MATURI VENKATA SUBBA RAO
ENGINEERING COLLEGE
(An Autonomous Institution)

BACHELOR OF ENGINEERING

ACADEMIC REGULATIONS , SCHEME OF INSTRUCTION & SYLLABI (R-21)

COMPUTER SCIENCE AND INFORMATION TECHNOLOGY
(I to VI Semesters)

ACADEMIC YEAR 2024-25

(Sponsored by Matrusri Education Society, Estd.1980)

ACADEMIC RULES AND REGULATIONS
for
Four Year
BACHELOR OF ENGINEERING
DEGREE PROGRAMME

Maturi Venkata Subba Rao (MVSR) Engineering College

(An Autonomous Institution)

(Sponsored by Matrusri Education Society, Estd.1980)

Approved by AICTE, Affiliated to Osmania University
Accredited by NAAC and ISO 9001:2015 Certified Inst.
NBA Accreditation: CIVIL, CSE, ECE, EEE, IT and MECH.

website: www.mvsrec.edu.in

Counseling Code: TSEAMCET/TSECET/TSICET: MVSR

PGECET: MVSR1

(For the batches admitted in 2022-23, 2023-24(R-21))

B.E. PROGRAMME
(Full-time)

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of
ACADEMIC RULES & REGULATIONS

ACADEMIC RULES AND REGULATIONS For

Four Year Degree Programme in Engineering of

Maturi Venkata Subba Rao (MVSR) Engineering College

(For the batch admitted in 2022-23, 2023-24 (R-21))

PREAMBLE: All the Rules and Regulations, here in after specified shall be read as a whole for the purpose of interpretation. Any reference to college in these Rules and Regulations stands for Maturi Venkata Subba Rao (MVSR) Engineering College. In case of arising a doubt, the interpretation of the Academic Council, the Statutory Body constituted as per UGC regulations of the college is final. The Academic council has the powers to make amendments to these regulations whenever necessary and shall be approved byGoverning Body (GB).

ABBREVIATIONS:

AC	Academic Council
AICTE	All India Council for Technical Education
BE	Bachelor of Engineering
BoS	Board of Studies
GB	Governing Body
C	Credits
CGPA	Cumulative Grade Point Average
CIE	Continuous Internal Evaluation
CP	Credit Point
D	Drawing
GO	Government Order
GP	Grade Point
L	Lecture
MOOC	Massive Open Online Course
MVSREC	Maturi Venkata Subba Rao Engineering College
NPTEL	National Programme on Technology Enhanced Learning
P	Practical
SEE	Semester End Examination
SGPA	Semester Grade Point Average
SWAYAM	Study Webs of Active Learning for Young and Aspiring Minds
T	Tutorial
UG	Under Graduate
UGC	University Grants Commission

NOMENCLATURE:

S. No.	Keywords	Definition
1	**Governing Body**	Highest administrative body of the Institute. GB is an authority as per the AICTE/ UGC regulations and responsible to perform functions as may be necessary and deemed fit for the proper development of the institution.
2	**Academic Council**	Highest academic body of the Institute and is responsible for the maintenance of standards of instruction, education and examination within the Institute. Academic Council is an authority as per the AICTE / UGC regulations and has the right to take decisions on all academic matters including academic research.
3	**Academic Year**	A period that is necessary to complete courses of study. It consists of two consecutive (one odd +one even) semesters.
4	**Autonomous Institute**	An Institute designated as 'Autonomous' by University Grants Commission (UGC), New Delhi in concurrence with the affiliating University i.e., Osmania University, Hyderabad and Telangana State Government.
5	**Board of Studies**	An authority, as defined in UGC regulations, constituted by the Principal for each of the department separately. The board is responsible for curriculum design and update in respect of all the programmes offered by a department.
6	**Course**	Usually referred to, as „papers" is a component of a programme. All courses need not carry the same weightage. The learning objectives and learning outcomes are defined for each course. A course is designed to comprise lectures/ tutorials/ laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/ assignments/ presentations/self-study etc. or a combination of some of these.
7	**Course Evaluation**	Continuous Internal Evaluation (CIE) in the Semester & Semester End Examination (SEE) constitutes the main assessment prescribed for each course.
8	**Continuous Internal Evaluation (CIE)**	To be normally conducted by the course instructor which includes class tests, problem solving exercises, group discussions, assignments, quizzes, mini-projects & seminars conducted anytime throughout the semester.
9	**Credit**	A unit by which the course work is measured. One credit is equivalent to one lecture hour of teaching (lecture or tutorial) or two hours ofpractical / field work per week.
10	**Grade Point**	It is a numerical weight allotted to each letter grade on a 10-point scale. A+ =10, A = 9, B = 8, C = 7, D = 6, E = 5 and F = 0.
11	**Credit Point**	A product ofgrade point and number ofcredits for a course.

12	**Cumulative Grade Point Average (CGPA)**	It is a measure of overall cumulative performance, of a student in all semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters of the program. It is expressed upto two decimal places.
13	**Programme**	A programme or specialization of a degree programme like Civil Engineering, Mechanical Engineering etc.
14	**Curriculum**	Curriculum incorporates all the courses that are offered in a specific programme. It also indicates the planned interaction of students with instructional content, materials, and resources.
15	**Degree**	A student who fulfills all the programme requirements is eligible to receive a degree.
16	**Grading**	To be normally done using Letter Grades as qualitative measure of achievement in each Course like: A+ (Outstanding), A (Excellent), B (Very Good), C (Good), D (Average), E (Pass), F (Fail) based on the marks (%) scored in (CIE+SEE) of the course and conversion to grade done by relative/absolute grading.
17	**Mandatory Courses**	Compulsory non-credit courses that a student need to study as prescribed in the programme.
18	**Massive Open Online Courses (MOOC)**	Open access online courses aimed at providing ways to learn new skills.
19	**Revision of Regulations, Curriculum and Syllabi**	The institution, from time to time may revise, amend or change the regulations, scheme of examinations, curriculum and syllabi with the approval of the academic council.
20	**Semester End Examination (SEE)**	To be normally conducted at the institutional level which will cover the entire course syllabi. The SEE questions are to be set from each unit. The questions are to be based on Blooms Taxonomy
21	**Semester**	Each year of study is divided into two semesters. Semester shall consist of 16 weeks of academic work excluding Semester End Examination and Evaluation.
22	**Semester Grade Point Average (SGPA)**	It is a measure of performance of work done in a semester. It is ratio of total credit points secured by a student in various theory and lab courses offered in each semester and the total course credits taken during that semester. It shall be expressed upto two decimal places.

I. ADMISSION PROCEDURE

1. A candidate for admission to the Four Year Degree Programme in Engineering must have passed the Intermediate Examination of the Board of Intermediate Education, Government of Telangana with Mathematics, Physics and Chemistry as optional courses, or any other examination recognized by the Government of Telangana as equivalent there to.

2. A candidate will be admitted strictly in accordance with the guidelines issued by State Government of Telangana from time to time.

II. DURATION AND PROGRAMMES OF STUDY

The duration of the programme is eight semesters (four years) such as I, II, III, IV, V, VI, VII and VIII. Each academic year shall comprise of two semesters.

Instruction per semester	---	16 weeks
Preparation holidays (includes practical exams)	---	02 weeks

No admission/ readmission/ promotion are entertained after four weeks of the commencement of instruction ofsemester in I, II, III and IV years.

In case there are any court cases consequent to which the authorities are compelled to admit any candidate after the announced last date of admissions, the admission (seat) of such a student would be reserved for the subsequent year on a supernumerarybasis.

No refund of Tuition fee will be made after the commencement of instruction for students who wish to cancel their admission.

1. The following programmes ofstudy are offered by the college.

S. No	Programme
i).	Automobile Engineering
ii).	Civil Engineering
iii).	Computer Science and Engineering
iv).	Computer Science and Engineering (Data Science)
v).	Computer Science and Engineering (AI &ML)
vi).	Computer Science and Engineering (IOT-CS-BCT)
vii).	Computer Science and Information Technology
viii).	Electrical and Electronics Engineering
ix).	Electronics and Communication Engineering
x).	Information Technology
xi).	Mechanical Engineering

The schedule of study of all programmes is regulated by the Academic council of Maturi Venkata Subba Rao (MVSR) Engineering College.

2. Candidate who fails to fulfill all the requirements for the award of the degree as specified here in after within (N+2) academic years from the time of admission, *as per the UGC Guidelines on determination of uniform span period (UGC Letter No. F-12-1/2015 (CPP-II) dated and 15.10.2015 and Osmania University letter No.336/M/Acad.I/2016 dated 21.03.2016)*, will forfeit his/her seat in the programme and his/her admission will stand cancelled, where "N" is the number of years of programme of study. For four year regular B.E. degree programme maximum duration ofstudy is (N+ 2) =4 +2 = 6 years.

   Candidate admitted to the second year under lateral entry scheme shall fulfill all the requirements for the award of the degree as specified here in after within (N+2=3+2=5) five academic years from the time of admission failing which he/she will forfeit his/her seat and his/her admission will stand cancelled.

III. RULES AND REGULATIONS OF ATTENDANCE

1. Candidates admitted to a particular programme of study are required to pursue **Regular programme of study** before they are permitted to appear for the Semester End Examination.
2. **A regular programme of study** means putting in attendance of not less than 75% in each semester.
3. In special cases and for sufficient cause shown, the Academic Council (AC) may condone the deficiency in attendance to the extent of 10% on medical grounds subject to the submission of medical certificate (signed by Competent Authority) along with the payment of condonation fee too.. However, in respect of women candidates who seek condonation of attendance due to pregnancy, the Academic Council (AC) on the specific recommendations may condone the deficiency in attendance to the extent of 15% (as against 10% condonation for others) on medical grounds (Valid Medical certificate) subject to submission of medical certificate to this effect. Such condonation is permitted only once during the programme of study. Medical certificate along with the fitness is to be submitted within a week days on reporting to the class work.

   * **Shortage of attendance below 65 % shall in no case be condoned.**
4. The fee for condonation of attendance on medical grounds shall be Rs. 2000/- (Rupees Two Thousand only) payable through DD/ Banker Cheque drawn in favour of Principal, Maturi Venkata Subba Rao (MVSR) Engineering College.
5. Attendance of N.C.C / N.S.S Camps or Inter collegiate or Inter-University or Inter State or International matches or debates or Educational Excursions or such other Inter University activities as approved by the authorities involving journeys outside the city in which the college is situated will not be counted as absence.

   i. Such absence shall not exceed four weeks per semester of the total period of instructions.

   ii. Such leave should be availed with prior permission from the Principal and not be availed more than twice during the programme of study.

   iii Without anyprior permission, such leave shall be treated as absence.

   iv While calculating the attendance, the number of classes not attended in each subject shallbe added to the numerator.

6. The attendance shall be calculated on the aggregate of courses from the date of commencement of classes/ date of readmission in case of detained candidates as per the almanac.
7. In case of candidates who fail to put in the required attendance in a programme of study, he/she shall be detained in the same semester and will not be permitted to appear for the Semester End Examination. Such candidates shall have to seek re admission into the same semester during the subsequent year in order to appear for the examination after fulfilling the attendance requirements and on payment ofrequisite tuition fee.

IV. SCHEME OF INSTRUCTIONS AND EXAMINATION

1. Instructions in various courses in each semester of all four years shall be provided by the college as per the scheme of instruction and syllabi prescribed. All students have to register for the courses offered in the Semester before starting ofthat particular semester.

2. The total number ofcredits for all eight semesters is 160 as per AICTE Model Curriculum

3. The distribution of marks/grade* based on Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE) shall be as follows:

Subject	Continuous Internal Evaluation (CIE)	Semester End Examination (SEE)
Each theory subject	**30 ****	**70 ******
Each practical or drawing Subject for which less than 6 periods / week are provided in the scheme of instruction	**25 ****	**50**
Each practical or drawing Subject for which 6 or mor Periods/week are provided in the scheme o instructio	**50 *****	**100**
Project Work – I	**50 #**	**---**
Project Work – II	**50 #**	**100 ##**

Total marks = CIE + SEE

***** Grades are allotted based on the marks secured in CIE and SEE as per the following criteria.

Academic Performance	Grade		Grade points
	Letter	Description	
90% ≤ Marks ≤ 100%	**A +**	Outstanding	10
80% ≤ Marks < 90%	**A**	Excellent	9
70% ≤ Marks < 80%	**B**	Very Good	8
60% ≤ Marks < 70%	**C**	Good	7
50% ≤ Marks < 60%	**D**	Average	6
40% ≤ Marks < 50%	**E**	Pass	5
0% ≤ Marks < 40%	**F**	Fail	0
	AB	Absent	

** Out of 30 CIE marks for theory, 10 marks are allotted for Assignments/Tutorials/Quizzes etc. (At least two assignments and two quizzes are to be conducted) in the course. The rest of the 20 marks are allotted to internal tests. Two internal tests will be conducted in each semester. Each test will carry 20 marks, out of which 6 marks for PART-A (compulsory), consisting of three short answer questions and from Part- B two questions consisting of subjective questions are to be attempted from the remaining three questions and each question carries 7 marks. Average of two tests plus marks obtained in assignments/tutorials/quizzes etc. will be taken as CIE marks.

*** Out of 25/50 CIE marks for Practical/drawing, 10/ 20 are allotted for viva- voce exam / Quiz test, 15/30 marks for laboratory record/drawing sheets and observations.

**** The SEE question paper consists of seven questions and each question carries 14 marks. The first question is compulsory and covers the entire syllabus as part A. Student has to answer four questions from the remaining six questions that cover the entire syllabus as part B.

The CIE evaluation of BE Project (Project Work - I & II) consists of a maximum of 50 marks which will be distributed as per the guidelines given below:

i. **30 Marks** are allocated for quality of the project work covering
   1. Literature review
   2. Innovation/ Originality
   3. Methodology and
   4. Relevance / Practical application which will be awarded by the supervisor.

ii. **20 Marks** are allocated to candidate's performance in terms of viva-voce examination and overall subject knowledge. Marks will be awarded by the committee constituted by the HoD.

The evaluation of BE Project (Project Work - II) for Semester End Examination consists of a maximum of 100 marks which will be distributed as per the guidelines given below:

iii. **50 Marks** are allocated for quality of the project work covering
   a. Literature review
   b. Innovation / Originality
   c. Methodology and
   d. Relevance/ Practical application, which will be awarded jointly by the internal and external examiners.

iv. **50 Marks** are provided for candidate's presentation and performance in terms of viva-voce examination and overall subject knowledge. Out of 50 Marks 30 marks will be awarded by the internal examiner and 20 marks by the external examiner concerned.

Note:

i. A course that has CIE but no SEE as per scheme is treated as Pass/ Fail for which pass marks are 40% of CIE marks.

ii. Mandatory courses shall not carry any credits but, securing **40% of total marks**, shall be **necessary requirement** for the student to qualify for the **award of Degree.**

I. The details of instruction period, examination schedule, vacation etc. shall be notified by the Principal, Maturi Venkata Subba Rao Engineering College.

II. The medium of instruction and examination shall be English.

III. At the end of each semester, SEE shall be held as prescribed in the respective Schemes of Examination. The examinations pertaining to the semester just ended, will be called, regular examinations and the examinations pertaining to the other semesters will be called supplementary examinations. To enable the B.E. Final Year students to complete the program requirements in time, there shall be a Make-up / Supplementary Exam for VIII semester only, which will be scheduled within one month of publication of results of VIII semester regular examinations.

IV. The examinations prescribed may be conducted by means of written papers, practical and viva-voce, inspection of certified CIE work in Drawing and Laboratories and Workshop, or by means of any combination of these methods as may be deemed necessary. Candidates will be required to produce complete Lab Records of the Practical work done by them in

each practical examination, along with other materials prepared or collected as part of Laboratory work / Project.

V. Allthe general rules for examinations (given under item no. X) shall be adhered to.

VI. Acandidate shall be deemed to have fully passed a course, if he/she secures

- A minimum of 40% marks for each theory course in the Semester End Examination (SEE)
- A minimum of 40% marks (E – Grade) for each theory course considering both CIE and SEE.
- A minimum of 50% marks for each Practical/ Drawing/ Project work in the Semester End Examination (SEE)
- A minimum of 50% marks (D – Grade) for each Practical/ Drawing/ Project work considering both CIE and SEE.

Important note: The candidate has to mandatorily appear at the SEE in all the Practical/Laboratory/Drawing Courses irrespective of marks secured under CIE.

VII. In case of hearing impaired, orthopedically handicapped and visually challenged candidates, 10% reduction in pass marks in each subject is admissible as per G.O. Ms. No.150, dated 31-08-2006.

VIII. If a candidate desires to have his/her answer scripts revaluated, he/she can apply for it as per the college norms and notification of the College Examination Branch.

IX. A candidate can also obtain a photocopy of the corrected answer book of the theory courses of SEE only against payment. For more details in this regard, the press note of the College Examination Branch after the declaration ofresults maybe referred.

