to maintain blood pressure 13. Apply Poiseuille's law on normal arterial waveform and its variations. 14. Explain the basis for changes in resistance on the basis of vascular tree and how these changes affect blood pressure and velocity of flow. 15. Explain the control of blood flow to various tissue beds. 16. Describe the processes involved in solute and fluid transport in the capillaries. 17. Explain how the capillary blood flow is controlled by vascular smooth muscle at the level of arteriole and pre-capillary sphincter level. 18. Discuss how the nervous system and circulating hormones affect the distribution of blood flow though out vascular beds 19. Explain control of capillary blood flow by vascular smooth muscle at the level of arteriole and pre-capillary sphincter level. 20. Discuss different types of congenital heart diseases. 21. Describe pathophysiology of various types of shock.
Course Outcome	<p>After the completion of this course students are able to:</p> <ol style="list-style-type: none"> 1. Assess normal and abnormal heart sounds. 2. Discuss important congenital anomalies and their significance. 3. Understand regulation of cardiac output and TPR by the cardiovascular control center 4. Explain various important Hemodynamic factors affecting blood flow. 5. Interpret ECG changes in cardiac disorders and arrhythmias. 6. Discuss long term and short term mechanisms for regulation of blood flow and their contribution in development of hypertension
Course Contents	<p>Knowledge of advanced physiology of cardiovascular system and Hemodynamics with reference to control of blood pressure and blood flow. The course will also cover conduction defects, arrhythmias and congenital heart diseases.</p> <p>Explore how Cardiac output propels blood through the arteries and veins as a function of ventricular contraction.</p>
Recommended Textbooks	<p>Cardiovascular Hemodynamics for the Clinician edited by George A. Stouffer Textbook of Clinical Hemodynamics by Michael Ragosta ISBN1416040005, 9781416040002</p>
Recommended Reference Books	<ol style="list-style-type: none"> 1. Cardiovascular Hemodynamics: An Introductory Guide 2. edited by Saif Anwaruddin, Joseph M. Martin, John C. Stephens, Arman T. Askari 3. Benjamin Cummings: Interactive Physiology 10-System Suite. Benjamin-Cummings

	Publishing Company, Subs of Addison Wesley Longman, Inc. Latest Ed.
Web and other resources	<p><u>Websites:</u> http://www.acs.ac.nz/upload/resource/4%20Haemodynamics.pdf https://healthmanagement.org/c/icu/issuearticle/the-future-of-haemodynamic-monitoring-from-planet-mars-to-resource-limited-countries</p> <p><u>Journals:</u></p> <ol style="list-style-type: none"> 1. Cardiovascular physiology 2. American journal of heart and cardiovascular physiology <p><u>Others:</u> British Journal of Physiology</p>

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 3CH	Outcome
1	Generation and conduction of cardiac impulse	3 hour	Understand the sequential contraction of atria and ventricles by a wave of electrical depolarization initiated by pacemaker cells
2	Abnormal activation of the heart	3 hour	Describe conduction defects and various types of heart blocks and role of cardiac pacemakers
3	Correlation between electrical and mechanical events of the heart during cardiac cycle.	3 hour	Discuss the correlation of different CVS parameters during different phases of cardiac cycle.
4	Understand physiological principles to manage a person in shock due to various reasons	3 hour	Explain physiological responses to various types of shocks.
5	Pathophysiology of Heart sounds and murmurs	3 hour	Describe the basis of production of heart sounds and murmurs
6	Effects of changing strength and rate of contraction on cardiac output	3 hour	Discuss various factors affecting cardiac output, stroke volume ,end diastolic volume and ejection fraction
7	Electrical events during cardiac cycle	3 hours	Explain the electrical events during atrial and ventricular depolarization and repolarization
8	Assessment of volume and pressure changes during cardiac cycle	3 hour	Interpret volume and pressure changes by the use of Wiggers diagram and pressure loop diagram
9	Mid-Term Exam		
10	Theories governing blood flow	3 hour	Discuss different types of blood flow and theories for their regulation
11	Role of medullary centers in control of blood pressure	3 hour	Describe the role of medullary centers in blood pressure regulation
12	Role of renal mechanisms in long term regulation of blood pressure	3 hour	Discuss local factors regulating blood pressure
13	Pathophysiology of Hypertension	3 hour	Discuss various causative factors of primary and secondary hypertension

14	Congenital anomalies of cardiovascular system	3 hour	Explain the molecular basis of different congenital heart diseases and blood vessels
15	Significance of microcirculation	3 hour	Highlight the functions of lymphatic vessels and the return of fluid and plasma proteins that leak out from capillaries into the tissue spaces
16	Role of lymphatic system in edema prevention	3 hour	Discuss role of lymphatic pathology in the production of edema and varicose veins
17	Regulation of cardiovascular functions	3 hour	Discuss the role of central mechanisms and autonomic nervous system in regulation of cardiac functions
18	Final-Term Exam		

Course Code	PHY 868
Credit hours	3+0
Course Title	Pulmonary and Renal Physiology
Pre-Requisite	Basic knowledge of renal and respiratory Physiology
Course Objective	<ol style="list-style-type: none"> 1. Discuss the role of vascular and airway trees to form blood gas interface 2. Describe pressure and air flow changes during normal breathing 3. Explain mechanisms of changes in alveolar pressure into and out of the lungs. 4. Discuss different laws governing diffusion of gases across respiratory membrane 5. Explain transport of oxygen and carbon dioxide 6. Discuss significance of drawing oxygen hemoglobin dissociation curve in transport of oxygen 7. Explain the transport of carbon dioxide from the tissues to the alveoli 8. Discuss nervous and chemical regulation of respiration 9. Explain the response of respiratory system to changes in arterial oxygen level 10. Explain the factors playing role in regulation of glomerular filtration rate 11. Discuss clinical significance of renal plasma clearance 12. Discuss membrane transport mechanisms that govern solute and water reabsorption in different parts of nephron 13. Explain the development of cortico-papillary osmotic gradient in the concentration of urine 14. Describe the role of kidney in the maintenance of acid base balance 15. Discuss chronic obstructive airway disease and their effect on acid base balance. 16. Renal responses to extra water intake or dehydration 17. Discuss genetic renal abnormalities of clinical importance
Course Outcome	<p>By the end of this section, students will be able to:</p> <ol style="list-style-type: none"> 1. Understand the role of respiratory and renal mechanisms in the maintenance of homeostasis 2. Explain various factors affecting diffusion and transport of gases 3. Discuss physiological mechanisms involved in concentration and dilution of

	<p>urine and their regulation</p> <p>4. Discuss the role of genetic factors in renal anomalies</p>
Course Contents	<p>This course reviews and describes normal physiology of renal and respiratory mechanisms in body homeostasis and its disturbance in different disease conditions such as acid base disturbances.</p> <p>Describe Dalton's law, Henry's law and general gas laws for diffusion of gases.</p>
Recommended Text Books	Clinical Physiology of Acid-Base and Electrolyte Disorders 5th Edition by Burton Rose & Theodore Post ISBN-13: 978-0071346825
Recommended Reference Books	Fluids and Electrolytes: A Quick and Easy Comprehensive Book to Understand the Acid Base Balance of the Human Body. Clinical Assessment and Management ASIN : B096T473PK
Web and other resources	<p><u>Websites:</u></p> <p>Hopkins E, Sanvictores T, Sharma S. Physiology, Acid Base Balance. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2021 Jan</p> <p><u>Journals:</u></p> <ol style="list-style-type: none"> 1. American journal of renal physiology 2. Renal and epithelial physiology 3. Respiratory physiology and neurobiology <p><u>Others:</u></p> <ol style="list-style-type: none"> 1. Respiration physiology, science direct

18 Weeks Lecture Plan

Week #	Lecture Topic	Duration 3CH	Outcome
1	Branching and multiplicity of alveolar membrane	3 hour	Discuss structure of respiratory membrane and its peculiar multiplicity
2	Biophysical mechanisms and events in breathing and ventilation	3 hour	Describe role of various components and physical factors in mechanics of respiration
3	Pressure and air flow changes during breathing	3 hour	Review the pressure volume changes during breathing cycle
4	Laws governing diffusion of gases across the respiratory membrane.	3 hour	Discuss various laws for diffusion of gases across respiratory membrane
5	Gas exchange mechanisms in transport of oxygen and carbon dioxide.	3 hour	Discuss transport of oxygen in the free form and bound form and transport of carbon dioxide in dissolved, bound form and bicarbonate form
6	Significance of Oxygen hemoglobin dissociation curve in transport of oxygen	3 hour	Describe clinical significance of oxygen hemoglobin dissociation curve in transport of oxygen
7	Role of medullary centers in the generation and control of cyclic	3 hour	Explain the role of medullary centers in the control of breathing.

	breathing.		
8	Mid-Term Exam		
9	Role of central and peripheral chemoreceptors in regulation of respiration	3 hour	Explain the role of central and peripheral chemoreceptors in regulation of respiration
10	Mechanisms for the shift in alveolar ventilation	3 hour	Discuss different types of hypoxia with causes respiratory adaptations
11	Ultrafiltration of plasma through glomerular membrane	3 hour	Discuss process involved in urine formation and STARLING FORCES affecting GFR.
12	Different mechanisms for regulation of GFR	3 hour	Discuss tubule-glomerular and myogenic mechanisms for regulating GFR.
13	Role of plasma clearance in assessment of renal functions	3 hour	Describe the clinical importance of renal plasma clearance in assessment of kidney functions.
14	Role of renal transporters in the regulation of water and electrolyte balance	3 hour	Describe the process of reabsorption of water, electrolytes and nutrients in proximal and distal convoluted tubule
15	Formation of osmotically concentrated urine	3 hour	Discuss various mechanisms involved in countercurrent multiplication
16	Genetic disorders of renal system	3 hour	Discuss genetic basis of renal diseases
17	Renal responses in maintenance of acid base balance	3 hour	Discuss the role of kidneys in regulation of ECF hydrogen ion concentration (buffering mechanisms)
18	Final-Term Exam		

Curriculum Reconfiguration for BS(CS), BS(IT) and BS(AI) Programs in Accordance with OBE**BS(CS)**

PEOs	<p>PEO 1: Apply computing knowledge and skills to design and develop effective solutions for complex real-life problems.</p> <p>PEO 2: Demonstrate ethical and moral conduct in professional practices.</p> <p>PEO 3: Manifest life-long learning and inter-personal skills for sustainable career development and professional growth.</p>	
PLOs	<p>PLO1 Academic Education: To prepare graduates as computing professionals.</p> <p>PLO2 Knowledge for Solving Computing Problems: Apply knowledge of computing fundamentals, knowledge of a computing specialization, and mathematics, science, and domain knowledge appropriate for the computing specialization to the 16 abstraction and conceptualization of computing models from defined problems and requirements.</p> <p>PLO3 Problem Analysis: Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.</p> <p>PLO4 Design/ Development of Solutions: Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.</p> <p>PLO5 Modern Tool Usage: Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.</p> <p>PLO6 Individual and Teamwork: Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.</p> <p>PLO7 Communication: Communicate effectively with the computing community and with society at large about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.</p> <p>PLO8 Computing Professionalism and Society: Understand and assess societal, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.</p> <p>PLO9 Ethics: Understand and commit to professional ethics, responsibilities, and norms of professional computing practice.</p> <p>PLO10 Life-long Learning: Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.</p>	

Mapping of PLOs to PEOs	No.	Program Learning Outcomes (PLOs)	PEOs				
			PEO-1	PEO-2	PEO-3		
	1	Academic Education	✓	✓			
	2	Knowledge for solving Computing Problems	✓				
	3	Problem Analysis	✓				
	4	Design/ Development of Solutions	✓		✓		
	5	Modern Tool Usage	✓	✓			
	6	Individual and Teamwork		✓	✓		
	7	Communication				✓	
	8	Computing Professionalism and Society		✓	✓		
	9	Ethics		✓			
	10	Life-long Learning				✓	

BS(IT)

PEOs	<p>PEO-1: Apply principles and practices of information technology and computing knowledge to solve challenging problems in relevant professions.</p> <p>PEO-2: Demonstrate the ability to use modern tools learnt during degree program to design and develop effective solutions.</p> <p>PEO-3: Practice communication skills as an individual or team player who possesses strong managerial and entrepreneurial abilities.</p> <p>PEO-4: Function ethically and responsibly while making technical or managerial decisions to contribute effectively in profession and society.</p>

PLOs	<p>PLO1 Academic Education: To prepare graduates as computing professionals.</p> <p>PLO2 Knowledge for Solving Computing Problems: Apply knowledge of computing fundamentals, knowledge of a computing specialization, and mathematics, science, and domain knowledge appropriate for the computing specialization to the 16 abstraction and conceptualization of computing models from defined problems and requirements.</p> <p>PLO3 Problem Analysis: Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.</p> <p>PLO4 Design/ Development of Solutions: Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.</p> <p>PLO5 Modern Tool Usage: Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.</p> <p>PLO6 Individual and Teamwork: Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.</p> <p>PLO7 Communication: Communicate effectively with the computing community and with society at large about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.</p> <p>PLO8 Computing Professionalism and Society: Understand and assess societal, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.</p> <p>PLO9 Ethics: Understand and commit to professional ethics, responsibilities, and norms of professional computing practice.</p> <p>PLO10 Life-long Learning: Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.</p>
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	No.	Program Learning Outcomes (PLOs)	PEOs			
			PEO-1	PEO-2	PEO-3	PEO-4
Mapping of PLOs to PEOs	1	Academic Education	✓			
	2	Knowledge for solving Computing Problems	✓		✓	
	3	Problem Analysis	✓		✓	
	4	Design/ Development of Solutions		✓	✓	
	5	Modern Tool Usage		✓		
	6	Individual and Teamwork			✓	
	7	Communication			✓	
	8	Computing Professionalism and Society		✓	✓	✓
	9	Ethics		✓		✓
	10	Life-long Learning	✓			✓

BS(AI)

PEOs	<p>PEO-1: Utilize knowledge to solve real-world problems by applying theory, principles, and methods of computing in general and artificial intelligence in particular.</p> <p>PEO-2: Demonstrate social and ethical responsibility in professional life.</p> <p>PEO-3: Manifest lifelong learning for sustained professional and personal progression.</p> <p>PEO-4: Practice effective communication and teamwork skills.</p>
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PLOs	<p>PLO1 Academic Education: To prepare graduates as computing professionals.</p> <p>PLO2 Knowledge for Solving Computing Problems: Apply knowledge of computing fundamentals, knowledge of a computing specialization, and mathematics, science, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.</p> <p>PLO3 Problem Analysis: Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.</p> <p>PLO4 Design/ Development of Solutions: Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.</p> <p>PLO5 Modern Tool Usage: Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.</p> <hr/> <p>PLO6 Individual and Teamwork: Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.</p> <p>PLO7 Communication: Communicate effectively with the computing community and with society at large about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.</p> <p>PLO8 Computing Professionalism and Society: Understand and assess societal, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.</p> <p>PLO9 Ethics: Understand and commit to professional ethics, responsibilities, and norms of professional computing practice.</p> <p>PLO10 Life-long Learning: Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.</p>
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	No.	Program Learning Outcomes (PLOs)	PEOs			
			PEO-1	PEO-2	PEO-3	PEO-4
Mapping of PLOs to PEOs	1	Academic Education	✓		✓	
	2	Knowledge for solving Computing Problems	✓		✓	
	3	Problem Analysis	✓			
	4	Design/ Development of Solutions	✓	✓		
	5	Modern Tool Usage	✓		✓	
	6	Individual and Teamwork				✓
	7	Communication				✓
	8	Computing Professionalism and Society		✓	✓	
	9	Ethics		✓		
	10	Life-long Learning	✓		✓	



Pakistan Engineering Council

(Constituted under Pakistan Engineering Council Act, 1976 enacted by the Parliament)

Engineering Accreditation Department (EAD)

Ataturk Avenue (East),
G-5/2, Islamabad

PEC/EAD/40-GB/004/2021
May 21, 2021

All Vice Chancellors/ Rectors/ Heads
HEIs in Pakistan

Subject: **Permission for Appearance of Students in the Exam to Complete Their Degrees
in more than Seven (07) Academic Years**

Dear Sir/ Madam

The PEC Governing Body in its 40th meeting held on February 10, 2021, deliberated on Article 5(b) of PEC Regulations of Engineering Education in Pakistan and the decision made is as under;

"It was concluded that relaxation be granted to all those students for further three years up to December 31, 2023, who failed to complete their degree within seven years of time."

2. In light of above decision, all such students who could not complete their degree may please be approached to complete their degrees before 31-12-2023.
3. This is for information and compliance/ adherence, please.

A handwritten signature in black ink, appearing to read "M. Saeed".

(Engr. Dr Ashfaq Ahmed Sheikh)
Additional Registrar/ Head EAD

Copy to:

- a. The Convener-EAB
- b. Section Heads (Zone I, II & III)
- c. PS to Chairman/ Registrar

CHANGES REQUIRED IN BS (CE) CURRICULUM 2020

Following changes are required to remove the inconsistencies in the road map BCE 2020 curriculum was approved in 36th ACM. Detail is as under:

a. **Page 144**

For: Social Science Elective-I (Professional Ethics/Sociology for Engineers)

Read: Social Science Elective-I

For: Social Science Elective-II (Engg. Economics)

Read: Social Science Elective-II

b. **Page 145**

For: Data Communication & Networking

Read: Computer Communication & Networking

For: Cloud and Distributed Computing

Read: Depth Elective-I

For: Depth Elective-I

Read: Depth Elective-II

For: Depth Elective-II

Read: Depth Elective-III

For: Depth Elective-III

Read: Depth Elective-IV

c. **Page 148**

The titles of Management Science Electives (MSE - I) table and Management Science Electives (MSE - II) table are to be swapped.

REVISED PEOs OF BACHELOR OF COMPUTER ENGINEERING PROGRAM

Existing PEOs	Proposed PEOs
<ul style="list-style-type: none"> PEO 1: Attain an ability to identify and solve challenging problems in their professions by applying theory, principles and related tools learnt during degree program. PEO 2: Demonstrate effective communication as an individual or team player with strong managerial and entrepreneurial skills. PEO 3: Maintain highest ethical and professional standards in pursuing their careers. PEO 4: Engage in life-long learning to continually polish their professional capabilities for their personal growth and the betterment of society 	<ul style="list-style-type: none"> PEO 1: Demonstrate excellence in the profession through in-depth knowledge and skills in the field of Computer Engineering. PEO 2: Demonstrate effective management and communication skills being an individual or a team member. PEO 3: Show professional integrity and commitment to social and ethical responsibilities. PEO 4: Engage in continuous professional development for their personal growth and the betterment of society.

Mapping of PLOs to PEOs

	Graduate Attributes As per Pakistan Engineering Council	PEO 1	PEO 2	PEO 3	PEO 4
PLO 1	Engineering Knowledge	✓			
PLO 2	Problem Analysis	✓			
PLO 3	Design/Development of Solutions	✓			
PLO 4	Investigation	✓			
PLO 5	Modern Tool Usage	✓			
PLO 6	The Engineer and Society			✓	✓
PLO 7	Environment and Sustainability			✓	
PLO 8	Ethics			✓	
PLO 9	Individual and Team Work		✓		
PLO 10	Communication		✓		
PLO 11	Project Management		✓		
PLO 12	Lifelong Learning				✓



HIGHER EDUCATION COMMISSION

H-9, Islamabad (Pakistan) Phone: (051) 90802750, Fax: (051) 90802753
E-mail: ismdeel@hec.gov.pk

Muhammad Ismail
Consultant (Quality Assurance Division)

Ref. 1-1 (NQF)/QAD/2017/HEC/ 49-/

Date: May 23, 2017

Subject: **Grant of MPhil Allowance @ Rs. 2500/- Per Month**

1. Reference to F.No.3(6)Imp/2016-Vol-II-4 dated January 04, 2017 on subject cited above.
2. Under the provision of Section 10 clause 1(o) of HEC's Ordinance No. LIII, dated 11.09.2002, the Quality Assurance Division of HEC has devised the Admission and Award of Degree Criteria for MS/MPhil/PhD/Equivalent Programs. As per HEC approved criteria (enclosed), there is no difference between MS and MPhil degrees except nomenclature. As such, there are two types of MS/MPhil Degrees that are mentioned below:
 - a. MS/MPhil by Course Work (30 credit hours)
 - b. MS/MPhil by Thesis (24 credit hours course work + 06 credit hours thesis)
3. It is further added that in some cases, nomenclature was changed from MPhil to MS after the introduction of BS and MS programs by HEC. As such following types of degrees are awarded as equivalent to 18 years of schooling:

S#	Degree Title	Description
i	a. MPhil Degree (with thesis) b. MS Degree (with thesis)	Both are equal degrees, awarded after 24 credit hours course work + 06 credit hours thesis. There is no difference except nomenclature.
ii	a. MPhil Degree by Course Work b. MS Degree by Course Work	Both are equal degrees, awarded after 30 credit hours course work. There is no difference except nomenclature.
iii	Equivalent degrees of Other disciplines like Engineering, Agriculture, Law, MBA, etc.	In these disciplines, degrees are not awarded with MS/ MPhil Title while these degrees are equated to 18 years of schooling.

4. According to above referred Office Memorandum of Govt. of Pakistan, Finance Division, the MPhil allowance is granted to those only who acquire/possess the degree of MPhil recognized by the HEC. However, in view of the above mentioned clarification, all those who have MPhil or MS degrees (18 years schooling) should be eligible to draw the allowance (@ Rs. 2500/- per month).
5. Forwarded for your favorable consideration, please.

With kind regards,

Enclosure: **as above**

Mismail
(Muhammad Ismail)

Mr. Faisal Nadeem

Accounts Officer (Imp),
Government of Pakistan, Finance Division (Regulations Wing), Islamabad
FBC Building, Near State Bank of Pakistan.

BACHELOR OF REMOTE SENSING & GIS (BS RS & GIS)

ACADEMIC DETAILS	
1	Faculty/Department: Bahria School of Engineering and Applied Sciences, Department of Earth and Environmental Sciences, Bahria University Karachi Campus
2	Name of the Programme: Bachelor of Remote Sensing & GIS (BS RS & GIS)
3	Mission of the Programme: To prepare students who can learn emerging knowledge of Remote Sensing and GIS and develop their skills to serve in interdisciplinary research projects using geospatial sciences.
4	Objectives of the Programme: <ul style="list-style-type: none"> • o provide understanding about fundamental concepts of Remote Sensing and Geographical Information System (GIS). • o impart practical knowledge based skills through theory, practical work/lab and field exercises. • o learn about the tools which are used in GIS related field work meant for exploring natural resources and environmental management. • o augment team work ethics for any industrial project. • o provide computing, mathematical and logical skills critical for solving problems through Thesis/internship in technological projects. • o develop effective presentation, oral and written communication skills
5	Outcomes of the Programme: Graduates capable of fulfilling developmental and research needs in the domain of Remote Sensing and GIS.
6	Rationale for the Programme: The Department of Earth & Environmental Sciences (BUKC) has proposed to offer BS RS & GIS (4 years). BS RS&GIS is designed to provide a platform for students getting knowledge about emerging geospatial technologies including Remote Sensing and GIS. This program provides a foundation to focus on the application of the Remote Sensing and GIS technologies for the management of Pakistan's natural and environmental resources. E&ES is aimed that the young scientists utilize the knowledge and skills of these disciplines towards identification and mitigation of the most profound challenges in the domains of RS and GIS Applications through research initiatives. It is envisioned that the graduates of BS RS&GIS may find their possible careers over a wide canvas that includes the following; Natural Resources and Environments (exploration, monitoring, management) Geosciences (minerals exploration, earthquake, tsunami mapping)

	<p>Water Resources (river, lakes, flood mapping, monitoring, and prediction) Social Sciences (crime monitoring, revenue collection, health care, elections) Urban Planning (city planning, transportation & utility network planning) Agriculture (crop planning, crop health monitoring, yield forecasting) Meteorology and Climatology (monitoring, mapping, prediction) Navigation and Tracking Applications (mapping and modeling) Geographical location-based geospatial research projects etc.</p>												
7	<p>Brief Description of the Programme: The curriculum of the BS RS & GIS program includes coursework in geography, remote sensing, GIS, computer sciences, modelling, and related courses. The courses are based on theoretical knowledge, practical, fieldwork, case studies, and research thesis. The program also encourages students to take courses in ethics and social responsibility, with the opportunity to participate in some of the internship programs at relevant organizations and industries to solve specific problems in various applications of both geospatial fields of Remote sensing and GIS.</p>												
8	<p>Duration: 4 years</p>												
9	<p>Venue(s): <input checked="" type="checkbox"/> On Site/<input type="checkbox"/> Off Site/<input type="checkbox"/> Both On & Off Site (<i>Tick one; if Off Site, give details</i>) Sir Syed Block, Bahria University Karachi Campus 13- National Stadium Road, Karachi</p>												
10	<p>Programme Scheduling Format: Morning (Bi- Semester)</p>												
11	<p>Proposed Date of Commencement: Fall 2022</p>												
12	<p>Mode of Study/Examination: Mode of study for BS Remote Sensing & GIS is based on on-campus/online classroom teaching (subject to BU policies under COVID situation). The students' performance will be evaluated through Assignments, Quizzes, Mid-term, and Final exams for each course in each semester. Students will be required to undertake a 6 credit hours Thesis considering their keen interest in any subdomain of Remote Sensing or GIS.</p>												
13	<p>Additional Faculty Member(s) Required: For intake of two batches per annum (40 students), at least 4 faculty members (1 Ph.D. and 3 MS) are required for the BS RS&GIS program. Following 04 faculty members are already available, whereas, the rest of the experienced FM will be inducted as per the requirement. Dr. Salma Hamza, Ph.D. – Associate Professor/HoD Research Interests: Environmental Geology, GIS, Groundwater, Mineralogy Dr. M Jahangir Khan, Ph.D.– Assistant Professor Specialization: Geophysics, GIS & RS, Earthquakes Ms. Shaista Iftikhar, Ph.D. (In Progress) – Sr. Assistant Professor Specialization: Geophysics, Groundwater modelling, GIS Mr. Muhammad Irfan, Ph.D. (In Progress) – Assistant Professor Specialization: Geophysics, Groundwater modelling, GIS Note: Total 06 FMs are required after Semester –IV (Year-3), additional FM will be inducted as per the following plan.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Year</th> <th>No. of FMs</th> <th>PhD</th> <th>MS</th> </tr> </thead> <tbody> <tr> <td>First Year</td> <td>4</td> <td>2</td> <td>2</td> </tr> <tr> <td>Second Year</td> <td>4</td> <td>2</td> <td>2</td> </tr> </tbody> </table>	Year	No. of FMs	PhD	MS	First Year	4	2	2	Second Year	4	2	2
Year	No. of FMs	PhD	MS										
First Year	4	2	2										
Second Year	4	2	2										

		Third Year	6	2	4	
		Fourth Year	6	2	4	
14	Additional Skilled-Worker(s) Required: (<i>Indicate if there is a requirement for additional Skilled Staff, full-time/part-time, along with their qualifications/skill sets.</i>) <u>Model-1:</u> 01 Ph.D. in GIS/Remote Sensing will be required as PFM. He/She will be teaching 03 courses (maybe in both BS/MS programs) <u>Model-2:</u> 01 MS in GIS/Remote Sensing will be required as PFM (Lecturer), or 02Ph.D/MS in GIS will be required as VFM. 01 Lab Engineer is working already. However, one more Lab Engineer will be required with research experience in the domains of GIS/RS.					
15	Additional Classroom(s) required: Total of six classrooms will be required, with the following breakdown. First Year: 2 Classrooms Second Year: 3 Classrooms Third Year: 5 Classrooms Fourth Year: 6 Classrooms					
16	Additional Requirement for Laboratories: GIS and Computer Lab already exist at E&ES, BUKC. However, up-gradation of the Lab will be additionally required for the advanced research work (Year-4, i.e. 2026-27).					
17	Additional Requirement for Books, Subscriptions, Memberships to Online Research Sites/ Repositories: At least 100 books, journals, and resources.					
18	Minimum Entry Level: Minimum 50% marks in Intermediate (HSSC) Examination (Pre-Medical/Pre-Engg./ICS/ General Science/Diploma of Associate Engineering) or equivalent qualification. Deficiency: For Pre-Medical students, the following one deficiency courses of mathematics will be taught during the first year. - Mathematics MAT 105 (0 Credit Hours)					
19	Admission Criteria: As per BU Policy related to Admission Matric/O-level: 10% Intermediate/A-level: 40% CBT/Entry Test Score: 50%					
20	Additional/Different Examination Requirement (<i>Indicate if there will be any examination requirement, additional to or different from the BU Academic Rules or Examination Policy in vogue</i>). Nil					
21	Number of Admissions Expected for First Intake: 20 admissions for the first intake.					
22	Number of Admissions Planned/Expected for Subsequent Intakes: 20 admissions per intake.					
23	Referred by: DBOS, FBOS					
24	Complete Plan of Studies, inclusive of complete Roadmap: Complete plan for BS Remote Sensing and GIS Program is attached with this document (Appendage 4130)					