V. RULES OF PROMOTION

S. No.	Semester / Class	Conditions to be fulfilled	
1.	From I-Semester to II-Semester	Regular programme of study of B.E. I-Semester	
2.	From II-Semester to III-Semester	a)	Regular programme of study of B.E. II-Semester
		b)	Must have earned at least 50% of credits (rounded to the next nearest integer) prescribed for B.E. I-Semester and II-Semester.
3.	From III-Semester to IV-Semester	Regular programme ofstudy of B.E. III-Semester	
4.	From IV-Semester to V-Semester	a)	Regular programme of study of B.E. IV-Semester

		b)	No. of backlog credits, if any of B.E. I, II, III and IV Semester put together shall not exceed 50% (rounded to the next nearest integer) of the total number of credits prescribed for the B.E. III & IV-Semester
5.	From V-Semester to VI-Semester	Regular programme of study of B.E. V-Semester	
6.	From VI- Semester to VII-Semester	a)	Regular programme of study of B.E. VI-Semester
		b)	Number of backlogs credits if any of B.E. I, II, III, IV, V and VI Semester put together shall not exceed 50% (rounded to the next nearest integer) of the total number of credits prescribed for the B.E. V & VI-Semester
7.	From VII-Semester to VIII-Semester	Regular programme ofstudy of B.E. VII-Semester	

Note: 1. If a candidate has more than permitted number ofcredits as backlogs, he/she will be detained.

2. The candidate who wishes to take readmission into the year in which he/she is detained will have to pay the total tuition fee of that year and all the credits earned during that year shall become null and void.

VI. GRADING SYSTEM

1. Candidates who have passed all the examinations of the B.E. Degree Programme shall be awarded Cumulative Grade Point Average (CGPA) in accordance with the grade secured by them in all eight Semesters taken together, including the CIE marks secured in thosesemesters. The grade secured shall be shown in the memorandum of marks as per the performance in CIE and SEE.
A minimum CGPA of 5 is required for the award of Degree. The consolidated memorandum of marks will reflect the credits/ grade scored in each course.

1. Semester Grade Point Average (SGPA) & Cumulative Grade Point Average (CGPA)

Calculation:

a) $$\text{SGPA} = \frac{\sum_{i=1}^{p} (\text{Letter Grade Point}_i \times \text{Credits}_i)}{\sum_{i=1}^{p} \text{Credits}_i}$$

Where i = 1, 2, ….. p represent the number of courses in a particular semester. SGPA is calculated upto second decimal point and it is calculated only when all courses in that semester are Cleared/ Passed.

b) $$\text{CGPA} = \frac{\sum_{j=1}^{m} [(\text{SGPA})_j \times (\text{Total Credits})_j]}{\sum_{j=1}^{m} \text{Total Credits}_j}$$

where j= 1, 2, ….m represent the number of semesters ofthe entire programme.

CGPA at a given point of Semester is calculated upto second decimal point. It is calculated only when total credits earned are equal to total credits prescribed as per scheme upto a semester in which the candidate has last appeared for SEE.

c) Courses in which the candidate has failed are not included in computing SGPA/ CGPA.

VII. AWARD OF DEGREE

The degree of bachelor of engineering will be conferred on candidate who has pursued a regular programme of study of four academic years (three academic years for candidates admitted in II-Year under lateral entry scheme), as hereinafter prescribed in the scheme of instruction and has passed all the examinations as prescribed in the scheme ofexaminations.

Note: For **mandatory and audit courses (non-credit),** student shall be awarded a Grade without any credit. This shall not be counted for the computation of SGPA/CGPA.

VIII. AWARD OF GOLD MEDAL

(i) A student securing highest CGPA in **single attempt** is eligible for award of Gold Medal.

(i) Are admitted student is not eligible for Gold medal.

IX. IMPROVEMENT OF OVERALL SCORE

1. A candidate who wishes to improve his/her overall score may do so within one academic year immediately after having passed all the examinations of the B.E. degree programme, by reappearing in not more than two semesters (all courses pertaining to the semester taken together) examinations without violating the rule mentioned in the item II.3.

2. For the award of the overall score, he/she will have the benefit of the higher SGPA secured in the corresponding semester(s).

X. GENERAL RULES OF EXAMINATIONS

1. Application for permission to appear in any examination shall be made available online through college website (www.mvsrec.edu.in) as per the notification.

2. When a candidate's application is found in order and he/she is eligible to appear in Semester End Examination (SEE), the College Examination Branch shall furnish him with a Hall-Ticket, enabling the candidate to appear in the Semester End Examination. The Hall- Ticket shall have to be produced by the Candidate before he/she is admitted to the premises where the Examination is likely to be held.

3. A candidate who does not present himself/herself for examination for any reason whatsoever, excepting shortage of attendance, shall not be entitled to claim refund of the whole or part of the examination fee, for subsequent Examination(s).

4. A candidate after he/she has been declared successful in the all examinations, shall be given a provisional certificate stating the year of examination, the branch in which he/she was examined and, the overall grade secured. However, the candidates have to obtain degree certificate (convocation) from the Examination Branch, Osmania University, Hyderabad.

5. No candidate shall be allowed to put in attendance for a programme or appear at examinations for different degrees and different faculties simultaneously.

6. Students who have appeared once in any examination of the programme need not put in fresh attendance, if they wish to reappear at the corresponding examination, notwithstanding the fact that the college may have introduced new courses. They will, however, have to appear at the examinations according to the scheme of examination any syllabi in force.

XI. TRANSITORY REGULATIONS

1. Whenever a course or scheme of instruction is changed in a particular semester/year, two more examinations immediately following thereafter shall be conducted according to the old syllabus/regulations, provided the content in the course has changed more than 40%.

2. Candidates not appearing at the examinations or failing in them shall take the examination subsequently according to the changed syllabus/regulations.

XII. RANGE OF CREDITS

1. A regular student will be eligible to get an Under Graduate degree in Engineering if he/she secures the credits as specified in the Scheme of Instruction and Examinations.

   A lateral entry student shall be declared eligible to get an Under Graduate degree in Engineering if he/she

   i. Secures required credits as specified in the Scheme of Instruction and Examinations from Semester - III to Semester - VIII
   ii. Qualifies bridge courses and mandatorycourses specified if any during Semester - I and Semester – II

XIII. MALPRACTICE AND AWARD OF PUNISHMENT

Schedule on the Nature of Malpractice and Award of Punishment

"Examination" in this context refers to all the papers taken by the candidate on the same hall-ticket.

MALPRACTICE AND AWARD OF PUNISHMENT

S. No	Malpractice	Award of Maximum Punishment
1	Possession of the prohibited (written or printed) papers, books, notes during the examination period but which were not used.	Shall be debarred from appearing at the subsequent papers of the examination apart from cancelling the result of the examination in which he/she had indulged in malpractice.
2	Matter relevant to the examination being written on any part of the body or on the clothes worn, or in the instrument, wrapping, etc.	-do-
3	Attempting to take help from any prohibited papers, notes, written or printed matter, writings on the walls, furniture and attempting to take help from or giving help to other regarding answer to any question or questions ofthe examination paper.	-do-

4	Taking help from or consulting of prohibited written or printed material; consulting and/or taking help from or helping other examinee during the examination period inside the examination hall or outside it; with or without their consent, or helping other candidate to receive help from anyone else.	-do-
5	An examinee who attempts to disclose his/her identity to the paper valuer by writing his/her roll number at a place other than the place prescribed for it, or by writing his/her name or any coded message or an examinee who makes an appeal to the paper valuer in the answer book.	Cancelling the result of that paper
6	Writing such as invocation of God's name in any form.	To be ignored
7	Writing on the question paper or other papers; the answer to questions, rough work, etc., with no intention of passing it on to another examinee.	To be warned not to do so.
8	Using abusive and obscene language in the answer book.	Cancellation of the result of that paper
9	Examinee allowing or destroying prohibited material found in his possession or acting in any other manner with a view to destroy evidence.	Cancellation of the result of all examinations taken or proposed to be taken during that session and prohibiting his/her admission to or continuation in any course for a period of one year.
10	Refusing to obey instructions of the Chief Superintendent/Invigilator.	Cancelling the result of that paper
11	Smuggling an answer book/additional answer book/ matter into or out of the examination hall.	Cancellation of the result of all examinations taken or proposed to be taken during that session and prohibiting his/her admission to or continuation in any course for a period of one year.

12	Inserting in or removing from the answer book/additional answer book of any sheet.	-do-
13	Substituting wholly or partly an answer book/additional answer book.	-do-
14	Impersonation even at a single examination.	To be dealt with as per law
15	Cases of examinees when conspiring to interchange in Roll Nos.	Cancellation of the result of all examinations taken or proposed to be taken during that session and prohibiting their admission to any course for a period of one year.
16	Creation of disturbance or otherwise misbehaving in and around the examination hall during or before the examination.	Cancelling the results of all examinations taken or proposed to be taken during that session and prohibiting admission in to or continuation in any course of study for a period of two years.
17	Guilty of assaulting/abusing intimidating any person connected with the examination work any time before, during or after the examination.	Cancelling the result of all examinations taken or proposed to be taken during that session and the next session and prohibiting admission into or continuation in any course for a period of two years.
18	Punishments for malpractices not defined here would be recommended on the merits of the individual cases by the malpractices committee.	

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Annexure -I
Academic Regulations for B.E. with Minor program

From the academic year 2023-24 onwards MVSREC (Autonomous) has introduced a brand new Minor Degree program for the batch admitted in 2021-22 (First Autonomous Bath) to embark on a journey of exploration and expand their knowledge in cutting-edge fields like Data Science, AI&ML, Additive Manufacturing and design, IoT and Innovation & Entrepreneurship.

1. The **Bachelor of Engineering (B. E.) with Minor** program focuses on the fundamental principles of multiple Engineering disciplines, critical & analytical thinking and the ability to develop a distinctive approach to the interdisciplinaryproblems.

The keyobjectives of offering B.E. with Minor program are:

- To expand the domain knowledge of the students in one of the other branches of engineering.
- To increase the employ ability of under graduate students keeping in view of better opportunity in inter disciplinary areas of engineering &technology.
- To provide an opportunity to students to pursue their higher studies in the inter-disciplinary areas in addition to their own branch of study.
- To offer the knowledge in the areas which are identified as emerging Technologies/thrust areas of Engineering.

2. Minor courses and the offering Departments

S.No.	Minor Program	Eligible branch of students	@Offering Department	Award of Degree
1.	Artificial Intelligence & Machine Learning	All branches, except B.E. in IT, CSE and Allied branches	CSE	"B. E. in Branch name with Minor in Artificial Intelligence & Machine Learning"
2.	Data Science	All branches, except B. E In IT, CSE and Allied branches	IT	"B.E.in branch name with Minor In Data Science"
3.	IOT	All branches, except B.E in ECE, CSE(IOT)	ECE	"B.E. in branch name with Minor inIOT"
4.	Innovation and Entrepreneurship	All branches.	Management Science /MBA	"B.E. in branch name with Minor in Innovation and Entrepreneurship"

5.	Sustainable Energy Engineering	All branches, except B.E in EEE	EEE	"B.E.in branch name with Minor in Sustainable Energy Engineering
6.	Construction Management & Administration	All branches, except B.E in Civil Engineering	Civil Engineering	"B.E.in branch name with Minor in Construction Management & Administration
7.	Additive Manufacturing and design	All branches, except B.E in Mechanical Engineering& Auto Mobile Engineering	Mechanical Engineering	"B.E.in branch name with Minor in3D Printing and Design

B. Academic Regulations for B.E. Degree with Minor programs

1. The weekly instruction hours, internal & external evaluation and award of grades are on par with regular 4-Years B. E. program.
2. For B. E. with Minor, a student needs to earn additional 18 credits (over and above the required 160 credits for B. E degree). The list of courses of each Minor program, their respective credits weightage and semester-wise break- up of the courses are enclosed as Annexure. All these 18 credits need to be completed in III year and IV year only.
3. After registering for the Minor programme, if a student is unable to earn all the required 18 credits in a specified duration (n+2), he/she shall not be awarded Minor degree. However, if the student earns all the required 160 credits of B.E., he/she will be awarded only B. E degree in the concerned branch.
4. There is no transfer of credits from Minor program courses to regular B. E. degree course& vice versa.
5. These 18 credits are to be earned from the additional Courses offered by the host department in the college as well as from the MOOCS platform.
6. For the course selected under MOOCS platform following guidelines may be followed:

   a. Prior to registration of MOOCS courses, formal approval of the courses, by the University is essential. University before the issue of approval considers the parameters like the institute / agency which is offering the course, syllabus, credits, duration of the programme and mode of evaluation etc.

b. Minimum credits for MOOCS course must be equal to or more than the credits specified in the Minor course structure provided bythe University.

c. Only Pass-grade/marks or above shall be considered for inclusion of grades in minor grade memo.

d. Any expenses incurred forthe MOOCS courses are to be met bythe students only.

7. The choice to opt/take a Minor program is purely on the choice of the students.

8. The student shall be given a choice of withdrawing all the courses registered and/or the credits earned for Minor program at any time; and in that case the student will be awarded only B. E. degree in the concerned branch on earning the required credits of 160.

9. The student can choose only one Minor program along with his/her basic engineering degree.

10. The B.E. with a Minor program shall be offered from the AY 2023-24 onwards. The students who are pursuing their III year I semester in the current academic year can register for the Minor program if they fulfill the eligibility criteria.

11. A student can graduate with a Minor if he/she fulfills the requirements for his/her regular B.E. program as well as fulfills the requirements for Minor program.

Note:-

i. The institute shall maintain a record of students registered and pursuing their Minor programs, program-wise and parent branch- wise. The same report will be sent to the University once the enrolment process is complete.

ii. The Institute / Department will prepare the time-tables for each Minor course offered without any overlap/clash with other courses of study in the respective semesters

5. Eligibility conditions for the student to register for Minor course

a) A student can opt for B.E. degree with Minor program if she/he has good academic record and must have min CGPA of 6.5 till II Year I Semester (III semester) at the time of entering into III year I semester.

b) Prior approval of mentor and Head of the Department for the enrolment into Minor program, before commencement of III year I Semester (V Semester), is mandatory

c) If more than 50% of the students in a branch fulfil the eligibility criteria (as stated above), the number of students given eligibility should be limited to 50%.

6. Registration for the courses in Minor Program

a) At the beginning of each semester, just before the commencement of classes, students shall register for the courses which they wish to take in that semester.

b) The students should choose a course from the list against each semester (from Minors course structure) other than the courses they have studied/registered for regular B.E. programme. No course should be identical to that of the regular B.E course. The students should take the advice of faculty mentors while registering for a course at the beginning of semester.

c) The maximum number of courses for the Minor is limited to two (three in case of inclusion of lab) in a semester along with regular semester courses.

d) The registration fee to be collected from the students by the College is Rs**. 1000/-** per one credit.

e) A fee for late registration may be imposed as per the norms.

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
Maturi Venkata Subba Rao (MVSR) Engineering College
(An Autonomous Institution)

Four Year Degree Programme
in
B.E. (COMPUTER SCIENCE and INFORMATION TECHNOLOGY) (Tentative)

Structure of Undergraduate Engineering program for the bathes admitted from the Academic Year 2023-24:

S. No	Course Work – Subject Area	Credits/ Semester								Credits
		I	II	III	IV	V	VI	VII	VIII	
1	Humanities and Social Sciences (HS)	3	2	-	3	-	-	-	-	**8**
2	Basic Sciences (BS)	9	9	-	3	-	-	-	-	**21**
3	Engineering Sciences (ES)	6	9	3	-	-	-	-	-	**18**
4	Professional Subjects –Core (PC)	-	-	18	13	17	14	11	-	**73**
5	Professional Subject-Electives (PE)	-	-	-	-	3	6	3	3	**15**
6	Open Subjects – Electives (OE)	-	-	-	-	-	3	3	3	**9**
7	Project Work, Seminar and/or Internships (PW)	-	-	-	1	2	-	3	10	**16**
8	Mandatory Courses (MC) (Non-Credit)	MC	-	MC	-	-	-	MC	-	-
	Total	**18**	**20**	**21**	**20**	**22**	**23**	**20**	**16**	**160**
	Contact Hours/ Week	26	26	29	27	29	28	30	26	**221**

B.E. (Computer Science and Information Technology) I - SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/ week	CIE	SEE	Duration of SEE (Hrs.)	
Theory Courses										
1	U21BSN01MT	Engineering Mathematics – I	3	1	-	4	30	70	3	4
2	U21BSN01PH	Engineering Physics	3	-	-	3	30	70	3	3
3	U21HSN01EG	English	2	-	-	2	30	70	3	2
4	U21ESN01CS	Programming for Problem Solving using C	3	-	-	3	30	70	3	3
5	U21MCN01PO	Indian Constitution	2	-	-	2	30	70	3	-
Practical/ Laboratory Courses										
6	U21BSN81PH	Physics Lab	-	-	4	4	25	50	3	2
7	U21HSN81EG	English Laboratory	-	-	2	2	25	50	3	1
8	U21ESN81CS	Programming for Problem Solving using C Lab	-	-	4	4	25	50	3	2
9	U21ESN82ME	Basic Workshop Practice	-	-	2	2	25	50	3	1
		Induction Program	Three weeks before commencement of classwork of semester I							
		Total	**13**	**1**	**12**	**26**	**250**	**550**	**-**	**18**

B.E. (Computer Science and Information Technology) II - SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/ week	CIE	SEE	Duration of SEE (Hrs.)	
Theory Courses										
1	U21BSN02MT	Engineering Mathematics – II	3	-	-	3	30	70	3	3
2	U21BSN01CH	Engineering Chemistry	3	-	-	3	30	70	3	3
3	U22ESN02CS	Problem Solving using Python Programming	3	-	-	3	30	70	3	3
4	U22ESN01EC	Basic Electronics & Sensors	3	-	-	3	30	70	3	3
5	U21HSN02EG	Effective Technical Communication in English	2	-	-	2	30	70	3	2
Practical/ Laboratory Courses										
6	U21BSN81CH	Chemistry Lab	-	-	4	4	25	50	3	2
7	U22ESN82CS	Problem Solving using Python Programming Lab	-	-	2	2	25	50	3	1
8	U22ESN81EC	Basic Electronics & Sensors Lab	-	-	2	2	25	50	3	1
9	U21ESN82CE	Engineering Drawing Practice	-	-	2	2	25	50	3	1
10	U21BSN81MT	Computational Mathematics Lab	-	-	2	2	25	50	3	1
		Total	**14**		**12**	**26**	**275**	**600**		**20**

B.E. (Computer Science and Information Technology) III - SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/ week	CIE	SEE	Duration of SEE (Hrs.)	
Theory Courses										
1	U21ES301CS	Logic and Switching Theory	3	-	-	3	30	70	3	3
2	U21PC301CS	Database Management Systems	3	-	-	3	30	70	3	3
3	U21PC303CS	Discrete Mathematics	2	1	-	3	30	70	3	3
4	U21PC304CS	Data Structures and Algorithms Using 'C'	3	-	-	3	30	70	3	3
5	U21PCN01CS	Object Oriented Programming using JAVA	3	-	-	3	30	70	3	3
6	U21MCN01CE	Environmental Science	2	-	-	2	30	70	3	-
Practical/ Laboratory Courses										
7	U21PC381CT	Database Management Systems Lab	-	-	4	4	25	50	3	2
8	U21PC384CS	Data Structures and Algorithms using 'C' Lab	-	-	4	4	25	50	3	2
9	U21PCN81CS	Object Oriented Programming Using JAVA Lab	-	-	4	4	25	50	3	2
		Total	**16**	**1**	**12**	**29**	**255**	**570**	**-**	**21**

B.E. (Computer Science and Information Technology) IV– SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/ week	CIE	SEE	Duration of SEE (Hrs.)	
Theory Courses										
1	U21PC401CT	Computer Organization and Microprocessor	3	-	-	3	30	70	3	3
2	U21PC402CT	Web Programming	3	-	-	3	30	70	3	3
3	U21HSN01CO	Finance & Accounting	3	-	-	3	30	70	3	3
4	U21PCN02CS	Software Engineering	3	-	-	3	30	70	3	3
5	U21BSN03MT	Engineering Mathematics-III (Probability & Statistics)	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
6	U21PC481CT	Computer Organization and Microprocessor Lab	-	-	2	2	25	50	3	1
7	U21PC482CT	Web Programming Lab	-	-	4	4	25	50	3	2
8	U21PCN82CS	Software Engineering Lab	-	-	2	2	25	50	3	1
9	U21PW481CT	Theme Based Project	-	-	2	2	25	50	3	1
		Total	**15**	**-**	**10**	**25**	**250**	**550**	**-**	**20**

B.E. (Computer Science and Information Technology) V – SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/ week	CIE	SEE	Duration of SEE (Hrs.)	
Theory Courses										
1	U21PC501CT	Design and Analysis of Algorithms	3	-	-	3	30	70	3	3
2	U21PCN04CS	Operating Systems	3	-	-	3	30	70	3	3
3	U21PCN05CS	Automata Languages and Computation	3	-	-	3	30	70	3	3
4	U21PCN06CS	Computer Networks	3	-	-	3	30	70	3	3
5	U2XPE51XXX	Professional Elective - I	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
6	U21PC581CT	Design and Analysis of Algorithms Lab	-	-	2	2	25	50	3	1
7	U21PC582CT	Full Stack Development Lab	-	-	4	4	25	50	3	2
8	U21PCN84CS	Operating Systems Lab	-	-	2	2	25	50	3	1
9	U21PCN86CS	Computer Networks Lab	-	-	2	2	25	50	3	1
10	U21PW581CT	Mini Project	-	-	4	4	25	50	3	2
		Total	**15**	**-**	**14**	**29**	**275**	**600**	**-**	**22**

Professional Elective – I		
S.No.	**Course Code**	**Course Title**
1	U21PE511CT	Fundamentals of Data Science
2	U21PE512CS	Advanced Algorithms
3	U22PE513AL	Image Processing
4	U21PE514CS	Cyber Security, Ethics & Laws
5	U22PE515DS	Game Development

B.E. (Computer Science and Information Technology) VI – SEMESTER

S. No.		Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	Pr/ Drg	Contact Hrs/ week	CIE	SEE	Duration of SEE (Hrs.)	
Theory Courses										
1	U21PC601CT	Embedded Systems and IoT	3	-	-	3	30	70	3	3
2	U21PC601CS	Compiler Construction	3	-	-	3	30	70	3	3
3	U21PC602CS	Artificial Intelligence and Machine Learning	3	-	-	3	30	70	3	3
4	U2XPE62XXX	Professional Elective -II	3	-	-	3	30	70	3	3
5	U2XPE63XXX	Professional Elective -III	3	-	-	3	30	70	3	3
6	U21OE61XXX	Open Elective – I	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
7	U21PC681CT	Embedded Systems and IoT Lab	-	-	2	2	25	50	3	1
8	U21PC682CS	Artificial Intelligence and Machine Learning Lab	-	-	4	4	25	50	3	2
9	U22PC683AL	DevOps Lab	-	-	4	4	25	50	3	2
		*Summer Internship	* To be conducted after the VI Semester in the summer vacation and to be evaluated in VII Semester.							
		Total	**18**	**-**	**10**	**28**	**255**	**570**	**-**	**23**

Professional Elective – II		
S. No.	**Course Code**	**Course Title**
1	U21PE621CT	Distributed Databases
2	U21PE622CT	Graph Theory
3	U21PE623CT	Agile Software Development
4	U22PE621DS	Object Oriented System Development
5	U22PE623CB	Wireless Sensor Networks
Professional Elective – III		
S. No	**Course Code**	**Course Title**
1	U21PE631CT	Computer Vision
2	U21PE632CT	Robotic Process Automation
3	U22PE631DS	Human Computer Interaction
4	U22PE632CB	Software Project Management

5	U22PE635CB	Natural Language Processing

Open Elective –I		
S.No.	**Code**	**Course Title**
1	U21OE611AE	Automobile Engineering
2	U21OE611CE	Disaster Mitigation
3	U21OE611CS	Fundamentals of Data Structures
4	U21OE611EC	Principles of Electronic Communications
5	U21OE612EC	Electronic Instrumentation
6	U21OE611EE	Electrical Energy Conservation and Safety
7	U21OE611IT	Database Systems
8	U21OE611ME	Operation Research and Techniques
9	U21OE612ME	Industrial Robotics
10	U21OE611EG	Soft skills and Interpersonal Skills

B.E. (Computer Science & Information Technology) VII– SEMESTER (TENTATIVE)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/ week	CIE	SEE	Duration of SEE (Hrs.)	
Theory Courses										
1	U21PC701CT	Neural Networks & Deep Learning	3	-	-	3	30	70	3	3
2	U22PCN01AL	Distributed Systems & Cloud Computing	3	-	-	3	30	70	3	3
3	U2XPE74XXX	Professional Elective–IV	3	-	-	3	30	70	3	3
4	U21OE72XXX	Open Elective - II	3	-	-	3	30	70	3	3
5	U21MCN01PY	Essence of Indian Traditional Knowledge	2	-	-	2	30	70	3	-
Practical/ Laboratory Courses										
6	U21PC781CT	Neural Networks & Deep Learning Lab	-	-	4	4	25	50	3	2
7	U21PC782CT	Mobile Application Development Lab	-	-	4	4	25	50	3	2
8	U22PCN81AL	Distributed Systems & Cloud Computing Lab	-	-	2	2	25	50	3	1
9	U21PW781CT	Project Work - I	-	-	2	2	50	-	-	1
10	U21PW782CT	*Summer Internship	-	-	4	4	50	-	-	2
		Total	**14**	**-**	**16**	**30**	**325**	**500**	**-**	**20**

Professional Elective – IV		
S. No.	**Code**	**Course Title**
1	U21PE741CT	Mobile Computing
2	U21PE742CT	High Performance Computing
3	U22PE741DS	Intellectual Property Rights
4	U22PE742DS	Multicore Architectures and Programming
5	U22PE745AL	Cryptography and Network Security

Open Elective –II		
S.No.	**Code**	**Course Title**
1	U21OE721AE	Automotive Vehicle Maintenance
2	U21OE721CE	Green Building Technologies
3	U21OE721CS	Principles of Operating systems
4	U21OE721EC	Basic Navigation System
5	U21OE722EC	Principles of Mobile Communications
6	U21OE721EE	Non-Conventional Energy Sources
7	U21OE721IT	Fundamentals of Software Engineering
8	U21OE721ME	Entrepreneurship
9	U21OE721MT	Transform Calculus

B.E. (Computer Science & Information Technology) VIII– SEMESTER (TENTATIVE)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/ week	CIE	SEE	Duration of SEE (Hrs.)	
Theory Courses										
1	U2XPE85XXX	Professional Elective – V	3	-	-	3	30	70	3	3
2	U21OE83XXX	Open Elective – III	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
3	U21PW881CT	Project Work - II	-	-	20	20	50	150	-	10
		Total	**6**	**-**	**20**	**26**	**110**	**290**	**-**	**16**

Professional Elective – V		
S.No.	**Code**	**Course Title**
1	U22PE851AL	Quantum Computing
2	U22PE852DS	Information Retrieval Systems
3	U22PE853CB	Software Quality Testing
4	U22PE854AL	Blockchain Technology and Applications
5	U22PE855CB	Bigdata Analytics

Open Elective – III		
S.No.	**Code**	**Course Title**
1	U21OE831AE	Motor Sport Engineering
2	U21OE831CE	Road Safety Engineering
3	U21OE831CS	Artificial Intelligence Techniques
4	U21OE831EC	Fundamentals of IOT
5	U21OE832EC	Principles of Computer Communication & Networks
6	U21OE831EE	Smart Building Systems
7	U21OE831IT	Principles of Information Security
8	U21OE831ME	Material Handling
9	U21OE832ME	Smart Materials and Sensors
10	U21OE831PH	Nano Materials

B.E. (Computer Science and Information Technology) I - SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/ week	CIE	SEE	Duration of SEE (Hrs.)	
Theory Courses										
1	U21BSN01MT	Engineering Mathematics – I	3	1	-	4	30	70	3	4
2	U21BSN01PH	Engineering Physics	3	-	-	3	30	70	3	3
3	U21HSN01EG	English	2	-	-	2	30	70	3	2
4	U21ESN01CS	Programming for Problem Solving using C	3	-	-	3	30	70	3	3
5	U21MCN01PO	Indian Constitution	2	-	-	2	30	70	3	-
Practical/ Laboratory Courses										
6	U21BSN81PH	Physics Lab	-	-	4	4	25	50	3	2
7	U21HSN81EG	English Laboratory	-	-	2	2	25	50	3	1
8	U21ESN81CS	Programming for Problem Solving using C Lab	-	-	4	4	25	50	3	2
9	U21ESN82ME	Basic Workshop Practice	-	-	2	2	25	50	3	1
		Induction Program	Three weeks before commencement of classwork of semester I							
		Total	**13**	**1**	**12**	**26**	**250**	**550**	**-**	**18**

*** 3 Weeks** induction program will be organized before commencement of the coursework of Semester–I

BS: Basic Science
ES: Engineering Science
HS: Humanities and Social Sciences

L: Lecture
T: Tutorial
P: Practical

CIE: Continuous Internal Evaluation
SEE: Semester End Evaluation
D: Drawing

Note:

1. Each contact hour is a clock hour
2. The duration of the practical class is two hours, however it can be extended wherever necessary, to enable the student to complete the experiment.

Course Code	Course Title						Core/Elective
U21BSN01MT	**Engineering Mathematics - I**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**1**	**-**	**-**	**30**	**70**	**4**

Course Objectives

The objectives of this course is to

- To Introduce the concepts of sequences, series and their properties
- To Introduce the concepts of mean value theorems and curvature
- To Introduce the concepts of multiple integrals
- To Study vector differential and vector integral calculus

Course Outcomes

After completing this course, the student will be able to:

- Determine the convergence of infinite series using various tests of convergence
- Solve problems based on the fundamental theorem of differential calculus, find radius of curvature, evolutes and envelopes and expand functions using Taylor & MacLaurin series
- Evaluate Double and Triple integrals in Engineering Problems
- Solve problems based on vector differentiation.
- Solve problems based on vector integration

UNIT-I

Infinite Series: Introduction to sequences, Infinite series, general properties of infinite series, geometric series, series of positive terms, Harmonic series(p-series),Comparison test, D'Alembert's ratio test, Raabe's test, Cauchy's n^{th} root test, Alternating series, absolute and conditional convergence (11 Hours)

UNIT-II

Differential Calculus: Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem(without proofs) and their applications, Taylor and Maclaurin series, Curvature, Radius of curvature(Cartesian form),Centre of Curvature, Evolute and Involute, Envelope of a family of curves (11 Hours)

UNIT-III

Multiple Integrals: Introduction to functions of two and three variables, Double integrals, Change of order of integration, Change of variables from Cartesian to Plane Polar coordinates, Triple integrals (Cartesian) (10 Hours)

UNIT-IV

Vector Differentiation: Scalar and vector point functions, Vector operator del, Gradient, Unit normal vector, Directional derivative, Angle between surfaces, Divergence, solenoidal vector, Curl, Irrotational vector, Laplace operator applied to scalar and vector point functions.(10 Hours).

UNIT-V

Vector Integration: Line integral-work done, Surface integral, Volume integral, Green's theorem in a plane, Stoke's theorem, Gauss divergence theorem(without proofs) and their verifications.(10 Hours)

Prescribed Text Books:

1. R. K. Jain & S. R .K. Iyengar, *Advanced Engineering Mathematics*, Narosa Publications, 5th Edition 2016.
2. B. S. Grewal, *Higher Engineering Mathematics*, Khanna Publications, 44th Edition, 2018.

Suggested Readings:

1. B.V. Ramana, Higher Engineering Mathematics, 23rd reprint, 2015.
2. N.P. Bali, M. Goyal, A Textbook of Engineering Mathematics, Laxmi publications, 2010
3. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley, 9th Edition, 2012.
4. Calculus and Analytic Geometry by George B Thomas Jr. and Ross L.Finney
5. Calculus: One -Variable Calculus with An Introduction to Linear Algebra, Vol 1 by Tom M. Apostol

Course Code	Course Title						Core/Elective
U21BSN01PH	**Engineering Physics**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To introduce principles of Wave Mechanics and Electromagnetic theory.
- To explain the properties and applications of semiconducting materials.
- To explain the properties and applications of Magnetic and Superconducting materials
- To explain the principles of Laser technology, Optical fibers and their applications in various disciplines
- To introduce Nano Science and Nanotechnology

Course Outcomes

- Recall the principles of Wave Mechanics and apply them to solve particle in a box, list the fundamental laws of electricity and magnetism and make use of these laws to derive Maxwell's Electromagnetic wave equation and Poynting theorem.
- Explain and illustrate Semiconducting materials along with their applications.
- Classify Magnetic Materials and explain properties, Identify applications of Ferro Magnetic Materials and Superconducting Materials.
- Explain the principle of Laser and Optical Fiber; Summarize different types of Laser sources and optical fibers; identify the applications of Laser and Optical Fiber.
- Summarize various types of Nanomaterials, their preparation methods and list out various Characterization Techniques and applications of Nanomaterials.

UNIT-1: WAVE MECHANICS AND ELECTROMAGNETIC THEORY

De-Broglie's hypothesis, Wave function and its physical significance, Schrodinger's time independent wave equation, Schrodinger's time dependent wave equation, Particle in 1D potential box.

Gauss's laws in electrostatics and magnetostatics, Faraday's law and Ampere's law in Electromagnetic induction, Maxwell's equations in Integral and differential forms, Conducting current and Displacement current, Electromagnetic wave equation in dielectric medium, Poynting theorem.

UNIT-2: SEMICONDUCTORS AND DEVICES

Introduction to Semiconductors - Intrinsic and Extrinsic Semiconductors, Concept of hole, Expression for Carrier concentration and conductivity in Intrinsic Semiconductors, Hall Effect and its applications. Semiconductor devices P-N junction diode, LED,Thermistor.