25	Course Outlines, Descriptions, Pre-Requisites & Readings (Compulsory & Recommended) Course outlines for BS Remote Sensing and GIS Program are attached with this document for reference.																																																																																									
FINANCIAL DETAILS																																																																																										
1	Source of Funding: BU Fully																																																																																									
2	Degree Duration: 4 years Annual or Semester System: Semester																																																																																									
3	Expected fee to be charged based on Cost & Benefits Analysis: <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Semester</th> <th colspan="3">Students</th> <th colspan="2">Fee per student</th> <th colspan="3">Total Fee</th> </tr> <tr> <th>Fresh</th> <th>Existing</th> <th>Total</th> <th>Fresh</th> <th>Existing</th> <th>Fresh</th> <th>Existing</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Fall 2022</td><td>20</td><td>0</td><td>20</td><td>105,480</td><td>0</td><td>2,109,600</td><td>0</td><td>2,109,600</td></tr> <tr> <td>Spring 2023</td><td>20</td><td>20</td><td>40</td><td>105,480</td><td>69,480</td><td>2,109,600</td><td>1,389,600</td><td>3,499,200</td></tr> <tr> <td>Fall 2023</td><td>20</td><td>40</td><td>60</td><td>105,480</td><td>69,480</td><td>2,109,600</td><td>2,779,200</td><td>4,888,800</td></tr> <tr> <td>Spring 2024</td><td>20</td><td>60</td><td>80</td><td>105,480</td><td>69,480</td><td>2,109,600</td><td>4,168,800</td><td>6,278,400</td></tr> <tr> <td>Fall 2024</td><td>20</td><td>80</td><td>100</td><td>105,480</td><td>69,480</td><td>2,109,600</td><td>5,558,400</td><td>7,668,000</td></tr> <tr> <td>Spring 2025</td><td>20</td><td>100</td><td>120</td><td>105,480</td><td>69,480</td><td>2,109,600</td><td>6,948,000</td><td>9,057,600</td></tr> <tr> <td>Fall 2025</td><td>20</td><td>120</td><td>140</td><td>105,480</td><td>57,900</td><td>2,109,600</td><td>6,948,000</td><td>9,057,600</td></tr> <tr> <td>Spring 2026</td><td>20</td><td>140</td><td>160</td><td>105,480</td><td>57,900</td><td>2,109,600</td><td>8,106,000</td><td>10,215,600</td></tr> </tbody> </table> <p>* Rs. 3860/- per credit hour and 18 credit hours per semester (Total 135 credit hours) * For first semester: Rs. 21000 (Admission fee), Rs. 5000 (Miscellaneous) and Rs. 10000 (Security Deposit - Refundable) shall be applicable.</p>	Semester	Students			Fee per student		Total Fee			Fresh	Existing	Total	Fresh	Existing	Fresh	Existing	Total	Fall 2022	20	0	20	105,480	0	2,109,600	0	2,109,600	Spring 2023	20	20	40	105,480	69,480	2,109,600	1,389,600	3,499,200	Fall 2023	20	40	60	105,480	69,480	2,109,600	2,779,200	4,888,800	Spring 2024	20	60	80	105,480	69,480	2,109,600	4,168,800	6,278,400	Fall 2024	20	80	100	105,480	69,480	2,109,600	5,558,400	7,668,000	Spring 2025	20	100	120	105,480	69,480	2,109,600	6,948,000	9,057,600	Fall 2025	20	120	140	105,480	57,900	2,109,600	6,948,000	9,057,600	Spring 2026	20	140	160	105,480	57,900	2,109,600	8,106,000	10,215,600
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7	Total Estimated Salaries of all Additional Human Resources per annum (B7):				
		Posts	Qualification		Per Semester Salary (6 months)
	Regular Semester	FM	PhD	MS	
	Fall 2022	0	0	0	0
	Spring 2023	0	0	0	0
	Fall 2023	0	0	0	0
	Spring 2024	0	0	0	0
	Fall 2024	2	0	2	780,000
	Spring 2025	2	0	2	780,000
	Fall 2025	2	0	2	780,000
	Spring 2026	2	0	2	780,000
* MS qualified FM @ Rs. 65,000 per month					
Total estimated salaries per annum of HR: Rs. 1,560,000 (per annum)					
8	Cost of Additional Laboratory Equipment/Tools (B8):				
	N/A				
9	Cost of Additional Classrooms (B9):				
	N/A				
10	Cost of Additional Books, Subscription & Memberships to on-line Sites/Repositories (B10):				
	Year 2: Rs. 100,000/-				
11	Off-Site rental Expenses and Cost of other Fixtures (B11):				
	N/A				
12	Miscellaneous Expenses required for Starting the Program (B12):				
	Advertisement: Rs. 100,000/- Printing & Stationery: Rs. 50,000/- Admin Cost: Nil Outreach visit: Rs. 50,000/- Total: Rs. 200,000/-				
13	Annual Recurring Expenditures in Subsequent Years (B13):				
	Salaries: Rs. 1,560,000 (per annum) Rentals: Nil Subscriptions/Memberships: Nil Advertisements: Rs. 100,000 Printing & Stationery: Rs. 50,000 Admin Cost: Nil Outreach visit: Rs. 50,000 Total: Rs. 1,760,000				
14	Total Cost of the Programme (B14): [Add B(7) to B(12)] Rs. 3,420, 000/-				
15	Net Cost of the Programme (B15): [Subtract B(1) from B(14)] Rs.- 3,420, 000/-				
16	Net Earnings in First Year (B16): [Subtract B(15) from B(5)] Rs. 79,200/-				

ROAD MAP - BS REMOTE SENSING & GIS**YEAR -1****Semester I**

Pre-req	Course code	Course Title	Credit Hours		CR/Sem
			Theory	Lab	
<i>None</i>	PAK 102	Pakistan Studies	3	0	18
<i>None</i>	RGS 103	Fundamentals of GIS	2	0	
<i>None</i>	RGL 103	Fundamentals of GIS Lab	0	1	
<i>None</i>	ENG 103	English -I	3	0	
<i>None</i>	MAT 105*	Mathematics (for Pre-Med.)	0	0	
<i>None</i>	CSC 102	Introduction to Computers and Programming	2	0	
<i>None</i>	CSL 102	Introduction to Computers and Programming Lab	0	1	
<i>None</i>	PHY 103	Physics	2	0	
	PHL 103	Physics Lab	0	1	
<i>None</i>	RGS 104	Physical Geography	2	0	
	RGL 104	Physical Geography Lab	0	1	

*Academic credit hour of this course is zero but its contact hours, teaching materials and tuition fee are equal to a 3 credit hour course.

Semester II

Pre req	Course code	Course Title	Credit Hours		CR/Sem
			Theory	Lab	
<i>ENG 103</i>	ENG 104	English II	3	0	18
<i>None</i>	ISL 102/ SOC 360	Islamic Studies / Ethics	3	0	
<i>MAT 105</i>	MAT 115	Calculus & Analytical Geometry	3	0	
<i>None</i>	MTB 111	Introduction to Film Making & Analysis	2	0	
<i>None</i>	MTL 111	Introduction to Film Making & Analysis Lab	0	1	
<i>None</i>	RGS 105	Fundamentals to Earth Sciences	2	0	
<i>None</i>	RGL 105	Fundamentals to Earth Sciences Lab	0	1	
<i>RGS 104</i>	RGS 106	Introduction to Remote Sensing	2	0	
<i>RGL 104</i>	RGL 106	Introduction to Remote Sensing Lab	0	1	

YEAR-2**Semester III**

Pre-req	Course code	Course Title	Credit Hours		CR/Sem
			Theory	Lab	
ENG 104	HSS 320	Technical Writing & Presentation Skills	3	0	18
None	GSC 340	Chemistry	2	0	
None	GSL 340	Chemistry Lab	0	1	
None	HSS 111	Introduction to International Relations	3	0	
None	RGS 201	Introduction to Cartography	2	0	
None	RGL 201	Introduction to Cartography Lab	0	1	
RGS 104	RGS 202	GPS & Surveying	2	0	
RGL 104	RGL 202	GPS & Surveying Lab	0	1	
None	PSY 107	Introduction to Psychology	3	0	

Semester IV

Pre-req	Course code	Course Title	Credit Hours		CR/Sem
			Theory	Lab	
None	MAT 205	Statistics	3	0	18
None	GEO 223	Urban and Town Planning	3	0	
RGS 106	RGS 204	Introduction to Photogrammetry	2	0	
RGL 106	RGL 204	Introduction to Photogrammetry Lab	0	1	
RGS 103	RGS 206	Database Management Systems	2	0	
RGL 103	RGL 206	Database Management Systems Lab	0	1	
RGS 106	RGS 207	Active Remote Sensing & Space Laws	3	0	
RGS 104	RGL 251	Geospatial Field Work & Report-I	1	2	

YEAR-3**Semester V**

Pre-req	Course code	Course Title	Credit Hours		CR/Sem
			Theory	Lab	
None	RGS 315	Human Geography	3	0	18
RGS 207	RGS 316	Microwave & Hyper Spectral RS	2	0	
RGS 207	RGL 316	Microwave & Hyper Spectral RS Lab	0	1	
RGS 206	RGS 317	Spatial Decision Support Systems	3	0	
RGS 206	RGS 318	Spatial Data Infrastructure & Visualization	2	0	
RGL 206	RGL 318	Spatial Data Infrastructure & Visualization Lab	0	1	
RGS 103	RGS 360	Spatial Data Analysis	2	0	
RGL 103	RGL 360	Spatial Data Analysis Lab	0	1	
RGS 103	RGS 320	Geospatial Project Management	3	0	

Semester VI

Pre-req	Course code	Course Title	Credit Hours		CR/Sem
			Theory	Lab	
None	GEO 324	Research Methodology	3	0	15
CSC 102	RGS 330	Web GIS	2	0	
CSL 102	RGL 330	Web GIS Lab	0	1	
RGS 106	RGS 331	Digital Image Processing	2	0	
RGL 106	RGL 331	Digital Image Processing Lab	0	1	
RGS 202	RGS 332	Satellite Navigation Systems	3	0	
RGL 251	RGL 351	Geospatial Field Work & Report-II	1	2	

YEAR-4**Semester VII**

Pre-req	Course code	Course Title	Credit Hours		CR/Sem
			Theory	Lab	
None	RGS 319	Multidisciplinary Applications of GIS & RS	2	0	15
None	RGL 319	Multidisciplinary Applications of GIS & RS Lab	0	1	

RGS 360	RGS 361	Integrated Geospatial Technologies	2	0	
RGL 360	RGL 361	Integrated Geospatial Technologies Lab	0	1	
None	ENV 425	Occupational Health & Safety	3	0	
CSC 102	GEO 321	Computing with MATLAB	2	0	
CSL 102	GEL 321	Computing with MATLAB Lab	0	1	
None		Elective I	2	0	
None		Elective-I Lab	0	1	

Semester VIII

Pre-req	Course code	Course Title	Credit Hours		CR/Sem
			Theory	Lab	
None	RGS 471	Legal and Social Issues in Geospatial Sciences	3	0	15
None		Elective II	2	0	
		Elective II Lab	0	1	
None		Elective III	2	0	
		Elective III Lab	0	1	
GEO 324	RGS 490	Thesis	0	6	
		Total Credit Hours			135

General Education Courses (18 credit hours)

Pre-req	Course code	Course Title	Theory	Lab	CR
None	ENG 103	English-1	3	0	3
Eng-103	ENG 104	English-1I	3	0	3
Eng-104	HSS 320	Technical Writing & Presentation Skills	3	0	3
None	PAK 102	Pak Studies	3	0	3
None	ISL 102	Islamic Studies/Ethics	3	0	3
None	CSC 102	Introduction to Computers and Programming	2	1	3

Mathematics and Science Foundation Courses (6 credit hours)

Pre-req	Course code	Course Title	Theory	Lab	CR
None	MAT 105	Mathematics	0	0	0
MAT-105	MAT 115	Calculus & Analytic Geometry	3	0	3
None	MAT 205	Statistics	3	0	3

Core Courses (75 credit hrs)

Pre-req	Course code	Course Title	Theory	Lab	CR
None	RGS 103	Fundamentals of GIS	2	1	3
None	RGS 104	Physical Geography	2	1	3
None	RGS 105	Fundamentals to Earth Sciences	2	1	3
RGS 104	RGS 106	Introduction to Remote Sensing	2	1	3
None	RGS 201	Introduction to Cartography	2	1	3
RGS 104	RGS 202	GPS & Surveying	2	1	3
RGS 106	RGS 204	Introduction to Photogrammetry	2	1	3
RGS 103	RGS 206	Database Management Systems	2	1	3
RGS 106	RGS 207	Active Remote Sensing & Space Law	3	0	3
RGS 104	RGL 251	Geospatial Field Work & Report-I	1	2	3
RGL 251	RGL 351	Geospatial Field Work & Report-II	1	2	3
None	RGS 315	Human Geography	3	0	3
RGS 207	RGS 316	Microwave & Hyper Spectral RS	2	1	3
RGS 206	RGS 317	Spatial Decision Support Systems	3	0	3
RGS 206	RGS 318	Spatial Data Infrastructure & Visualization	2	1	3
None	RGS 319	Multidisciplinary Applications of RS & GIS	2	1	3
RGS 103	RGS 360	Spatial Data Analysis	2	1	3
RGS 103	RGS 320	Geospatial Project Management	3	0	3
CSC 102	RGS 330	Web GIS	2	1	3
RGS 106	RGS 331	Digital Image Processing	2	1	3

RGS 202	RGS 332	Satellite Navigation Systems	3	0	3
RGS 360	RGS 361	Integrated Geospatial Technologies	2	1	3
None	RGS 471	Legal and Social Issues in Geospatial Sciences	3	0	3
GEO 324	RGS 490	Thesis	0	6	6

Distribution Courses (27 credit hours)

Pre-req	Course code	Course Title	Theory	Lab	CR
None	GEO 324	Research Methodology	3	0	3
None	ENV 425	Occupational Health & Safety	3	0	3
CSC 105	GEO 321	Computing with MATLAB	2	1	3
None	GSC 340	Chemistry	2	1	3
None	PHY 103	Physics	2	1	3
None	HSS 111	Introduction to International Relations	3	0	3
None	GEO 223	Urban and Town Planning	3	0	3
None	PSY 107	Introduction to Psychology	3	0	3
None	MTB 111	Introduction to Film Making & Analysis	2	1	3

BS RS & GIS Electives (9 Credit Hours)

Pre-req	Course code	Course Title	Theory	Lab	CR
CSC 102	AIC 201	Artificial Intelligence	2	0	2
CSL 102	AIL 201	Artificial Intelligence Lab	0	1	1
CSC 102	AIC 301	Machine Learning	2	0	2
CSL 102	AIL 301	Machine Learning Lab	0	1	1
CSC 102	AIC 303	Artificial Neural Networks	2	0	2
CSL 102	AIL 303	Artificial Neural Networks Lab	0	1	1
RGS 201	RGS 451	Computer Aided Drafting/Drawing	2	0	2
RGL 201	RGL 451	Computer Aided Drafting/Drawing Lab	0	1	1
RGS 206	RGS 452	Data Structures and Algorithms	2	0	2
RGL 206	RGL 452	Data Structures and Algorithms Lab	0	1	1
RGS 319	RGS 453	GIS for Disaster Management	3	0	3
RGS 317	RGS 454	Spatial Data Modelling	2	0	2
RGL 317	RGL 454	Spatial Data Modelling Lab	0	1	1

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RGS 319	RGS 455	Land & Water Information System	2	0	2
RGL 319	RGL 455	Land & Water Information System Lab	0	1	1
RGS 330	RGS 456	GIS Programming & Python	2	0	2
RGL 330	RGL 456	GIS Programming & Python Lab	0	1	1

DETAILS OF COURSE CONTENTS

The courses contents of courses being offered in BS Geoscience and BS Environmental Sciences Program are followed as same in BS Remote Sensing & GIS.

RGS 104 Physical Geography

(3 Credit Hours)

Course Outline:

Scope and status of physical Geography, The basic concept and theories in physical Geography, Factors of Landform Development, Desert Landforms, Glaciers and their topographic effects, Karsts topography, Type of soil, Factors and elements of weather and climate, Composition and structure of atmosphere, Horizontal and vertical distribution of temperature, The distribution of pressure and seasonal variations, Wind Circulation, Humidity and forms of condensation, Classification of Climate, Characteristic features of the oceans, Temperature, salinity distribution, cause and effects, Ocean circulation: Waves, currents and tides, their nature, causes and effects and impact on man and environment.

Lab Outline:

Study and identification of landforms using air photos and General topographic sheet, Use and making of various models showing various types of landforms, Recording and observation of weather data from a mini weather station, Identification of cloud types, Drawing of World map showing continents and oceans using Google Earth.

Reference Books/Material:

1. Strahler, A.N. (2004) "Modern Physical Geography" New York: John Wiley.
 2. Gabler, R.E, Sager, R.J and Wise, D.L (2012). Essentials of Physical Geography, Latest Edition. Saunders College Publishing, New York. ISBN 0-03-098237-5.
 3. Scott, R.C (1996) Introduction to physical geography, West Publishing Co, New york. ISBN: 0-314-06260-2.

RGS 105 Fundamentals of Earth Science

(3 Credit Hours)

Course Outline:

Overview of Earth, Geological Framework of Earth, Structure and Composition of Earth; Deformation and Mountain Building Processes, Rock Cycle Volcanoes, Identification of rocks and minerals in hand specimen, Identification of different rock units and geological structures in field, Geological Hazards; Earthquakes, Tsunamis, Floods, Landslides, Mass-movements, Geological Time Scale; Cenozoic, Mesozoic, Paleozoic, Fossils and Evolution, Global Change in the Earth System, Economic Geology; Exploration and Exploitation of Natural Resources, Petroleum Basins of Pakistan. Field visit to different nearby rocky area.

Lab Outline:

Identification of rocks and minerals in hand specimen, Identification of different rock units and geological structures in field; Preparation of Geological Maps; Field visit of different geological sections and land for and hazard prone areas.

Reference Books/Material:

1. McGeary, D., Plummer, C.C. & Carlson, D.H., (2004) Physical Geology: Earth revealed. McGraw Hill, Boston.
 2. Murphy, B and Nance D (1999). Earth Science Today. ITP, Brooks Cole Publishing, NYC. ISBN 0-534-52182-7.
 3. Dutch, S.I; Monroe, J.S and Moran, J.M (1998). Earth Science, Wadsworth, ISBN: 0 314 20111

RGS 106 Introduction to Remote Sensing

(3 Credit Hours)

Course Outline:

Definition and History of satellite Remote sensing, Remote sensing and earth energy budget, Electromagnetic spectrum and radiation, Elements of Remote Sensing operation, Physical foundation of Visible, Infrared and microwaves remote sensing, high and low resolution remote sensing, Theoretical explanation of reflection, absorption and transmission, High resolution multi-spectral data, Introduction to Aerial Photograph, Sensor Systems, Platforms (Types and Orbital Characteristics), Thermal Infrared (Characteristics, TIR Band Properties, TIR Image Interpretation, Intro to Microwave (Importance and applications), Digital Image Processing (Overview of computer based image processing), Applications (agriculture, urban, natural resources etc.)

Lab Outline:

Introduction to labs, Layer stacking, Pixel Data, Single band image interpretation, False color predictions, False color composite Images Interpretation, Visual Interpretation of aerial photographs, Various sensors data comparison, Thermal Infrared Image interpretation, Intro to ERDAS Imagine, display, Geo-linking, Zooming, Identification of target features.

Reference Books/Material:

1. Campbell, James B. (2011). Introduction to Remote Sensing, 5th Ed. The Guilford Press.
 2. Sabins S.F (2000). Remote Sensing: Principles and Interpretation, Third Edition. Freeman and Company, New York. ISBN: 0 – 7167-2442-1.
 3. Lillesand, T. M. and Kiefer, R. W. (2004). Remote Sensing and Image Interpretation, 5th edition. (John Wiley and Sons), ISBN 0-471-15227-7
 4. Jensen, J. (2000) Remote Sensing of the Environment: An Earth Resources Perspective, Amazon Publishers

RGS 201 Introduction to Cartography

(3 Credit Hours)

Course Outline:

Introduction to Cartography, Nature of Cartography, Map Types. History of Cartography, Map Symbols, Lettering, Scale and direction, Coordinate systems, Map Projections Graphical and datum, Map Projections Mathematical. Perspective, non-perspective, conventional, Generalization, Thematic Maps, Descriptive Statistics, Class Intervals, Choropleth Maps, Proportional Symbol Maps, Dot Maps, Isarithmic Maps, Cartograms, Flow Maps, Graduate Colour Maps, Map Compilation, Map Design, Map Production Software.

Lab Outline:

Map reading, Assignment on Types of Maps symbology, Development of Symbol Charts, Development of Graphical Map Projections, Large to small scale map conversion, Data classification and Thematic Mapping, Map composite development, Misleading cartography.

Reference Books/Material:

1. Slocum, Robert McMaster, Fritz Kessler, Hugh Howard (2004) Thematic Cartography and Geographic Visualization, 2nd Edition, Terry. ISBN, 0130351237.
 2. Robert G. Cromley (2003) "Digital Cartography". Prentice Hall Inc.
 3. Campbell, B. J. (2006). Introduction to Remote Sensing, 4th Ed., The Guilford Press, New York, ISBN # 0-7484-0663-8
 4. M.J. Kraak & F.J. Ormeling, (1996) "Cartography- Visualization of Spatial Data." Addison Wesley Longman Limited.
 5. Robinson, A.H., Morrison,J.L., Muhrcke, A.J.,Kimerling and Guptil,S.C. (1995) "Elements of Cartography" 6th edition, John Wiley & Sons, New York.

RGS 202 GPS & Surveying**(3 Credit Hours)****Course Outline:**

Introduction to GPS, GPS Data, Position and Time from GPS, Pseudo-Range Navigation, Receiver Position, Velocity, and Time, Carrier Phase Tracking (Surveying), GPS Satellite Signals, GPS Error Sources, GPS survey procedure, Differential GPS Techniques. Overview of surveying, objects and classifications of surveying, scales, survey tasks, survey principles and methods, accuracy and precision, measurement and errors, coordinate systems and computation, direct distance measurements, errors in measurement of distance and corrections, height measures, leveling and its types, bench marks, leveling staff, sources of errors in leveling and accuracies, angular measurements, reading systems of optical theodolites, indirect distance measurements, reciprocal leveling, traverse survey, triangulation and trilateration,

Lab Outline:

GPS value reading, Easting Northing & elevation, Map Projections and Datum Settings, GPS based surveys, tracking and data processing, Planimetric & vertical errors calculations, Instrumental surveys will be included for measuring the distance, angles and heights. Major emphasis will be towards theodolite and leveling surveys.

Reference Material:

1. Bray, H. (2014). You are here: From the Compass to GPS, the History and Future of how We Find Ourselves. Basic Books.
2. Denny, M. (2012). The science of navigation: from dead reckoning to GPS. JHU Press.
3. Wolf P R., Ghilani C, (2005), Elementary Surveying : An Introduction to Geomatics ,11th Edition, Prentice Hall, USA, ISBN 0131481894
3. Wirshing R., Wirshing R. J., (1985), Schaum's Outline of Introductory Surveying, McGraw-Hill, UK, ISBN 0070711240
4. Michael Kennedy (2002), "The Global Positioning System and GIS: An Introduction" 2nd Edition, Taylor & Francis, New York. ISBN: 0 – 415-28608-5
5. Anderson, J. M., Mikhail E. M., (1998), Surveying Theory and Practice, 7th Ed., MCB/McGraw-Hill, US, ISBN 0-07-015914-9
6. Paul Zarchan (1996), "Global Positioning System: Theory and Application, Volume I, American Institute of Aeronautics and Astronautics, Inc., Washington DC. ISBN: 1563471078

RGS 103 Fundamentals of GIS**(3 Credit Hours)****Course Outline:**

Introduction, Definitions, Key components of GIS, Functional Subsystem, Raster Data Model, Vector Data Model, Attribute Data Model, Data Acquisition Techniques, Data sources, Data capturing techniques and procedures, Data Transformation, Visualization of spatial data, Layers and Projections, Map Design: Symbols to Portray Points , Lines and Volumes , Graphic Variables , Visual Hierarchy, Data Classification Graphic Approach , Mathematical Approach, Spatial Analysis: Overlay Analysis ,Spatial analysis, Neighborhood functions, Network and overlay analysis, buffering, Spatial data Quality: Components of Data Quality , Micro Level Components , Macro Level Components , Usage Components Sources of Error, Accuracy, Project work.

Lab Outline:

Introduction to GIS Lab (hardware / software), Raster/Vector/Attribute Data Display, Scanning, Digitization, Coordinate based point mapping, Raster / Vector Conversion, Digitization of Map features, Data layer integration and display of different projections, Map layout, Data Classification and Thematic Mapping, Handling with Topological Errors, Overlay and network analysis.

Reference Books/Material:

1. Chang, K. T. (2010), "Introduction to Geographical Information Systems" Higher Education, McGraw-Hill
 2. Huisman, O. and de By, R. A.(2009), "Principles of Geographic Information Systems: An Introductory Textbook", ITC Educational Textbook Series; 1, ISBN 978-90-6164-269-5
 3. Bolstad, P. (2007), "GIS Fundamentals", 3rd Edition, Atlas Books. ISBN: 978-0-9717647-2-9
 4. Aronoff, S. (2004) "Geographic Information Systems: A Management Perspective", WDL Publications, Ottawa, Fifth Edition. ISBN - 0912804008
 5. Clarke, K. (2004) "Getting started with Geographic Information System", Prentice Hall , New York, Second Edition. ISBN – 1879102897
 6. McDonald, R. and Burrough, P. (2001) "Principles of Geographic Information Systems", Oxford University Press, Oxford, Second Edition ISBN - 0198233855

RGS 204 Introduction to Photogrammetry (3 Credit Hours)

Course Outline:

Introduction, history and Overview, Analog, analytical, and digital photogrammetry, Photogrammetric cameras, Sensor, films and filters, Data acquisition methods. Single photograph properties, Spatial measurement and scale calculation, Problems with aerial photograph and rectification of a single aerial photograph, Aerial Photograph Interpretation, Types of Aerial Photograph and mosaics, Stereoscopic Analysis DEM generation, Orthophotography/Orthoimage, applications.

Lab Outline:

Comparison of formats, Area and scale measurement, Parallax and radial displacement, Visual interpretation of aerial photographs, vertical airphotos, Mirror stereoscopic interpretation, Orthorectification, case studies.

Reference Material:

1. David, P. P., & James D. K. (2012). Aerial Photography and Image Interpretation 2nd Edition. John Wiley & Sons, Inc. New Jersey. ISBN-13: 978-0470879382
 2. Paul, W., DeWitt, B., & Wilkinson, B. (2014). Element of Photogrammetry with Application in GIS. McGraw Hill. ISBN-13: 978-0071761123
 3. Sabins S.F (2000). Remote Sensing: Principles and Interpretation, Third Edition. Freeman and Company, New York. ISBN: 0 – 7167-2442-1.
 4. Lo, C.P (1986). Applied Remote Sensing (Longman).
 5. Philipson, W.R (1997) Manual of Photographic Interpretation (2nd edition) (American Society for Photogrammetry and Remote Sensing).
 6. Colwell, R.N (ed.) (1983) Manual of Remote Sensing Second Edition in 2 volumes (American Society of Photogrammetry)

RGS 206 Database Management Systems (3 Credit Hours)

Course Outline:

Basic database concepts; Entity Relationship modeling, Relational data model and algebra, Structured Query language; RDBMS; Database design, functional dependencies and normal forms; Transaction processing and optimization concepts; concurrency control and recovery techniques; Database recovery techniques; Database security and authorization, Database normalization process techniques, Query optimization (Relational Algebra), Small Group Project implementing a database. Concepts of database securities. Development of a GUI interface.

Lab outline:

Structured Query language commands, PL/SQL Commands, Creating & populating tables, Design of simple database, Indexing concepts, Performance of concurrency protocols, Partial & full recovery techniques,. Design and implementation of a simple MIS system.

Reference Books/Material:

1. Date, C.J. (2004) Database Systems, Addison Wesley Pub. Co. ISBN - 0201385902
2. Connolly R. and P.Begg (2003) Database Systems: A Practical Approach to Design, Implementation and Management, Addison-Wesley Pub. Co ISBN – 0321210255
3. Elmasri, R. and Navathe, S.B (2004) “Fundamentals of Database Systems” Addison-Wesley Pub. Co ISBN – 0-201760355
4. Rigaux, P. Scholl, M. and Voisard, A.(2001) “Spatial Databases: With Application to GIS” Morgan Kaufmann; 2nd edition ISBN – 01017386802

RGS 207 Active Remote Sensing & Space Laws**(3 Credit Hours)****Course Outline**

Introduction to Active Remote Sensing Types of Active Remote Sensing. Advantages and Disadvantages of Active Remote sensing, Sensor and Platform (Space and airborne, MSS, TM, ETM, HRV, LISS, IKONOS-2, Quick bird-2, AVHRR and others), working Mechanism, Spectral Characteristics of multispectral images, Basic Concepts, Image Geometry, Data Compression and Reconstruction, Image Pre-processing and Classification, Field Verification, Data Fusion Techniques. Space Laws, History, International Space Agency, SUPARCO, Satellite Launching; Mechanism, Space Ethics. Applications of Active Remote Sensing and Space Laws.