UNIT-3: MAGNETIC MATERIALS AND SUPER CONDUCTORS

Introduction- Basic definitions of magnetism- Origin of Magnetic moment, Classification of Magnetic materials- Dia, Para, Ferro, Anti-ferro and Ferri Magnetic materials. Types of magnetic materials and their properties, Weiss molecular field theory of Ferromagnetism, Hysteresis of Ferromagnetic material based on domain theory, Soft and Hard magnetic materials, Ferrites and their applications.

Superconductors and their properties, Meissner effect, Type-I and Type-II Superconductors, BCS Theory, High Tc superconductors, Applications of Superconductors.

UNIT-4: MODERN OPTICS

Introduction to LASERs, Characteristics of Lasers, Spontaneous and Stimulated emissions, Components of LASERs, LASERs operating in UV- Vis-IR Regions, Types of LASERS- Solid State LASER(RUBY LASER), Gas LASER(He-Ne Laser), and Semiconductor LASER, Applications of LASERs.

Introduction to Optical fiber, Basic principle – Total internal reflection, Propagation of light through the fiber - Numerical Aperture and Acceptance angle, Step-Index and Graded- Index optical fibers, Applications of Optical fibers.

UNIT- 5: NANO MATERIALS AND EXPERIMENTAL TECHNIQUES (8)

Origin of Nano Science- Bulk and Nano materials, types of nanomaterials, Surface to volume ratio and Quantum confinement effect, properties of nanomaterials, fabrication of nanomaterials- Top-down approach and Bottom-up approach, Ball milling method, and Sol-Gel methods, Elementary ideas of Carbon nanotubes (CNT'S)

Material characterization techniques- X- Ray diffraction, RAMAN Spectroscopy, SEM and TEM, Applications of nanomaterials.

Suggested Books:

1. M.S. Avadhanulu and P.G. Kshirasagar, A text book Engineering Physics, S. Chand and Co., 9th edition, 2010.
2. R.K. Gaur and S.L. Gupta, Engineering Physics, Dhanpat Rai publications, 8th edition, 2001.
3. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning India(P) Ltd., 2012
4. R. Murugesan and K. Sivaprasath, Modern Physics, S. Chand & Company, 13th edition, 2007.
5. A. Goswami, Thin Film Fundamentals, New Age International, 2007.
6. A.K. Bandopadhyay, Nano Materials, New Age International, 1st edition, 2007.
7. Engineering Physics by M. Armugam
8. Engineering Physics by K.J. Pratap, et. al.

Course Code	Course Title						Core/Elective
U21HSN01EG	**English**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	**2**

Course Objectives

The objectives of this course is to enhance the English language abilities of students by

- Using authentic material for language learning
- Developing appreciation to a variety of content-rich texts
- Strengthening their grammar and vocabulary
- Improving reading and comprehension skills and also encouraging them to think critically and creatively
- Honing their writing skills

Course Outcomes

After completing this course, the student will be able to:

- Demonstrate the skill of reading to summarize, paraphrase and give an accurate account of authentic texts of various genres
- Infer and make predictions based on the comprehension of a text
- Employ Academic Vocabulary appropriately with a distinction of its formal and informal use
- Apply different reading strategies to comprehend different texts and decode new words encountered
- Undertake guided and extended writing using accurate grammatical structures and vocabulary

UNIT - I

Reading : A.G. Gardener – "On Saying Please"
Vocabulary: Word formation - Prefixes, Suffixes, Root Words
Grammar : Articles, Prepositions, Determiners
Writing : Guided Writing (Expanding the outline/Writing from verbal cues)

UNIT - II

Reading : Fritz Karinthy – "Refund "
Vocabulary: Word formation- Compounding and Blending, Contractions
Grammar : Transitions, Connectives
Writing : Paragraph-writing

UNIT - III

Reading : Narayan Murthy – "Value System"
Vocabulary: Synonyms, Antonyms, One Word Substitutes
Grammar : Voice
Writing : Letter-writing

UNIT - IV

Reading : Robert Frost – "Stopping by Woods on a Snowy Evening"
Vocabulary: Homophones, Homonyms, Homographs
Grammar : Narration (Direct-Indirect Speech)
Writing : Precis writing

UNIT - V

Reading : Stephen Leacock – "On the Need for a Quiet College"
Vocabulary: Inclusive Language, Euphemisms
Grammar : Tenses
Writing : Paraphrasing and Summarizing

Suggested Readings:

1. Board of Editors. Language and Life: A Skills Approach. Orient BlackSwan, 2018.
2. Sudharshana, NP and C Savitha, English For Engineers. Cambridge University Press, 2018.
3. Kumar, Sanjay and Pushp Lata, English Language and Communication Skills for Engineers. Oxford University Press, 2018.

Course Code	Course Title						Core/Elective
U21ESN01CS	**Programming for Problem Solving Using C**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

The objectives of this course is to impart knowledge of

- To introduce the concept of computing environment, number systems, algorithms, flowcharts and implementation using variables with various data types and selection statements.
- To introduce the logic building techniques using control statements and arrays
- To understand modular and structure programming using functions and strings
- To learn the alternative to iteration using recursion and familiarization with structures and macros
- To understand memory management using pointers and dealing with files

Course Outcomes

After completing this course, the student will be able to:

- Formulate simple algorithms/flowcharts there by translating them into programs using variables with various data types and selection statements.
- Implement logic building techniques using control statements and arrays
- Apply modular and structure programming using functions and strings
- Analyze the iteration with recursion and implementation of structures and macros.
- Illustration of memory management techniques using pointers and implement the file handling approach.

UNIT - I

Introduction to computers: Introduction to components of a computer system, Operating system, Number system: Decimal, binary, octal, hexa decimal systems.

Algorithms/Flowcharts: Logical and Numerical problem solving

Introduction to C Programming: Structure of C, Execution phases in C (Compiler, interpreter, Linker, loader), C-tokens, syntax & semantics in compilation, Identifiers, variables, keywords, Data Types, Operators, precedence & associativity rules, Expression evaluation, Type conversion.

Selection statements: simple if, if-else, else-if ladder, nested if-else, switch

UNIT - II

Iteration statements: while, do-while, for, **Unconditional statements:** break, continue, goto, return

Arrays: 1-D arrays, **Searching Techniques:** Linear, binary search, **Sorting algorithms:** bubble sort and selection sort, 2-D arrays: Matrices

UNIT - III

Strings: Defining & initializing strings, String manipulation functions (predefined, user-defined)

Functions: Taxonomy of functions, built-in functions, parameter passing techniques: call by value, Passing arrays to functions: Idea of call by reference **Storage classes:** auto, register, static, extern

UNIT - IV

Recursive functions: Recursion definition, Iteration vs Recursion, Example programs: GCD, Factorial, sum of digits, fibonacci

Structures: Defining & accessing structured data, Array of structures, passing structure to function, nested structures, Difference between structure & union

Preprocessor directives: Macros, #define, #if, #elif

UNIT - V

Pointers: Introduction to pointers, Defining pointers, pointer arithmetic, Array of pointers, pointer to array, Null pointer, generic pointer, double pointers, passing pointer to function: call by address, Accessing structure using pointer, self- referential structure, Dynamic memory allocation

File Handling: I/O streams, File operations, file modes, Sequential/Random accessing files, command line arguments.

Text Book:

1. B.A. Forouzan and R.F.Gieverg, "A structured Programming Approach in C" language learning 2013.

Reference Books:

1. "C How to program" by Paul Deitel & Harvey Deitel 7th edition,PHI
2. "Computer Fundamentals and Programming in C" - A.K. Sharma, Universities Press,2nd edition,2018
3. "Programming in ANSI C" - E. Balagurusamy, TMH, 2008
4. Byron Gottfried - "Theory and practice of Programming with C", Schaum"s Outline McGrawHill,1990
5. "Programming in C"- Pradip Dey, Manas Ghosh, Oxford University Press, 2nd edition
6. Brian W Kernighan and Dennis M Ritchie, "The C programming Language", Prentice Hall of India,1988

Course Code	Course Title						Core/Elective
U21MCN01PO	**Indian Constitution**						**Mandatory**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	**-**

Course Objectives

The objectives of this course is to impart knowledge to

- To Educate the Students on Democratic values and Principles Articulated in the Constitution
- To help the students understand the structure of Union, State and local governments
- To Create Awareness among the students about the Fundamental Rights and Duties.
- To Make Students understand the nature and characteristics of relations between union and state governments
- To divulge the students about the statutory institutions and policies.

Course Outcomes

After completing this course, the student will be able to:

- Demonstrate Comprehensive Knowledge about the constitution of India.
- Understand the basic provisions of the Union, State and local Governments
- Differentiate between the Fundamental rights and Directive principles of State policy
- Show an enhanced level of analyzing the relations between Union and State governments.
- Understand the functioning of statutory bodies

UNIT - I

Evolution of the Indian Constitution: 1909 Act,1919 Act,1935 Govt of India Act, Constituent Assembly: Composition and Functions, Basic structure of Indian Constitution, Fundamental features of the Indian Constitution.

UNIT - II

Rights and Duties: Fundamental Rights, Directive principles of State Policy and Fundamental Duties, Public Interest Litigation (PIL).

UNIT - III

Union Government: Legislature, Executive-President, Prime Minister, Council of Minister Judiciary, Judicial Review and activism

State Government: Executive: Governor, Chief Minister, Council of Minister

Local Government: Panchayat Raj Institutions, Urban Governance

UNIT - IV

Union-State relations-Administrative, (inter-state council),
Legislative & Financial Relations, Finance Commission of India, NITI Aayog.

UNIT - V

Statutory Institutions: Elections-Election Commission of India, National Human Rights Commission, National Commission for Women.

Suggested Books:

1. M. Laxmikanth, "Indian Polity"
2. D. D. Basu, "Constitution of India"
3. Rajeev Bhargava, "Politics and Ethics"

Practical/ Laboratory Courses

Course Code	Course Title						Core/Elective
U21BSN81PH	**Physics Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**4**	**25**	**50**	**2**

Course Objectives

- To analyze a Semiconducting device and determine its temperature Coefficient of Resistance, Energy Gap, Electrical Conductivity, Mobility, concentration of charge carriers and its efficiency.
- To determine the wavelength of a given laser source, Sodium vapour lamp by using diffraction grating.
- To explain the principle of Optical Fiber and determine its Numerical Aperture, Acceptance Angle and losses.
- To demonstrate Torsional Pendulum, LCR Series and Parallel Circuit and calculate Rigidity Modulus of a given wire and frequency of LCR Series and Parallel Circuit.
- To examine the nature of Ferro Magnetic Materials, Dielelctric Materials and Calculate their related parameter
- To explain Seebeck Effect and Determine Seebeck Coefficient of thermoelectric device.

Course Outcomes

After completing this course, the student will be able to:

- Analyze a Semiconducting device and determine its temperature Coefficient of Resistance, Energy Gap, Electrical Conductivity, Mobility, Concentration of charge carriers and efficiency.
- Determine the Wavelength of Laser source, Sodium Vapour lamp using diffraction grating.
- Explain the principle of Optical Fiber and determine its Numerical Aperture, Acceptance angle and losses.
- Demonstrate Torsional Pendulum, LCR series and Parallel circuit and calculate the Rigidity Modulus of given metallic wire, resonant frequency of LCR Series & Parallel circuit.
- Examine the nature of ferromagnetic materials, dielectric materials and calculate their related parameter.
- Explain Seebeck Effect and determine Seebeck Coefficient of thermoelectric device.

List of experiments:

1. To Determine the Numerical aperture (NA), Acceptance Angle of the Optical Fiber, and to study the various losses that occur in optical fiber.
2. To determine the wavelength (λ) of the given Laser source.
3. To determine V-I characteristics of the given LED.
4. To draw the V-I characteristics of a Solar Cell and calculate the Fill Factor and Series Resistance.
5. To draw the I-V Characteristics of P-N Junction diode and to evaluate the resistance for forward bias and reverse bias.

6. To determine the constants of A, B and α using Thermistor characteristics.
7. To find the values of Electrical conductivity and energy gap of Ge crystal.
8. To determine the wavelength of radiation emitted by Sodium vapour lamp using Diffraction Grating.
9. To study the behavior of Series LCR Resonant circuit and to estimate the resonant frequency and Q factor.
10. To study the variation in current and voltage in parallel LCR Circuit and to find the resonant frequency of parallel LCR Circuit.
11. Determination of rigidity of modulus of Torsional pendulum.
12. To determine the Dielectric constant of the given Dielectric samples.
13. To draw the curve between the magnetizing field and the intensity of magnetization of the specimen (soft iron rod) and to find out i) Coercivity ii) Retentivity and iii) Hysteresis loss.
14. To Calculate Seebeck Coefficient of the given sample.
15. To determine the Hall coefficient, Carrier concentration and mobility of charge carriers of semiconducting material.
16. To determine the velocity of the Ultrasonic Waves.

Course Code	Course Title						Core/Elective
U21HSN81EG	**English Laboratory**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

To enhance the listening and speaking skills of students by

- Giving them sufficient practice in listening with comprehension.
- Providing them ample opportunities to improve their public speaking skills.
- Training them in the use of correct pronunciation, stress, and intonation.
- Sensitizing them to the use of verbal and non-verbal communication appropriate to the context.
- Encouraging them to learn the art of conversation to suit formal and informal situations.
- Preparing them to make formal presentations and face interviews.

Course Outcomes

On Successful completion of the course, the students will be able to:

- Listen, understand, and interpret formal and informal spoken language
- Speak English with acceptable pronunciation, stress, and intonation
- Present themselves with confidence in formal situations
- Be able to perform in fluency, accuracy and time management based activities such as JAM and Picture Perception
- Participate in individual and group activities with relative ease.

List of Activities

1. Listening for Comprehension
2. Pronunciation, Intonation, Stress, and Rhythm
3. Conversation Skills
4. Introducing Oneself and others
5. Asking for and Giving Information
6. Making Requests and Responding to them Appropriately
7. Giving Instructions and Responding to them Appropriately
8. Making Formal Announcements and Emceeing
9. Picture Perception
10. JAM
11. Role play
12. Group Discussions
13. Interview Skills
14. Presentation Skills

Suggested Readings:

1. Board of Editors. Language and Life: A Skills Approach. Orient BlackSwan, 2018.
2. Balasubramanian, T. A Textbook of English Phonetics for Indian Students. Macmillan, 1981
3. CIEFL. EXERCISES IN Spoken English. Parts. I- III. Oxford University Press. Pillai,
4. Radhakrsihna G. Spoken English For You - Level II. 8th Edition. Emerald Publishers, 2014.
5. Sethi, J and PV Dhamija. A Course in Phonetics and Spoken English. 2ndEdition. Prentice Hall India Learning Private Limited, 1999.

Course Code	Course Title						Core/Elective
U21ESN81CS	**Programming for Problem Solving Using C Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**4**	**25**	**50**	**2**

Course Objectives

The objectives of this course is to impart knowledge of

- Understand the fundamentals of programming in C Language.
- Write, compile and debug programs in C.
- Formulate solutions to problems and implement them in C.
- Effectively choose programming components to solve computing problems
- To apply the sorting and searching techniques on given set of data

Course Outcomes

After completing this course, the student will be able to:

- Choose appropriate data type for implementing programs in C language.
- Design and implement modular programs involving input output operations, decision making and looping constructs.
- Implement search and sort operations on arrays.
- Apply the concept of pointers for implementing programs on dynamic memory management and string handling.
- Design and implement programs to store data in structures and files.

Write C programs for following:

1. Express and compute few mathematical equations in C language

Selection statements:

2. Finding roots of a quadratic equation
3. Implement arithmetic calculator using switch
4. Check whether entered year is a leap year or not

Iteration statements:

5. Find maximum and minimum value in a given set of numbers
6. Print multiplication table of value X upto Y times
7. Print prime numbers between M & N, Check for armstrong number or not
8. Convert a decimal number to binary and vice versa
9. Display pyramid of numbers and pascal triangle upto N rows

Arrays:

10. Find maximum, minimum and sum of all numbers in a 1-D array
11. Implement linear & binary search using 1-D array
12. Implement bubble sort & selection sort using 1-D array
13. Find the sum and product of two matrices using 2-D arrays
14. Check whether a matrix is an identity matrix or not using 2-D arrays

Programs on Strings:

15. Perform string manipulation functions , convert a lowercase string into uppercase
16. Demonstrate on call by value & call by reference using functions

Programs on Recursion:

17. GCD, sum of digits, fibonacci series, factorial

Structures & Union:

18. Using an array of structures, Store 5 students information (name, roll no, subject1, subject2, subject3, total_marks), compute total_marks of each student and display details of each student.
19. Store 3 employee information (name, salary, designation) and access each employee using union.

Pointers:

20. Demonstrate on pointer arithmetic
21. Find the biggest and smallest of array using pointer to array
22. Implement dynamic memory allocation

Files:

23. Writing/reading/appending some data to a file
24. Copy the contents of one file to other file
25. Count the frequency of characters, lines and words in a given file

Reference Books:

1. "C How to program" by Paul Deitel & Harvey Deitel 7th edition,PHI
2. "Computer Fundamentals and Programming in C" - A.K. Sharma,Universities Press,2nd edition,2018
3. "Programming in ANSI C" - E. Balagurusamy, TMH, 2008
4. Byron Gottfried - "Theory and practice of Programming with C", Schaum"s Outline McGrawHill,1990
5. "Programming in C"- Pradip Dey,Manas Ghosh, Oxford University Press, 2nd edition
6. Brian W Kernighan and Dennis M Ritchie, "The C programming Language", Prentice Hall of India,1988

Course Code	Course Title						Core/Elective
U21ESN82ME	**Basic Workshop Practice**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**2**	**25**	**50**	**1**

Course Objectives

- Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.
- To provide hands on experience about use of different engineering materials, tools, equipment and processes those are common in the engineering field.
- To gain a good basic working knowledge required for the production of various engineering products.
- To study different hand operated power tools, uses and their demonstration.
- Adopt safety practices while working with various tools.

Course Outcomes

After completing this course, the student will be able to:

- Demonstrate an understanding of and comply with workshop safety regulations.
- Identify and apply suitable tools for different trades of Engineering processes including material removing, measuring and chiselling.
- Undertake jobs connected with Engineering Workshop trades including sheet metal and house wiring.
- Apply basic electrical engineering knowledge for house wiring practice.

A. TRADE FOR EXERCISES:

Course Objective:

To impart hands-on practice on basic engineering trades and skills.

1. **House wiring**-Exercises-Single lamp, parallel/Series connection of 2 bulbs and Stair case wiring.
2. **Sheet metal**-Forming and Bending. Model making. Exercises-Taper Tray, Open Scoop, Funnel.

B. IT WORKSHOP:

Computer hardware, identification of parts, Disassembly, Assembly of computer to working condition, operating system installation.

1. System Assembling, Disassembling and identification of Parts / Peripherals
2. Operating System Installation-Install Operating Systems like Windows, Linux along with necessary Device, Drivers
3. MS-Office / Open Office
   a) Word - Formatting, Page Borders, Reviewing, Equations, symbols.
   b) Spreadsheet - organize data, usage of formula, graphs, charts.
   c) Power point - features of power point, guidelines for preparing an effective presentation.
   d) Access- creation of database, validate data.
4. Trouble Shooting-Hardware troubleshooting, Software troubleshooting.

Reference Books:

1. Venugopal.K, "Workshop manual", Anuradha Publications, Kumbakonam, TN, 2012
2. K.C. John, "Mechanical Workshop" 2nd Edn., PHI, 2010.
3. Hajra Choudary, "Elements of Workshop Technology" Vol. 1, Asian Publishers, Edn., 1993.
4. Computer Hardware, Installation, Interfacing, Troubleshooting and Maintenance, K.L. James, Eastern. Economy Edition.

Note: At least three exercises to be done from each trade

B.E. (Computer Science and Information Technology) II - SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/ week	CIE	SEE	Duration of SEE (Hrs.)	
Theory Courses										
1	U21BSN02MT	Engineering Mathematics – II	3	-	-	3	30	70	3	3
2	U21BSN01CH	Engineering Chemistry	3	-	-	3	30	70	3	3
3	U22ESN02CS	Problem Solving using Python Programming	3	-	-	3	30	70	3	3
4	U22ESN01EC	Basic Electronics & Sensors	3	-	-	3	30	70	3	3
5	U21HSN02EG	Effective Technical Communication in English	2	-	-	2	30	70	3	2
Practical/ Laboratory Courses										
6	U21BSN81CH	Chemistry Lab	-	-	4	4	25	50	3	2
7	U22ESN82CS	Problem Solving using Python Programming Lab	-	-	2	2	25	50	3	1
8	U22ESN81EC	Basic Electronics & Sensors Lab	-	-	2	2	25	50	3	1
9	U21ESN82CE	Engineering Drawing Practice	-	-	2	2	25	50	3	1
10	U21BSN81MT	Computational Mathematics Lab	-	-	2	2	25	50	3	1
		Total	**14**		**12**	**26**	**275**	**600**		**20**

*** 3 Weeks** induction program will be organized before commencement of the coursework of Semester – I

BS: Basic Science,
ES: Engineering Science
HS: Humanities and Social Sciences

L: Lecture
T: Tutorial
P: Practical
D: Drawing

CIE: Continuous Internal Evaluation
SEE: Semester End Evaluation

Note:

1. Each contact hour is a clock hour
2. The duration of the practical class is two hours, however it can be extended wherever necessary, to enable the student to complete the experiment.

Course Code	Course Title						Core/Elective
U21BSN02MT	**Engineering Mathematics - II**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

The objectives of this course is to

- To provide an overview of ordinary differential equations and their applications.
- To study Linear algebra and its uses in solving systems of linear equations.
- To study Eigenvalue problems and Quadratic forms.
- To study the special functions Gamma and Beta functions.

Course Outcomes

After completing this course, the student will be able to:

- Solve first order differential equations.
- Solve higher order differential equations.
- Solve a system of linear equations.
- Solve eigenvalue problems and Quadratic forms.
- Apply Beta and Gamma Functions to evaluate definite integrals

UNIT - I

Differential Equations of First Order: Exact differential equations, Integrating factors, Linear differential equations, Bernoulli's and Riccati's. Applications of first order differential equations - Orthogonal trajectories of a given family of curves (Cartesian form)Newton's Law of Cooling, Growth and Decay.

UNIT - II

Differential Equations of Higher Order :Solutions of second and higher order linear homogeneous equations with constants coefficients, Solutions of non-homogeneous linear differential equations with constants coefficients, Method of reduction of order, Method of variation of parameters, Applications of second order differential equations-LCR circuits.

UNIT - III

Matrices : Rank of a matrix, Elementary Row/Column operations, Echelon form, Normal form, Linear dependence and independence of vectors, System of linear equations, Linear transformation.

UNIT - IV

Eigenvalues and Eigenvectors: Eigenvalues, Eigenvectors, properties of Eigenvalues, Cayley - Hamilton theorem (without proof), Quadratic forms, Reduction of quadratic form to canonical form, Rank, Index, Signature and Nature of quadratic forms.

UNIT - V

Special Functions: Gamma function, Beta function, properties of Gamma and Beta functions, relation between Beta and Gamma functions, evaluation of definite integrals using Beta and Gamma functions.

Prescribed Text Books:

1. R. K. Jain & S .R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Edition 2016.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 44th Edition, 2018.

Suggested Readings:

1. B.V. Ramana, Higher Engineering Mathematics, 23rd reprint, 2015.
2. N.P. Bali, M. Goyal, A textbook of Engineering Mathematics, Laxmi publications, 2010.
3. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley, 9th Edition, 2012.

Course Code	Course Title						Core/Elective
U21BSN01CH	**Engineering Chemistry**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

The objectives of this course is to

- To relate how the basic concepts and principles of chemistry can be applied to practical utility in a broader perspective of the society.
- To distinguish the ranges of electromagnetic spectrum and its interaction with matter and to develop knowledge of various spectroscopic techniques at atomic and molecular levels.
- To identify and apply various principles of electrochemistry and corrosion which are essential for an engineer in industry.
- To bring adaptability to the concepts of chemistry and to acquire the required skills to become a perfect engineer.

Course Outcomes

After completing this course, the student will be able to:

1. Explain and apply the knowledge of various electrodes, electrode potentials and Nernst equations to construct electrochemical cells and thereby to calculate EMF of a cell.
2. Analyze different types of corrosion, mechanism, factors affecting metallic corrosion and control corrosion by various methods.
3. Explain the origin of UV-Vis absorption in terms of electronic transitions in determination of structures of various molecules and Analyze microscopic chemistry in terms of atomic and molecular orbitals
4. Identify and make use of various polymers as material for engineering applications.
5. Classify various energy sources and illustrate the importance and applications of renewable and non-renewable energy sources.
6. Relate the concepts of liquid crystals, composites and green chemistry to modify engineering processes and materials.

UNIT – I

Electro Chemistry & Corrosion and Its control: Electro Chemistry: Electrochemical Cells-Electrolytic and galvanic cells-notation.Cell Reaction and Cell EMF. Electrode Potential, Standard electrode potential. Electrochemical series and Applications. Free Energy and EMF. Nernst equation and its derivation, Applications -Numerical problems. Types of electrodes-Standard hydrogen electrode, Calomel electrode Silver-Silver Chloride, Quinhydrone and glass electrodes. Determination of pH using Quinhydrone electrode coupled with saturated Calomel electrode.

Corrosion: Definition, Causes and effects. Types of corrosion, Chemical corrosion, and its mechanism. Electrochemical corrosion and its mechanism. Galvanic corrosion, Concentration cell Corrosion-Waterline and Pitting corrosion. Factors affecting rate of corrosion. Corrosion control methods- Cathodic Protection –Sacrificial anode and impressed current cathode methods. Surface Coatings-Types. Electroplating and Electroless plating of metal coatings.

UNIT– II

Molecular Structure & Spectroscopic techniques: Regions of electromagnetic spectrum, Molecular spectroscopy.

Rotational Spectroscopy: Rotation of molecules, rotational spectra of rigid diatomic molecules, selection rules.

Vibrational Spectroscopy: The vibrating diatomic molecule, simple and harmonic oscillators of a diatomic molecule, selection rules, applications of IR spectroscopy.

NMR Spectroscopy: Criteria for NMR activity (Magnetic and nonmagnetic nuclei), basic concepts and principle of 1H NMR spectroscopy, Chemical shift, Magnetic Resonance Imaging.

UNIT - III

Polymeric Materials: Polymers: Basic terminology - Monomer and its functionality, Polymers, and degree of polymerization. Types of Polymerizations- Chain Growth, Step Growth Polymerization – Examples. Plastics, Fibers, Elastomers – Characteristics and Examples. Preparation, Properties & Uses of the following polymers- PVC, Bakelite, Nylon 6:6,Buna-S, Butyl Rubber and Silicone Rubber. **Conducting polymers:** Concept, Classification of conducting polymers with examples. Mechanism of conduction in trans Polyacetylene. Enhancement of conduction by doping. Applications of conducting polymers.

Biodegradable polymers: Concept, Preparation, Properties, and applications of polylactic acid.

UNIT - IV

Energy Sources: Introduction-Renewable and non-renewable energy sources with Examples. **Chemical fuels:** Definition, Classification of chemical fuels-primary, Secondary and Solid, Liquid, Gaseous fuels -examples. **Solid fuels:** Coal & its composition, and its ranking

Liquid fuels: Petroleum- Fractional distillation of petroleum. Cracking and its significance. Knocking, Octane Number and Cetane number.

Gaseous Fuels: LPG, CNG-composition, properties and uses

Biodiesel: Concept -Transesterification- Carbon neutrality. Advantages of Biodiesel.

Batteries: Definition, Types of batteries-Primary batteries; Zn-Carbon battery. Secondary batteries; Construction, working & applications of Lead-acid, Lithium -ion batteries.

Fuel cells: Definition, Types of fuels cells, Construction, Applications of working of H2-O2 fuel cells and Methanol-O2 Fuel cells.

Solar cells: Concepts of photovoltaic cells and its applications.

UNIT - V

Liquid Crystals, Composites and Green Chemistry: Liquid Crystals: Introduction, classification of liquid crystals-Thermotropic and Lyotropic liquid crystals - Chemical constitution & liquid crystalline behavior. Molecular ordering in liquid crystals- Nematic, Smectic and Cholesteric liquid crystals - Applications.

Composite materials: Concept, composition, and characteristic properties of composites. Classification of composites based on matrix, reinforcement, and ply. Advantages and applications of composites. **Green Chemistry:** Concept, Principles of Green Chemistry with Examples.

Text Book:

1.PC Jain, M Jain Engineering Chemistry, Dhanapathi Rai and sons (16th edition), New Delhi

Reference Books:

1. Sashi Chawla, Textbook of Engineering Chemistry, Dhanapathi Rai &sons, New Delhi.
2. O.G. Palanna, Engineering Chemistry, TMH Edition.
3. Puri, Sharma and Pathania Principles of physical chemistry, Vishal Publishing Co.
4. Polymer chemistry by Gowariker.
5. Fundamentals of Molecular Spectroscopy, by C.N. Banwell, McGraw Hill Publication.
6. Fundamentals of Spectroscopy by Y. R. Sharma.
7. Shikha Agarwal, Engineering Chemistry fundamentals and applications, Cambridge University press.

Course Code	Course Title						Core/Elective
U22ESN02CS	**Problem Solving using Python Programming**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

The objectives of this course is to impart knowledge of

- Enabling students to Learn basic fundamentals of python.
- To improve logical skills by working with control statements, mathematical functions.
- To learn about modular programming through functions and recursive programs.
- To handle logical, syntax errors and define custom errors as per real world problems enabling students to learn python built-in modules.

Course Outcomes:

After completing this course. the student will be able to:

- Implement basic syntax, semantics in python and improve logical skills
- Formulate mathematical computations. store data using strings, collection types
- Perform modular programming using functions and recursion
- Apply basic data structures of python to solve problems
- Handle and define multiple exceptions logically, syntactically and also able to access files.

UNIT-I

Basics of Python Programming : Features of Python, Writing and Executing First Python Program, Literal Constants : Numbers, Strings, Variables and Identifiers Data Types: Assigning or Initializing Values to Variables, Multiple Assignment, Multiple Statements on a Single Line, Boolean Input Operation, Comments, Reserved Words, Indentation, Operators and Expressions: Arithmetic Operators, Comparison Operators, Assignment and In-place or Shortcut Operators, Unary Operators Bitwise Operators, Shift Operators, Logical Operators, Membership Operators, Identity Operators, Operators Precedence and Associativity, Expressions in Python, Operations on Strings, Concatenation, Multiplication (or String Repetition), Slice a String, Other Data Types: Tuples Lists, Dictionary, Type Conversion .

UNIT-II

Decision Control Statements: Introduction to Decision Control Statements, Selection/Conditional/Branching Statements: if Statement, if-else Statement, Nested if Statements, if-elif-else Statement .Basic Loop Structures/ Iterative Statements: while loop, for Loop, Selecting an appropriate loop. Nested Loops, The break Statement, The continue Statement, The pass Statement, The else Statement used with Loops.

Strings: Introduction, Concatenating, Appending, and Multiplying Strings, Strings are Immutable, String Formatting Operator, Built-in String Methods and Functions, Slice Operation, Specifying Stride While Slicing Strings, () and chr() Functions, in and not in operators, Comparing Strings, Iterating String, The String Module, Regular Expressions, The match() Function, The search() Function, The sub() Function .

UNIT-III

Functions and Modules: Introduction, Need for Functions, Function Definition, Function Call, Function Parameters, Variable Scope and Lifetime, Local and Global Variables, Using the Global Statement, Resolution of Names, The return statement, More on Defining Functions, Required Arguments, Keyword Arguments Default Arguments, Variable -length Arguments, Lambda Functions or Anonymous Functions, Recursive Functions, Greatest Common Divisor, Finding Exponents, The Fibonacci Series, Recursion vs Iteration.

Modules: The from…import statement, Name of Module, Making your own Modules, The dir() function, The Python Module, Modules and Namespaces, Packages in Python, Standard Library modules.

UNIT-IV

Data Structures in python: Sequence, Lists Access Values in Lists, Updating Values in Lists, Nested Lists, Cloning Lists, Basic List Operations , List Methods, List Comprehensions, Looping in Lists, Functional Programming: filter() Function, map() Function, reduce() Function Tuple: Creating Tuple, Utility of Tuples, Accessing Values in a Tuple, Updating Tuple Deleting Elements in Tuple, Basic Tuple Operations, Tuple Assignment, Tuples for Returning Multiple Values, Nested Tuples, Checking the Index: index() method, Counting the Elements: count() Method, List Comprehension and Tuples, Variable-length Argument Tuples, The zip() Function, Advantages of Tuple over List

Sets: Creating a Set, Comparing Sets, Mathematical Set Operations, Mutable Set Operators and Methods, Set Comprehensions

Dictionaries: Creating a Dictionary, Accessing Values, Adding and Modifying an Item in a Dictionary, Modifying an Entry, Deleting Items, Sorting Items in a Dictionary, Looping over a Dictionary, Nested Dictionaries, Built-in Dictionary Functions and Methods

UNIT-V

File Handling: Introduction, File Path, Types of Files, Opening and Closing Files, Reading and Writing Files, File Positions, Renaming and Deleting Files, Directory Methods, Methods from the os Module.

Error and Exception Handling: Introduction to Errors and Exceptions , Handling Exceptions, Multiple Except Blocks, Multiple Exceptions in a Single Block, Except Block Without Exception , The else Clause, Raising Exceptions , Instantiating Exceptions, Handling Exceptions in Invoked Functions, Built-in Exceptions, user-defined exceptions, re-raising exceptions, The finally Block, Assertions in Python

Text Book:

1. Reema Thareja,"Python programming using problem solving approach ", Oxford university press.

References Books:

1. Mark Summerfield, "Programming in Python 3:A Complete Introduction to the Python Language",2nd edition, Addison-Wesley.
2. Martin C. Brown," PYTHON: The Complete Reference", McGraw-Hill, 2001.
3. E Balagurusamy,"Introduction to Computing and Problem Solving Using Python", McGrawHill.