Lab Outline:

Introduction to Image Processing of Active Sensors, Multispectral Image comparisons, Visual Interpretation of Images, Image pre-processing, Student Projects.

Reference Material:

1. Campbell, James B. (2002) “Introduction to Remote Sensing”, 3rd Ed., The Guilford Press ISBN # 0-7484-0663-8 (pbk).
2. Henderson, F.M and Lewis, A.J (Latest edition), “Principles and Applications of Imaging Radar”.

RGS 315 Human Geography**(3 Credit Hours)****Course Outline**

Scope and Status of human Geography, Basic concepts and theories including Environmental determinism, Possibilism, Probabilism and cognitive behaviorism, Population: Population distribution, density and growth. Population change including migration, Population composition and Structure, Human Activities: Primary, secondary and Tertiary (agriculture, mining, forestry animal husbandry, poultry, light and heavy industries, transport and trade and tourism) and their impacts on environment, Natural resources, distribution and utilization: Renewable and non-renewable resources e.g., Air, land, water, fauna and flora fossil fuel metallic and non-metallic minerals, Energy generation and consumption, Human Settlements: Evolution and housing types, Urban and Rural contrast, Land Use/land cover Pattern e.g. Commercial, Industrial and Residential, Open and Green Spaces, Transport, Theories of urban structure e.g., Concentric Zone Theory, Multiple Nuclei Theory, Sector Theory, Rural Settlements, Dispersed, Nucleated and Ribbon Settlements, City-Size, Distribution, Rank-Size Rule, Primate Cities.

Reference Books/Material:

1. Knox, P.L. & S.A. Marston (2003) "Places and Regions in Global Context: Human Geography" Prentice Hall. (3rd Edition)
 2. Becker, A. & Secker (2002) "Human Geography: Culture, Society, and Space" John Wiley and Sons. (7th Edition)
 3. Blij, H.J.D. (2002) "Human Geography: Culture, Society, and Space" John Wiley and Sons (7th Edition)

RGS 316 **Microwave & Hyper Spectral RS** **(3 Credit Hours)**

Course Outline:

Introduction of new and advanced developments that are taking place especially in microwave and hyper spectral remote sensing. Basic concepts, Types of sensors, History, Advantages and Disadvantages of Active Remote sensing; data acquisition, working mechanism, Spectral and spatial characteristics of microwave and hyper spectral images (RADAR, SRTM, SAR, AIRSAR, SLAR etc.); RADAR Image Geometry and interferometry, Data Compression and Reconstruction, RADAR Image Pre-processing and Classification, Field Verification, Data Fusion Techniques, Microwave Applications, Hyperspectral Remote Sensing Channels and Spectral Libraries Sensors (AIS, AIVIS etc.); Applications of Radar and hyper spectral datasets, Image Interpretation.

Lab Outline:

Introduction to Microwave Image Processing Module, Microwave Image Comparisons, Visual Interpretation of Radar Images, Radar Image pre-processing (Total Power Image, Like and Unlike Polarization, Ground Resolution, Rectification and Registration, Optical and RADAR data fusion case studies.

Reference Books/Material:

1. Campbell, James B. (2002) Introduction to Remote Sensing. 3rd Ed., The Guilford Press.
 2. Henderson, F.M and Lewis, A.J (1998) Principles and Applications of Imaging Radar. Manual of Remote Sensing. 3rdEd. Vol. 2. John Wiley and Sons, New York..
 3. Peebles, P.Z (1998) Radar Principles. Wiley Inter science, New York.
 4. Elachi, C. (1988) Space-borne Radar Remote Sensing: Applications and Techniques. IEEE Press, New York.

RGS 317 Spatial Decision Support Systems (3 Credit Hours)

Course Outline:

Decision Making Processes (Introduction, Major decision-making Paradigms, Models of decision-making, Different types of problem, Hierarchy of decisions); Methods and techniques to support spatial decisions; Performance modelling and types of criteria, Measurement Scales, Uncertainty in decision making process Decision Support Systems (Introduction, Origin, Definition and components, Fundamental Phases, Characteristics and Capabilities of DSS); GIS and Decision Support Systems, Integration of GIS and DSS Multicriteria Evaluation (Criteria properties, Criteria weighting, Pair wise comparison, Ranking techniques, Rating techniques, Sensitivity analysis, Redistribution criteria weight, Option Ranking methods, Weighted summation, Ideal point, Rank order); Methods and Tools for Collaborative Decision- Making; Consensus Evaluation; Conflict Analysis.

Reference Books/Material:

1. A . E. Turban and J. Aronson (1998), Decision Support Systems and Intelligent Systems, 5th edition, Prentice Hall. ISBN: 0-13-781674-8
 2. B .Sauter, V. (1997) "Decision Support Systems ", John Wiley & sons, HEC — RS&GIS Curricula 2005 29 Inc. ISBN: 0-471-31134-0

RGS 318 Spatial Data Infrastructure & Visualization (3 Credit Hours)

Course Outline:

Need and main components of Spatial Data Infrastructure (SDI), Metadata concepts, its structures and functionality, System Architecture for SDI Interoperability; Client Server Architecture, Data Quality Information (DQI) Accuracy, Precision, Bias Error Modeling, Problems of information sharing (Heterogeneities), Distributed database concept, SDI Technologies; Legal aspects of SDI.

Introduction to spatial data visualization, Visualization Process, Visualization Strategies, Statistical and Visual Foundation, Principles of Symbolization, Principles of Colour, Tri-Simulate(chromatic Model, Intensity, Hue and Saturation, Map Design Process, Mapping Techniques; Map Animation, Virtual Reality, Electronic Atlases and Multimedia.

Lab Outline:

Comparison of working SDI's, Development of Metadata according to Standards, Development of Architecture of SDI, Data Standardization, Data transformations and translations, Data Modeling Abstraction of real world, Types of abstraction, 3D Modelling

Reference Books/Material:

1. Robert, C. H. (2005) " SDI : A View from Europe" Oxford University Press, Oxford, ISBN: 089875982X.
2. Groot, R. (2001). Geospatial Data Infrastructure: Concepts, Cases, and Good Practice (Spatial Information Systems (Cloth)), Oxford University Press.
3. Beth E. Lachman (2001). Lessons for the Global Spatial Data Infrastructure: International Case Study Analysis, RAND Corporation.
4. Mapping Science Committee (1993), " Toward a Coordinated Spatial Data Infrastructure for the Nation,".National Academy Press.

RGS 319 Multidisciplinary Application of GIS & RS (3 Credit Hours)

Course Outline:

Introduction to the scope of both GIS and satellite remote sensing in modern era, identification of trending applications for mapping and modelling of natural hazards/disasters (urban floods, earthquakes, tsunami, land sliding etc.) water related issues, environmental issues, administrative and managerial issues, land cover/ land uses, developmental projects, watershed management, urban planning, rural areas planning etc.

Related lab work considering scope of course, interest of students, data and software resource availability.

Reference Books/Material:

1. Lillesand, T. M. and Kiefer, R. W. (2004), "Remote Sensing and Image Interpretation", 5th ed., (John Wiley and Sons), ISBN 0-471-15227-7
2. Mather, P M (2004), "Computer Processing of Remotely Sensed Images", 3rd Ed., (John Wiley and Sons), ISBN 0-470-84919-3
3. Campbell, James B. (2002), "Introduction to Remote Sensing", 3rd Ed., The Guilford Press, ISBN # 0-7484-0663-8 (pbk).

RGS 320 Geospatial Project Management (3 Credit Hours)

Course Outline:

Overview, project management, project organization, projection selection models and techniques, Cost Benefit analysis, Project planning, project scheduling, project monitoring, reporting and controlling, and project termination.

Reference Books/Material:

1. Merideth, J.R., Sammuel, J. Manbel. (1989) Project Management, New York, John Wiley. ISBN: 0471-85319-4
2. Choudhry, S. Taha, (2000) Project Management, India, McGraw Hill.ISBN: 0-13-032374-8
3. Littlel. M.D., Mirrlees, J.M. (1982) Project Appraisal and Planning for Developing Countries, India, Oxford and IBH. ISBN: 0-435-84501-2

RGS 330 Web GIS

(3 Credit Hours)

Course Outline:

Basic concepts and theory of interactive platform, as the combination of web and GIS (Geographic Information Systems). Introduction to the expanding scope of web and mobile-based mapping applications of GIS. Cloud GIS. Introduction to Google Earth Engine. Development procedures of Web GIS applications to e-government, e-business, e-science, and daily life, public services etc. Online maps and geospatial intelligence using various spatial data layers as web layers and maps.

Lab Outline:

Build interactive web based GIS app that use geospatial data in an attractive format. Create a map tour application using ArcGIS Online. Create web apps with ArcGIS Web AppBuilder or HTML, ArcJava Script.

Reference Books/Material:

1. Pinde Fu, 2015, Getting to Know Web GIS. ESRI Press. Redlands, CA. ISBN-13: 978-1589483842 ISBN-10: 1589483847.
2. Pinde Fu, and Jiulin Sun. 2010. Web GIS: Principles and Applications. ESRI Press. Redlands, CA. ISBN 158948245X (Available at Amazon
3. Sui, D., Elwood, S., & Goodchild, M. (Eds.). (2012). Crowdsourcing geographic knowledge: volunteered geographic information (VGI) in theory and practice. Springer Science & Business Media.
4. Longley, P., & Batty, M. (2003). Advanced spatial analysis: the CASA book of GIS. ESRI
5. Petroulos, E. (2014). Google Maps: Power Tools for Maximizing the API. McGraw Hill Professional.

RGS 331 Digital Image Processing

(3 Credit Hours)

Course Outline:

Data Sources and Procurement, Data Formats (BSQ, BIL, BIP, etc.) Theory of Image Processing Techniques; Image Subsetting & Enhancement, Image Cleaning, Atmosphere Path Correction,, Image Mosaicing and Color Balancing, Image Rectification, Registration and Re-sampling, Band Ratios, Vegetation Indices, Image Filtering, Difference Images, Principal Component Analysis, Classification Schemes, Types, Algorithms, Field data collection, Qualitative and quantitative techniques, sampling techniques, Error matrices, Ground-Verification (Field Verification). Demonstration of image processing software.

Lab Outline:

Intro to lab and software, Image Management (Import/Export & Display), Enhancement Techniques, Spectral and spatial digitizing (image masking), Mosaicing and color balancing, Rectification and Registration and Re-sampling, Band Ratio, Vegetation Indices, Difference images, Image filters, Signature selection, Supervised, Unsupervised and Hybrid classification, ISODATA, MDM, MLC, and Bayesian classification, Error Matrix Generation, Classification validation, field work. Project work will be based on data sets obtained from resource monitoring agencies such as SUPARCO).

Reference Books/Material:

1. Mather, P M (2011). Computer Processing of Remotely Sensed Images, 4th Ed. (John Wiley and Sons), ISBN: 9780470742389
 2. Jensen, J. (2009) Remote Sensing of the Environment: An Earth Resources Perspective, 2nd Ed. Pearson Publishers, ISBN: 9788131716809
 3. Gibson, P.J and Power, C.H (2000). Introductory Remote Sensing: Digital Image Processing and Applications. Routledge. ISBN 0-415-18962-4
 4. Sonka, M; Hlavac, V and Boyle, R (1999). Image Processing, Analysis and Machine Vision (2nd Edition) International Thompson Publishing (ITP) Company. ISBN 0-534-95393-X
 5. Jensen, J. R. (2002), Digital Image Processing: A Remote Sensing Perspective, Prentice Hall, New York.

RGS 332 Satellite Navigation Systems (3 Credit Hours)

Course Outline:

Fundamental framework and applications of modern global navigation satellite systems (GNSS) and inertial navigation systems (INS). Need and evolution of GPS Modernization as Global Navigation Satellite System (GNSS). The course gives an overview of satellite based radio navigation systems such as: GPS, GLONASS, GALILEO and BEIDOU, the basics of receiver design, wave propagation in the atmosphere; Geodesy, the geodetic fundamentals of navigation e.g., positioning, reference- and coordinate systems and computational methods for navigation and positioning on the surface of the earth.

Reference Books/Material:

1. Van Sickle, Jan (2015) *GPS for Land Surveyors*, 4th Ed. CRC Press. (ISBN: 978-1-4665-8310-8)
 2. Kaplan, E.D., Hegarty C.J.: Understanding GPS/GNSS, Principles and Applications, 3rd Edition (ISBN: 978-1630810580).
 3. McCormac J. C., McCourmac J. C., Anderson W., (1999), Surveying, 4th Edition, Wiley, UK, ISBN 0471366579

RGS 360 Spatial Data Analysis (3 Credit Hours)

Course Outline:

Introduction to spatial data type, Potentials of spatial data, Spatial Analysis, Point pattern analysis, Lines and networks, Area objects and spatial autocorrelation, types of area objects, Geometric properties of areas, Boundary Analysis, Buffering and neighbourhood function, Proximity Analysis, Neighbourhood Function/Analysis, Modelling and storing field data, Spatial interpolation, type, Methods / algorithms, Derived measures on surfaces, Map overlay, Vector and raster overlay operations, Problems in simple Boolean polygon overlay, Multivariate data, multidimensional space, Multivariate data and multidimensional space, Distance, difference and similarity, Cluster analysis, PCA, New approaches to spatial analysis, Interpolation techniques, surface modelling, DTM/DEM, Multi-criteria and Multi-attribute Modelling, Uncertainties in spatial modelling. Spatial data interpretation.

Lab Outline:

Assignment on Spatial Analysis for various applications, Geo-coding and Point analysis exercise, Network analysis, Areal analysis exercise, Buffer analysis exercise, Multivariate analysis, Assignment on advanced spatial analysis, Interpolation of elevation data and surface modeling, Suitability analysis, Risk Modeling, Assignment on uncertainties in spatial modelling.

Reference Books/Material:

1. Chang, Krang-tsung (2002) "Introduction to Geographic Information Systems" McGraw Hill. ISBN: 0-07-049552-1
 2. David O' Sullivan and David J. Unwin (2003) "Geographic Information Analysis", John Wiley & Sons, Inc., Canada. ISBN: 0-471-2117-1
 3. David L. Verbyla (2002) "Practical GIS Analysis", , Taylor & Francis, London
 4. John Stillwell & Graham Clarke (2004) "Applied GIS and Spatial Analysis", John Wiley & Sons, UK. ISBN: 1-57504-101-4

RGS 361 Integrated Geospatial Technologies

(3 Credit Hours)

Course Outline:

Use of geospatial techniques and methods (database designs, field surveys, GIS, GPS, satellite remote sensing images of active and passive sensors, programming algorithms) to design and development geospatial products and applications.

Lab Outline:

Introduction to any GIS software (QGIS, ArcGIS, Geometica etc.) which can handle integrated datasets and perform meaningful data integration. Generate integrated data products for further analysis, interpretation and application.

Reference Books/Material:

1. Lillesand, T. M. and Kiefer, R. W. (2004), "Remote Sensing and Image Interpretation", 5th ed., John Wiley and Sons, ISBN 0-471-15227-7.
 2. Gibson, P.J and Power, C.H (2000). Introductory Remote Sensing: Digital Image Processing and Applications. Routledge. ISBN 0-415-18962-4

RGS 471 Legal and Social Issues in Geospatial Sciences

(3 Credit Hours)

Course Outline:

Introduction to the course, standardization of spatial objects, ethical issues, spatial areas, legal aspects of data, use data from other organizations, legal issues in vector data and raster data, reporting and controlling etc. Map ethics (making, production, publishing); Social and ethical issues in cartography, data modelling and spatial data visualization etc.

Reference Books/Material:

1. Samuel, J. (2009), "Legal issues in GIS", London, John Wiley.
 2. Lillesand, T. M. and Kiefer, R. W. (2004), "Remote Sensing and Image Interpretation", 5th ed., John Wiley and Sons, ISBN 0-471-15227-7
 - 3.

RGL 251 Geospatial Field Work & Report-I

(3Credit Hours)

One-week fieldwork, demonstration of field instruments used to collect geospatial data; Basic mapping procedures of surveying using GPS and other mapping tools for measuring the distance, angles and heights. Map reading, Understanding of standard symbology such as Survey of Pakistan symbology; Development of Symbol Charts. Identification of features in the field such as rocks, terrains, land cover, vegetation, land use objects, and other physical objects. Preparation of spatial database and a basic map.

Reference Books/Material:

1. Rangwala, S. C. R. P. S. (2005). Surveying and Levelling: Charotar Publishing House Pvt. Limited.
 2. Sickle, J.V. (2015) GPS for Land Surveyors.

RGL 351 Geospatial Field Work & Report-II (3 Credit Hours)

One-week fieldwork for mapping of various terrains and their structures or coastal environment & morphological features by using integrated GIS and RS Techniques with other datasets. Fieldwork also includes the lab work to develop Graphical Map Projections, Development of at least two map projections each from conical, cylindrical, and plane projection, Large to small scale map conversion, Data classification and Thematic Mapping, Map composite development, Visit to mapping organizations such as Survey of Pakistan (if possible).

Reference Books/Material:

1. Lliffe, J.C., and Lott, R. (2008), "Datum and Map Projections: For Remote Sensing, GIS and Surveying", 2nd Edition, Whittles Publishing, Scotland UK. ISBN: 142007041X

RGS 490 Thesis

(6 Credit Hours)

Students will be required to conduct research work during Final Year Project/Thesis work considering their keen interest in any subdomain of Remote Sensing or GIS.

AIC 201 Artificial Intelligence

(3 Credit Hours)

Course Outline:

An Introduction to Artificial Intelligence and its applications towards Knowledge Based Systems; Introduction to Reasoning and Knowledge Representation, Problem Solving by Searching (Informed searching, Uninformed searching, Heuristics, Local searching, Minmax algorithm, Alpha beta pruning, Game-playing); Case Studies: General Problem Solver; Recent trends in AI and applications of AI algorithms; Basic architecture of neural networks.

Reference Books/Materials:

1. Russell, S. and Norvig, P. "Artificial Intelligence. A Modern Approach", 3rd ed, Prentice Hall, Inc., 2015.
 2. Norvig, P., "Paradigms of Artificial Intelligence Programming: Case studies in Common Lisp", Morgan Kaufman Publishers, Inc., 1992.
 3. Luger, G.F. and Stubblefield, W.A., "AI algorithms, data structures, and idioms in Prolog, Lisp, and Java", Pearson Addison-Wesley. 2009.

AIC 301

Machine Learning

(3 Credit Hours)

Course Outline:

Introduction to machine learning; concept learning: General-to-specific ordering of hypotheses, Version spaces Algorithm, Candidate elimination algorithm; Supervised Learning: decision trees, Naive Bayes, Artificial Neural Networks, Support Vector Machines, Overfitting, noisy data, and pruning, Measuring Classifier Accuracy; Linear and Logistic regression; Unsupervised Learning: Hierarchical Algomerative Clustering. k-means partitional clustering; Self-Organizing Maps (SOM) k-Nearest-neighbor algorithm; Semi-supervised learning with EM using labeled and unlabeled data; Reinforcement Learning: Hidden Markov models, Monte Carlo inference Exploration vs. Exploitation Trade-off, Markov Decision Processes; Ensemble Learning: Using committees of multiple hypotheses, bagging, boosting.

Reference Books/Materials:

1. Machine Learning, Tom, M., McGraw Hill, 1997.
 2. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, MIT Press, 2012

AIC 303

Artificial Neural Network

(3 Credit Hours)

Course Outline

Introduction to data mining and basic concepts, Association Rule mining using Apriori Algorithm and Frequent Pattern Trees, Introduction to Classification Types, Supervised Classification (Decision trees, Naïve Bayes Classification, K-Nearest Neighbors, Support Vector Machines etc.), Unsupervised

Classification (K Means, K Median, Hierarchical and Divisive Clustering, Kohonen Self Organizing maps), outlier & anomaly detection, Web and Social Network Mining, Data Mining Trends and Research Frontiers. Fundamentals of Neural Networking, Case Studies of Neural Networking, Implementing concepts using software.

Reference Books/ Materials:

1. Jiawei Han & Micheline Kamber, Jian Pei (2011). Data Mining: Concepts and Techniques, 3rd Edition.
2. Pang-Ning Tan, Michael Steinbach, and Vipin Kumar (2005). Introduction to Data Mining.
3. Charu C. Aggarwal (2015). Data Mining: The Textbook
4. D. Hand, H. Mannila, P. Smyth (2001). Principles of Data Mining. MIT Press

RGS 451 Computer Aided Drafting/Drawing (3 Credit Hours)

Course Outline:

Introduction to engineering drawing/map, concept of lines, polygons, orthographic projection, projection of points, projection of lines, solids of revolution, introduction to Auto CAD map, drawing of 2D figure, drawing views of 3D Solids, Topology and Errors.,

Lab Outline:

Introduction to CAD Environment, Concept of reference systems, unit systems, points, reference plane, Drawing Lines, poly lines, 2nd order curves, polygons, cross-sectional areas, solid of revolution, shading, textures, rendering, etc.

Reference Books/Material:

1. Sham Tickoo, Auto CAD 2004: A Problem Solving Approach
2. David Frey, AutoCAD 2005 and AutoCAD LT 2005: No Experience Required

RGS 452 Data Structures and Algorithms (3 Credit Hours)

Course Outline:

Introduction to data structures and Algorithms and their inter linkage; Efficient storage of ADTs (Abstract Data Types) and memory intensive problems. Advantages and disadvantages of different data structures using Arrays, Stacks, Queues, Priority Queues and Linked Lists. Recursion, sorting and searching algorithms, Hashing, Binary tree algorithm, Storage and retrieval performance of different techniques

using various data structures. Introduction to theory of NP-Completeness and problem transformation.

Lab outline:

Implementing ADTs using arrays, dynamic memory, Implementation of stacks, Queues & priority Queues, linked lists (single, double, circular), tree searching algorithms, hash algorithms, performance of different data structure techniques, bubble sort and insertion sort for random and ordered data sets. Implementation and comparison of linear search and binary search.

Reference Books/Material:

1. Frank M. Carrano, Paul Helman, Robert Veroff, Data Abstraction and Problem Solving with C++, 2nd ed, Addison-Wesley, 1998
2. Lafore, Data Structures and Algorithms (SAMS teach yourself), Sams Publishing, 1999
3. Horowitz, Sahni, and Mehta Fundamentals of Data Structures in C++, Computer Science Press, 1995

RGS 453 GIS for Disaster Management (3 Credit Hours)

Course Outline:

Spatial information Post-Disaster Impact and Damage Analysis, The use of satellite imagery for disaster relief and recovery, Impact analysis and preliminary damage assessment, Building damage assessment,

Pre-Disaster Risk Assessment, Hazard Assessment, Elements at risk and vulnerability assessment, Types and methods of risk assessment, risk evaluation, cost-benefit analysis, Risk Information for Risk Reduction Planning, Risk evaluation, Visualization of risk information, Risk information and spatial planning, Disaster risk zoning, Flood Mapping, Disease mapping and prediction, Land degradation and Monitoring, Food security and environmental monitoring, Monitoring urban sprawl, GIS and disaster management cycle, GIS and Emergency Shelters, GIS and distribution of Relief, Challenges of using GIS in disaster management, GPS and its applications in Disaster management, risk assessment maps, GIS models in disaster management; assembling spatial information for disaster management and analysis, GIS and fire monitoring.

Reference Books/Material:

1. Marsh, W.M. & Grosha, J. (2005), "Environmental Geography: Science, land use and earth system", John Wiley and sons. Hoboken.
 2. Course Manual: Introduction to Disaster Management by Virtual University of Small States of the Common Wealth (VUSSC) Disaster Management Version 1.0
 3. Jonathan Li, Sisi Zlatanova, Andrea Fabbri (eds), Geomatics Solutions for Disaster Management (Lecture Notes in Geoinformation and Cartography), 2007, 1st Edition, Publisher: Springer, ISBN: 3540721061
 4. Brimicombe, A. (2003), "GIS, Environmental Modeling and Engineering", Taylor and Francis.
 5. Carrara and Guzitti (eds) (20001), Geographical Information System in Assessing Natural hazards (Advances in Natural and Technological Hazards Research), Kluwer Academic Publishers

RGS 454

Spatial Data Modelling

(3 Credit Hours)

Course Outline:

Introduction to Fields, Objects, Geometry, Objects represented in raster, Vector Structure, Vector data representing the geometry of geographical objects, Networks and graphs, Properties of Graphs, graph areas and error checking procedures, Terrain object classed and generalization hierarchies aggregation hierarchies, object association, Fuzzy set theory, fuzzy boundaries, Uncertainties of Spatial Objects.

Lab Outline:

Preparation of Symbolic Charts for representation of Earth Features, Assignment on Geometry of spatial objects, Utility Network Analysis, Spatial data generalization and aggregation.

Reference Books/Material:

1. Michael, N. D.(2003) " Fundamentals of Geographic Information Systems" Third Edition, John Wiley & sons.
 2. Heywood, I., Cornelius, S. and Carver, S. (1999) " An introduction to Geographic Information System", Addison Wesley Longman, New York, second edition.
 3. DeMers, M. (1996) "Fundamentals of Geographic Information Systems", John Wiley & Sons, New York.

RGS 455

Land & Water Information System

(3 Credit Hours)

Course Outline:

Introduction to course, Displaying geographic data, Structure of spatial data in ILWIS, Displaying maps and Layer management, about domains, coordinates, representation and table, Attribute data, pixel information, spatial data input, spatial data management, Attribute data handling, Image processing, spatial and non-spatial data imports, Spatial data analysis, retrieval, classification and measurement operations, Spatial data analysis, overlay operations, spatial data analysis, neighbourhood and

connectivity operations, Using digital Elevation Models, Geostatistical tools (Probabilities), Presentation of results.

Reference Books/Material:

1. ITC (2008) .“ILWIS Application Guide”, International Institute for Aerospace Survey and Sciences, Netherland.
2. Aronoff, S. (2005). “Remote Sensing for GIS Managers”. ESRI Press, New York.

RGS 456 GIS Programming & Python (3 Credit Hours)

Course Outline:

Intro to course; fundamentals of geodatabase processing; fundamentals of Python; using variables; naming conventions and reserved words; testing and printing variable values, Looping and control structures, Debugging, optional and required parameters, Objects, properties and methods; the OO paradigm; Object Model Diagrams, The geo-processor object, introduction, Functions and parameters, passing and returning values, Multiple inputs and complex parameter passing, Selections and sets, SQL basics.

Advanced programming topics such as creating multiprocessing applications, using version control software, Python package management and code distribution, the design and implementation of graphical user interfaces, solving of complex geoprocessing tasks on both proprietary and open source GIS platforms in Python.

Lab outline:

Introduction to Lab, Looping statements, Getting and setting object parameters, Exploring the geo-processor object, Arcpy and object-oriented programming exercises/ projects.

Reference Books/Material:

1. Kang-Stung Chang Programming (2005) ArcObjects with VBA: A Task-Oriented Approach, CRC Press LLC. ISBN: 0849327814
2. Ralston, B. A. (2002), Developing GIS Solutions with Map Objects and Visual Basic, On word Press, New York. ISBN: 0766854388
3. Kropla, B. (2005) “MapServer: Open Source GIS Development” Apress, Co. ISBN: 1590594908
4. Rigaux, P. Scholl, M. and Voisard, A. (2001) “Spatial Databases: With Application to GIS” Morgan Kaufmann; 2nd edition.ISBN: 1558605886.