Course Code	Course Title						Core/Elective
U22ESN01EC	**Basic Electronics and Sensors**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Engineering Physics	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

The objectives of this course is to impart knowledge of

- Understand the characteristics of PN diode, zener diode, and illustrate their applications as rectifier and regulator.
- Understand the construction and characteristics of transistors (BJT & FET) and analyze small signal model of CE amplifier
- Classify negative feedback amplifiers, oscillators and analyze their parameters.
- Understand the working of different transducers and their applications.
- Study of sensors and Data acquisition systems.

Course Outcomes :

1. Illustrate the applications of PN and Zener diode.
2. Explain the structure and working of BST & FET and analyze their characteristics.
3. Classify Feedback Amplifiers & Oscillator circuits.
4. Demonstrate the applications of Transducers.
5. Classify sensors and demonstrate their applications.

UNIT- I

PN Junction Diode: Formation, characteristics and application. Rectifiers: types of rectifiers, ripple factor, efficiency, PIV, TUF of half wave rectifier and full wave center tapped rectifier, comparison of rectifiers. Filters (Qualitative treatment only): Types of filters and circuits. Zener diode: Construction, characteristics, application as regulator.

UNIT -II

Transistor: BIT (N-P-N) construction, working, biasing, modes (regions) of operation, characteristics of CE configuration, BIT as an amplifier (CE), Exact and approximate h-parameter model, analysis of CE amplifier using approximate h-parameter models, comparison of (CB,CE, CC) configurations. **FET:** (Qualitative treatment only) (N-Channel) JFET construction, working, V-I characteristics, parameters, comparison with BJ.

UNIT -III

Feedback (Qualitative treatment only): Concept, block diagram, types, comparison, negative feedback, advantages, Topologies of four negative feedback amplifier. **Oscillators:** (Qualitative treatment only) RC phase shift, Hartley, Colpitts and Crystal oscillator.

UNIT -IV

Transducers: Definition, classification, requirements. Construction and operation of strain guage, LVDT and capacitive transducers lo mcasure force. **Temperature Transducers:** Resistance Thermometers, Themistor, Thermo couple.

UNIT-V

Sensors: Definition, Characteristics of Sensors, Light Sensors: Photo Diode, LDR, LED, LCD.
Data Acquisition System: Block Diagram, R-2R Ladder DAC, Successive approximation ADC.

Text Books:

1. S.Salivahanan, N.Suresh Kumar, Electronic Devices and Circuits, McGraw Hill Education, 4 edition.
2. D. Patranabis, Sensors and Transducers, PHI 2nd Edition 2013.

References:

1. Millman and Halkias, "Integrated electronics" - Tata Mcgraw-hill.
2. Robert Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 11th ed., Pearson India Publications, 2015.

Course Code	Course Title						Core/Elective
U21HSN02EG	**Elective Technical Communication in English**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	**2**

Course Objectives:

To facilitate the students to learn the:

- Features of Technical Communication
- Aspects of data interpretation with the help of visual aids
- Types of Official Correspondence/IOC
- Types of Professional Correspondence
- Techniques of Report Writing

Course Outcomes

On successful completion of the course, the students will be able to:

1. Handle technical communication effectively
2. Enhance their skills of information transfer using variety of visual aids
3. Use different types of Inter Office Correspondence
4. Use different types of Professional correspondence to communicate effectively
5. Use various techniques of writing to generate different types of Reports

Unit-I

Introduction to Communication: General & Technical

- Differences between General and Technical writing
- Communication: Process, Flow/Channels of communication and Barriers to Communication
- Technical Communication: Types & Features - Accuracy, Precision, Brevity, Clarity, Format, Layout, Style & Use of Visual aids

Unit- II

Technical Writing I - Information Transfer

- Information Transfer - Introduction & Types
- Verbal to Non-verbal
- Non-verbal to Verbal
- Use of Graphic Organizers: Significance & Classification in Data Interpretation,

Unit -III

Technical Writing II - Inter Office Correspondence

- Introduction of various types of correspondence: Layout, Style & Etiquette
- Emails
- Circulars, Agendas, Minutes of Meetings, Memos

Unit -IV

Technical Writing III- Correspondence through Letters

- Letters for specific purposes - Enquiry & Response, Sales - Placement of Orders- Claim Letters, Cover letters / Job Applications, CV & Resume Writing

Unit-V

Technical Writing IV- Report Writing

- Introduction to Report Writing: Formal elements of a Report
- Feasibility report
- Progress report
- Project report

Suggested Reading:

1. Raman, Meenakshi & Sharma, Sangeeta. (2015). Technical Communication: Principles and Practice (3d ed.). New Delhi, OUP.
2. Rizvi, Ashraf, M. (2017). Effective Technical Communication (2~ ed.). New Delhi, Tata McGraw Hill Education.
3. Sharma, R.C., & Mohan, Krishna. (2017.) Business Correspondence & Report Writing: A practical approach to business & technical Communication (4° ed.). New Delhi, Tata McGraw Hill Education.
4. Tyagi, Kavita &Misra, Padma. (2011). Advanced Technical Communication. New Delhi, PHI Leaning.
5. Jungk, Dale. (2004). Applied writing for technicians. New York, McGraw-Hill Higher Education.
6. Munter, Mary. (2011). Guide to Managerial Communication: Effective Business Writing and Speaking. New Delhi, Pearson.
7. Andrea J. Rutherford (2006) *Basic Communication Skills for Technology*. 2nd Edition, Chennai, Pearson Publications.
8. Geraldine E. Hynes. (2010), *Managerial Communications-Strategies and Applications*. New York, McGraw Hill.
9. Terry O' Brien. (2012) *Little Red Books – Modern Writing Skills*. Hyderabad, Rupa Publications.
10. Martin Cutts. (2013) *Oxford Guide to Plain English*. New Delhi, OUP.

Practical/ Laboratory Courses

Course Code	Course Title						Core/Elective
U21BSN81CH	**Chemistry Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**4**	**25**	**50**	**2**

Course Objectives

During the course the student is expected to

- Introduce practical applications of chemistry concepts to solve engineering problems.
- Measure the molecular or ionic properties such as conductance, redox potentials.
- To determine the rate constant of reactions from concentrations as a function of time.
- Know the laboratory practices implemented in a research and industrial chemistry laboratory setting.
- To learn to synthesize polymers.

Course Outcomes

After completing this course, the student will be able to:

- Estimate the hardness of the water sample.
- Apply the principles of Electrochemistry & Colorimetry in quantitative estimations.
- Measure the properties of liquids such as surface tension and Viscosity.
- Estimate the rate constants of reactions from concentration of reactants/ products as a function of time.
- Synthesize Polymer.

List of experiments:

1. Estimation of Fe (II) by Permanganometry.
2. Estimation of Fe (II) by Dichrometry.
3. Estimation of Hardness of water by EDTA Method.
4. Estimation of HCI by Potentiometry.
5. Potentiometric estimation of Iron Fe (II) by Permanganometry.
6. Estimation of HCI by Conductometry.
7. Estimation of CH3COOH by Conductometry.
8. Estimation of HCl & CH_3COOH in mixture by Conductometry.
9. Estimation of HCI by pH metry.
10. Verification of Beer-Lamberts Law AND estimation of Manganese in $KMnO_4$ by Colorimetry.
11. Determination of Viscocity of Liquids using Oswald's viscometer.
12. Determine of surface tension by using Stalagmometer.
13. Synthesis of nylon 6,6.
14. Determination of rate constant of acid catalyzed hydrolysis of methyl acetate.
15. Determination of Partition Coefficient of CH3COOH in n-Butanol and Water.

Text books:

1. Vogel's text book of Practical organic chemistry, 5thEdition.

Reference Books:

1. Senior Practical Physical Chemistry, B. D. Khosala. A. Gulati and V. Garg (R. Chand &Co.,Delhi).
2. Text book on experiments and Calculations in Engineering Chemistry-S.S. Dara.
3. An introduction to practical chemistry, K.K. Sharma and D.S. Sharma (Vikas Publications, NewDelhi).
4. Laboratory manual on Engineering Chemstry,S.K.Bhasin& Sudha Rani(Dhanpat Rai Publishing Company).

Course Code	Course Title						Core/Elective
U22ESN82CS	**Problem Solving using Python Programming Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**2**	**25**	**50**	**1**

Course Objectives

The objectives of this course is to impart knowledge of

- Enabling students to learn basic fundamentals of python
- To improve logical skills by working with control statements, mathematical functions
- To learn about modular programming through functions and recursive programs
- To handle logical, syntax errors and define custom errors as per real world problems
- Enabling students to learn python built-in modules

Course Outcomes

After completing this course, the student will be able to:

1. Implement basic syntax, semantics in python and improve logical skills.
2. Formulate mathematical computations, store data using strings, collection types.
3. Perform modular programming using functions and recursion.
4. Handle and define multiple exceptions logically, syntactically and also able to access files.
5. Implement built-in modules in various domains like big data, machine learning.

List of Experiments

1. Demonstrate the following Operators in Python with suitable examples. i) Arithmetic Operators it) Relational Operators in) Assignment Operator iv) Logical Operators) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators
2. Company decides to give bonus to all its employees on Diwali. a 5% bonus on salary is given to the male workers and 10% bonus on salary to the female workers. Write a program to enter the salary and gender of the employee. If the salary of the employee is less than Rs..10000, then the employee gets an extra 2% bonus on salary. Calculate the bonus that has to be given to the employee and display the salary that the employee will get.
3. Write a program to calculate the roots of quadratic equation.
4. Write a program to enter a decimal number. Calculate and display the binary equivalent of this number.
5. Read x, y and print all prime numbers between x and y where x<=y.
6. Write a program to check whether the given number is an "amicable" numbers/ Armstrong number/Strong number.
7. Write a program using a for loop to calculate the value of an investment. Input an initial value of investment and annual interest, and calculate the value of investment over time.
8. a) Demonstrate the different ways of creating list objects with suitable example programs.
    a. Demonstrate the following functions/methods which operates on lists in Python with suitable examples: i) list( ) ii) len( ) iii) count( ) iv) index( ) v)append( ) vi) insert( ) vii) extend( ) viii)remove( ) ix)pop( ) x)reverse( ) xi)sort( ) xii)copy( ) xili) clear( )

b. Demonstrate the following with suitable example programs: List slicing

i) Demonstrate the different ways of creating tuple objects with suitable

9. a) Demonstrate the different ways of creating tuple objects with suitable example programs
   b) Demonstrate the following functions/methods which operates on tuples in Python with suitable examples: i) len( ) ii)count( ) iii)index( ) iv) sorted( ) v)min( ) vi) max( ) vii)cmp() viii) reversed()
10. a) Demonstrate the different ways of creating set objects with suitable example programs.
    b) Demonstrate the following functions/methods which operates on sets in Python with suitable examples: i) add() ii) update() iii) copy() iv) pop() v) remove() vi)discard() vii) clear() viii) union() ix) intersection() x) difference()
11. a) Demonstrate the different ways of creating dictionary objects with suitable example programs.
    b) Demonstrate the following functions/methods which operates on dictionary in Python with suitable examples: i) dict () ii) len() iii) clear() iv) get() v)pop() vi) popitem () vii) keys() viii) values() ix) items() x) copy() xi) update()
12. a) Write a Python program to demonstrate various ways of accessing the string.
    i) By using Indexing (Both Positive and Negative) ii) By using Slice Operator
    b) Demonstrate the following functions/methods which operates on strings in Python with suitable examples: i) len() ii) strip() iii) rstrip() iv)Istrip() v) find() vi) rfind() vii) index()viii)rindex() ix) count() x) replace() xi)split() xii) join() xiii) upper() xiv) lower() xv) swapcase() xvi) title() xvii) capitalize() xviii) starts with() xix) endswith()
13. Write a program that counts the occurrences of a character in a string. Do not use built-in count functions.
14. Write a program that creates a list of 10 random integers. Then create two lists - Odd List and Even List that has all odd and even values in the list respectively.
15. Write a program that generates a set of prime numbers and another set of odd numbers. Demonstrate the result of union, intersection, difference, and symmetric difference operations on these sets.
16. Write a program that creates a dictionary of radius of a circle and its circumference
17. Compute a Polynomial Equation given that the Coefficients of the Polynomial are stored in a List.
18. Search the Number of Times a Particular Number Occurs in a List.
19. Read a List of Words and Return the Length of the Longest One.
20. Remove the ith Occurrence of the Given Word in a List where Words can repeat.
21. Count the number of alphabets, consonants, vowels, digits, special characters in a sentence.
22. Store some elements in the dictionary and remove a given key from the dictionary.
23. To display which Letters are in the First String but not in the Second.
24. Write a function to compute ged, factorial, Fibonacci series.
25. Write a recursive function to compute ged, factorial, and Fibonacci series.
26. Demonstrate on predefined multiple exceptions.
27. Demonstrate on custom exceptions.
28. Read the Contents of a File in Reverse Order.
29. Read the csv file to print the statistical summary of each attribute and visualize the data.
30. Write a Numpy program to compute sum of all elements, sum of each column and sum of each row of a given array.

Text Book:

1. Reema Thareja,*"Python programming using problem solving approach ",* Oxford university press.

Reference Books*:*

1. Mark Summerfield, "*Programming in Python 3:A Complete Introduction to the Python Language"*,2nd edition, Addison-Wesley
2. Martin C. Brown,*" PYTHON: The Complete Reference",* McGraw-Hill, 2001.
3. E Balagurusamy,"*Introduction to Computing and Problem Solving Using Python"*, McGrawHil

Course Code	Course Title						Core/Elective
U22ESN81EC	**Basic Electronics and Sensors Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Physics Lab	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives:

- Understand characteristics of Diode
- Study the Transistor Configurations
- Study the characteristics of FET
- Understand the concepts of oscillators
- Study the characteristics of Sensors.

Course Outcomes:

- Analyze diode circuits & application
- Analyze the characteristics of BJTs & FETs
- Understand the R and LC oscillator circuits and calculate the frequency of oscillation
- Understand the characteristics of various sensors

List of Experiments:

1. CRO Applications, Measurements of R. L and C using LCR meter
2. Characteristics of Semiconductor Diodes (Si, Ge and Zener)
3. Half wave and Full-Wave Rectifiers
4. Zener diode as a voltage regulator
5. Static Characteristics of BJT- Common emitter configuration
6. Static Characteristics of FET
7. Study of CE Amplifier
8. RC- Phase Shift Oscillator
9. Hartley and Colpitts Oscillator
10. Characterize the temperature sensor (Thermistor)
11. Study the characteristics of Photo Diode.

* Note: Minimun of 8 experiments to be done.

Course Code	Course Title						Core/Elective
U21ESN82CE	**Engineering Drawing Practice**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	**2**	-	**25**	**50**	**1**

Course Objectives

The objectives of this course is to impart knowledge

- To make students communicate effectively through a common drawing language and understand any engineering drawing.
- To prepare the students to use techniques, skills and modern engineering tools necessary for engineering practice.
- To prepare students to design a system, component and any desired requirement through computer drafting.
- To enhance the imaginative skills of a student and thereby making them creative.

Course Outcomes

After completing this course, students will be able to:

1. Understand engineering drawing and its place in society.
2. Expose virtual aspects of engineering drawing practice.
3. Recognize modern technical tools of engineering drawing like AUTOCAD and apply in different fields of engineering.
4. Think creatively in getting alternative options to practical problems to engineering.
5. Communicate technical aspects through engineering drawing.

Sheet No	Description of the Topic	Contact Hours Drawing
1	Introduction to Engineering Drawing - Principles of Engineering Drawing and their Significance Introduction to AutoCAD - Basic commands and simple drawings	2
2	Construction of Scales - Types of scales and Construction of plain scale	2
3	Conic Sections - Construction of ellipse, parabola and hyperbola by general method and any special method	2+2
4	Concept of Quadrant System - Understand the quadrant system with the help of points and lines	2+2
5	Projection of Planes - Simple positions and plane inclined to single plane	2+2
6	Projection of Solids - Simple positions and plane inclined to single plane	2+2
7	Isometric Drawing - Simple planes and solidsin isometric views (Combination ofSolids)	2+2
8	Orthographic Projections - Conversion of geometric figures and drawings fromisometric view to orthographic view	2+2

Text Books:

1. N.D. Bhatt, V. M Panchal & P. R. Ingle , "Engineering Drawing", Charotar Publishing House, 2014
2. M. B. Shah, & B. C. Rana , "Engineering Drawing and Computer Graphics", Pearson Education, 2008
3. S. N. Lal, "Engineering Drawing with Introduction to Auto CAD", Cengage Learning India Pvt Lid, New Delhi, 2018.
4. B. Agrawal & C. M. Agrawal, "Engineering Graphics", TMH Publication, 2012
5. K. L. Narayana, & P Kannaiah, "Text book on Engineering Drawing", Scitech Publishers, 2008.
6. Corresponding set of CAD Software Theory and User Manuals

NOTE:

1. At least 6 sheets must be drawn.
2. Sheet number 1 to 3 (Graph sheets / drawing sheets)
3. Sheet number 4 to 8 (AutoCAD drawings)

Course Code	Course Title						Core/Elective
U23BSN81MT	**Computational Mathematics Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**2**	**25**	**50**	**1**

Course Objectives

During the course the student is expected to

- To Know the history and features of Math tools like SCILAB/MATLAB
- To Know the local environment of MATLAB/SCILAB
- To study the concept of definite integrals, differential equations and system of equations using MATLAB/SCI LAB.
- To study the concept of Eigenvalues and Eigenvectors using MATLAB/SCI LAB.
- To study simple mathematical functions using 2D and 3D plots.

Course Outcomes

After completing this course, the student will be able to:

1. Understand the main features of the MATLAB/SCILAB program development environment to enable their usage in higher learning.
2. Evaluate definite integrals using MATLAB/SCI LAB.
3. Solve linear differential equations with constant coefficients using MATLAB/SCI LAB.
4. Solve a system of linear equations using MATLAB/SCI LAB.
5. Find Eigenvalues and Eigenvectors using MATLAB/SCILAB.
6. Interpret and visualize simple mathematical functions using 2D and 3D plots.

List of Programs:

1. Introduction to MATLAB and GUI
2. Basic operators of MATLAB/ SCI LAB
3. Finding roots of algebraic equations.
4. Determinant of matrices.
5. Rank of a matrix
6. Solving systems of linear equations using matrices.
7. Eigenvalues.
8. Eigenvectors.
9. Solution of first order linear differential equations.
10. Solution of second order linear homogeneous differential equation with constant coefficients.
11. Evaluating definite integrals
12. Data plotting for 2D and 3D

B.E. (Computer Science and Information Technology) III - SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/ week	CIE	SEE	Duration of SEE (Hrs.)	
Theory Courses										
1	U21ES301CS	Logic and Switching Theory	3	-	-	3	30	70	3	3
2	U21PC301CS	Database Management Systems	3	-	-	3	30	70	3	3
3	U21PC303CS	Discrete Mathematics	2	1	-	3	30	70	3	3
4	U21PC304CS	Data Structures and Algorithms Using 'C'	3	-	-	3	30	70	3	3
5	U21PCN01CS	Object Oriented Programming using JAVA	3	-	-	3	30	70	3	3
6	U21MCN01CE	Environmental Science	2	-	-	2	30	70	3	-
Practical/ Laboratory Courses										
7	U21PC381CT	Database Management Systems Lab	-	-	4	4	25	50	3	2
8	U21PC384CS	Data Structures and Algorithms using 'C' Lab	-	-	4	4	25	50	3	2
9	U21PCN81CS	Object Oriented Programming Using JAVA Lab	-	-	4	4	25	50	3	2
		Total	**16**	**1**	**12**	**29**	**255**	**570**	**-**	**21**

Course Code	Course Title						Core/Elective
U21ES301CS	**Logic and Switching Theory**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Boolean Algebra	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. Discuss number systems, conversions, Complement arithmetic, Boolean algebra and logic gates.
2. Minimization of logic functions using K-map and Tabular method.
3. Discuss about design and analysis of combinational logic circuits.
4. Discuss about design and analysis of Sequential logic circuits.
5. Explain various Programmable Logic Devices.

Course Outcome:

Upon completion of the course, student will be able to

1. Manipulate numeric information in different forms
2. Minimize Boolean expressions using the theorems , Map and Tabular methods
3. Design and analyse combinational circuits
4. Design and analyse sequential circuits
5. Design PLD

UNIT -I

Number System and Boolean Algebra: Number Systems Decimal, Binary, Octal, Hexa-decimal, Base Conversion Methods, Complements of Numbers, Signed Binary Numbers, Codes- Binary Codes, Binary Coded Decimal Code (BCD) Unit Distance Codes, Parity Codes. Basic Logic Gates (AND, NAND, OR, NOR, EX-OR, EX-NOR), Properties of XOR Gates, Universal Gates, Basic Theorems and Properties of Boolean algebra, Boolean Functions, Canonical and Standard Forms, Min-terms and Max-terms,

UNIT -II

Minimization Techniques: Introduction, The minimization with theorems , The Karnaugh Map Method, Three, Four and Five variable K- Maps, Prime and Essential Implications, Don't Care Map Entries, Using the Maps for Simplifying, Quine-McCluskey Method, Don't Care entries , AND-OR, OR-AND and NAND/NOR Realizations, Exclusive-OR and Equivalence Functions.

UNIT -III

Combinational Circuits: Design with basic logic gates, Single Output and Multiple Output Combinational Logic Circuit Design, Analysis of combinational circuits, Design Procedure – Half Adder, Full Adder, Half Subtractor, Full Subtractor, Parallel Binary Adder, Parallel binary subtractor, Binary Multiplier, Multiplexers, De-Multiplexers, decoder, Encoder, Code Converters, Magnitude Comparator.

UNIT -IV

Sequential Circuits: Introduction, Memory element, S-R, J-K and D Latch operation, Race around condition, Master Slave J-K Flip Flop, Flip-Flop types: S-R, J-K, D, T, State table, State diagram, Characteristic equation and excitation table, Flip flop conversions, Analysis of sequential circuits.

Sequential Logic Design: Design of sequential circuits, Counters - Asynchronous and Synchronous, Registers.

UNIT -V

Programmable Logic Devices (PLDs): General structure of a Programmable Array Logic (PAL), Programmable Logic Arrays (PLAs), Programmable Read only Memory (PROM), Structure of CPLDs and FPGAs, 2-input and 3-input lookup tables (LUT).

Finite State machine (FSM) representation using Moore and Mealy state models - Sequence Detector.

Text Books:

1. Digital Design- Morris Mano, PHI, 3rd Edition.
2. Switching Theory and Logic Design- A. Anand Kumar, PHI, 2nd Edition.
3. Switching and Finite Automata Theory- Zvi Kohavi & Niraj K. Jha, 3rd Edition, Cambridge.

Reference Books:

1. Ronald J.Tocci, Neal S. Widmer &Gregory L.Moss, "Digital Systems: Principles and Applications," PHI, 10/e, 2009.
2. Digital Fundamentals – A Systems Approach – Thomas L. Floyd, Pearson, 2013.
3. Fundamentals of Logic Design- Charles H. Roth, Cengage LEanring, 5th, Edition, 2004.
4. Digital Logic Applications and Design- John M. Yarbrough, Thomson Publications, 2006.
5. Digital Logic and State Machine Design – Comer, 3rd, Oxford, 2013.

Course Code	Course Title						Core/Elective
U21PC301CS	**Database Management Systems**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. To Learn mathematical concepts as applied in computer
2. To introduce three scheme architecture and DBMS functional components.
3. To learn formal and commercial query languages of RDBMS
4. To Study different file organization and indexing techniques.
5. To familiarize theory of serializablity and implementation of concurrency control, and Recovery

Course Outcomes:

Upon completion of the course, student will be able to

1. Understand the mathematical foundations on which RDBMS are built.
2. Model a set of requirements using the Extended Entity Relationship Model (EER), transform an EER model into a relational model and refine the relational model using theory of normalization.
3. Use the knowledge of file organization and indexing to improve database application performance.
4. Understand the working of concurrency control and recovery mechanisms in RDBMS.
5. Compare and contrast RDBMS with NoSQL databases.

UNIT-I

Introduction: Database System Application, Purpose of Database Systems, View of Data, Database Language, Relational Databases, Database Design, Object-Based and Semi-Structured Databases, Data Storages and Querying , Transaction Management, Data Mining and Analysis, Database Architecture, Database Users and Administrators.

Database Design and the E-R Model: Overview of the Design Process, The Entity Relationship Model Constraints, Entity-Relationship Design issues, Weak Entity Sets Extended E-R Features Database Design for banking Enterprise, Reduction to Relational Schemas, Other Aspects of Database Design.

UNIT-II

Relational Model: Structure of Relational Databases, Fundamental Relational-Algebra Operations, Additional Relational-Algebra Operations, Extended Relational-Algebra Operations, Null Values, Modification of the Databases.

Relational Database Design: Features of Good Relational Design, Atomic Domains and First Normal Form, Functional Dependency Theory, Decomposition using Functional Dependencies.

UNIT-III

Indexing and Hashing: Basic Concepts, Ordered Indices, B+-tree index files, B-tree index files, multiple key access, static hashing, dynamic hashing, comparison of ordered indexing and hashing bitmap indices.

UNIT-IV

Transactions: Transaction concepts, transaction state, implementation of atomicity and durability, concurrent executions, serializability, recoverability, implementation of isolation, testing for serializability.

Concurrency Control: Lock based protocols, timestamp based protocols, and validation based protocols, multiple granularity, multi version schemes, deadlock handling, insert and delete operations, weak levels of consistency, concurrency of index structures.

UNIT-V

Recovery system: Failure classification, storage structure, recovery and atomicity, log-based recovery, recovery with concurrent transactions, buffer management, failure with loss of non-volatile storage, advanced recovery techniques, remote backup systems.

Introduction, Overview, and History of NoSQL Databases – The Definition of the Four Types of NoSQL Databases. Comparison of relational databases to NoSQL

Text Books:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, Database System Concepts, McGraw-Hill, 6th Edition, 2010
2. Ramakrishnan, Gehrke, Database Management Systems, McGraw-Hill, 3rd Edition, 2003

Reference Books:

1. Elmasri, Navathe, Somayajulu, Fundamentals of Database Systems, Pearson Education, 4th Edition, 2004.
2. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications,1st Edition ,2019.

Course Code	Course Title						Core/Elective
U21PC303CS	**Discrete Mathematics**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**1**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. To learn logical notations to define and reason about fundamental mathematical concepts such as sets, relations, functions and Induction.
2. To model relationships, analyze data, apply probability concepts and use functions to solve problems.
3. Understand random and discrete variables.
4. To formulate problems and solve generating functions and recurrence relations
5. To model and solve problems using graphs and trees.

Course Outcomes:

After completing this course, the student will be able to:

1. Apply Propositional and Predicate logic for a variety of problems in various domains.
2. To distinguish random and discrete variables and compute expected value and variance.
3. Formulate recurrence relations for a sequence and solve first order and second order recurrence relations by finding the corresponding generating functions.
4. To understand the properties implied by the definitions of algebraic system and demonstrate examples of groups, subgroups, homomorphism.
5. Develop the given problem as a graph network and solve with the techniques of graph theory.

UNIT-I

Logic and Set theory – Logic, Propositional equivalences – Predicates and quantifiers – Nested Quantifiers-Sets-Set Operations, Venn diagrams.

Mathematical Reasoning- Mathematical Induction, Recursive Definitions, The Fundamental Theorem of Arithmetic.

Relations and Functions: Relations & their Properties, Representing relations – Closures, equivalence relations, partial orderings, Types of functions-bijective, inverse and composite functions.

UNIT -II

Counting Techniques: Principle of Inclusion and Exclusion, Pigeonhole principle, Binomial coefficients, Permutations and Combinations, Derangements.

Discrete Probability: An Introduction to Discrete Probability theory, Expected Value and Variance.

UNIT -III

Generating Functions: Introduction, Definitions and examples**,** Exponential Generating function.

Recurrence relations – Solving First-order and second order linear Recurrence Relations, Recurrence relations with constant coefficients, Divide and conquer relations.

UNIT -IV

Algebraic Structures: Algebraic System, Properties, Semi-groups, groups, monoids, homomorphism, isomorphism, Group codes and their applications.

UNIT-V

Graph Theory: Graphs and their Properties, Degree, Connectivity, Path, Cycle, Isomorphism, Hamiltonian graphs, Euler and Planar graphs, Graph coloring, Chromatic number.

Trees: Definitions, Properties and Examples, Rooted Trees, Spanning Trees, Minimum Spanning Trees.

Text Books:

1. Kenneth H. Rosen – Discrete Mathematics and its Application – 5th Edition, McGraw Hill, 2003
2. Joel. Mott. Abraham Kandel, T.P. Baker, Discrete Mathematics for Computer Scientist & Mathematicians, Prentice Hail N.J., 2nd Edition, 1986.

Reference Books:

1. Ralph P. Grimaldi , B. V. Ramana -Discrete and Combinatorial Mathematics : An Applied Introduction-5th Edition.
2. J.P. Tremblay, R. Manohar, Discrete Mathematical Structure with Application to Computer Science, McGraw Hill – 1997.
3. J. K. Sharma, Discrete Mathematics, Second Edition, Macmillan, 2005.

Course Code	Course Title						Core/Elective
U21PC304CS	**Data Structures and Algorithms Using 'C'**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

1. To teach efficient storage mechanisms of data for an easy access.
2. To design and implement of various basic and advanced data structures.
3. To solve real world problems with the help of fundamental data structures.
4. To understand concepts about searching and sorting techniques.
5. To Understand basic concepts about Linear and Non-linear data structures.

Course Outcomes

After completing this course, the student will be able to:

1. Choose appropriate data structure for a specific problem definition.
2. Handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.
3. Apply concepts learned in various domains like DBMS, compiler construction etc.
4. Use linear and non-linear data structures like stacks, queues, linked list.
5. Write the programs using data structures in C

UNIT-I

Enumerated, Structure ,and Union Types in C – The Type Definition (typedef), Enumerated types, Structures –Declaration, initialization, accessing structures, operations on structures, Complex structures, structures and functions, Passing structures through pointers, self-referential structures, unions, bit fields, C programming examples. Data Structures – Introduction to Data Structures, abstract data types. Definition of Linear and Non-linear data structures.

UNIT-II

Stacks: Definition, operations, array implementation in C. Stack Applications: Factorial Calculation, Infix to postfix Transformation, Evaluating Arithmetic Expressions.

Queues: **Definition and operations, array implementation in C, Dequeue (Double ended queue)** Circular Queues, Applications of Queues.

UNIT-III

Linear list – Singly linked list implementation, insertion, deletion and searching operations on linear list, Circular Singly linked lists- Operations on Circularly Singly linked lists, Doubly linked list implementation, insertion, deletion and searching operations, applications of linked lists. Stacks and Queues implementation using linked list.

UNIT-IV

Trees – Definitions, tree representation, applications of trees , Binary tree representation, binary tree properties, binary tree traversals, Operations on Binary Trees(clone, delete, Mirror), Heaps, Binary search tree, Operations.

Balanced Search Trees: AVL tree Operations

UNIT-V

Graphs: Basic concepts, Representations of Graphs: using Linked list and adjacency matrix, Graph algorithms. Graph Traversals (BFS & DFS)

Searching Techniques: List Searches using Linear Search, Binary Search

Sorting Techniques: Basic concepts, insertion sort, heap sort, Selection sort

Hashing- Collision Resolution Techniques.

Text Books:

1. Fundamentals of Data structures in C, 2nd Edition, E.Horowitz, S.Sahni and Susan Anderson Freed, Universities Press.
2. Data Structures using C. ReemaThareja , Oxford
3. Data Structures, 2/e, Richard F, Gilberg , Forouzan, Cengage

Reference Books:

1. Data structures and Algorithm Analysis in C, 2nd edition, M.A.Weiss, Pearson.
2. Data Structures using C, A.M.Tanenbaum, Y. Langsam, M.J.Augenstein, Pearson.
3. Data structures and Program Design in C, 2nd edition, R.Kruse, C.L.Tondo and B.Leung,Pearson
4. Data structures A Programming Approach with C, D.S.Kushwaha and A.K.Misra, PHI.
5. Data Structure with C, Seymour Lipschutz, TMH

Course Code	Course Title						Core/Elective
U21PCN01CS	**Object Oriented Programming using Java**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. To understand fundamentals of object-oriented programming in Java which includes defining classes, invoking methods, difference between applet and application programs, using class libraries
2. To create Java application programs using sound OOP practices such as interfaces, exception handling, multithreading.
3. Explore I/O, language and other packages.
4. Use Collection framework, AWT and event handling to solve real world problems.
5. Exploring JDBC package to create database centric applications.

Course Outcomes:

After completing this course, the student will be able to:

1. Identify classes, objects, members of a class and the relationships needed to solve a problem.
2. Use interfaces and creating user-defined packages.
3. Utilize exception handling and Multithreading concepts to develop Java programs.
4. Compose programs using the Java Collection API.
5. Design a GUI using GUI components with the integration of event handling along with Database.
6. Create files and read from computer files.

UNIT-I

Introduction: OOP concepts, history of Java, Java buzzwords, data types, variables, scope and lifetime of variables, operators, expressions, control statements, type conversion and casting, simple java programs.

Classes and Objects: Concept of classes, objects, constructors, methods, this keyword, super keyword, garbage collection, overloading methods and constructors, parameter passing, Arrays. String handling: String, String Buffer, String Builder

UNIT -II

Inheritance: Base class object, subclass, member access rules, super uses, using final with inheritance, method overriding, abstract classes.

Interfaces: Defining and implementing an interface, differences between classes and interfaces and extending interfaces, Polymorphism.

Packages: Defining, creating and accessing a package, importing packages.