MASTER OF SCIENCE IN REMOTE SENSING & GIS

A. ACADEMIC DETAILS	
1	Faculty/Department: Faculty of Engineering and Sciences, Bahria University Karachi Campus, Department of Earth and Environmental Sciences
2	Name of the Programme: Masters of Remote Sensing & GIS
3	Mission of the Programme: To prepare postgraduate students to learn and develop applied skills of emerging knowledge of Remote Sensing and GIS so that they can contribute effectively in interdisciplinary research projects using geospatial sciences and technologies.
4	Objectives of the Programme: To provide an understanding of the fundamental concepts of Remote Sensing and Geographical Information System (GIS). To impart advance practical knowledge and skills of various sub-domains of Remote Sensing and GIS. To augment learning and training of GIS related software to cater the need industrial projects. To develop effective presentation, logical and written communication skills to actively contribute in research activities.
5	Outcomes of the Programme: Graduates capable of fulfilling developmental and research needs in the domain of Remote Sensing and GIS. It is envisioned that the graduates of MS RS&GIS may find their possible careers over a wide canvas that includes the following; <ul style="list-style-type: none"> • Natural Resources and Environments (exploration, monitoring, management) • Geosciences (minerals exploration, earthquake, tsunami mapping) • Water Resources (river, lakes, flood mapping, monitoring and prediction) • Social Sciences (crime monitoring, revenue collection, health care, elections) • Urban Planning (city planning, transportation & utility network planning) • Agriculture (crop planning, crop health monitoring, yield forecasting) • Meteorology and Climatology (monitoring, mapping, prediction) • Navigation and Tracking Applications (mapping and modelling) • Geographical location-based integrated geospatial projects etc.
6	Rationale for the Programme: The Department of Earth & Environmental Sciences (BUKC) has proposed to offer MS RS & GIS (2 years). MS RS&GIS is designed to provide a platform for students getting knowledge about emerging geospatial technologies including Remote Sensing and GIS. This program provides a foundation to focus on the application of the Remote Sensing and GIS technologies for the management of Pakistan's natural and environmental resources. It is aimed that the scholars will become GIS experts/professionals and serve in most profound challenges in the domains of RS and GIS Applications through research initiatives.
7	Brief Description of the Programme: The curriculum of the MS RS & GIS program includes coursework and research thesis.
8	Duration: 2 years
9	Venue(s): <input checked="" type="checkbox"/> On Site/Off Site/Both On & Off Site (<i>Tick one; if Off Site, give details</i>) Sir Syed Block, Bahria University Karachi Campus 13- National Stadium Road, Karachi

10	Programme Scheduling Format: Evening (Bi-Annual)												
11	Proposed Date of Commencement: Fall 2022												
12	<p>Mode of Study/Examination:</p> <p>Mode of study for MS Remote Sensing & GIS is based on on-campus classroom teaching (BU policies under COVID). The students performance will be evaluated through Assignments, Quizzes, Mid-term, and Final exams for each course in each semester. Students will be required to undertake 6 credit hours Thesis considering their keen interest in any subdomain of Remote Sensing or GIS.</p>												
13	<p>Additional Faculty Member(s) Required:</p> <p>For intake of two batches per annum (20 students), at least 4 faculty members (1 PhD and 3 MS) are required for the MS RS&GIS program. Following 04 faculty members are already available, whereas, experienced VFM will be inducted as per the requirement.</p> <p>Dr. Salma Hamza, Ph.D – Associate Professor/HoD Research Interests: Environmental Geology, GIS, Water Resources</p> <p>Dr. M Jahangir Khan, Ph.D. – Assistant Professor Specialization: Geophysics, GIS & RS, Earthquakes</p> <p>Ms. Shaista Iftikhar, Ph.D. (In Progress) – Sr. Assistant Professor Specialization: Geophysics, Groundwater Modelling, GIS, Environments</p> <p>Mr. Muhammad Irfan, Ph.D. (In Progress) – Assistant Professor Specialization: Geophysics, Groundwater, GIS, Environments</p> <p>Note: Total 04 FMs are required additional FM will be inducted as per the following plan.</p> <table border="1"> <thead> <tr> <th>Year</th> <th>No. of FMs</th> <th>PhD</th> <th>MS</th> </tr> </thead> <tbody> <tr> <td>First Year</td> <td>4</td> <td>2</td> <td>3</td> </tr> <tr> <td>Second Year</td> <td>4</td> <td>2</td> <td>2</td> </tr> </tbody> </table>	Year	No. of FMs	PhD	MS	First Year	4	2	3	Second Year	4	2	2
Year	No. of FMs	PhD	MS										
First Year	4	2	3										
Second Year	4	2	2										
14	<p>Additional Skilled-Worker(s) Required: (<i>Indicate if there is a requirement for additional Skilled Staff, fulltime/part-time, along with their qualifications/skill sets.</i>)</p> <p><u>Model-1:</u> 01 PhD in GIS/Remote Sensing will be required as PFM. He/She will be teaching 03 courses (may be in both BS/MS programs)</p> <p><u>Model-2:</u> 01 MS in GIS/Remote Sensing will be required as PFM (Lecturer), or 02 PhD/MS in GIS will be required as VFM. 01 Lab Engineer is working already. However, one more Lab Engineer will be required with research experience in the domains of GIS/RS.</p>												
15	<p>Additional Classroom(s) required: Total six class rooms will be required, with the following breakdown.</p> <p>First Year: 2 Classrooms Second Year: 1 Classroom</p>												
16	<p>Additional Requirement for Laboratories:</p> <p>Basic GIS and Computer Lab already exists at E&ES, BUKC. However, upgradation of the Lab will be additionally required for the advance research projects.</p>												
17	<p>Additional Requirement for Books, Subscriptions, Memberships to Online Research Sites/ Repositories: At least 100 books, journals and resources.</p>												

18	Minimum Entry Level: BS (Remote Sensing/GIS) or 16 years of education in Earth Sciences/Natural Sciences/Physical Sciences/Engineering with 2.5 CGPA or 50% Marks in annual examination system and must qualify BU CBT Entry Exam.
19	Admission Criteria: As per BU Policy related to Admission in MS Programs
20	Additional/Different Examination Requirement <i>(Indicate if there will be any examination requirement, additional to or different from the BU Academic Rules or Examination Policy in vogue).</i> Nil
21	Number of Admissions Expected for First Intake: 10 admissions for first intake.
22	Number of Admissions Planned/Expected for Subsequent Intakes: 10 admissions per intake.
23	Referred by: DBOS, FBOS
24	Complete Plan of Studies, inclusive of complete Roadmap: Complete plan for MS Remote Sensing and GIS Program is attached with this document (Appendage 4131).
25	Course Outlines, Descriptions, Pre-Requisites & Readings (Compulsory & Recommended) Course outlines for MS Remote Sensing and GIS Program are attached with this document for reference are attached as per Appendage 4131.

B. FINANCIAL DETAILS

1	Source of Funding: BU Fully								
2	Degree Duration: 2 years Annual or Semester System: Semester								
3	Expected fee to be charged based on Cost & Benefits Analysis:								
	Students				Fee per student		Total Fee		
	Semester	Fresh	Existing	Total	Fresh	Existing	Fresh	Existing	Total
	Fall 2022	10	0	10	96,460	0	964,600	0	964,600
	Spring 2023	10	10	20	96,460	56,460	964,600	564,600	1,529,200
	Fall 2023	10	20	30	96,460	14,160	964,600	706,200	1,670,800
	Spring 2024	10	30	40	96,460	14,160	964,600	847,800	1,812,400
	* Rs. 4720 per credit hour and 12 credit hours per semester (Total 30 credit hours)								
	* For first semester: Rs. 25000 admission fee, Rs. 5000 (misc.) and 10000 refundable security fee shall be applicable.								
4	Expected Number of students for 1st & 2nd Intakes: 20 students								
5	Expected Earning from first two Intakes (B5): Rs. 1,529,200								
	Students				Fee per student		Total Fee		
	Semester	Fresh	Existing	Total	Fresh	Existing	Fresh	Existing	Total
	Fall 2022	10	0	10	96,460	0	964,600	0	964,600
	Spring 2023	10	10	20	96,460	56,460	964,600	564,600	1,529,200
6	Expected Earnings for the Next Years (B6):								
	Students				Fee per student		Total Fee		
	Semester	Fresh	Existing	Total	Fresh	Existing	Fresh	Existing	Total
	Fall 2023	10	20	30	96,460	14,160	964,600	706,200	1,670,800
	Spring 2024	10	30	40	96,460	14,160	964,600	847,800	1,812,400
	Total 2 years earnings: Rs. 5,977, 000/-								

7	Total Estimated Salaries of all Additional Human Resources per annum (B7):				
		Posts	Qualification		Per Semester Salary (6 months)
	Regular Semester	FM	PhD	MS	
	Fall 2022	0	0	0	0
	Spring 2023	0	0	0	0
	Fall 2023	2	0	2	780,000
	Spring 2023	2	0	2	780,000
* MS qualified FM @ Rs. 65,000 per month					
Total estimated salaries per annum of HR: Rs. 1,560,000 (per annum)					
8	Cost of Additional Laboratory Equipment/Tools (B8): N/A				
9	Cost of Additional Classrooms (B9): N/A				
10	Cost of Additional Books, Subscription & Memberships to on-line Sites/Repositories (B10): Year 2: Rs. 100,000/-				
11	Off-Site rental Expenses and Cost of other Fixtures (B11): N/A				
12	Miscellaneous Expenses required for Starting the Program (B12): Advertisement: Rs. 100,000/- Printing & Stationery: Rs. 50,000/- Admin Cost: Nil Outreach visit: Rs. 50,000/- Total: Rs. 200,000/-				
13	Annual Recurring Expenditures in Subsequent Years (B13): Salaries: Rs. 1,560,000 (per annum) Rentals: Nil Subscriptions/Memberships: Nil Advertisements: Rs. 100,000 Printing & Stationery: Rs. 50,000 Admin Cost: Nil Outreach visit: Rs. 50,000 Total: Rs. 1,760,000				
14	Total Cost of the Programme (B14): [Add B(7) to B(12)] Rs. 1,860,000/-				
15	Net Cost of the Programme (B15): [Subtract B(1) from B(14)] Rs. 1,860,000/-				
16	Net Earnings in First Year (B16: [Subtract B(15) from B(5)] Rs. 4,117,000/-				

ROAD MAP - MS REMOTE SENSING & GIS**YEAR -1****Semester I**

Sr. No	Course code	Course Title	Credit Hours		Category as per HEC/BU Policy	Remarks
			Theory	Lab		
1	RGS 504 RGL 504	Advanced Remote Sensing and Image Processing Advanced Remote Sensing and Image Processing Lab	2	1	Compulsory Course	HEC roadmap NUST IGIS
2	RGS 505 RGL 505	Advanced GIS Advanced GIS Lab	2	1	Compulsory Course	HEC roadmap Existing MS ES
3	RGS 506 RGL 506	Advanced Geo-database and Programming Advanced Geo-database and Programming Lab	2	1	Compulsory Course	HEC roadmap
4	ESC 701	Research Methodology	3	0	Compulsory Course	Existing MS ES
Total Credit Hours		12				
Practical Learning Lab (3 contact hours)						

Semester II

Sr. No	Course code	Course Title	Credit Hours		Category as per HEC Policy	Remarks
			Theory	Lab		
1		Elective-I	2	1		
2		Elective-II	2	1		
3		Elective-III	2	1		
4		Elective-IV	2	1		
Total Credit Hours		12				
Practical Learning Lab (4 contact hours)						

YEAR-2**Semester III**

Sr. No	Course code	Course Title	Credit Hours	Category as per HEC Policy	Remarks
1	RGS 600	Thesis	3		

Semester IV

Sr. No	Course code	Course Title	Credit Hours	Category as per HEC Policy	Remarks
1	RGS 600	Thesis	3		

List of Elective Courses

Sr. No.	Course Code	Course Title	Credit Hours	Remarks
1	RGS 551 RGL 551	Advanced Computer Drafting / Drawing Advanced Computer Drafting / Drawing Lab	2 1	HEC/NUST (IGIS)
2	RGS 552 RGL 552	Advanced Web GIS Advanced Web GIS Lab	2 1	HEC/NUST (IGIS)
3	RGS 553 RGL 553	Advanced Photogrammetry Advanced Photogrammetry Lab	2 1	Uni. of Pesh.
4	RGS 554 RGL 554	GIS for Coastal Zone Management GIS for Coastal Zone Management Lab	2 1	HEC roadmap
5	RGS 555 RGL 555	Land Use Planning and Management Land Use Planning and Management Lab	2 1	HEC roadmap
6	RGS 556 RGL 556	Advanced Digital Image Processing Lab	2 1	NUST (IGIS)
7	RGS 557 RGL 557	Advanced Integrated Geospatial Technologies Advanced Integrated Geospatial Technologies Lab	2 1	HEC roadmap
		Any elective course may be from <ul style="list-style-type: none"> ▪ EC Raodmap ▪ S Environmental Sciences ▪ S Geophysics 		

Course Details**RGS 504 Advanced Remote Sensing and Digital Image Processing (3 Credit Hours)****Course Outline:**

In depth understanding of satellite remote sensing operation, image processing, analysis and interpretation. empirically based image transformations, filtering of images, discrete fourier transformations, principal components analysis, and spatial modeling, advanced image classifications such as fuzzy classifications, neural classifiers, spatial and spectral segmentation, sub pixel classification. SAR interferometry, applications of SAR interferometry, image spectrometry, Feature Extraction from Hyperspectral data, Image Residuals, Spectral Fingerprints, Absorption-band Parameters, Spectral Derivative Ratio, Classification Algorithms for Hyperspectral Data, radar remote sensing, speckle noise and suppression, texture analysis, data Fusion, DEM extraction from stereo SAR.

Lab Outlines:

Intro to ERDAS Imagine or any other software, used for lab exercises of above course content. Single band image, Multispectral image interpretation, Various sensors data comparison, Thermal Infrared Image interpretation, Enhancement Techniques, Spectral and spatial digitizing (image masking), Mosaicing and color balancing, Rectification and Registration and Re-sampling, Identification of target features, various features extraction. Data classification, Thematic Mapping, Optical and RADAR data fusion case studies

Books Recommended:

- 1 Campbell, James B. (2011) Introduction to Remote Sensing, 5th Ed., (The Guilford Press) ISBN: 9781609181765.
2. Mather, P M (2011). Computer Processing of Remotely Sensed Images, 4th Ed. (John Wiley and Sons), ISBN: 9780470742389
3. Jensen, J. (2009) Remote Sensing of the Environment: An Earth Resources Perspective, 2nd Ed. Pearson Publishers, ISBN: 9788131716809.
4. Mather, P (2004). Computer processing of remotely sensed images. Third Edition, J Wiley. ISBN 0-470-849193.
5. David A Landgrebe (2003) Signal Theory Methods in Multispectral Remote Sensing (Wiley Series in Remote Sensing and Image Processing) Wiley-Interscience; Bk&CD-Rom edition ISBN: 047142028X.
6. Henderson, F.M and Lewis, A.J (1998). Principles and applications of Imaging Radar. Manual of Remote Sensing, Third Edition Volume 2. John Wiley and Sons. ISBN 0-471029406-3.
7. Roger M. McCoy (2004) Field Methods in Remote Sensing The Guilford Press ISBN: 1593850794
8. Walter G. Egan, Walter Egan (2003) Optical Remote Sensing: Science and Technology (Optical Engineering) Marcel Dekker ISBN: 0824741315
9. Fawwaz T. Ulaby (1986), Microwave Remote Sensing: Active and Passive, Volume I: Fundamentals and Radiometry (March, Artech House Publishers ISBN: 0890061904

RGS 504 Advanced Geographical Information System (3 Credit Hours)

Course Outline:

Basic Theory and Principles of Geographic Information Systems, Co-ordinate System and Map Projection, Drawing of Map Projections and Error Estimations, Understanding of Cartographic Errors and Rectification Procedures, Cleaning and Editing Cartographic Data Visualization of Geospatial Data, Symbolization and Map Layouts Development, 3D Visualization of Spatial Data, Alternate Approaches for Mapping (Geocoding, Survey Data Integration), Geocoding and Survey Data Integration in GIS, Point Pattern Analysis, Lines and Networks, Performing Network Analysis, Area Objects and Spatial Autocorrelation, Describing and Analyzing Fields, Spatial Interpolations, Geostatistical Analysis, Map Overlay Analysis, Multivariate Data, Multidimensional Space and Spatialization, GIS Modeling and Related Issues.

Lab Outline:

Introduction to GIS Lab (hardware / software), Raster/Vector/Attribute Data Display, Digitization, Coordinate based point mapping, Raster / Vector Conversion, Digitization of Map features, Data layer integration, Map layout, Assignment on advanced spatial analysis, Interpolation of elevation data and surface modeling, Suitability analysis, Risk Modeling, Assignment on uncertainties in spatial modelling.

Books Recommended:

1. John Stillwell (2004) Applied GIS and Spatial Analysis John Wiley & Sons, Ltd. England ISBN: 0470844094.
2. Aronoff, S. (2004) "Geographic Information Systems: A Management Perspective", WDL Publications, Ottawa, Fifth Edition. ISBN - 0912804008
3. Burrough, P.(2002) "Principles of Geographic Information Systems for Land Resources Management", Oxford University Press, Oxford, Second Edition. ISBN - 0198233655
4. McDonald, R. and Burrough, P. (2001) "Principles of Geographic Information Systems", Oxford University Press, Oxford, Second Edition ISBN - 0198233855
5. Jacek Malczewski (1999) GIS and Multicriteria Decision Analysis John Wiley & Sons, Inc. ISBN: 0471329444.

RGS 505 Advanced Geo-database and Programming

(3 Credit Hours)

Course Outline:

fundamentals of geo-processing; fundamentals of Python; using variables; Database and Geodatabase, Integration of Data into Geodatabase Topology, Subtypes and Attribute Domains, Relationship Classes and Geometric Networks, UML and CASE Tools for Geodatabase, Overview of Visual Basic, Understanding Map Objects, Maps and Layers Controls, Coordinates and Map Projections, Geometrics, Map Display and Features Rendering, Data Access and Control, Address Matching, Application Deployment, Web GIS concepts, Cartography.

Lab outline:

Scope of GIs based Lab works and software applications, Looping statements, Getting and setting object parameters, Link ArcGIS and Python based programming applications; Exploring the geo-processor object, geomorphological features clipping exercises, raster statistics exercise, students projects

Books Recommended:

1. Ralston, B. A. (2002), Developing GIS Solutions with MapObjects and Visual Basic, Onword Press, New York. ISBN: 0766854388
2. Kropka, B. (2005) "MapServer: Open Source GIS Development" Apress, Co. ISBN: 1590594908
3. Rigaux, P. Scholl, M. and Voisard, A.(2001) "Spatial Databases: With Application to GIS" Morgan Kaufmann; 2nd edition.ISBN: 1558605886.
4. Kang-Tsung Chang Programming (2005) ArcObjects with VBA: A Task-Oriented Approach, CRC Press LLC. ISBN: 0849327814
5. Philippe Rigaux, et al (2002) Spatial Databases: With Application to GIS (Morgan Kaufmann Series in Data Management Systems) Academic Press, U.S
6. Menno-Jan Kraak (2001) Web Cartography, Taylor & Francis ISBN: 074840869X

ELECTIVE COURSES

RGS 551	Computer Aided Drafting	(3 Credit Hours)
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Course Outline:

Introduction to engineering drawing/map, concept of lines, polygons, orthographic projection, projection of points, projection of lines, solids of revolution, introduction to Auto CAD map, drawing of 2D figure, drawing views of 3D Solids, Topology and Errors.,

Lab Outline:

Introduction to CAD Environment, Concept of reference systems, unit systems, points, reference plane, Drawing Lines, poly lines, 2nd order curves, polygons, cross-sectional areas, solid of revolution, shading, textures, rendering, etc.

Books Recommended:

1. Sham Tickoo, Auto CAD 2004: A Problem Solving Approach
2. David Frey, AutoCAD 2005 and AutoCAD LT 2005: No Experience Required

RGS 552	Web GIS	(3 Credit Hours)
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Course Outline:

Basic concepts and theory of interactive platform such as Google Earth Engine, as the combination of web and GIS (Geographic Information Systems). Introduction to the expanding scope of web and mobile-based mapping applications of GIS. Cloud GIS. Introduction to Google Earth Engine. Development procedures of Web GIS applications to e-government, e-business, e-science, and daily life, public services etc. Online maps and geospatial intelligence using various spatial data layers as web layers and maps.

Lab Outline:

Build interactive web based GIS app that use geospatial data in an attractive format. Create a map using using ArcGIS Online or GEE. Create web apps with ArcGIS Web AppBuilder or HTML, ArcJava Script.

Books Recommended:

1. Pinde Fu, 2015, Getting to Know Web GIS. ESRI Press. Redlands, CA. ISBN-10: 1589483847.
2. Pinde Fu, and Jiulin Sun. 2010. *Web GIS: Principles and Applications*. ESRI Press. Redlands, CA. ISBN 158948245X (Available at Amazon)
3. Lillesand, T. M. and Kiefer, R. W. (2004). Remote Sensing and Image Interpretation, 5th edition. (John Wiley and Sons), ISBN 0-471-15227-7

RGS 553	Advanced Photogrammetry	(3 Credit Hours)
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Course Outline:

Introduction to course, Analog and digital photogrammetry; Types of Aerial Photographs and mosaics Photogrammetric cameras; Review of data acquisition and single photograph properties; Spatial measurement and scale calculation; Aerial Photograph Interpretation; Stereoscopic Analysis DEM generation, Orthophotography/ Orthoimage, Drone Photogrammetry, Creation of geospatial products such as orthophotos and topographic mapsapplications.

Lab Outline:

Comparison of formats, Sensor, films and filters, Data acquisition methods, Area and scale measurement, Visual interpretation of aerial photographs, vertical airphotos, problems with aerial photograph and rectification of a single aerial photograph, exercises of Drone Photogrammetry, case studies.

Books Recommended:

1. Sabins S.F (2000) Remote Sensing: Principles and Interpretation. Third Edition. Freeman New York.
2. Lo, C.P (latest version) Applied Remote Sensing. Longman, London.
3. Philipson, W.R (1997) Manual of Photographic Interpretation. 2nd ed., American Society for Photogrammetry and Remote Sensing.
4. Colwell, R.N (ed.), (Latest version) Manual of Remote Sensing. 2nd Ed., 2 vol., American Society of Photogrammetry

RGS 554 GIS for Coastal Zone Management (3 Credit Hours)

Course Outline: Introduction and scope of marine GIS, Introduction to Marine Regions, Water Resources, Spatial Formation and Distribution of Oceans, Characteristics of Oceans, Marine datasets Monitoring of Ocean Pollution using RS and GIS, Tools and Technologies for coastal resources mapping and modelling, Traditional Ecological Knowledge and Coastal GIS. Marine Spatial Planning Challenge, Applications and Case Studies.

Reference Books/Material:

1. Darius Bartlett, Jennifer Smith (2019). GIS for Coastal Zone Management. CRC Press
2. Robin K H Falconer " Experience with Geographic Information System (GIS) in the marine world". Hydrographic Journal
3. R G Humphreys A. R. I. C. S., Dip. H. S. "Marine Information System" the Hydrographic Journal
4. Kurt Fedra & Endrico Fedli" GIS technology and special analysis in Coastal Zone Management" by. EEZ Technology Edition 3.

RGS 555 Advanced Integrated Geospatial Technologies (3 Credit Hours)

Course Outline:

In depth understanding about application of geospatial data sets for various projects, Projects organization planning and management, such as urban project planning, Application of satellite image processing techniques, Accuracy testing between different data sets, Use of geospatial techniques and methods (database designs, field surveys, GIS, GPS, satellite remote sensing images of active and passive sensors, programming algorithms) to design and development geospatial products and applications.

Lab Outline:

Introduction to any GIS software (QGIS, ArcGIS, ERDAS, GEE, Arcpy etc.) which can handle integrated datasets and perform meaningful data integration. Generate integrated data products for further analysis, interpretation and application.

Reference Books/Material:

1. Lillesand, T. M. and Kiefer, R. W. (2004), "Remote Sensing and Image Interpretation", 5th ed., John Wiley and Sons, ISBN 0-471-15227-7.
2. Gibson, P.J and Power, C.H (2000). Introductory Remote Sensing: Digital Image Processing and Applications. Routledge. ISBN 0-415-18962-4

RESTRUCTURING OF DBOS & DRC

1. PhD Rules point 6 needs following amendments after the establishment of Bahria Business School Karachi.

- a. Since the position of Principal did not exist at departmental level, hence, restructuring is required for better management and quality assurance.
- b. Principal should be included in the composition of ACM, HERC, FBOS and FRC. However, DRC and FRC needs to be restructured and to be held at school level.
- c. All departments can send their agendas to BASR and BOS (any other name may be suggested).
- d. The Committees shall be constituted and chaired by the Principal, details given below.

2. **Composition – Core Members**

- a. 10 PhD qualified faculty members of School.
- b. Two to three faculty members with MS/ MPhil qualification (if PhD FMs are not available).

3. **Composition – Elective Members.** There shall be two to three elective members including from non-teaching departments of the BU and from other Higher Education Institutions, and industry with expertise relevant to the candidate's research-work, provided their qualification is not lower than the candidate's programme.

Terms of Reference

- a. Appoint Principal Supervisor(s)/Co-Supervisor(s) for MS/MPhil programmes.
- b. Supervisor(s) to be selected by BASR for PhD scholars.
- c. Conduct/manage research proposal/theses defense through the PGP Coordinator.
- d. On the recommendation of the Principal Supervisor, approve/ratify any minor changes in the topic of the MS/MPhil thesis if made without changing the main theme.
- e. Evaluate the bimonthly progress reports of MS/MPhil scholars submitted by the Supervisors to HOD/PGP Coordinator.
- f. Recommend Exemptions/TOC cases to the FRC.
- g. Internal/external Viva Voce Examiner shall be selected by FRC for MS/MPhil programmes.
- h. Undertake any other research related responsibility assigned by the Dean/ Principal/ HOD.
- i. BASR shall meet at least twice a year. The quorum for a meeting of the BASR shall be half of the total number of core members, a fraction being counted as one. BASR shall maintain minutes of its meetings and forward to the PGP Directorate.
- j. Decisions of the committee shall be made by consensus and, if that is not possible, by majority vote. Only core members shall be entitled to exercise vote.

Appendage 4113**Revision of Semester-Wise Roadmap in accordance with HEC UG Policy 2020****Program: BBA****Faculty: Business Studies****Semester 1:**

Sr. #	Course Code	Course Title	Credit Hours		Category as per HEC Policy	Remarks (Existing or New Course, CHs added, etc.)
			Theory	Lab		
1	ENG 105	Functional English (English I)	3		Expository Writing (1)	Existing
2		Introduction to Environment and Sustainability	3		Natural Sciences (1)	New Course
3	ECO 110	Microeconomics	3		Social Science (1)	Existing
4	QTM 101	Business Mathematics	3		Quantitative Reasoning (1)	Existing
5	HSS 202	Intro to Sociology	3		Arts and Humanities (1)	Existing Shift from S2
6	MIS 161	IT Skills	3		Minor	Existing
Total Credit Hours			18			
7	Practical Learning Lab (4 contact hours per week)					

Semester 2:

Sr. #	Course Code	Course Title	Credit Hours		Category as per HEC Policy	Remarks (Existing or New Course, CHs added, etc.)
			Theory	Lab		
1	ENG 120	English Writing Skills (English II)	3		Expository Writing (2)	Existing
2		Natural Resource and Trade (Maritime)	3		Natural Sciences (2)	New
3	ECO 121	Macroeconomics	3		Social Science (2)	Existing
4	QTM 120	Business Mathematics II / Numeracy Skills	3		Quantitative Reasoning (3)	Existing
5	HSS 115	Introduction to Media Studies	3		Arts and Humanities (2)	New
6	ENG 222	Oral Communication	3		Expository Writing	Change in title from Oral communication (Public speaking) Shift from S3
Total Credit Hours			18			
7	Practical Learning Lab (4 contact hours per week)					

Semester 3:

Sr. #	Course Code	Course Title	Credit Hours		Category as per HEC Policy	Remarks (Existing or New Course, CHs added, etc.)
			Theory	Lab		
1	BCM 204	Business Communication	3		Minor	Existing
2	PAK 101	Pakistan Studies	3		Pakistan Studies	New as current roadmap has Analysis of Pakistani industry not Pakistan Studies Shift from S4
3	ISL 101/ ETH 102	Islamic Studies/ Ethics	3		Islamic/Religious Studies	New as current roadmap has Islamic Socio-Economic Studies Shift from S4
4	ACC 101	Principles of Accounting	3		Distribution	Existing Shift from S2
5	MKT 110	Principles of Marketing	3		Distribution	Existing Shift from S1
6	MGT 111	Principles of Management	3		Distribution	Existing Shift from S1
Total Credit Hours			18			
7	Practical Learning Lab (4 contact hours per week)					

Semester 4:

Sr. #	Course Code	Course Title	Credit Hours		Category as per HEC Policy	Remarks (Existing or New Course, CHs added, etc.)
			Theory	Lab		
1	ACC 102	Financial Accounting	3		Major	Existing Shift from S2
2	MKT 231	Marketing Management	3		Major	Existing Shift from S3
3	QTM 110	Business Statistics	3		Major	Existing Shift from S3
4	MGT 211	Self Management (PMT 211) Fundamentals of Project Management	3		Distribution (Major)	Existing Shift from S4
5	MGT 242	Organizational Theory and Behavior	3		Major	Existing Shift from S3
6	MGT 463	Corporate	3		Distribution	Existing

		Skills (Self Management) (MGT 486 Personal and Professional Development)				Shift from S8
		Total Credit Hours		18		
7	Practical Learning Lab (4 contact hours per week)					

Semester 5:

Sr. #	Course Code	Course Title	Credit Hours		Category as per HEC Policy	Remarks (Existing or New Course, CHs added, etc.)
			Theory	Lab		
1	QTM 205	Statistical Inference	3		Major (Distribution)	Existing Shift from S3
2	ACC 203	Cost Accounting	3		Major	Existing Shift from S4
3	FIN 201	Fundamentals of Finance	3		Major	Existing Shift from S4
4	HRM 253	Human Resource Management	3		Major	Existing Shift from S4
5	SOC 350	Business Ethics	3		Major	Existing Shift from S4
6	MGT 301	Business Law	3		Distribution	Existing Shift from S4
Total			18			

Semester 6:

Sr. #	Course Code	Course Title	Credit Hours		Category as per HEC Policy	Remarks (Existing or New Course, CHs added, etc.)
			Theory	Lab		
1	FIN 202	Financial Management	3		Major	Existing Shift from S4
2	ACC 304	Managerial Accounting	3		Major	Existing Shift from S4
3	SCM 360	Supply Chain Management	3		Major	Existing Shift from S5
4	RMT 240	Research Methods & Techniques	3		Major	Existing
5	MGT 363	Entrepreneurship	3		Major	Existing No change
6	OPM 360	Operation & Production Management	3		Major	Existing Shift from S4
Total			18			

Semester 7:

Sr. #	Course Code	Course Title	Credit Hours		Category as per HEC Policy	Remarks (Existing or New Course, CHs added, etc.)
			Theory	Lab		
1	RMT 621	Operation Research	3		Major	Existing Shift from S5
2	MIS 461	Advance Application of IT in Business	3		Distribution	Existing Shift from S6
3	MIS 460	E-Commerce	3		Distribution	Existing Shift from S6
4		Specialization-I	3		Minor	Existing No change
5		Specialization-II	3		Minor	Existing No change
Total			15			

Semester 8:

Sr. #	Course Code	Course Title	Credit Hours		Category as per HEC Policy	Remarks (Existing or New Course, CHs added, etc.)
			Theory	Lab		
1	MGT 487	Change Management	3		Distribution	Existing No change
2	HSS 403	Pakistan and Geo-political Studies (Specialization-III)	3		Major	Existing Shift from S6
3		Specialization-III (Capstone Project I/Thesis - I /Specialization IV)	3		Minor	Existing No change
4		Specialization-IV (Capstone Project II/Thesis-II /Specialization V)	3		Minor	Existing No change
Total			12			

PROGRAM SUMMARY:

Total Courses	Total Credit Hours
45	135

ELIGIBILITY CRITERIA FOR MS/ MPHIL PROGRAMMES AS PER HEC POLICY

Programme	Existing BU Eligibility Criteria	Proposed Eligibility Criteria
MS Finance (1.5 Years Weekend)	<ul style="list-style-type: none"> • 16 years of business/relevant education, 50% marks in annual exams. 2.5/4.0 CGPA in semester system. • 16 years of non-business education will be required to do 30 credit hours of deficiency courses to become eligible for the MS Finance program. 	<ul style="list-style-type: none"> • 16 years of business education, social sciences and other relevant education (e.g. Economics, Commerce, Management, Supply Chain Management, Project Management, Finance or Business etc.) as per HEC Revised Policy. • 50% marks in annual exams. 2.5/4.0 CGPA in semester system. • Must pass Bahria University admission test. OR NTS – GAT general with 50 Marks obtained in less than two years prior to admissions. (Polices of HEC shall apply as amended from time to time).
MS in Management Sciences (1.5 Years Program)	<p>16 years education from HEC recognized educational universities / institutes, students with business / management sciences backgrounds with the minimum of 50% marks or CGPA 2.5/4.0 in a discipline. Must pass Bahria University admission test. OR NTS – GAT general with 50 Marks obtained in less than two years prior to admissions. (Polices of HEC shall apply as amended from time to time).</p>	<ul style="list-style-type: none"> • 16 years of business education, social sciences and other relevant education (e.g. Economics, Commerce, Management, Supply chain Management, Project Management, Finance or Business etc.) as per HEC Revised Policy. • 50% marks in annual exams or 2.5/4.0 CGPA in semester system. • Must pass Bahria University admission test. OR NTS – GAT general with 50 Marks obtained in less than two years prior to admissions. (Polices of HEC shall apply as amended from time to time).
MS Supply Chain Management (1.5 Years Weekend)	<p>Students eligible for the MS Supply Chain Management should have 16 years of business background or commerce education with the minimum of 50% marks in non-CGPA degree or CGPA 2.5/4.0. GAT General with 50% Marks (is accepted but not mandatory).</p> <ul style="list-style-type: none"> • 16 years of non-business education will be required to do 30 credit hours of deficiency courses to become eligible for the MS Finance program. 	<ul style="list-style-type: none"> • 16 years of business education, social sciences and other relevant education (e.g. Economics, Commerce, Management, Supply chain Management, Project Management, Finance or Business etc.) as per HEC Revised Policy. • 16 years of non-business education will be required to do 30 credit hours of deficiency courses to become eligible for the MS SCM. • 50% marks in annual exams or 2.5/4.0 CGPA in semester system.

		<ul style="list-style-type: none"> Must pass Bahria University admission test OR NTS – GAT general with 50 Marks obtained in less than two years prior to admissions. (Polices of HEC shall apply as amended from time to time).
MS Marketing & Sales	<p>Applicant must have 16 years of Business or Management education/ equivalent degree with 2.5/4 CGPA or 50% marks. Students with the non-business background will take deficiency courses as per HEC rules.</p>	<ul style="list-style-type: none"> 16 years of business education, social sciences and other relevant education (e.g. Economics, Commerce, Management, Supply chain Management, Project Management, Finance or Business etc.) as per HEC Revised Policy. 50% marks in annual exams or 2.5/4.0 CGPA in semester system. Must pass Bahria University admission test. OR NTS – GAT general with 50 Marks obtained in less than two years prior to admissions. (Polices of HEC shall apply as amended from time to time).
MS Economics (2 Year)	<ul style="list-style-type: none"> Applicant must have 16 years of Economics / Finance / Banking /Accounting /Statistics /relevant education/ equivalent degree with 2.5/4 CGPA or 50% marks Applicant must have clear GAT/GRE or Bahria University admission test. Students with non-business background will take deficiency courses as per HEC rules. HEC's attestation on the candidate's local degree (on the back of the original degree). HEC's equivalency certificate for the candidate's foreign degree. 	<ul style="list-style-type: none"> 16 years of business education, social sciences and other relevant education (e.g. Economics, Commerce, Finance or Business etc.) as per HEC Revised Policy. 50% marks in annual exams or 2.5/4.0 CGPA in semester system. Must pass Bahria University admission test. OR NTS – GAT general with 50 Marks obtained in less than two years prior to admissions. (Polices of HEC shall apply as amended from time to time).
M.Phil in Management Sciences	<p>16 years of education with Masters/Bachelors/ equivalent degree from an HEC recognized university in the relevant discipline/field of study with a minimum CGPA 2.5/4.0 or 50% marks where CGPA is not given.</p> <p>GAT (Gen)/GRE (General) passed with minimum 50% marks or BU test (50% minimum passing marks). Result are to be submitted at the</p>	<ul style="list-style-type: none"> 16 years of business education, social sciences and other relevant education (e.g. Management, Economics, Commerce, Finance or Business etc.) as per HEC Revised Policy. 50% marks in annual exams or 2.5/4.0 CGPA in semester system. Must pass Bahria University admission test. OR NTS – GAT general with 50 Marks obtained in less than

	<p>time of application in case of GAT (General) or GRE (General) or as prescribed by the University.</p> <p>HEC's attestation on the candidate's local degrees (on the back of the original degrees). HEC's equivalency certificate for the candidate's foreign degrees</p>	<p>two years prior to admissions. (Polices of HEC shall apply as amended from time to time).</p>
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HEC Policy (MS/MPhil Programmes)

 **HIGHER EDUCATION COMMISSION**
H-9, Islamabad (Pakistan)
Phone: (051) 90402116, Fax: (051) 90402102,
E-mail: fshah@hec.gov.pk

No. DD/SS&H/CDSSH/HP>List/2015 Dated: 3rd February 2015

NOTIFICATION

It is hereby to notify all concerned that the list of subjects for disciplines of Social Sciences, Arts & Humanities and Business Education has been revised and stated below:

Social Sciences

- Archeology
- Anthropology
- Archival Studies
- Economics
- Econometrics
- Disaster Economics
- Political Science
- Public Administration
- Defence & Strategic Studies
- International Relations
- Psychology including Clinical, Industrial, Developmental Psychology
- Philosophy
- Sociology
- Iqbal Studies / Iqbaliyat
- Rural Development Studies
- Social Work
- Criminology
- Library and Information Sciences
- History
- Demography and Population Studies
- Ethnography
- Conservation Studies
- Religious Studies / Comparative Religion
- Islamic Studies / Arabic Studies
- Education
- Special Education
- Law and Legislature
- Home Economics
- Pakistan Studies
- Peace & Conflict Studies
- Behavioral Sciences
- Women and Gender Studies
- American Studies
- Area Studies
- Development Studies
- Journalism
- Mass communication
- Media Studies
- Rural / Urban Studies
- Women Studies

Arts & Humanities

- Fine Arts
- Liberal Arts
- Photography
- Performing Arts
- Musicology
- Film / Film Production
- Physical Education and Sports
- Languages and Literature
- Translation Studies
- Museology (Museum Science)
- Curatorial Studies
- Design
- History of Art & Design
- Architecture
- Urban & Town Planning
- Pedagogy of Arts & Design
- Visual Arts

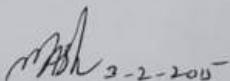
[Signature] PAGE 1 OF 2

Business Education

- Finance all subjects including
 - Accounting
 - Public Finance
- Business Administration/Studies
- Organization Science
- Operations Research & Supply Chain
- Marketing
- Finance
- Banking
- Commerce
- Administrative Sciences
- Management Information Systems
- Skills Development
- Industry Focused Disciplines
- Management Sciences:
 - Human Resource Management/Human Resource Development
 - Financial Management
 - Marketing Management
 - Management
 - Quality Management
 - Project Management
 - Disaster and Risk Management
 - Hotel Management
 - Services Management

Note: - Other related subjects can be added after confirmation from the experts in the relevant disciplines.

With Best Regards,



3-2-2015

Dr. Muhammad Tahir Ali Shah
Dy. Director (Academics) / Focal Person (Social Sciences & Humanities)
Higher Education Commission, Sector H-9, Islamabad.
Ph : 90402116, Fax : 90402102
Email : tshah@hec.gov.pk

Appendage 4116

**INCLUSION OF MANDATORY MEDIA LAB HOURS IN BS (MEDIA STUDIES) FROM FALL 2022 SEMESTER
AT BH3S-IC & KC**

1. Keeping in view the need of practical learning, rapidly changing landscape of digital media and to enable students to stay relevant in their upcoming professional careers, mandatory Media Lab hours in *BS (Television Broadcasting and Digital Media)* from Fall 2021 semester were approved in 40th ACM. Same practice is proposed to be included in *BS (Media Studies)* as this program also requires extensive practical expertise.
2. After deliberation, Dept of Media Studies, BH3S-IC and KC proposed the inclusion of 80 x mandatory Media Lab hours in *BS (Media Studies)* from Fall 2022. The agenda item
3. Proposed Media Lab hours will be non-credited mandatory requirement for the completion of BS (Media Studie)s degree program.
4. The Lab hours will be in addition to the already existing lab and project-based learning.
5. Students will be required to complete a minimum of 80 hours of Media Lab (24 hours in first 4 and 56 hours in last 4 semesters of degree programme) at BU Media House (FM, BU TV and Bahria Tribune).
6. Under this initiative, students will be offered various specialization streams such as audio and video editing, camera work, radio and TV anchoring, production, animation/ designing, news writing, script/ screen writing, blogging/V-logging etc.
7. Lab activities will be directly supervised by the faculty members and technical staff of Media House.
8. Lab hours will be part of students' regular weekly timetable.
9. Lab hours will be depicted in the students' Transcript as tabulated below:

Course	Program	Credit Hours	Course Code
Media Lab Hours	BS (Media Studies)	0 (Non-Credited)	*MED 467

*80 Media Lab Hours

Appendage 4119**ESTABLISHMENT OF BAHRIA UNIVERSITY HEALTH SCIENCES POSTGRADUATE INSTITUTE (BUHSC-PGI)**

1. Faculty of Health Sciences (FHS) that started with establishment of Bahria University Medical & Dental College in 2009 has grown into Bahria University Health Sciences Campus in 2021 with Medical, Dental, Physical Therapy and Nursing Colleges and future College of Allied Health Sciences under one umbrella. Postgraduate programmes of MPhil (Anatomy), MPhil (Pathology) and MPhil (Pharmacology) were started in 2017 in BU Medical College while in 2021 MPhil (Biochemistry) and MPhil (Physiology) were added to this progeny. PhD in Health Sciences with 6 specialities is expected to be added in Fall 2022, while PG programmes of other disciplines of BUHS in basic and clinical subjects (Medical, Dental, Physical Therapy, Nursing, Public Health, MLT, etc) will be add in future years as essential expansions aligned with the future growth plan and Vision 2030 of Bahria University.

2. Considering the above stated, establishment of Bahria University Health Sciences - Postgraduate Institute of (BUHS-PGI) is proposed by BUHSC, as per the details given below. The proposal is supported by FBoS-HS, and is recommended for approval by the Academic Council.

- a. **Mission of BUHS-PGI.** To attain highest standards in knowledge and creativity driven health professional learning, teaching and transformative research through evidence based approach for prevention, diagnosis and treatment of human illnesses by providing quality health care to the community.
- b. **Objectives of BUHS-PGI**
 - i. To formulate and provide integrated strategies for replenishing the academia in the health professional's educational set up with key principles of knowledge and creativity in teaching, training and research framework supporting the long-term health professional needs of Pakistan.
 - ii. To bring forward cost-effective treatment, preventive and care management solutions in health professional's fields aligned with the economic and financial dimensions of Pakistan.
 - iii. To produce leaders of next generation in health professional's fields with critical thinking and self-reflection to participate in policy making in Health Sciences fields.
 - iv. To improve health professional quality care standards in the region by establishing collaborative linkages with leading institutions nationally and internationally.
- c. **Terms of Reference of BUHS-PGI**
 - i. To align the vision of Bahria University for health professional education in Pakistan.
 - ii. To equip health professional students with the ability to understand basic principles of learning & research, application of evidence-based reference tool, behavioral and communication skills (verbal, written and body language), empathy, compassion and professionalism for provision of holistic applied and patient-centered approach.
 - iii. To abreast health professional students with technological advances in medical and health sciences related fields, such as integration of information technology to connect healthcare facilities and institutions nationwide.
 - iv. To formulate and advocate key principles of teaching, training and research framework standards for health professional education and policy making in Pakistan.
 - v. To provide strategies and steer the long-term development of health professional education in the country by bringing forward cost-effective treatment, preventive and care management solutions aligned with the economic and financial dimension in the country.

- vi. To energize the health care delivery standard by replenishing the academia and researchers in health professional's educational set up.
- vii. To establish linkages with leading institutions nationally and internationally for collaboration on regional and global health issues.

d. **Rationale of BUHS-PGI**

- i. To cater existing and future horizontal & vertical additions of postgraduate programs and their students with a more focused approach.
- ii. To generate good quality projects and qualified academic workforce.
- iii. To act as center for faculty development programs in Health Sciences.
- iv. To act as an instrument for retention of faculty in Health Sciences.
- v. To act as a source of increment in undergraduate student intake in health sciences with the provision of postgraduate programs under the same roof for career buildup.
- vi. To provide qualified workforce for undergraduate & postgraduate teaching and training.
- vii. To create learning and research environment aligned with future growth plan & vision 2030 of BU.
- viii. To enhance the ranking of the Bahria University.
- ix. To enhance prestige and repute of Bahria University.

ONGOING POSTGRADUATE PRROGRAMMES UNDER UMBRELLA OF BUHSC

1. **Basic Medical Sciences – Master of Philosophy Programs (Regulatory body HEC)**

- a. MPhil Program Anatomy
- b. MPhil Program Pathology
 - i. Histopathology
 - ii. Microbiology
- c. MPhil Program Pharmacology
- d. MPhil Program Biochemistry
- e. MPhil Program Physiology

2. **Clinical Medical Sciences – Fellowship of College of Physicians & Surgeons Pakistan -FCPS**

(Regulatory body CPSP) in the disciplines of:

- a. Medicine & Allied (Dermatology, Psychiatry etc.)
- b. Surgery & Allied (Orthopedics, Anesthesiology etc.)
- c. Obstetrics & Gynecology
- d. Ophthalmology (EYE)
- e. Otorhinolaryngology (ENT)
- f. Pediatrics
- g. Pathology
- h. Radiology
- i. Dentistry (OMFS & Operative Dentistry)

FUTURE PLAN OF BUHS-PGI (YEAR WISE)

Basic Health Sciences

Year	No. of Programs	Medical	Dental	Public Health	Physical Therapy	Allied Heal	Nursing
2021-22	01 With 06 specialties	PhD in Health Science in specialities of Anatomy, Patho-H, Patho-M, Pharma, Biochem, Physio, Public Health	MDS	—	—	—	—

Target in-process. DBOS & FBOS approved. Will be presented in 41st ACM			—	—	—	—	—
2022-23	PhD in Health Sciences with more number of student induction	MDS & MPhil Community Dentistry	—	—	—	—	—
2023-24	PhD in Health Sciences with more number of student induction	MPhil Oral Biology	MPh/MSPH	MPhil	MPhil	MPhil	MPhil
2024-25	2-4	MPhil Immunology	MPhil Oral Pathology	MPh/MSPH	MPhil	MPhil	MPhil
2025-26	2-4	MPhil Heamatology	MPhil Oral Medicine	MPh/MSPH	MPhil	MPhil	MPhil
2026-27	2-4	MPhil Virology	PhD	MPh/MSPH	MPhil	MPhil	MPhil
2027-28	2-4	MPhil Genetics	PhD	PhD	PhD	PhD	PhD
2028-29	2-4	MPhil Clinical Pathology	PhD	PhD	PhD	PhD	PhD
2029-30	2-4	MPhil Mol. Biology	PhD	PhD	PhD	PhD	PhD
Total Programs 20-32							
In addition 05 MPhil Programs already running in BUHS							

*Subjected to availability of space, relevant PhD faculty& resources

Clinical Health Sciences

Future Year	No. of Programs	Medical	Dental	Public Health
2020-21	—	—	—	—
2021-22	02	—	FCPS /MDS	—
2022-23	02	—	FCPS /MDS	—
2023-24	02	—	FCPS /MDS	**FCPS
2024-25	04	MD/ MS	FCPS /MDS	—
2025-26	04	MD/ MS	FCPS /MDS	—
2026-27	05	MD/ MS/ ***FCPS	FCPS /MDS	—
2027-28	05	MD/ MS/ ***FCPS	FCPS /MDS	—
2028-29	05	MD/ MS/ ***FCPS	FCPS /MDS	—
2029-30	05	MD/ MS/ ***FCPS	FCPS /MDS	—
Ideally Total Programs 34				

*Subjected to availability of space, relevant faculty& resources

** FCPS in Public Health

*** FCPS in Clinical Anatomy, Clinical Physiology, Clinical Biochemistry, Clinical Pharmacology

Type of Programs till 2030

S No.	Program Name	Domain
1	MPhil	Basic Health Sciences
2	PhD	Basic Health Sciences
3	FCPS	Clinical Medical & Dental Sciences
4	FCPS	Basic Medical & Dental Sciences
5	MD/MS	Clinical Medical & Dental Sciences
6	MDS	Clinical Dental Sciences

No. 1 & 2 Inclusive of Medical, Dental, Physical therapy, MLT, Nursing, Public Health

* Subjected to availability of space, relevant faculty & resources

** All FCPS candidates to be given stipend as per PMDC & CPSP rules

*** Whereas MPhil / PhD / MD/ MS/ MDS/candidates will:

- (a) provide services as part of teaching internship in undergraduate & postgraduate programs
- (b) be part of dedicated working force of the institution
- (c) submit fee to university semester wise per credit hour for period of specific program
- (d) not be entitled for any stipend /salary / honorarium

Visiting Faculty Requirement for PhD Programs in Health Sciences

	Subject	Qualifications	Year	Program	Requirement
	Genetics	PhD	2017 Already a VFM in MPhil	PhD	01
	Molecular Biology with Lab. expertise	PhD	2022	PhD	01

Faculty Requirement for Disciplines of Dentistry:

- a. MPhil Programs – 2 PhD for each program
- b. MDS Program – as per requirement of PMC
- c. PhD program – 03 PhD for each separate program

Faculty Requirement for Disciplines of DPT, MLT, Nursing: As per HEC guidelines

Faculty / Staff Requirement for Clinical Medical & Dental Health Sciences: To be specified prior to the launch of the program, if any

REQUIREMENTS

ANNEXURE 1: Infrastructure Requirements

ANNEXURE 2: Fixtures & Furniture Requirement

ANNEXURE 3: Equipment & Audiovisual Aids Requirement

ANNEXURE 4: IT & Other Requirement

ANNEXURE 5: Staff Requirement

ANNEXURE 6: PhD Faculty Requirement Initially for PhD

ANNEXURE – 1
INFRASTRUCTURE REQUIREMENT

S No	Space Title	Number	Capacity	Surface Area
1	Secretariat office	01	3-4 secretarial staff members	20X 30= 600 sqft
2	Chairperson office	01	Office space for one gazetted officer	12X50=600 sqft
3	Focal person PG & Academic Coordinator	02	Office space for two gazetted officer	12X25= 300 sqft 300 X2=600sqft
4	Record room	01	Space to keep record of 50 students per year for next 10 years	12X20=240 sqft
5	Lecture hall / Seminar room	01	For 100 students each	40X90=3600 sqft
6	PG- student cubicles	100	25 students MPhil 1 st year 25 students MPhil 2 nd year 50 students PhD 50 students MD / MS/ MDS program	4X6=24 sqft 24X150=3600 sqft
7	PG – Library	01	For 60 students at one time	40X90=3600 sqft
8	Tutorial rooms	06	For Basic Medical Sciences MPhil subjects PhD/ FCPS / MCPS/ MD/ MS/ MDS individual classes 25-30 students at one time	20X20=400 sqft 400X6=2400 sqft
9	Skill learning area	01	For 30-40 students at one time	30X50=1500 sqft
10	Conference room	01	For 40 persons at one time	20X50=1000 sqft
11	Multipurpose Hall	01	For 60-70 students at one time	40X90=3600 sqft
12	Faculty lounge / Tea room/ Refreshment room	01	To provide sitting area to 40-50 persons during break time	20X50=1000 sqft
13	Pantry	01	To cater tea and refreshments for 25-35 persons at one time	15X10=150 sqft
Total Surface Area = 22,500 sq ft approx.				

ANNEXURE – 2
FIXTURES & FURNITURE REQUIREMENT

S No	Space Title	Number	Furniture	Quantity
1	Secretariat office	01	Office Table Computer side table Office chair Visiting chair Box cabinet File cabinet Notice Board	03 03 03 06 10 10 01
2	Associate Dean / VP PG Office	01	Office Table Executive Computer side table Office chair Visiting chair Sofa set 07 seater Book shelf File cabinet	01 01 01 02 01 01 01
3	Focal person PG & Academic Coordinator	02	Office Table Computer side table Office chair Visiting chair Sofa set 05 seater Book shelf File cabinet	02 02 02 04 02 02 02
4	Record room	01	Office Table Computer side table Office chair Visiting chair Box cabinet File cabinet	01 01 01 02 20 20
5	Lecture hall	01	Student chairs Rostrum Table White Board Notice Board	100 01 01 01 01
6	PG- student cubicles	150	Office Table Computer side table Office chair Visiting chair Book shelf	150 150 150 150 150
7	PG – Library	01	Counter with shelves Counter chair Books racks Office table Office computer side table Office chair Visiting chair	01 01 20 02 02 02 02

			Library Tables Library chair for table Computer Carrels Notice Board	12 72 50 01
9	Tutorial rooms	06	Office Table Office Chair Student Chair White Board	06 06 180 06
10	Skill learning area	01	Office Table Office Chair Stools Table Display Racks White Board	01 01 50 04 10 01
11	Conference room	01	Conference Table Conference Table chair Rostrum Office Table Office Chair Side Wall Table	01 50 01 01 01 02
12	Multipurpose Hall	01	Rostrum Office Table Office Chair	01 01 01
13	Faculty Lounge / Tea room/ Refreshment room	01	Serving Counter Sofa set 05 seater Centre Table set Dining Table Dining Chair	01 02 02 02 40
14	Pantry	01	Kitchen cabinet	05

ANNEXURE – 3
EQUIPMENT & AUDIOVISUAL AIDS REQUIREMENT

S No	Equipment	Qty & Requirement Site
1	Computer system	65 PG-secretariat (03), offices(03), seminar room, conference room, skill room (01 each) tutorial rooms (06), library (50)
2	Printer	08 PG-secretariat (03), offices (03), library (02)
3	Scanner	02 PG-secretariat (01), library (01)
4	Multimedia with screen	10 Seminar room(01), conference room (01), tutorial rooms (06), skill room (01) , Multipurpose room (01)
5	Mic system	04 Seminar room(01), conference room (01), skill room (01) , Multipurpose room (01)
6	Presenter	10 Seminar room(01), conference room (01), tutorial rooms (06), skill room (01) , Multipurpose room (01)
7	Telephone sets	10 PG-secretariat (01), offices (03), Cubicles (03), library (01), skill room(01), Multipurpose room (01)
8	Air conditioners	Centralized System/ Split AC
9	Photocopy machine	02 PG-secretariat (01), library (01)

ANNEXURE – 4
IT & OTHER REQUIREMENT

S No	Facility	Requirement Site
1	Internet	PG- secretariat, offices, seminar room, conference room, skill room, student cubicles, tutorial rooms, library
2	Telephone	PG- secretariat, offices, student cubicles, library
3	Air conditioning	Centralized System/ Split AC

ANNEXURE – 5
STAFF REQUIREMENT FOR SANCTIONING

S No	Name of Post	Requirement	Pay Group
1	PA / Office Supervisor	01	7
2	Computer operators	04 01 for MPhil 01 for PhD 01 for MDS, MD, MS programs 01 for Residency Program	6
3	Clerks	03 01 for Associate Dean/VP 01 for record keeping 01 for Library	5
4	Librarian	01	8
5	Naib Qasid	03 01 for Associate Dean/VP 01 for floor 01 for library	2
6	Sweeper	01	1

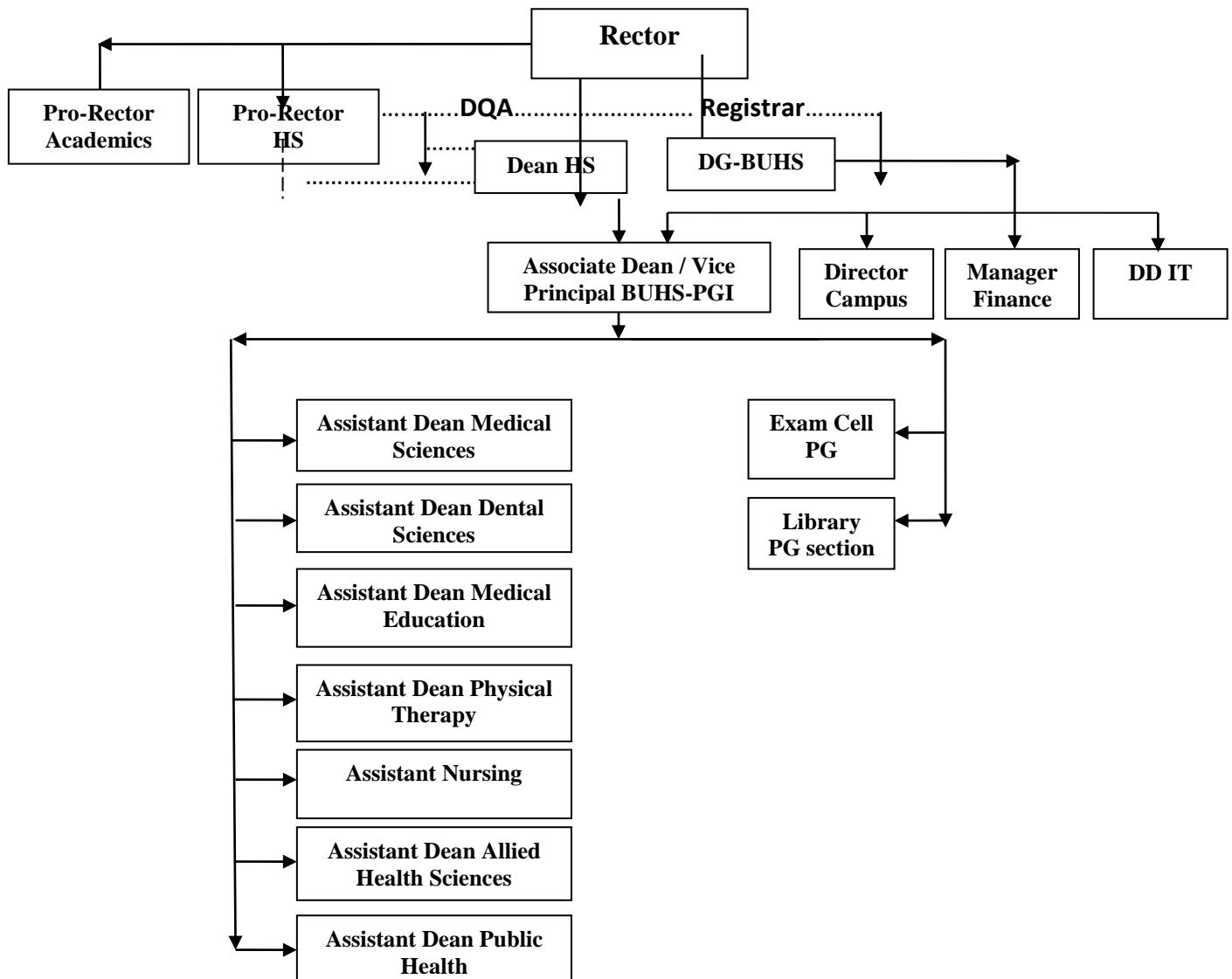
ANNEXURE – 6**PhD FACULTY REQUIREMENT FOR MPHIL & PHD PROGRAMS**

S No	Subject	Requirement
1	Pathology-Histopathology (Full Time Faculty)	01
2	Biostatistics & Epidemiology (Full Time Faculty)	01
3	Molecular Biology with Lab Expertise (Visiting Faculty)	01

RECOMMENDATIONS OF BUHS FOR BUHS-PGI

1. Establishment of Postgraduate institute will enhance the ranking & prestige of Bahria University and the Health Sciences Campus
2. Establishment of BUHS-PGI should be undertaken as per the requirements mentioned above in the Medical College premises on the 6th floor of BUHS building upon shifting of Dental College to new building in 2022, for which following are the justifications:
 - a. PG programs utilize and share the departmental labs & equipment in the Medical College building.
 - b. Teaching faculty of postgraduate programs, is mainly the same as that of undergraduate (MBBS) program and they have offices located in Medical College building. The faculty must be given honoraria to conduct postgraduate classes on contact hour bases.
 - c. Finances of 80 Million are required (@3500 per sft22, 200 X 3500 =77,700,000/), as per estimates taken in 2020, for building up of new Premises. This can be saved upon; as minimal changes will be needed if 6th floor of BUHS building is approved & utilized for BUHS-PGI.
3. Waiting for a separate new premises, will defer the addition of proposed programs nearly by 5- 6 years. This is contradictory to the future growth plan of BUHS and vision 2030 of Bahria University. BUHS in such a scenario will be unable to actively contribute for the ranking of Bahria University.
4. Approval of BUHS-PGI in Principle with all requirements may be approved in 41st ACM meeting March 2022.

ORGANOGRAM OF BUHS-PGI



Appendage 4120**RATIFICATION OF MPHIL ROADMAPS**

Course Code	Course Title	Credit Hours	Theory	Practical
MED 701	Research methodology	3+0	3	0
MED 712	Medical Biology & Genetics	2+0	2	0
MED 713	Medical Education, Ethics & Writing	2+0	2	0
MED 714	Instruments & Animal use in research	2(1+1)	1	1
MED 715	Journal Club –I	No credit hour	0	0
MED 718	Teaching Internship –I	No credit hour	0	0
Total Credit Hours in semester-I		9	8	1

MPHIL ANATOMY**SEMESTER-I****SEMESTER-II**

Course Code	Course Title	Credit Hours	Theory	Practical
ANA 730	Neuro-Anatomy with Head & Neck	3(2+1)	2	1
ANA 731	GIT with related abnormalities	3(2+1)	2	1
XXX XXX	Elective-I	3 (2+1)	2	1
MED 716	Journal Club –II	No credit hour	0	0
MED 719	Teaching Internship -II	No credit hour	0	0
Total Credit Hours in semester-II		9	6	3

SEMESTER-III

Semester-I & semester II are pre-requisite to proceed to semester-III

Course Code	Course Title	Credit Hours	Theory	Practical
XXX XXX	Elective-II	3 (2+1)	2	1
XXX XXX	Elective-III	3 (2+1)	2	1
THS 700	Thesis-I	3+0	3	0
MED 717	Journal Club –III	No credit hour	0	0
MED 720	Teaching Internship -III	No credit hour	0	0
Total Credit Hours in semester-III		9	7	2

SEMESTER-IV

Sr.No	Pre-requisite course code	Course Code	Course Title	Credit Hours	Theory	Practical
1	THS 700	THS 701	Thesis-II	3+0	3	0
Total Credit Hours in Semester-IV				3	3	0

ELECTIVE LIST			
S No.	Course Code	Course Title	Credit Hours
1	MED 706	Tissue Processing	3 (1+2)
2	MED 708	Cadaveric Dissection	3 (1+2)
3	MED 709	Advanced Microscopic Techniques	3 (1+2)
4	ANA 732	Microscopic Structure of Tissue	3 (2+1)
5	ANA 733	Developmental Anatomy	3 (2+1)
6	ANA 734	Musculoskeletal System	3 (2+1)
7	ANA 735	Cardiovascular & Respiratory System	3 (2+1)
8	ANA 736	Urogenital System	3 (2+1)
9	ANA 737	Reticuloendothelial System	3 (2+1)

CORE COURSES			
S No.	Course Code	Course Title	Credit Hours
1	MED 712	Medical Biology & Genetics	2+0
2	MED 713	Medical Education, Ethics & Writing	2+0
3	MED 714	Instruments & Animal use in research	2(1+1)
4	ANA 730	Neuro-Anatomy with Head & Neck	3(2+1)
5	ANA 731	GIT with related abnormalities	3(2+1)
6	THS 700	Thesis-I	3+0
7	THS 701	Thesis-II	3+0
8	MED 715, 716, 717	Journal Club-I, II, III	No credit hour
9	MED 718, 719, 720	Teaching Internship-I, II, III	No credit hour

UNIVERSITY REQUIREMENT			
S No.	Course Code	Course Title	Credit Hours
1	MED 701	Research Methodology	3+0

MPHIL ROADMAP – PATHOLOGY

SEMESTER-I				
Course Code	Course Title	Credit Hours	Theory	Practical
MED 701	Research Methodology (University Requirement)	3+0	3	0
MED 712	Medical Biology & Genetics	2+0	2	0
MED 713	Medical Education, Ethics & Writing	2+0	2	0
MED 714	Instruments and Animal use in research	2(1+1)	1	1
MED 715	Journal Club -I	No credit hour	0	0
MED 718	Teaching Internship-I	No credit hour	0	0
Total Credit Hours in Semester-I		9	8	1

SEMESTER-II

Course Code	Course Title	Credit Hours	Theory	Practical
PAT 740	General Pathology & Basic Microbiology	3 (2+1)	2	1
PAT 750	Special Pathology*	3 (2+1)	2	1
PAT 751	Microbiology & Mycology**	3 (2+1)	2	1
XXXXXX	Elective- I	3(1+2)	1	2
MED 716	Journal Club -II	No credit hour	0	0
MED 719	Teaching Internship-II	No credit hour	0	0
Total Credit Hours in Semester- II		9	5	4

*for Histopathology

**for Microbiology

SEMESTER-III

Semester-I & Semester-II are pre-requisite to proceed to

SEMESTER-III

Course Code	Course Title	Credit Hours	Theory	Practical
XXXXXX	Elective-II	3(1+2)	1	2
XXXXXX	Elective-III	3(1+2)	1	2
THS 700	Thesis-I	3+0	3	0
MED 717	Journal Club-III	No credit hour	0	0
MED 720	Teaching Internship-III	No credit hour	0	0
Total Credit Hours in Semester-III		9	5	4

SEMESTER-IV

Sr.No.	Pre-requisite course code	Course Code	Course Title	Credit Hours	Theory	Practical
1	THS 700	THS 701	Thesis-II	3+0	3	0
Total Credit Hours in Semester-IV				3	3	0

ELECTIVE LIST				
S. No	Course Code	Course Title	Credit Hours	
1	PAT 742	Tissue processing for histopathology	3(1+2)	
2	PAT 743	Histopathology laboratory procedures & reporting	3(1+2)	
3	PAT 744	Endocrine & Renal disorders	3(1+2)	
4	PAT 745	Molecular pathology laboratory- related to tissue pathology	3(1+2)	
5	PAT 746	Microbiology laboratory - procedures & reporting	3(1+2)	
6	PAT 747	Molecular pathology laboratory- related to infectious diseases	3(1+2)	
7	PAT 748	Virology	3(1+2)	
8	PAT 749	Parasitology	3(1+2)	

CORE COURSES			
Sr.No	Course Code	Course Title	Credit Hours
1	MED 712	Medical Biology & Genetics	2+0
2	MED 713	Medical Education, Ethics & Writing	2+0
3	MED 714	Instruments & Animal use in research	2(1+1)
4	PAT 740	General Pathology & Basic Microbiology	3(2+1)
5	PAT 750	Special Pathology*	3(2+1)
6	PAT 751	Microbiology & Mycology**	3(2+1)
6	THS 700	Thesis-I	3+0
7	THS 701	Thesis-II	3+0
8	MED 715, 716, 717	Journal Club-I, II, III	No credit hour
9	MED 718, 719, 720	Teaching Internship-I, II, III	No credit hour

*for Histopathology

**for Microbiology

UNIVERSITY REQUIREMENT

Sr.No.	Course Code	Course Title	Credit Hours
1	MED 701	Research methodology	3+0

Sr.No.	Course Code	Course Title	Credit Hours	Theory	Practical
1	MED 701	Research Methodology	3+0	3	0
2	MED 712	Medical Biology & Genetics	2+0	2	0
3	MED 713	Medical Education, Ethics & Writing	2+0	2	0
4	MED 714	Instruments & Animal use in research	2(1+1)	1	1
5	MED 715	Journal Club -I	No credit hour	0	0
6	MED 718	Teaching Internship -I	No credit hour	0	0
Total Credit Hours in Semester-I			9	8	1

MPHIL ROADMAP - PHARMACOLOGY**SEMESTER-I****SEMESTER-II**

Sr.No.	Course Code	Course Title	Credit Hours	Theory	Practical
1	PHM 721	Pharmacological concepts & Adrenergic Pharmacology	3(2+1)	2	1
2	PHM 722	Cholinergic & Cardio-Respiratory Pharmacology	3+0	3	0
3	XXX XXX	Elective -I	3+0	3	0
4	MED 716	Journal Club -II	No credit hour	0	0
5	MED 719	Teaching Internship -II	No credit hour	0	0
Total Credit Hours in Semester-II			9	8	1

SEMESTER-III

Semester-I & Semester-II are Pre-requisite to proceed to Semester -III

Sr.No.	Course Code	Course Title	Credit Hours	Theory	Practical
1	XXX XXX	Elective-II	3+0	3	0
2	XXX XXX	Elective-III	3+0	3	0
3	THS 700	Thesis-I	3+0	3	0
4	MED 717	Journal Club -III	No credit hour	0	0

5	MED 720	Teaching Internship -III	No credit hour	0	0
Total Credit Hours in Semester-III			9	9	0

SEMESTER-IV

Sr.No.	Pre-requisite course code	Course Code	Course Title	Credit Hours	Theory	Practical
1	THS 700	THS 701	Thesis-II	3+0	3	0
Total Credit Hours in Semester-IV				3	3	0

ELECTIVE LIST			
S. No.	Course Code	Course Title	Credit Hours
1	MED 706	Tissue Processing	3(1+2)
2	MED 707	Drug Bio-screening & Herbal Medications	3(2+1)
3	PHM 723	Neuropharmacology	3+0
4	PHM 724	Endocrine & Gastrointestinal Pharmacology	3+0
5	PHM 725	Chemotherapy	3+0
6	PHM 726	Toxicology	3+0
7	PHM 727	Pharmacogenetics	3+0
8	PHM 728	Autacoids & Analgesics	3+0
9	PHM 729	Age specific Pharmacology	3+0
10	PHM 730	Dental Pharmacology	3+0

CORE COURSES			
Sr.No.	Course Code	Course Title	Credit Hours
1	MED 712	Medical Biology & Genetics	2+0
2	MED 713	Medical Education, Ethics & Writing	2+0
3	MED 714	Instruments & Animal use in research	2(1+1)
4	PHM 721	Pharmacological concepts & Adrenergic Pharmacology	3(2+1)
5	PHM 722	Cholinergic & Cardio-Respiratory Pharmacology	3+0
6	THS 700	Thesis-I	3+0
7	THS 701	Thesis-II	3+0
8	MED 715, 716, 717	Journal Club-I, II, III	No credit hour
9	MED 718, 719, 720	Teaching Internship-I, II, III	No credit hour

UNIVERSITY REQUIREMENT			
Sr.No.	Course Code	Course Title	Credit Hours
1	MED 701	Research methodology	3+0

MPHIL BIOCHEMISTRY - ROADMAP**SEMESTER-I**

Sr No	Course Code	Course Title	Credit Hours	Theory	Practical
1	MED 701	Research Methodology	3+0	3	0
2	MED 712	Medical Biology & Genetics	2+0	2	0
3	MED 713	Medical Education, Ethics & Writing	2+0	2	0
4	MED 714	Instruments and Animal use in research	2(1+1)	1	1
5	MED 715	Journal Club -I	No credit Hour	0	0
6	MED 718	Teaching Internship-I	No credit Hour	0	0
Total credit hours in semester-I			9	8	1

SEMESTER-II

Sr No	Course Code	Course Title	Credit Hours	Theory	Practical
1	BIO 750	Advances in Biochemistry and neurosciences	3+0	3	0
2	BIO 751	Advances in Clinical biochemistry	3(2+1)	2	1
3	XXXXXXX	Elective –I	3+0	3	0
4	MED 716	Journal Club-II	No credit hour	0	0
5	MED 719	Teaching Internship-II	No credit hour	0	0
Total credit hours in semester-II			9	8	1

SEMESTER-III

Semester-I & Semester-II are Pre-requisite to proceed to Semester -III

Sr No	Course Code	Course Title	Credit Hours	Theory	Practical
1	XXXXXXX	Elective-II	3+0	3	0
2	XXXXXXX	Elective-III	3+0	3	0
3	THS 700	Thesis-I	3+0	3	0
4	MED 717	Journal Club –III	No credit hour	0	0
5	MED 720	Teaching Internship - III	No credit hour	0	0
Total credit hours in semester-III			9	9	0

SEMESTER- IV

Sr.No.	Pre-requisite course code	Course Code	Course Title	Credit Hours	Theory	Practical
1	THS 700	THS 701	Thesis-II	3+0	3	0
Total Credit Hours in Semester-IV				3	3	0

ELECTIVE LIST

Sr.No.	Course Code	Course Title	Credit Hours
1	BIO 752	Chemical basis of Diet , Nutrition and recent trends in immunology	3(2+1)
2	BIO 753	Advances in Endocrinology	3+0
3	BIO 754	Fluids and electrolyte disorder	3+0
4	BIO 755	Enzymology and vitamins	3+0
5	BIO 756	Acid base disorders	3+0
6	BIO 757	Molecular mechanism of cancer	3+0
7	BIO 758	Minerals and detoxification	3+0

CORE COURSES

Sr.No.	Course Code	Course Title	Credit Hours
1	MED 712	Medical Biology & Genetics	2+0
2	MED 713	Medical Education, Ethics & Writing	2+0
3	MED 714	Instruments & Animal use in research	2(1+1)
4	BIO 750	Advances in Biochemistry and neurosciences	3+0
5	BIO 751	Advances in Clinical biochemistry	3(2+1)
6	THS 700	Thesis-I	3+0
7	THS 701	Thesis-II	3+0
8	MED 715, 716, 717	Journal Club-I, II, III	No credit hour
9	MED 718, 719, 720	Teaching Internship-I, II, III	No credit hour

UNIVERSITY REQUIREMENT			
Sr.No.	Course Code	Course Title	Credit Hours
1	MED 701	Research methodology	3+0

MPHIL PHYSIOLOGY - ROADMAP**SEMESTER- I**

Sr. No.	Course Code	Course Title	Credit Hours	Theory	Practical
1	MED 701	Research Methodology	3+0	3	0
2	MED 712	Medical Biology & Genetics	2+0	2	0
3	MED 713	Medical Education, Ethics & Writing	2+0	2	0
4	MED 714	Instruments & Animal use in research	2(1+1)	1	1
5	MED 715	Journal Club -I	No credit hour	0	0
6	MED 718	Teaching Internship -II	No credit hour	0	0
Total Credit Hours in Semester-I			9	8	1

SEMESTER- II

Sr. No.	Course Code	Course Title	Credit Hours	Theory	Practical
1	PHY 760	General ,Neuromuscular and Blood Physiology	3+0	3	0
2	PHY 761	Cardiorespiratory Physiology	3(2+1)	2	1
3	XXXXX	Elective –I	3+0	3	0

4	MED 716	Journal Club- II	No credit hour	0	0
5	MED 719	Teaching Internship- II	No credit hour	0	0
Total Credit Hours in Semester-II			9	8	1

SEMESTER –III**Semester-I & Semester-II are Pre-requisite to proceed to Semester –III**

Sr. No.	Course Code	Course Title	Credit Hours	Theory	Practical
1	XXXX	Elective-II	3+0	3	0
2	XXXXX	Elective-III	3+0	3	0
3	THS 700	Thesis-I	3+0	3	0
4	MED 717	Journal Club- III	No credit hour	0	0
5	MED 720	Teaching Internship- III	No credit hour	0	0
Total Credit Hours in Semester-III			9	9	0

SEMESTER- IV

Sr. No.	Pre-requisite course code	Course Code	Course Title	Credit Hours	Theory	Practical
1	THS 700	THS-701	Thesis-II	3+0	3	0
Total				3	3	0
Total Credit Hours in Semester -IV				3	3	0

ELECTIVE LIST

Sr. No.	Course Code	Course Title	Credit Hours	Theory	Practical
1.	PHY 762	Physiology of Health, Fitness & Exercise	3+0	3	0
2.	PHY 763	Haeme & Immune system	3+0	3	0
3.	PHY 764	Gastrointestinal Physiology	3+0	3	0
4.	PHY 765	Neurophysiology and special senses	3+0	3	0
5.	PHY 766	Renal Physiology	3+0	3	0
6.	PHY 767	Endocrine and Reproductive Physiology	3+0	3	0
7.	PHY 768	Electrophysiology	3(1+2)	1	2

CORE COURSES			
Sr.No.	Course Code	Course Title	Credit Hours
1	MED 712	Medical Biology & Genetics	2+0
2	MED 713	Medical Education, Ethics & Writing	2+0
3	MED 714	Instruments & Animal use in research	2(1+1)

4	PHY 760	General ,Neuromuscular and Blood Physiology	3+0
5	PHY 761	Cardiorespiratory Physiology	3(2+1)
6	THS 700	Thesis-I	3+0
7	THS 701	Thesis-II	3+0
8	MED 715,716,717	Journal Club-I, II, III	No credit hour
9	MED 718,719,720	Teaching Internship-I, II, III	No credit hour

UNIVERSITY REQUIREMENT			
Sr.No.	Course Code	Course Title	Credit Hours
1	MED 701	Research methodology	3+0

HEC ALLIGNED COURSE TITLE IN MPHIL BIOCHEMISTRY ROADMAP

Course Code	Title Approved by ACM	Title Approved by HEC
BIO 750	General Metabolism and Biological oxidation	Advances in Biochemistry and neurosciences
BIO 751	Clinical Biochemistry and Heme Metabolism	Advances in Clinical biochemistry
BIO 752	Chemical Basis of life, diet and Nutrition	Chemical basis of Diet, Nutrition and recent trends in immunology
BIO 753	Endocrinology	Advances in Endocrinology
BIO 754	Water, Electrolyte Balance and Imbalance	Fluids and electrolyte disorder
BIO 757	Biochemistry of Cancer	Molecular mechanism of cancer

MPHIL ANATOMY – ROADMAP**SEMESTER-I**

Course Code	Course Title	Credit Hours	Theory	Practical
MED 701	Research methodology	3+0	3	0
MED 712	Medical Biology & Genetics	2+0	2	0
MED 713	Medical Education, Ethics & Writing	2+0	2	0
MED 714	Instruments & Animal use in research	2(1+1)	1	1
MED 715	Journal Club –I	No credit hour	0	0
MED 718	Teaching Internship –I	No credit hour	0	0
Total Credit Hours in semester-I		9	8	1

SEMESTER-II

Course Code	Course Title	Credit Hours	Theory	Practical
ANA 730	Neuro-Anatomy with Head & Neck	3(2+1)	2	1
ANA 731	GIT with related abnormalities	3(2+1)	2	1
XXX XXX	Elective-I	3 (2+1)	2	1
MED 716	Journal Club –II	No credit hour	0	0
MED 719	Teaching Internship -II	No credit hour	0	0
Total Credit Hours in semester-II		9	6	3

SEMESTER-III

Semester-I & semester II are pre-requisite to proceed to semester-III

Course Code	Course Title	Credit Hours	Theory	Practical
XXX XXX	Elective-II	3 (2+1)	2	1
XXX XXX	Elective-III	3 (2+1)	2	1
THS 700	Thesis-I	3+0	3	0
MED 717	Journal Club –III	No credit hour	0	0
MED 720	Teaching Internship -III	No credit hour	0	0
Total Credit Hours in semester-III		9	7	2

SEMESTER-IV

Sr.No	Pre-requisite course code	Course Code	Course Title	Credit Hours	Theory	Practical
1	THS 700	THS 701	Thesis-II	3+0	3	0
Total Credit Hours in Semester-IV				3	3	0

PROPOSAL FOR LAUNCHING
Bachelor of Science in Biotechnology

Title of the Programme

Bachelor of Science in Biotechnology

A. ACADEMIC DETAILS	
1	Faculty/Department: Department of Biotechnology, Bahria University Medical and Dental College
2	Name of the Programme: Bachelor of Science in Biotechnology
3	Mission of the Programme: The B.S. Degree in Biotechnology is designed to give you fundamental training in basic scientific principles as well as in specific concepts, techniques, and applications used in biotechnology. The Biotechnology B.S. is rigorous degree, providing excellent preparation for medical school, dental school, and graduate school, as well as for jobs in the life sciences. The students may seek their career in educational institutes, scientific research and development, management in biotechnology and pharmaceutical sector.
4	Objectives of the Programme: The students will be able to: <ul style="list-style-type: none"> • The graduates will contribute competently in the industry related to biotechnology by applying requisite technical skills • The graduates will demonstrate advancement in profession by enhancing their knowledge and skills in their relevant field. • The graduates will demonstrate commitment to ethical values and contribute positively towards the society. • learn the scope, concepts, and terminology of biotechnology; • investigate and explain current events and advances in biotechnology; • perform techniques involving measurement;
5	Outcomes of the Programme: <ul style="list-style-type: none"> • Graduates will be prepared with an ability to apply fundamental and specialized knowledge of biotechnology to the solution of complex biotechnological problems • Graduates will be able to deliver an ability to identify, formulate, research literature, analyze complex biotechnology problems, reaching substantiated conclusions towards formulation of hypothesis using fundamental principles of biotechnology. • The graduates will have an ability to design experimental solutions to validate biotechnology Hypothesis and design process while maintaining biotechnology standards, cultural, societal, and environmental considerations. • An ability to investigate complex issues in biotechnology in a methodical way including literature survey, and development of systems, analysis and interpretation of experimental data, and synthesis of information to derive valid conclusions. • An ability to investigate complex issues in biotechnology in a methodical way including literature survey, and development of systems, analysis and interpretation of experimental data, and synthesis of information to derive valid conclusions.

	<ul style="list-style-type: none"> An ability to communicate effectively, orally as well as in writing, on complex biotechnology activities with the biotechnology 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. 																
6	<p>Rationale for the Programme:</p> <p>Biotechnology refers to the employment of various types of “technology” to use, exploit, modify or improve existing biological processes for a specific purpose; its overarching goal is to enhance the quality of human life - be it directly or indirectly - by producing and/or developing effective pharmaceuticals, bioenergy, disease-resistant and high-yield crops as well as animals, and microbes for remediation in an efficient, cost-effective and ethically responsible manner. The field has already shown immense promise and further innovations are certain to culminate in dramatic improvements in existing technologies and outcomes. Biotechnology is the next wave of change that is likely to be as sweeping and invasive as that brought about by information technology</p>																
7	<p>Brief Description of the Programme:</p> <p>Bahria University Medical and Dental College is offering Bachelor of Science (BS) in Biotechnology. This is four Year degree Program consisting of Core (compulsory) courses and specialized courses. The program of study is as follows.</p> <table border="1"> <tr> <td>Course title</td><td>BS (4 year degree program) in Biotechnology</td></tr> <tr> <td>Course duration</td><td>4 YEARS</td></tr> <tr> <td>Study system</td><td>SEMESTER SYSTEM</td></tr> <tr> <td>No. of regular semesters</td><td>8</td></tr> <tr> <td>Semester Duration</td><td>18 weeks</td></tr> <tr> <td>Total credit hours</td><td>134 (HEC recommended: 124-136)</td></tr> <tr> <td>Number of courses per semester</td><td>5-6</td></tr> <tr> <td>Course Load per Semester</td><td>15-18 credit hr</td></tr> </table>	Course title	BS (4 year degree program) in Biotechnology	Course duration	4 YEARS	Study system	SEMESTER SYSTEM	No. of regular semesters	8	Semester Duration	18 weeks	Total credit hours	134 (HEC recommended: 124-136)	Number of courses per semester	5-6	Course Load per Semester	15-18 credit hr
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Course Load per Semester	15-18 credit hr																
8	Duration: 4 years																
9	Venue(s): On Site ✓ /Off Site/Both On & Off Site (<i>tick one/strike-through the ones not applicable; if Off Site, give details</i>)																
10	<p>Programme Scheduling Format:</p> <ul style="list-style-type: none"> • Morning ✓/Evening/Weekend (<i>tick one/strike-through the ones not applicable</i>) • Bi-Semester ✓/Trimester/Semester+Summer Session/Annual/Bi-Annual (<i>tick one/strike-through the ones not applicable</i>) 																
11	Proposed Date of Commencement: Fall 2022																
12	Mode of Study/Examination: Semester system																
13	<p>Additional Faculty Member(s) Required: (<i>Indicate if there is a requirement for additional faculty members, fulltime/visiting, along with qualifications.</i>)</p> <p>1) Full time dedicated faculty requirement includes one senior Biotechnologist as coordinator. 2) 1 Biotechnologist (MS) and 3 BS available as non-teaching staff, needs to be converted into</p>																

	one department as faculty member (Lecturer).
14	Additional Skilled-Worker(s) Required: (<i>Indicate if there is a requirement for additional Skilled Staff, fulltime/part-time, along with their qualifications/skill sets.</i>) No additional skilled worker is required.
15	Additional Classroom(s) required: (<i>The requirement is to include the number of classrooms and their capacities.</i>) One class room or well-equipped lecture hall of 30 student capacity is required initially and number will be increased up to four for each batch every year till fourth year.
16	Additional Requirement for Laboratories: (<i>The requirement is to include the number of laboratories, their equipment and their capacities.</i>) 1) For this program, Basic Research Lab exists in form of Multidisciplinary Research Lab which need to be upgraded for molecular facilities.
17	Additional Requirement for Books, Subscriptions, Memberships to Online Research Sites/ Repositories: <ol style="list-style-type: none"> 1. A text book of Biotechnology by RC Dubey. 2. Text book of Biotechnology by S.C Bhatia. 3. Biotechnology by John &Smith 2009. 4. Genetics, 6th edition by John Wiley and Sam. 5. Molecular Biology of Gene, 7th edition by Benjamin Cumming.
18	Minimum Entry Level: Intermediate
19	Admission Criteria: Candidates having 50% marks or above in Intermediate Science or equivalent examination are eligible to apply and all candidates seeking admission are required to appear in entrance test which will be conducted by Bahria University on particular time and date.
20	Additional/Different Examination Requirement (<i>Indicate if there will be any examination requirement, additional to or different from the BU Academic Rules or Examination Policy in vogue</i>). Examinations will be done as per BU rules for BS- Biotechnology .
21	Number of Admissions Expected for First Intake: 30
22	Number of Admissions Planned/Expected for Subsequent Intakes: 50
23	Referred by: FBOS: (<i>Indicate the FBOS meeting reference and Item No</i>) Competent Authority: (<i>Indicate the File No & date; reproduce the decision</i>)
24	Complete Plan of Studies, inclusive of complete Roadmap: (<i>Attach as Annex 'A'</i>) Road Map attached as Annexure A
25	Course Outlines, Descriptions, Pre-Requisites & Readings (Compulsory & Recommended) (<i>Attach as Annex 'B'</i>) Course outlines attached as Annexure B

B. FINANCIAL DETAILS																																																															
1	Source of Funding:																																																														
	<ul style="list-style-type: none"> • BU: Fully✓ /Partially: • Public Sector (B1): Fully/Partially (provide complete details; attach MOU, agreement etc.) • NNGO (B1): Fully/Partially (provide complete details; attach MOU, agreement etc.) • INGO (B1): Fully/Partially (provide complete details; attach MOU, agreement etc.) • UN/IGO (B1): Fully/Partially (provide complete details; attach MOU, agreement etc.) 																																																														
2	Degree Duration:		Annual or Semester System:																																																												
			Annual	Number of Years	4																																																										
			Semester:	Number of Semester	8																																																										
	Total Number of Credit Hours: 134																																																														
3	Expected fee to be charged based on Cost & Benefits Analysis: (show working) <i>Fee structure is proposed on the basis of comparative fee structure of other colleges</i> Expected fee proposed can be 85,000 at the time of admission and 60,000 per semester, Per annum fee can be calculated as : 60,000 + 60,000 = 1,20000/ year																																																														
4	Expected Number of students for 1st & 2nd Intakes: Approximately 15-30																																																														
5	Expected Earning from first two Intakes (B5): (Show working) Just <u>one intake</u> to be recommended as yearly practice is followed in various medical universities. A = Total fee of first intake: 85000 + 60000 = 145,000 B = No. of Students = 30 B5 = B X A = 4.35 million B5 = B x A = 4.35 million per intake																																																														
6	Expected Earning for the Next Five Years (B6): (show working) <i>Working of Five years is given below, as BS is four year program</i> A = Total fee of first intake: 85000 + 60000 = 145,000 B = fee of next year = 1,20,000 x 3 = 3,60,000 C = Total Earning/ student = A + B = 3,60,000 + 145,000 = 5,05,000/= D = (four years) = earning / expected no. of student = C X no. of students (30) = 15.5million/batch E = Five years include 05 batches intake																																																														
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Per Student</th><th>1st Year</th><th>2nd Year</th><th>3rd Year</th><th>4th Year</th><th>Earning/ Student</th><th>No. of Students</th><th>Total</th></tr> </thead> <tbody> <tr> <td>Batch 1</td><td>145,000</td><td>1,20,000</td><td>1,20,000</td><td>1,20,000</td><td>505,000</td><td>30</td><td>15.15 million</td></tr> <tr> <td>Batch 2</td><td>145,000</td><td>1,20,000</td><td>1,20,000</td><td>1,20,000</td><td>505,000</td><td>30</td><td>15.15 million</td></tr> <tr> <td>Batch 3</td><td>145,000</td><td>1,20,000</td><td>1,20,000</td><td>X</td><td>385,000</td><td>30</td><td>11.5 million</td></tr> <tr> <td>Batch 4</td><td>145,000</td><td>1,20,000</td><td>X</td><td>X</td><td>265,000</td><td>30</td><td>7.95 million</td></tr> <tr> <td>Batch 5</td><td>145,000</td><td>X</td><td>X</td><td>X</td><td>145,000</td><td>30</td><td>4.35 million</td></tr> <tr> <td colspan="7">B6 = 54.1 million</td><td>54.1 million</td></tr> </tbody> </table>							Per Student	1st Year	2nd Year	3rd Year	4th Year	Earning/ Student	No. of Students	Total	Batch 1	145,000	1,20,000	1,20,000	1,20,000	505,000	30	15.15 million	Batch 2	145,000	1,20,000	1,20,000	1,20,000	505,000	30	15.15 million	Batch 3	145,000	1,20,000	1,20,000	X	385,000	30	11.5 million	Batch 4	145,000	1,20,000	X	X	265,000	30	7.95 million	Batch 5	145,000	X	X	X	145,000	30	4.35 million	B6 = 54.1 million							54.1 million
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7	Total Estimated Salaries of all Additional Human Resources per annum (B7): (Show working)
	<u>1) Salary of Coordinator/ Senior Medical Technologist/ Assistant Professor,A:</u> Assistant Professor/ Senior Biotechnologist = 100,000 X 12 = 12 lac
	<u>1) Salaries calculated after conversion of nonfaculty into faculty, B:</u> 3 Lecturers = 50,000 X 3 = 1.6 lacs A = 1.6 lac X 12 = 18 lac / year
	B7 (Total salaries) = A+ B
	B7 = 3.00 million
8	Cost of Additional Laboratory Equipment/Tools (B8): (show working) 2.6 million
9	Cost of Additional Classrooms (B9): (Include furniture, technical aids etc) Furniture comprises of 50 chairs, multimedia, board, airconditioner comprises of approximately Available
10	Cost of Additional Books, Subscription & Memberships to on-line Sites/Repositories (B10): (show details) 0.5 million
11	Off-Site rental Expenses and Cost of other Fixtures (B11): (Show details) Nil
12	Miscellaneous Expenses required for Starting the Program (B12): - Advertisement; Printing & Stationery; Admin Cost; Any other - Total 0.2 million
13	Annual Recurring Expenditures in Subsequent Years (B13): - Salaries: 3.0 million - Advertisements: 0.2 million - Rentals; Subscriptions/Memberships: - - Printing & Stationery; Admin Cost; Any other - Total 3.524 million per year, i.e. Total 14.096 million for 4 years programme
14	Total Cost of the Programme (B14): [Add B(7) to B(12)] B14 = 6.04 million/ 1st year For five years = 20.136 /5year = 4.02/ Year
15	Net Cost of the Programme (B15): [Subtract B(6) from B(14)] 20.136 – 54.1 = 33.96 million / 5 years B15 = 33.96 million/5 year
16	Net Earnings in First Year (B16: [Subtract B(15) from B(5)] 33.96 – 4.35 = 29.61 million B16 = 29.61 million
17	Projected Annual Gross Earning in Subsequent Years (B 17): (show details & working; add 10% towards all expenses in subsequent years.) 10 % of 3.524 million = (0.3524 million + 3.524 = 3.894) / 54.1 million – 3.894 million = 50.26 million B17 = 50.26 million
18	Projected Annual Net Earning in Subsequent Years: [Subtract B(13) from B(17)] 14.096 (4 yr) + 6.04 (1 st year) million – 50.26million = 14.26 million B18 = 30.124 million

GRAPHICAL SUMMARY OF FINANCIAL DETAILS

Figure A shows annual expected earning and expenditure:

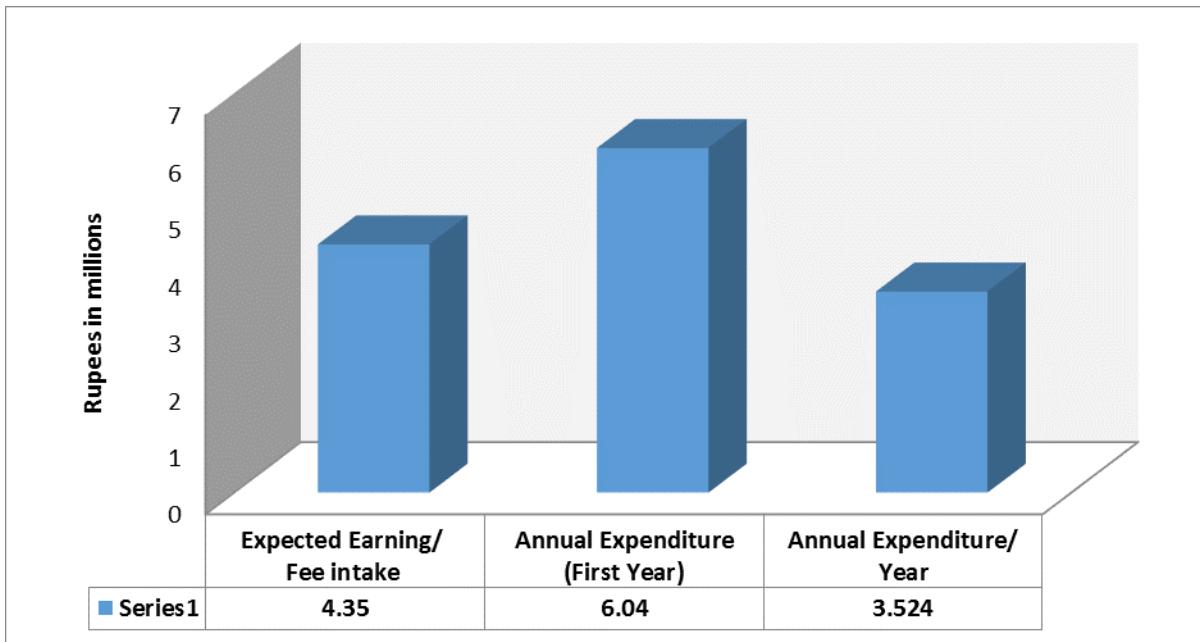
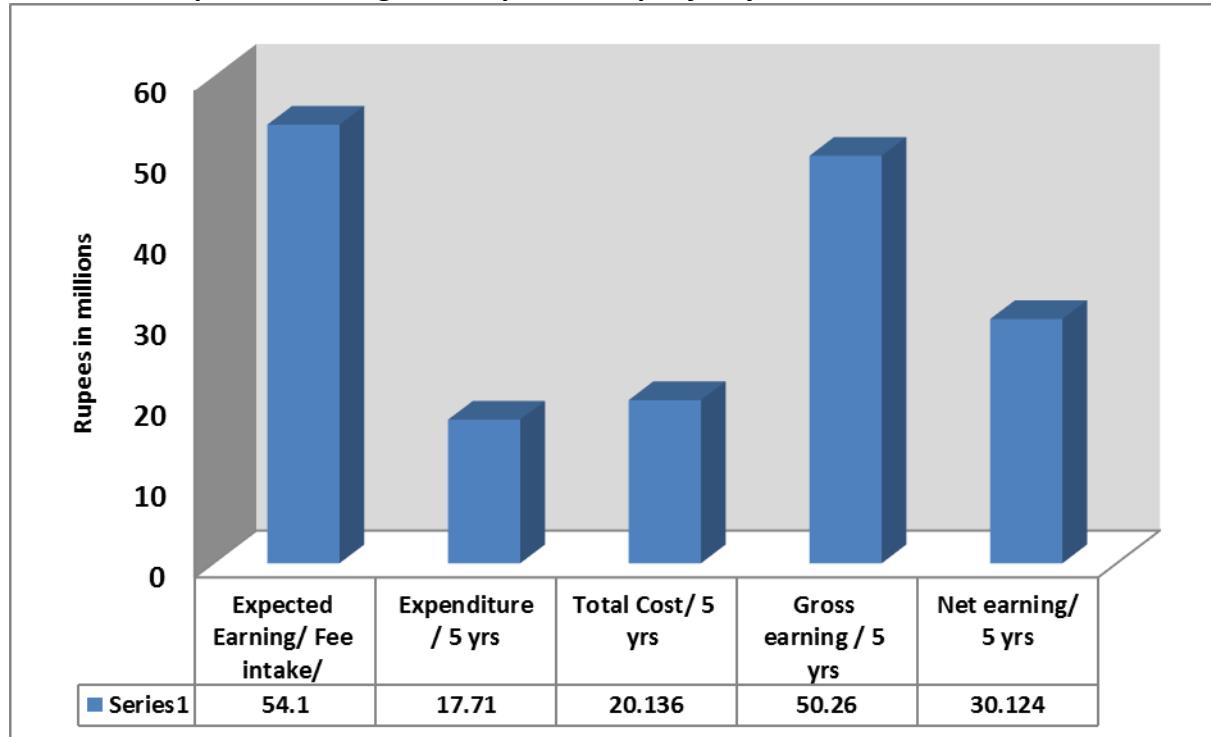


Figure B shows expected earnings and expenditure per five years :



Mapping of UG Courses in Specified Categories as per HEC UG Policy 2020**Program: BS Biotechnology****Faculty: Health Sciences*****a. General Education Requirement***

Sub-Category	Total Credit Hours	Course code	Course Title	Credit Hours
Breadth courses (6) - Art & Humanities (2) - Natural Sciences (2) - Social Sciences (2)	18	CSK 105	Communication Skills	3 + 0
		PES 111	Physical Education & Sports	3 + 0
		BIO 112	Biochemistry-I	2+1
		BIO 210	Biochemistry-II	2+1
		BSC 103	Behavioral Science	3+0
		SOC 209	Sociology	3+0
Foundational Skills courses (5) - Expository Writing (3) - Quantitative Reasoning (2)	15	ENG 116	English-I	3+0
		ENG 112	English II	3 + 0
		ENG 118	English-III	3+0
		CSC 107	Introduction to Computer Science	2+1
		PBI 208	Probability & Biostatistics	3+0
Civilizational courses - Pakistan Studies (1) - Islamic or Religious Studies (1)	6	PAK 102	Pakistan Studies	3+0
		ISL 102 OR SOC 361	Islamic Studies Ethics	3+0

b. Disciplinary Requirement

Sub-Category	Course code	Course Title	Credit Hours	Remarks (Existing or new course, CHs added, etc.)
Discipline courses	BIT 301	Introduction to Biotechnology	2 +1	Major (1)
	VIR 310	Virology	2	Major (2)
	CGE 114	Classical Genetics	2	Major (3)
	CPT 211	Basics & methods of Molecular Biology	2	Major (4)
	BPH 207	Biological Physics	2	Major (5)
	ACI 210	Analytical Chemistry & Instrumentation	2 +1	Major (6)
	RAB 403	Radiobiology	2	Major (7)
	MMB 303	NanoBiotechnology	2	Major (8)
	MBT 307	Microbial Biotechnology	2 + 1	Major (10)
	GRC 306	Marine biotechnology	3+0	Major (9)
	AGB 308	Agriculture Biotechnology	2 + 1	Major (11)

	FBT 309	Food Biotechnology	2 + 1	Major (12)
	HBT 405	Health Biotechnology	2 + 1	Major (13)
	IMB 404	Industrial Biotechnology	2 + 1	Major (14)
	EMB 403	Environmental Biotechnology	2 + 1	Major (15)
	GPR 404	Genomics and Proteomics	2 + 1	Major (16)
	BET 406	Biosafety & Bioethics	2 + 1	Major (18)
	RPT 406	Pharmaceutical Biotechnology	2 + 1	Major (17)
Lab/Field work/ Thesis	RPT 407	Research Project I	3+0	
	RPT 408	Research Project II	3+0	
	SMR 409	Seminar-I	1+0	
	SEM 410	Seminar-II	1+0	

c. Optional

Sub-Category	Course code	Course Title	Credit Hours	Remarks (Existing or new course, CHs added, etc.)
	MAS 102 OR CBI 105	Mathematics Cell Biology	3+0	*Optional (1)
	OCH 104	Organic Chemistry	2+1	Optional (2)
	ICH 107	Inorganic Chemistry	2+1	Optional (3)
	BMA 106	Biomathematics	3+0	Optional (4)
	PHC 111	Physical Chemistry	3+0	Optional (5)
	ACI 210	Analytical Chemistry & Instrumentation	2+1	Optional (6)

d. Distribution:

Sub-Category	Course code	Course Title	Credit Hours	Remarks (Existing or new course, CHs added, etc.)
Distribution courses	IMM 302	Immunology	3+0*	Distribution (1)
	PBE 304	Principles of Biochemical Engineering	2+1	Distribution (2)
	RMS 311	Research Methodology & Skill Enhancement	3+0	Distribution (3)
	BIN 305	Bioinformatics	1+2	Distribution (4)
	MOD 312	Molecular Diagnostics	2+0	Distribution (5)
	BTC 408	Fungal and Animal Biotechnology	2 + 1	Distribution (6)

	BIN 409	Water and Waste-Water Treatment Hospital Waste Management	2 + 1	Distribution (7)
	EPD 410	Biofuels and Biorefineries	2 + 0	Distribution (8)

e. Practical Learning Requirements

Category		Weeks/Hours
<i>Internship (9 weeks)</i>	INT 411	9 weeks
<i>Practical Learning Lab* (4 contact hrs per week)</i>		
	Youth Club	(4 contact hrs per week) in 1 st semester
	Sports	(4 contact hrs per week) in 2 nd semester

* Weekly planned PLL activities for the semester

Program Summary

Roadmap	Total Courses	Total CHs	Internship	PLL	Remarks
Existing	44	134			
Revised (as per HEC UGE Policy 2020)	44	134	9 weeks	<i>(4 contact hrs per week) 1st & 2nd semester</i>	

Revision of Semester-wise roadmap in accordance with HEC UG Policy 2020**Program: BS Biotechnology****Faculty: Health Science****Semester 1:**

Sr. #	Course Code	Course Title	Credit Hours		Category as per HEC Policy	Remarks (Existing or new course, CHs added, etc.)
			Theory	Lab		
1.	BIO 112	Biochemistry-I	2	1	Natural Science (1)	Same as previous
2.	MAS 102 CBI 105	Mathematics or Cell biology	3	0	*Optional (1)	Same as previous
3.	BSC 103	Behavioral Sciences	3	0	Social Sciences (1)	Same as previous
4.	COM 104	Computer Studies	2	1	Quantitative Reasoning (1)	Same as previous
5.	CSK 105	Communication Skills	3	0	Arts & humanities (1)	1 Course of 3 Hr added
6.	ENG 106	English -I	3	0	Expository Writing (1)	Same as previous
Total Credit Hours			16	2		
7	Practical Learning Lab (4 contact hours per week)					

* Optional: These are introductory courses in different disciplines that are offered by department, which students may enroll. The department will determine how many, if any, course credits earned in the optional course/s can count towards the Major or Distribution credit requirements.

Semester 2:

Sr. #	Course Code	Course Title	Credit Hours		Category as per HEC Policy	Remarks (Existing or new course, CHs added, etc.)
			Theory	Lab		
1	BIO 210	Biochemistry-II	2	1	Natural Science (2)	Same as previous
2	OCH 104	Organic Chemistry	2	1	Optional (2)	Same as previous
3	MSC 109	Sociology	3		Social Sciences (2)	Same as previous
4	PBI 208	Probability & Biostatistics	3	0	Quantitative Reasoning (2)	Same as previous
5	PES 111	Physical Education & Sports	3	0	Arts & Humanities (2)	1 Course added of 3 credit hrs
6	ENG 112	English -II	3	0	Expository Writing (2)	Same as previous
Total Credit Hours			16	2		
7	Practical Learning Lab (4 contact hours per week)					

Semester 3:

Sr. #	Course Code	Course Title	Credit Hours		Category as per HEC Policy	Remarks (Existing or new course, CHs added, etc.)
			Theory	Lab		
1	ICH 107	Inorganic chemistry	2	1	Optional (3)	Same as previous
2	BMA 106	Biomathematics	3	0	Optional (4)	Same as previous
3	BIT 301	Introduction to Biotechnology	2	1	Major (1)	Same as previous
4	ISL 102 OR SOC 361	Islamic Studies OR Ethics	3	0	Religious Studies	Same as previous
5	PAK 102	Pakistan Studies	3	0	Pak Studies	Same as previous
6	ENG 122	English -III	3	0	Expository Writing (3)	Same as previous
Total Credit Hours			16	2		
7	Practical Learning Lab (4 contact hours per week)					

Semester 4:

Sr. #	Course Code	Course Title	Credit Hours		Category as per HEC Policy	Remarks (Existing or new course, CHs added, etc.)
			Theory	Lab		
1	PHC 111	Physical Chemistry	2	1	Optional (5)	Same as previous
2	MIC 102	Microbiology	2	1	Optional (6)	Same as previous
3	VIR 310	Virology	2	1	Major (2)	Same as previous
4	CGE 114	Classical Genetics	2		Major (3)	Same as previous
5	CPT 211	Basics & methods of Molecular Biology	2	1	Major (4)	Merged two courses
6	BPH 207	Biological Physics	2		Major (5)	Same as previous
Total Credit Hours			12	4		
7	Practical Learning Lab (4 contact hours per week)					

* Major and Distribution: **Major** courses are in the discipline that the students declared as the main area of studies and are offered by a department. **Distribution** courses are those which the department determine to be allied with declared major or discipline and are offered by other departments.

Semester 5:

Sr. #	Course Code	Course Title	Credit Hours		Category as per HEC Policy	Remarks (Existing or new course, CHs added, etc.)
			Theory	Lab		
1	ACI 210	Analytical Chemistry & Instrumentation	2	1	Major (6)	Same as previous
2	RAB 403	Radiobiology	2	1	Major (7)	Same as previous
3	MMB 303	NanoBiotechnology	2	1	Major (8)	Same as previous
4	IMM 302	Immunology	2	1	Distribution (1)	Same as previous
5	PBE 304	Principles of Biochemical Engineering	2	0	Distribution (2)	Same as previous
6	SMR 409	Seminar-I	1			Same as previous
Total credit Hours			11	4	Same as previous	

Semester 6:

Sr. #	Course Code	Course Title	Credit Hours		Category as per HEC Policy	Remarks (Existing or new course, CHs added, etc.)
			Theory	Lab		
1	GRC 306	Marine biotechnology	2	1	Major (9)	Same as previous
2	MBT 307	Microbial Biotechnology	2	1	Major (10)	Same as previous
3	AGB 308	Agriculture Biotechnology	2	1	Major (11)	Same as previous
4	RMS 311	Research Methodology & Skill Enhancement	3	0	Distribution (3)	Same as previous
5	BIN 305	Bioinformatics	2	1	Distribution (4)	Same as previous
6	SEM 410	Seminar-II	1			Omitted
Total Credit Hours			11	4		

Semester 7:

Sr. #	Course Code	Course Title	Credit Hours		Category as per HEC Policy	Remarks (Existing or new course, CHs added, etc.)
			Theory	Lab		
1	FBT 309	Food Biotechnology	3	0	Major (12)	Same as previous
2	HBT 405	Health Biotechnology	3	0	Major(13)	Same as previous
3	EMB 403	Environment Biotechnology	3	0	Major (15)	Same as previous
4	IMB 404	Industrial Biotechnology	2	1	Major (14)	
5	RPT 407	Research Project I	3	0	Major (16)	Same as previous
6	MOD 312	Molecular diagnostics	2	1	Distribution (5)	Same as previous
Total Credit Hours			16	2		

Semester 8:

Sr. #	Course Code	Course Title	Credit Hours		Category as per HEC Policy	Remarks (Existing or new course, CHs added, etc.)
			Theory	Lab		
1	RPT 406	Pharmaceutical biotechnology	2	1	Major (17)	Same as previous
	BET 406	Biosafety & Bioethics	2	1	Major (18)	
3	BTC 408	Fungal and Animal Biotechnology	2	0	Distribution (6)	Same as previous
4	BIN 409	Water and waste water treatment Hospital waste management	3	0	Distribution (7)	Same as previous
5	EPD 410	Biofuels and bio refineries	2	0	Distribution (8)	Same as previous
	RPT 408	Research Project II	3	0		
6	INT 411	Internship (9 week)			Practical learning Component	
		Total Credit Hours	14	2		

Program Summary:

Total Courses	Total Credit Hours
44	134

**METHODOLOGY FOR IDENTIFICATION AND PROGRESS MONITORING
OF ACADEMICALLY WEAK STUDENTS**

1. **Background.** Academically weak students need to be identified so as to cater to their areas of improvement. Such students sometimes result in drop out if their academic issues are not addressed in due time. Therefore, as per needs assessment formal sessions for these students will be held with elaborate record keeping.
2. **Timelines.** The designed proforma are to be filled during mid of each module (BUMDC)/semester and after modular/ semester exams.
3. **Responsibility**
 - a. Respective mentors (BUMDC) which includes lecturer and senior lecturers.
 - b. Module / semester coordinators.
4. **Reviewed by**
 - a. First by dedicated supervisors including assistant professors, associate professors and professors at BUHS
 - b. Final assessment by Head of the concerned Department.
5. **Monitoring by**
 - a. Department of Medical Education (DME) along with Module / semester coordinator (BUMDC).
 - b. Subject HODs.
6. **Record Keeping**
 - a. Individual mentors.
 - b. Concerned Department.
7. **Compliance of Required Action.** Department of Medical Education (DME) and concerned VPs with the help of subject specialist fortnightly by meetings with subject expert and the student identified.
8. **Monitoring and Evaluation.** Student will be monitored for improvement by mentor and a brief evaluation report will be submitted to Department of Medical Education (DME) office.

BAHRIA UNIVERSITY MEDICAL AND DENTAL COLLEGE
Department of Medical Education

Student's Academic Progress Form

Name: _____ Roll Number: _____

Year of Study: _____

Module I/IV/VII/X/XIII (Tick the Relevant Module)

Subject	FAT Result	Module Result	Area of Weakness identified	Action Taken

Module I/IV/VII/X/XIII (Tick the Relevant Module)

Subject	FAT Result	Module Result	Area of Weakness identified	Action Taken

Module I/IV/VII/X/XIII (Tick the Relevant Module)

Subject	FAT Result	Module Result	Area of Weakness identified	Action Taken

* **FAT = Formative Assessment Tests**

Mentor's Name: _____

Mentor's signature _____

BAHRIA UNIVERSITY MEDICAL AND DENTAL COLLEGE
Department of Medical Education

ACADEMICALLY WEAK STUDENT'S IDENTIFICATION FORM

Name: _____ Roll Number: _____

Year of Study: _____

Subject	Area of Weakness Identified	Supporting Evidence	Date Identified	Action Taken

Mentor's Name: _____

Mentor's Signature: _____

Appendage 4122-B**FACULTY OF H&SS PERFORMA FOR IDENTIFICATION OF WEAK STUDENTS**

Weak Students Identification Form has been adopted with format as given below, which is filled by relevant faculty member and forwarded to respective Class Advisor by 4th and 12 weeks of the Semester. Class Advisor with the help of concerned Cluster Head and faculty member counsels the students.

Student Name: _____

Class: _____

Name of Class Advisor: _____

S No	Course	Teacher Name	Remarks	Action taken/ Progress

* Note: To be submitted to HOD at the end of 6th and 12th week of each semester.

Class Advisor

HOD

**FACULTY OF ES PROPOSED PROCEDURE FOR IDENTIFICATION AND IMPROVEMENT OF
ACADEMICALLY WEAK STUDENTS**

1. **Categorization of Weak Students.** Academically weak student can fall in following categories:
 - a. **Category-I:** Those having the status of probation/chance.
 - b. **Category-II:** Those not performing well in a course.

Procedure for the Identification of Weak Student

2. For students falling in Category-I following arrangement are required to be done:
 - a. There should be visibility of students to HoD of each batch on CMS which have the status of probation/chance separately. The status should be updated as soon the result is announced.
 - b. This visibility should also be given on CMS portal to FMs (for those students which are registered in a particular course taught by an FM).
3. In category-II, a student shall be considered weak if his marks in all assessments till mid-term are less than 60%.

Procedure for the Improvement of Weak Students

4. For students falling in Category-I, following arrangement are proposed for improvement of the performance:
 - a. These students may not be allowed to register course automatically. At the time of registration, these students will be counselled/advised by the ASA regarding course selection and number of courses to be registered. ASA will present his working to HoD before registering the courses.
 - b. During the classes, an FM should identify (seamlessly) these students and keep an eye on such students regarding their attendance and their participation during class.
 - c. If an FM finds such student inactive in class, he should counsel him and may also call these students during off class (visiting hours) for additional coaching.
 - d. In case the performance is below 60% after mid-term. The FM will refer these students to ASA. Corrective measures in terms of tutorial and counselling sessions shall then be arranged while looking at the nature of issue by ASA after discussion with HoD. The academically strong students may also be involved in the tutorial sessions (in certain cases weak students are shy to ask the questions from FMs). To encourage the academically strong students to hold these tutorial sessions, these students will be given certificates at the end of the semester.
5. For students falling in category-II, the procedure mentioned in para-d above will be applicable.
6. **Analysis and Continuous Improvement.** A department will compile the activities carried out for weak students and analyse the efficacy of the measures taken at the end of the semester and present to the principal.

Appendage 4123-A**RATIFICATION OF AMENDMENTS IN BU ADMISSIONS POLICY CLAUSES 2.8, 2.9 & 2.10****CURRENT CAUSES****2.8 Instructions on Eligibility**

- 2.8.1 Applicants for admission must meet the eligibility requirements set-forth by BU. Candidates are advised to confirm their eligibility prior applying online.
- 2.8.2 In case of annual system, eligibility will be determined on the basis of result in percentages.
- 2.8.3 In case of Semester system, eligibility will be determined on the basis of CGPA obtained out of 4.00.
- 2.8.4 In case the result is shown both in CGPA and percentage, CGPA will be considered.

2.9 Eligibility Criteria for Admission

- 2.9.1 Minimum eligibility criteria for admission in various Undergraduate and Postgraduate Programs offered by BU are as under:

- a. Engineering Programs: 60% in F.Sc (Pre-Engg.) or equivalent as per IBCC equivalence.
- b. Medical Sciences: 60% in F.Sc (Pre-Medical) or equivalent.
- c. Legal Studies: 50% in FA/F.Sc& pass LAT
- d. All other UG programs: Minimum 50%
- e. MBA/MS/MPhil Programs: CGPA 2.5/4.0 or 50% marks in Masters/Bachelors/ equivalent degree. For legal studies minimum CGPA of 2.5/4.0 or 50% marks where CGPA is not given.
- f. Ph.D Programs: CGPA 3.0/4.0 or 60% marks in MS/MPhil or equivalent degree.

- 2.9.2 Candidates of O/A Level or any other foreign equivalent qualification can apply on the basis of O Level (SSC) equivalence certificate obtained from Inter Board Committee of Chairmen (IBCC) office but confirmation of their admission is subject to provision of A Level (HSSC) equivalence certificate duly obtained from IBCC, Pakistan and Diploma of Associate Engineer (DAE) etc.

- 2.9.3 For all Pakistan based foreign examinations (A/O-levels), IBCC will not issue equivalence, unless the candidate has cleared Pakistan Studies, Islamic Studies and Urdu. However, for students who attempted overseas exams abroad (both O & A levels) these subjects are not compulsory.

- 2.9.4 Detailed eligibility and academic qualifications needed for different programs are discussed in respective chapters.

2.10 Ineligibility Criteria

- 2.10.1 Candidates with any of the following deficiencies shall be NOT eligible to apply for admissions:

- a. Having secured less than 50% marks in Matric and HSSC (except when seeking admission in Engineering and Medical Sciences programs of the University where minimum pass percentage is 60%).
- b. Having failed / not appeared in any subject in HSSC Part-I / II.
- c. Awaiting result of supplementary exam of HSSC Part-I.
- d. Having secured less than 50% marks in O/A level as per the equivalence certificate issued by IBCC.

- e. In case of O & A level / equivalent foreign qualification, those not in possession of valid O level or equivalent qualification certificate issued by IBCC at the time of applying to BU.
- f. GMAT/GRE taken more than 2 years before the BU admission deadline.
- g. Expelled from BU on disciplinary grounds.
- h. Having criminal conviction in offences of moral turpitude. (Also see Article 2.26)

Appendage 4123-B

UPDATED AMENDED CLAUSES 2.8,2.9 & 2.10

2.8 Instructions on Eligibility

- 2.8.1 Applicants for admission must meet the eligibility requirements set-forth by BU. Candidates are advised to confirm their eligibility prior applying online.
- 2.8.2 In case of annual system, eligibility will be determined on the basis of result in percentages.
- 2.8.3 In case of Semester system, eligibility will be determined on the basis of CGPA obtained out of 4.
- 2.8.4 In case the result is shown both in CGPA and percentage, CGPA will be considered.
- 2.8.5 The candidates awaiting result in HSSC/ Equivalent Part -II can apply for admission after provision of Hope Certificate/ Undertaking. Candidates appearing in A level Part-II/Equivalent exam would be required to submit O & A level IBCC certification for confirmation of admission in BU.
- 2.8.6 The candidates awaiting result in BS/MS final semester can apply for admission after provision of result of previous semesters and Undertaking.
- 2.8.7 In case of O & A level / equivalent foreign qualification, those candidates must be in possession of valid O level or equivalent qualification certificate issued by IBCC at the time of applying for admission in BU.

2.9 Eligibility Criteria for Admission

2.9.1 For all programmes, the eligibility criteria for admission will remain one step down. Minimum eligibility criteria for admission in various Undergraduate and Postgraduate Programs offered by BU are as under:

UG Programs

- a. Engineering Programs: 60% in F.Sc (Pre-Engg)/equivalent.
- b. Medical Sciences: 60% in F.Sc (Pre-Medical)/equivalent.
- c. Legal Studies: 50% in FA/F.Sc
- d. All other UG programs: Minimum 50% in HSSC/Equivalent.

PG & PhD Programs

- a. MBA / MS/LLM / MPhil programs: CGPA 2.5/4.0 or 50% marks in Masters /Bachelors / equivalent degree.
 - b. Ph.D programs: CGPA 3.0 / 4.0 or 60% marks in MS / MPhil or equivalent degree in the relevant discipline.
 - c. GMAT/GRE taken less than 2 years before the BU admission deadline.
- 2.9.2 Following are NOT eligible to apply for admissions into BU:
- a. Expelled from BU or any other University/ Institute inland or abroad.
 - b. Having criminal conviction in offences of moral turpitude (also see Article 2.27).
- 2.9.3 Detailed eligibility and academic qualifications needed for different programs are discussed in respective chapters.

RATIFICATION OF BU ADMISSION POLICY CLAUSE 6.5**CURRENT CLAUSE****6.5 CBT /Admission Test Subjects**

6.6.1. For all MBA/MS/LLM/MPhil Programs, there shall be 100 MCQs in a CBT. Each question shall be presented with four answer option. Only one of which shall be correct. The test shall carry 100 marks and time allowed shall be 120 minutes.

6.6.2. The test shall comprise three sections, (1) Verbal Reasoning (2) Quantitative Reasoning and (3) Analytical Reasoning. However, the actual percentage of each subject shall vary as shown below for following programs.

Category	Test Type	Verbal Reasoning	Quantitative Reasoning	Analytical Reasoning	Total
MS Test A	Business & Engineering Students	35%	35%	30%	100%
MS Test B	Humanities & Social Sciences Students	50%	30%	20%	100%
MS Test C	Biological & Related Sciences Students	45%	35%	20%	100%

PROPOSED AMENDMENT**6.5 CBT /Admission Test Subjects**

6.5.1. For all MBA/MS/LLM/MPhil Programs, there shall be 100 MCQs in a CBT. Each question shall be presented with four answer option. Only one of which shall be correct. The test shall carry 100 marks and time allowed shall be 120 minutes.

6.5.2. The test shall comprise three sections, (1) Verbal Reasoning (2) Quantitative Reasoning and (3) Analytical Reasoning. However, the actual percentage of each subject shall vary as shown below for following programs.

Category	Test Type	Relevant Subject	Verbal Reasoning	Quantitative Reasoning	Analytical Reasoning	Total
MS Test A	Business & Engineering Students	-	35%	35%	30%	100%
MS Test B	Humanities & Social Sciences Students*	50%	25%	10%	15%	100%
MS Test C	Biological & Related Sciences Students	50%	20%	10%	20%	100%
*For Admission in MS Media Studies		50%	20%	15%	15%	100%

RATIFICATION OF 2% SPORTS BASED ADMISSIONS IN BU**2.26 Procedure / Guidelines for 2% Quota Seats on Sports Based Admission in BU for UG Programs only**

2.26.1 Application Procedure. Candidates of **UG Programs** after completion of online registration process shall apply and submit the sports quota form along with following documents in their respective campuses in line with less developed & disabled quota candidates:

- a. Copy of ID Card/Form B.
- b. Copy of Paid Admission Processing fee slip.
- c. Sports participation Certificate(s) from relevant authority.

2.26.2 Eligibility. Only those candidates will be eligible for admission on 2% sports quota seat who will qualify the BU CBT/ ETS and will meet the minimum eligibility criteria of the program.

2.26.3 Assessment at CUs Level. A Sports committee is to be formulated at CUs level for the evaluation of the candidates performance/ Assessment. The sports committees of CUs will conduct proficiency/ assessment trials of the candidates and submit their performance result to Admissions Dte BUHO for finalization of Sports quota merit list, two weeks prior of commencement of classes.

2.26.4 Recommended Games. Following games have been recommended for quota-based applications:

- a. Cricket
- b. Football
- c. Hockey
- d. Volley Ball (Smashing)
- e. Table Tennis
- f. Badminton
- g. Basketball
- h. Golf
- i. Swimming
- j. Sailing
- k. Boxing
- l. Gymnastics
- m. Martial Arts
- n. Athletics
- o. Shooting
- p. Snooker
- q. Squash
- r. Tennis
- s. Any other game where the applicant's performance is of district level or above

2.26.5 Assessment Criteria by CUs. Proficiency level and trial assessment criteria of the candidates will be based on following parameters:

International Level	National Level	Provincial Level	Division Level	District Level
50%	45%	40%	35%	30%
Trial/Assessment Score - 50%				

2.26.6 Weightage Criteria for formulation of Final Merit list. After receiving assessment score from CUs, following will be the final merit list formulation procedure at Admissions Dte prior approval from Hon'ble Rector as per procedure in vogue as of disabled/less developed regions quota:

- a. Initial merit standing (CBT/ETS + HSSC + SSC) 50%
- b. Weightage of proficiency and trial assessment 50%.

RATIFICATION OF AMENDMENTS FOR STUDENTS' UNDETKAING ON PLAIN PAPER**Existing Clause of BU Admission Policy 2021****2.20 Undertaking**

2.20.1 A student admitted to any program at the University shall give an undertaking to the effect that he/she would abide by the University's Statutes, Regulations and Rules, and the Code of Conduct. The undertaking shall be made on Rs 20 stamp paper, and duly notarized, as per the specimen at Annex 'C'.

Amended/Approved Clause of BU Admission Policy 2021**2.20 Undertaking**

2.20.1 A student admitted to any program at the University shall give an undertaking to the effect that he/she would abide by the University's Statutes, Regulations and Rules, and the Code of Conduct. The undertaking shall be made on plain paper as per the specimen at Annex 'C'.

Existing Clause of Academic Rules 2016**2.5 Undertaking**

A student admitted to any programme at the University shall give an undertaking to the effect that he/she would abide by the University's Statutes, Regulations and Rules, and the Code of Conduct. The undertaking shall be made on a Rs 20 stamp paper, and duly notarized, as per the specimen at Annex 'A'.

Amended/ Approved Clause of Academic Rules 2016**2.5 Undertaking**

A student admitted to any programme at the University shall give an undertaking to the effect that he/she would abide by the University's Statutes, Regulations and Rules, and the Code of Conduct. The undertaking shall be made on plain paper, as per the specimen at Annex 'A'.

Existing Clause of Student Hand Book**1.28 Undertaking**

A student admitted to any program at the University shall give an undertaking to the effect that he/she would abide by the University's Statutes, Regulations and Rules, and the Code of Conduct. The undertaking shall be made on a Rs 20 stamp paper, and duly notarized, as per the specimen at Annex 'A'.

Amended/ Approved Clause of Student Hand Book**1.28 Undertaking**

A student admitted to any program at the University shall give an undertaking to the effect that he/she would abide by the University's Statutes, Regulations and Rules, and the Code of Conduct. The undertaking shall be made on plain paper, as per the specimen at Annex 'A'.

Note Mentioned in end of Annex A of Student Hand Book

Note: This document is to be printed on stamp paper of Rs 20/- before being submitted to Record Section. The form is to be attested by an Oath Commissioner before submission to Bahria University, Campus / Institute.

Amended/ Approved Note Mentioned in end of Annex A of Student Hand Book

Note: This document is to be printed on plain paper before submission to Record Section of Bahria University, Campus / Institute.

7.5 SOP FOR MERIT LISTS IMPLEMENTATION - UG PROGRAMS

- 7.5.1 Admissions/ IT Dte shall prepare merit lists of UG Programs based on academics and test %ages as per weightage formula.
- 7.5.2 Discipline wise merit lists shall be generated purely on merit with choices mentioned against each candidate.
- 7.5.3 The merit lists shall be forwarded to respective CUs for completion of admissions formalities.
- 7.5.4 Overall Result of Merit Gazette shall not be displayed on website. However, IT Dte is to enable visibility of all choices of the merit positions on website to individual candidates only.
- 7.5.5 The respective CUs shall display merit lists as per target intake of each discipline on BU website (without marks).
- 7.5.6 The CUs shall offer the admissions to the candidates as per their merit positions of the programs, irrespective of the candidates' choices. At the time of interview, candidates shall be given option (only one) to decide his/ her final choice from all lists and only one fee challan with due date (not more than 3 working days) shall be issued to each candidate.
- 7.5.7 CUs shall strictly follow the due dates and no extension in this regard shall be given to any candidate.
- 7.5.8 Upon expiry of fee submission due date next candidate shall be given admission. The candidate who fails to submit the fee will automatically drop down to the bottom of the merit list. However, the candidates applying for student study loan are to be accommodated accordingly.
- 7.5.9 Admissions of a particular program shall be closed upon meeting the target intake.
- 7.5.10 For additional admissions prior approval of BU-HO is required to be obtained.
- 7.5.11 The changeover program option shall only be exercised upon completion of admissions and within one week after the commencement of semester as per policy.
- 7.5.12 If merit of candidate's 1st choice drops due to availability of seats in a particular program, all those candidates who opted for 2nd / 3rd choice to secure admission are to be offered as per merit position of their program of 1st choice prior giving admission to a candidate at lower position. Admissions cells of relevant CUs are to inform the candidate regarding the fresh merit position/ situation as per procedure in vogue. If a candidate voluntarily opted for **2nd/3rd choice**, he/she/X is not to be given this option.



BAHRIA UNIVERSITY

ISLAMABAD CAMPUS

S.No. 0117616

Doctor of Philosophy in Management Sciences*

FINAL TRANSCRIPT



Reg #.: 20126
 Name: ADEEL SAQIB
 Father's Name: HAJI UMAR RAKHSH

Enrollment No: 01-280112-015
 Date of Birth: 07 March 1978

Fall Semester 2011

Course Code	Title	Grade	Grade Point	Cr. Hrs	Product
MGT 801	Logic and Research	B+	3.5	3	10.5
MGT 802	Advance Quantitative Research Methods	A	4	3	12
MGT 803	Critical Review of Literature	A	4	3	12

GPA : 3.63 CGPA: 3.63

Spring Semester 2012

Course Code	Title	Grade	Grade Point	Cr. Hrs	Product
MGT 802	Advance Quantitative Research Methods	B	3	3	9
MGT 803	Advance Theory of Organization and Management	A	4	3	12
MGT 805	Contemporary Issues in Management Sciences	A	4	3	12

GPA : 3.87 CGPA: 3.75

Doctoral Research Work

Course Code	Title	Grade	Grade Point	Cr. Hrs	Product
SCR 801	Ph.D Thesis	Approved & Successfully Defended		30	

Major Field: Management Sciences

Dissertation Title: The Role of Employee Silence and Organizational Learning between Toxic Leadership & Organizational Performance at Different Levels of Leader-Member Exchange Quality in Pakistani Banks

Supervisor of Dissertation: Prof Dr Mohammad Asif Khattak Department of Management Sciences, Bahria University, Islamabad Campus

Doctoral Research Evaluations:

Dr Weileng Chen

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 Email: saeed.hassan@gmail.com

Dr Muhammad Ahmed

Senior Assistant Professor

HOD Management Sciences
 Bahria University, Lahore Campus
 Email: mohamed.ahmed@bahria.edu.pk

Comprehensive Examination: 17 October 2012

Thesis Evaluation: 12 September 2016

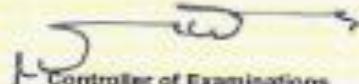
Thesis Defended: 16 June 2014

Doctorate of Philosophy: 06 August 2014

54 Credit hours completed.

* The Program consisted of 54 credit hours and 3 years duration.

Date: 30 September 2021


 Controller of Examinations

Note: Errors & omissions excepted.

Shangrila Road, Naval Complex, Sector E-8 Islamabad, Pakistan Tel: (92)9260002-7 Ext 1212, Fax: (92)51-9260666



BAHRIA UNIVERSITY ISLAMABAD

ISLAMABAD CAMPUS

FINAL TRANSCRIPT

Program : PhD MANAGEMENT SCIENCES*

S.No. 7446

Reg # : 22468
 Name : MUHAMMAD AYUB SIDDIQUI
 Father's Name : MIRBOOB AHMED SIDDIQUI

Enrollment No: D1-280102-008

Credit Hours Transferred

Course Code	Title	Credit Hours
MGT-804	Quantitative Research Methods	3
MGT-805	Advance Theory of Organization and Management	3
MGT-806	Pedagogy	3

Fall Semester 2010

Course Code	Title	Grade	Grade Point	Credit Hours	Product
MGT-801	Logic and Research	A	4	3	12
MGT-802	Qualitative Research Methods	A	4	3	12
MGT-803	Critical Review of Literature	A	4	3	12

GPA : 4.00 CGPA: 4.00

Doctoral Research Work

Course Code	Title	Grade	Credit Hours
GR 9006	PhD Thesis	Approved & Successfully Defended	36

Major Field: Management Sciences

Dissertation Title: Modeling Dynamics of Dividend Policy, Capital Structure and Agency Cost: Evidence from Nonfinancial Sector of Pakistan

Supervisor of Dissertation: Prof Dr Zahid Mehmood

Doctoral Research Evaluators:

Dr Cuong CAD Nguyen
 121 North Bell, Lincoln, Canterbury
 New Zealand

Dr Zahir Hossain
 Economics & Political Sciences Department
 Sultan Qaboos University
 Muscat, Sultanate of Oman

Prof Dr Mehboob Ahmed
 Bahria University
 Islamabad

Dr Muhammad Mazhar Iqbal
 Quaid-i-Azam University
 Islamabad

Comprehensive Examination: Completed on 16 May 2011

Thesis Evaluation: Completed on 11 January 2013

Thesis Defence: Completed on 30 April 2013

Doctorate of Philosophy: Completed on 13 July 2013

9 Credit hours transferred from International Islamic University, Islamabad.

45 Credit hours completed under this Program.

* The Program consisted of 64 credit hours and 3 years duration.

Date: 29 August 2013

FARRUKH MAHFOOZ
 Commodore
 Director Examinations

Note: Errors & omissions exempted

Shangria Road, Naval Complex, Sector E-8 Islamabad, Pakistan Tel: +92-51-9260002-7 Ext 212, Fax: +92-51-9260885

BAHRIA UNIVERSITY
P A K I S T A N



ACM AGENDA 4130

IMPLEMENTATION OF HEC UGE POLICY 2020

By Fazal Wahab
Director QA
19 May 2022

Scheme of Presentation

- Summary of the Case
- Salient Features of HEC UGE Policy 2020
- BU Readiness on Implementation of HEC UGE Policy
- Recommendations

✓ 20

Summary of the Case

- HEC Undergraduate Education Policy 2020 was promulgated by HEC in August 2020 for adoption in HEIs w.e.f. Fall 2021 semester
- Roadmaps of all UG programs except Engineering, CS, MBBS and BDS were reviewed and approved in 37th (Special) ACM on 24 February 2021
- Concerns of BU on this policy were officially communicated to HEC through Registrar letter
- Implementation of the Policy was postponed till Fall 2022 semester by HEC on the recommendations of Vice-Chancellor's Committee
- A committee was formulated under Pro-Rector (Academic) in June 2021 to monitor implementation of HEC UGE Policy 2020
- Several meetings of the committee were held to thoroughly discuss HEC UGE policy implementation by BU w.e.f. Fall 2022 as per instructions of HEC

Salient Features of new HEC UGE Policy 2020

1. Minimum 39 credit hours courses of General Education in Curriculum of all programs.
2. Teaching of these 39 credit hours courses restricted to first three semesters.
3. Minimum duration and credit hours of UG program to be 3 years and 120 credit hours.
4. Centralized admissions at university level, with option of specific program after completion of the 3rd semester.
5. Generalize Entry Test weightage of ranked scored for all programs.
6. Option of Double Major and Minor(s) at UG level.
7. Introduction of Practical Learning Lab (PLL) – 4 hours per week in four semesters.
8. Mandatory 9-weeks Internship for all UG programs.
9. Establishment of Academic Advisement System at all campuses.
10. Awarding Associate Degree after two years completion (at least 60 credit hours).
11. Option for students to switch between General and Professional Degree programs during their studies.

BU Readiness Status for Implementation of HEC UGE Policy

- Roadmaps of all UG programs except Engineering, CS, MBBS and BDS were reviewed and approved in 37th (Special) ACM on 24 February 2021.
- These programs are not fully aligned to teach 39 credit hours Gen Edn in first three semesters.
- BU has communicated its reservation to HEC on minimum 3 years duration and minimum 120 credit hours.
- **BU does not agree with:**
 - Centralized Admission System, due implications on low intake programmes.
 - Entry Test weightage of ranked scored for all admission, due existing weightage already close to proposed.
 - Option of Double Major and Minor at UG Level at this stage; may be adopted gradually.
 - Awarding Associate Degree after two years completion (at least 60 credit hours) due need of more clarity.
 - Option for students to switch between General and Professional Degree programs due different educational background.
- **BU principally agreed with:**
 - Introduction of Practical Learning Lab (PLL) subject to availability of resources and funding from HEC.
 - Mandatory 9-weeks Internship for all UG programs subject to availability of resources.
 - Establishment of Academic Advisement System at all BU Campuses.

Recommendations of the Committee

- Adoption of Roadmaps approved in 37th ACM may be pended till HEC response on the outcome/ recommendations of VCs meetings and BU queries.
- Clarification may be sought from HEC asked regarding alignment of LLB and DPT roadmaps with HEC UGE Policy.
- HEC may be intimated of the BU constraints in adopting the following features of HEC UGE Policy:
 1. Centralized Admission System.
 2. BU Entry Test weightage of ranked scored for all admission
 3. Option of Double Major and Minor at UG Level at this stage.
 4. Awarding Associate Degree after two years completion (at least 60 credits).
 5. Option for students to switch between Professional and General Degree programs during their studies

Ministry of Education
Government of Pakistan

Recommendations of the Committee (Contd..)

- Following aspects of the Policy may be further deliberated by the Deans/ Principals for respective programs' adoption methodology, resources requirement and adoption timeframe; in accordance with related HEC Guidelines:
 1. Introduction of Practical Learning Lab (PLL).
 2. Mandatory 9-weeks Internship for all UG programs.
 3. Establishment of Academic Advisement System at all Campuses

Thanks



HIGHER EDUCATION COMMISSION

Coordination Division
H-9, Islamabad (Pakistan)

15-54/Coord/2019/HEC/(QAD)/281

April 15, 2022

Notification

In continuation of HEC letter No.1-3/AD-QA/HEC/Duration/2020/5 dated October 12, 2020 the maximum duration of MS/MPhil/PhD/equivalent degree programs, for students who have availed the maximum period of their study programs and were about to complete the degree in Fall 2021 session, is hereby extended by one year i.e., until Fall 2022.

02. This is a one-time relaxation based on COVID-19 pandemic situation and may not be used as a precedence.
03. This is issued with the approval of the Competent Authority.



(Shahzaib Abbas)
Director (Coordination)

Distribution to:

The Registrars of all Public and Private Universities/DAIs.

cc.to:

- i. Advisor (Coordination), HEC, Islamabad
- ii. Advisor (Academics), HEC, Islamabad
- iii. Director Incharge (QAA), HEC, Islamabad
- iv. ES to Executive Director, HEC, Islamabad
- v. PS to Director Incharge (QA), HEC, Islamabad



HIGHER EDUCATION COMMISSION

Coordination Division
H-9, Islamabad (Pakistan)

15-54/Coord/2019/HEC/(QAD)/380

April 26, 2022

Notification

In continuation of HEC letter 15-54/Coord/2019/HEC/(QAD)/281 dated April 15, 2022, it is hereby clarified that one-time relaxation (based on Covid-19 pandemic situation) for completion of MS/MPhil/Equivalent and PhD degree, is till 28.02.2023.

02. This is a one-time relaxation based on COVID-19 pandemic situation and may not be used as a precedence.
03. This is issued with the approval of the Competent Authority.

A handwritten signature in blue ink, which appears to read "Shahzaib Abbasi".
(Shahzaib Abbasi)
Director (Coordination)

Distribution to:

The Registrars of all Public and Private Universities/DAIs.

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- v. PS to Director Incharge (QA), HEC, Islamabad

Launching of PhD Foundation Research Certification Course

Summary

1. The prime focus of Bahria Business school is to bring **academic and research excellence in its postgraduate programs**.
2. Currently, Bahria BBSI has more than 45 PhD Faculty and PhD student intake is 3-4 per semester due to lack of research orientation of students.
3. To improve the research culture, quality and inculcation of research orientation, it is proposed that **PhD Foundation Research Certification** be introduced for the new candidates interested in PhD degree.
4. The potential students having lack of strong research rigor and those with weak research background may be assessed and register for **PhD Foundation Research Certification (6 Cr research dissertation at MS-level)**.
5. After completion of the certification with requisite level of research orientation and rigor, these students will then be eligible for getting admission in PhD based on quality of assessment by respective examiners.
6. Preference may be given to students who have completed the certification with highly satisfactory level.
7. **PhD Foundation Certificate** will largely help improve the quality of PhD Research Program, increase students' intake and optimization of PhD Faculty utilization across MS and BS departments.

Proposed Recommendation

1. Precedence of the certification does exist for other courses as per the **Academic Rule 3.21- Offering regular Courses as certification as Certificate Courses to Non-Enrollees or Part-Timers**. It is therefore, suggested that the PhD foundation research certification course may also be introduced.

Appendage 3135**EXEMPTION OF BS (ACCOUNTING & FINANCE) COURSES TO ACCA STUDENTS**

S No	ACCA Courses	BU Courses		
		Course Codes	Course Title	CH
a	Financial Accounting	FIN 201 ACC 102	<ul style="list-style-type: none"> • Principles of Accounting • Financial Accounting 	3 3
b	Management Accounting	ACC 101 ACC 203	<ul style="list-style-type: none"> • Introduction to Finance • Cost Accounting 	3 3
c	Corporate and Business Law	MGT 508 MGT 301	<ul style="list-style-type: none"> • Corporate Law • Business Law 	3 3
d	Performance Management	ACC 304 ACC 400	<ul style="list-style-type: none"> • Managerial Accounting • Advanced Managerial Accounting 	3 3
e	Financial Reporting	ACC 305 ACC 320	<ul style="list-style-type: none"> • Financial Reporting-I • Financial Reporting-II 	3 3
f	Taxation	ACC 220 ACC 410	<ul style="list-style-type: none"> • Principles of Taxation • Advanced Taxation 	3 3
g	Audit and Assurance	ACC 306 ACC 412	<ul style="list-style-type: none"> • Principles of Auditing • Advanced Auditing 	3 3
h	Financial Management	FIN 202 FIN 320	<ul style="list-style-type: none"> • Financial Management • Financial Institution Management 	3 3
Total Credit Hours				48



Pakistan Engineering Council

(Constituted under Pakistan Engineering Council Act, 1976 enacted by the parliament)

Ataturk Avenue (East),
G-52, Islamabad

PEC/EAD/BU-Isb./Software/2022
April 27, 2022

Engr. Dr. Atif Raza Jafri
Dean (Engineering Sciences)
Bahria University,
Shangrila Road, E-8
Islamabad

Subject: Change of Scope Visit (Increase in Intake) Application for Bachelor of Software Engineering Program

Dear Sir,

Please refer to your letter No. BUIC/PEC/2022/113 dated March 30, 2022 on the subject cited above.

2. It is to inform that during scrutiny process of subject request, following shortcomings are observed for which compliance is required:

Sr.	PEC Criteria as per Change of Scope Visit Form	Response Submitted by HEI	Compliance Status/ PEC Requirement
i.	Faculty	<p>Detail of available dedicated faculty members in department is below:</p> <p>PhD (Comp Engg.) = 05 PhD (Elect Engg.) = 01 *PhD (Mech Engg.) = 01 **PhD (Non Engg.) = 01 MS (Comp Engg.) = 06 MS (Elect Engg.) = 01</p> <p>(*Faculty from not-relevant discipline, hence not countable **Non Engg faculty member, counted upto 20% of MFS)</p> <p>Countable Faculty = 14</p>	<p>Details of available dedicated Lab Engineers and Lab staff is missing which is required.</p>
ii.	Labs	<p>The HEI has provided list of following labs:</p> <p>Dedicated: SE Computing Lab 1 SE Computing Lab 2</p> <p>Projected:</p>	<p>Purchase order alongwith delivery report of equipment for SE Computing Lab 3 are required.</p> <p>Mapping of SE curriculum to available shared labs alongwith labs commitment chart for</p>

27/4/22
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Pakistan Engineering Council

(Constituted under Pakistan Engineering Council Act, 1976 enacted by the parliament)

Ataturk Avenue (East),
G-5/2, Islamabad

		SF Computing Lab 3 Shared: Networking Lab MP Lab Physics Lab	availability of mentioned labs to the proposed enhanced section in Software Engineering program are required. Labs (dedicated, proposed and shared) layout plan alongwith dimensions in sq.ft are required.
iii.	Infrastructure (Class Rooms)	02 dedicated classrooms for existing strength. 02 more classrooms have been allocated for increased strength of BSE program.	The HEI intends to accommodate 02 sections of 40 students in 03 existing and 02 additional classrooms; however, no plan for classrooms allocation for 02 sections per year in complete 04 years cycle is provided which is required. Further, the HEI statutory body approval for allocation of existing and proposed infrastructure to Software Engineering department as per Act is also required.
iv.	Infrastructure (Faculty Offices)	Sufficient officers available.	Details of available faculty offices alongwith statutory approval is required.
v.	Library	Number of existing books related to program = 449	Evidence of the enhancement of number of program related books/ titles to facilitate 02 sections of 80 students is required.

3. Forwarded for information and compliance, please.

Engr. Salman Ahmed
Assistant Registrar (EAD) / Zone-III

Copy to:

- Convener PEC Engineering Accreditation Board

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