UNIT –III

Exception handling: Concepts and benefits of exception handling, exception hierarchy, checked and unchecked exceptions, usage of-try, catch, throw, throws and finally, built in exceptions, creating User defined exceptions.

Multithreading: Difference between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads

UNIT –IV

Basic I/O Streams: Java I/O classes and interfaces, Files, Stream and Byte classes, Character streams, Serialization

Exploring java.lang: Object class, Wrapper classes

Exploring java.util: Scanner, StringTokenizer, Date

Collections framework: Overview, Collection interfaces: List, Set, Map Collection classes: ArrayList, LinkedList, HashSet, HashMap, Accessing Collection over Iterator, ListIterator.

UNIT –V

AWT & Event Handling: The AWT class hierarchy, user interface components - labels, buttons, canvas, scrollbars, text components, checkbox, checkbox groups, choices, lists. Events, event sources, event classes, event listeners, delegation event model, handling mouse and key board events, adapter classes.

Layout manager: Border, Grid, Flow, Card and Grid Bag layouts.

JDBC: Database Programming using JDBC: Introduction to JDBC, JDBC Drivers & Architecture, CRUD operation Using JDBC

Text Books:

1. Java The complete reference, 9th edition, Herbert Schildt, TMH.
2. Java Server Programming Java EE7 (J2EE 1.7): Black Book, (2014), Dreamtech Press

References:

1. Understanding OOP with Java, up dated edition, T. Budd, Pearson education.
2. Head First Java, 2nd Edition by Bert Bates, Kathy Sierra Publisher: O'Reilly Media, Inc.
3. An Introduction to programming and OO design using Java, J. Nino and F.A. Hosch, John Wiley & sons.
4. Database Programming with JDBC & Java, Second Edition, O'Reilly Media

Course Code	Course Title						Core/Elective
U21MCN01CE	**Environmental Science**						**Mandatory**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	-	-	-	**30**	**70**	-

Course Objectives:

1. To create awareness and impart basic knowledge about the environment and its allied problems.
2. To know the significance and functions of ecosystem.
3. To understand importance of biological diversity.
4. To study different forms of pollution and their impact on environment.
5. To know social and environment related issues and their preventive measures.

Course Outcomes:

After completing this course, students will be able to:

1. Develop an attitude of concern towards the environment.
2. Understand the importance of ecosystem.
3. Conservation of natural resources and biological diversity.
4. Develop knowledge on Environmental pollution and Environmental loss
5. Adopt environmental ethics to attain sustainable development

MODULE -I

The Multidisciplinary Nature of Environmental Studies: Definition, scope and importance, need for public awareness.

Natural Resources: Water Resources – Use and over utilization of surface and ground water, flood, drought, conflicts over water, Dams: Benefits and Problems. Food Resources–World Food Problems, effects of modern agriculture, fertilizer-pesticides problems, waterlogging, salinity, Forest Resources –Use and over exploitation, deforestation & its effect on tribal people. Land Resources–Land Degradation, soil erosion and desertification**.** Energy Resources –Growing energy needs, Renewable and Non-renewable energy resources.

MODULE -II

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in ecosystem, food chains, ecological pyramids, ecological succession, types of ecosystems (marine, pond, river, forest, grassland, desert)

MODULE -III

Biodiversity: Levels of Biodiversity, Bio-geographical classification of India, Value of biodiversity, Threats to biodiversity, endangered and endemic species of India, Conservation of biodiversity.

MODULE -IV

Environmental Pollution: Definition, Causes, effects and control measures of air pollution, water pollution, Soil pollution, noise pollution, thermal pollution, solid waste management

Environment Protection Act: Air, water, forest and wildlife Acts, issues in the enforcement of environmental legislation.

MODULE -V

Social Issues and the Environment: Watershed management and environmental ethics. Climate change, global warming, acid rain, ozone layer depletion.

Environmental Disaster Management: Types of disasters, impact of disasters on environment, infrastructure, and development. Disaster management cycle and disaster management in India.

Text books:

1. A.K.De, Environmental Chemistry, Wiley Eastern Ltd., 2016.
2. E.P.Odum, Fundamentals of Ecology, W.B. Sunders Co., USA, 2017
3. M.N. Rao and A.K.Datta, Waste Water Treatment, Oxford and IBK Publications, 2020
4. Benny Joseph, Environmental Studies, Tata McGraw Hill, 2005.
5. V.K.Sharma, Disaster Management, National Centre for Disaster Management, IIPE,1999.

Practical/ Laboratory Courses

Course Code	Course Title						Core/Elective
U21PC381CT	**Database Management Systems Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
PPS using C, OS, Data Structures	**-**	**-**	**-**	**4**	**25**	**50**	**2**

Course Objectives:

1. To identify entities and keys in E-R models from case studies.
2. Convert E-R models into relational models for database design.
3. To practice various DDL,DML commands in SQL.
4. To write simple and complex queries in SQL.
5. To familiarize working with PL/SQL.

Course Outcomes:

After completing this course, students will be able to:

1. Design ER and relational model for the given problem-domain
2. Declare and enforce integrity constraints on a database
3. Query a database using SQL DML / DDL
4. Implement procedures, Cursors and Triggers.
5. Familiarity with NoSQL Database using MongoDB

Week 1: E-R Model

Identifying Entities, attributes with different types of keys for a given case study.

Week 2: Conceptual design with E-R Model

Identify relationships appropriately and apply cardinalities for each relationship. Identify strong entities and weak entities (if any). Indicate the type of relationships (total / partial).

Week 3: Relational Model

Reduce E-R model designed in Week-2 into Relational model.

Week 4: Normalization

Apply Normalization concepts on the tables designed in week-3 so as to remove various anomalies.

Week 5: Installation of MySQL and practicing DDL commands

Week 6: Practicing DML commands

Week-7: Usage of Aggregate functions with group by and having.

Week 8: Querying: Usage of set operators and Creation and dropping of Views.

Week 9: Querying database using Sub Queries and Joins

Week 10: PLSQL: Implementing Procedures and Functions

Week 11: PLSQL: Implementing Triggers

Week 12: PLSQL: Implementing Cursors

Week 13: PLSQL: Importing and exporting databases.

Week 14: NoSQL CRUD operations with MongoDB

Suggested Tools: *https://erdplus.com/, MySQL Community Server, MySQL Workbench, Libre Base, MongoDB*

Course Code	Course Title						Core/Elective
U21PC384CS	**Data Structures and Algorithms using 'C' Lab**						**Core**
Prerequisite	Contact hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**4**	**25**	**50**	**2**

Course Objectives:

1. Design and construct simple programs by using the concept of structures as abstract data type.
2. To have a broad idea about how to use pointers in the implement of data structures.
3. To enhance programming skills while improving their practical knowledge in data structures.
4. To strengthen the ability to apply the suitable data structures for real world problems.

Course Outcomes:

After completing this course, students will be able to:

1. After completing this course, the student will be able to:
2. Implement various data structures using arrays, linked lists
3. Develop ADT necessary for solving problems based on Stacks and Queues
4. Implement binary trees, general tree structures, advanced search trees, heaps, graphs.
5. Implement hash functions and handle collisions
6. Implement various kinds of sorting techniques and apply appropriate techniques for solving a given problem

Implement the following using C

Linear data structures:

1. Stack using dynamic arrays
2. Infix to Postfix conversion
3. Evaluation of Postfix expression
4. Circular queue using arrays
5. Singly linked list operations
6. Doubly linked list operations
7. Stack using linked list
8. Queue Using Linked List
9. Insertion sort
10. Heap sort
11. Linear search
12. Binary search
13. Hashing

Non-linear data structures

14. Binary tree traversals
15. Binary search tree operations
16. Graph traversal techniques

Course Code	Course Title						Core/Elective
U21PCN81CS	**Object Oriented Programming using Java Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
--	**-**	**-**	**-**	**4**	**25**	**50**	**2**

Course Objectives:

The objectives of the course are to impart knowledge of:

1. To build software development skills using java programming for real world applications.
2. To implement frontend and backend of an application.
3. To implement classical problems using java programming.

Course Outcomes:

After the completion of the course, the student will be able to:

1. Develop Java applications using the concepts of Inheritance, interfaces, packages, access control specifies.
2. Implement the concepts of Exception Handling in java Applications.
3. Read and write data using different Java I/O streams.
4. Create graphical user interfaces and Applets by applying the knowledge of Event Handling.
5. Create robust applications using Java standard class libraries and retrieve data from a database with JDBC.
6. Ability to solve real-world problems by designing user friendly GUI with befitting backend through the APIs of Java.

List of Experiments

1. Write a Java program to illustrate the concept of class with method overloading.
2. Write a Java Program that reads a line of integers, and then displays each integer, and the sum of all the integers (Use StringTokenizer class of java.util).
3. Write a Java program to illustrate the concept of Single level and Multi level Inheritance.
4. Write a Java program to demonstrate the Interfaces & Abstract Classes.
5. Write a Java program to implement the concept of exception handling.
6. Write a Java program to illustrate the concept of threading using Thread Class and Runnable Interface.
7. Write a Java program that correctly implements producer consumer problem using the concept of inter thread communication.
8. Write a Java program to illustrate collection classes like Array List, LinkedList, TreeMap and HashMap.
9. Write a Java program to implement iteration over Collection using Iterator interface and ListIterator interface
10. Write a Java program that reads a file name from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes.
11. Write a Java program to illustrate the concept of I/O Streams.
12. Write a Java program to implement serialization concept.
13. Write a Java program to perform following CRUD operations on student data using JDBC
    i. Create & insert a student record

ii. Retrieve and display the existing student records
iii. Update & delete a student record

14. Write a Java awt program for handling mouse & key events
15. Write a Java awt program to implement Adapter classes

B.E. (Computer Science and Information Technology) IV– SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/ week	CIE	SEE	Duration of SEE (Hrs.)	
Theory Courses										
1	U21PC401CT	Computer Organization and Microprocessor	3	-	-	3	30	70	3	3
2	U21PC402CT	Web Programming	3	-	-	3	30	70	3	3
3	U21HSN01CO	Finance & Accounting	3	-	-	3	30	70	3	3
4	U21PCN02CS	Software Engineering	3	-	-	3	30	70	3	3
5	U21BSN03MT	Engineering Mathematics-III (Probability & Statistics)	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
6	U21PC481CT	Computer Organization and Microprocessor Lab	-	-	2	2	25	50	3	1
7	U21PC482CT	Web Programming Lab	-	-	4	4	25	50	3	2
8	U21PCN82CS	Software Engineering Lab	-	-	2	2	25	50	3	1
9	U21PW481CT	Theme Based Project	-	-	2	2	25	50	3	1
		Total	**15**	**-**	**10**	**25**	**250**	**550**	**-**	**20**

Course Code	Course Title						Core/Elective
U21PC401CT	**Computer Organization and Microprocessor**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
LST	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. To understand the structure and basic working principles of a computer system in terms of Instruction Level Architecture and Instruction Execution, processing unit and Memory System Design.
2. To learn various communication techniques between I/O devices and the processing unit.
3. To learn various memory organizations and understand the design of memory management techniques
4. To understand the Architecture of 8085 microprocessor.
5. To learn the design aspects of I/O and Memory Interfacing circuits.

Course Outcomes:

After completing this course, the student will be able to:

1. Understand the components and working of a computer system involving instruction sequencing and execution using memory.
2. Understand the working principles and design of a basic processing unit.
3. Evaluate various memory organizations and understand the design of memory management techniques.
4. Design and implement programs on 8085 microprocessor.
5. Design and Interface Input / Output Devices.

Unit I

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance, Multiprocessors and Multicomputer. Machine Instructions: Memory Locations and addresses, Memory Operations. Instructions and Instruction Sequencing, Addressing Modes.

Unit II

Basic Processing Unit: Some Fundamental Concepts- Register Transfers, Performing Arithmetic, Logic Operations, Execution of a Complete Instruction, Multiple Bus Organization, Hardwired Control. Micro programmed Control.

Unit III

Memory System: Basic Concepts, Semiconductor RAM Memories, Read-Only memories, Associative Memory, Cache Memory, Cache Memory Mapping, Virtual Memories.

Unit IV

Introduction to Microprocessor- Microcomputers and Assembly Language, Introduction to 8085 Assembly Language Programming, Microprocessor Architecture and its operations, Memory, Input and Output devices.

UNIT-V

Programming the 8085- Introduction to 8085 Instructions, Addressing Modes and Programming techniques with additional instructions, Stacks and Subroutines, Interfacing peripherals- Basic interfacing concepts.

Text Books:

1. Carl. V Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, 5th Edition (2017), Tata McGraw Hill Education.
2. William Stallings, "Computer Organization and Architecture, Designing for Performance", Pearson, 10th Edition, 2016.
3. Ramesh S. Gaonkar - Microprocessor Architecture, Programming, and Applications with the 8085-Prentice Hall (2002)

References:

1. M.Morris Mano, Rajib Mall, Computer System Architecture, 3rd Edition (2017), Pearson Education Asia.
2. David A Patterson, John L Hennessy, Computer Organization and Design: The Hardware/Software Interface, 5th Edition (2016), Morgan Kaufmann.
3. https://archive.nptel.ac.in/courses/106/105/106105163/
4. https://archive.nptel.ac.in/courses/108/105/108105102/

Course Code	Course Title						Core/Elective
U21PC402CT	**Web Programming**						**Core**
Prerequisite	Contact Hours per week				CIE	SEE	Credits
	L	T	D	P			
Programming in C & C++, Object Oriented Programming using JAVA	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. Learn various client side technologies for developing web based applications.
2. Learn the concepts of JavaScript for adding dynamic content
3. To Know about XML applications with DTD and Schema.
4. To familiarize the concepts about Servlets and JSP in dynamic web applications.
5. To learn how to develop web applications using PHP.

Course Outcomes:

After completing this course, the student will be able to:

1. Understand the concepts of HTML and CSS.
2. Acquire the knowledge to build web based applications using Javascript.
3. Know how to configure XML documents in Web application development
4. Understand and apply the concepts of servlet and JSP
5. Develop Web application using PHP

UNIT-I

A Brief Introduction to Internet, The World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators, MIME, HTTP

HTML5: Evolution of HTML and XHTML, Basic Syntax, Document Structure, Links, Images, Multimedia, Lists, Tables, Creating Forms. Cascading Style sheets.

UNIT-II

JavaScript: Overview, Object Orientation and JavaScript, Syntactic Characteristics, Primitives, Operators, Expressions, Input and Output, Control Statements, Objects Creation and modification, Arrays, Functions, Constructors, Pattern Matching. Manipulating DOM, HTML DOM Events

UNIT-III

XML: Introduction to XML, Syntax, XML document structure, Document Type Definition, Name spaces, XML Schemas, Display in raw XML documents, Displaying XML documents with CSS, XPath Basics, XSLT, XML Processors.

Database programming with JDBC: JDBC Drivers, Exploring JDBC Processes with the java.sql Package.

UNIT-IV

Servlets Technology: J2EE MVC Architecture, Exploring the Features of Java Servlet, Exploring the Servlet API, Explaining the Servlet Life Cycle, Creating a Sample Servlet, Exploring the Session Tracking Mechanisms.

JSP Technology: Advantages of JSP over Java Servlet, Architecture of a JSP Page, Life Cycle of a JSP Page, Working with JSP Basic Tags and Implicit Objects, Working with Action Tags in JSP.

UNIT-V

Introduction to PHP: Origins and uses of PHP, Overview, General Syntax Characteristics, Primitives Operators and Expressions, Output, Control Statements, Arrays, Functions, Pattern Matching, Form Handling, Files, Cookies, Session Handling

Text Books:

1. Robert W.Sebesta: Programming the World Wide Web, 4th Edition, Pearson Education, 2009.
2. Java Server Programming Java EE7 (J2EE 1.7): Black Book, (2014), Dreamtech Press.

Reference Books:

1. Porter Scobey, PawanLingras: Web Programming and Internet Technologies an E-Commerce Approach, 2nd Edition, Jones & Bartlett Learning
2. Bryan Basham, Kathy Sierra, Bert Bates: Head first Servlets & JSP, 2nd edition, OREILLY, 2008

Course Code	Course Title						Core/Elective
U21HSN01CO	**Finance and Accounting**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

The course will introduce the students

1. To provide understanding of the accounting aspects of business.
2. To provide understanding of financial statements.
3. To provide understanding of financial system.
4. To provide inputs necessary to evaluate the viability of projects.
5. To provide the skills necessary to analyse the financial statements.

Course Outcomes:

After successful completion of the course the students will be able to

1. Evaluate the financial performance of the business unit.
2. Take decisions on selection of projects.
3. Take decisions on procurement of finances.
4. Analyse the liquidity, solvency and profitability of the business unit.

UNIT-I

Basics of Accounting: Financial Accounting-Definition - Accounting Cycle –Journal Ledger - Cash Book –Bank Reconciliation Statement and Trial Balance (including problems)

UNIT-II

Final Accounts: Trading Account - Profit and Loss Account - Balance Sheet (including problems with adjustments like Closing Stock, Expenses Outstanding, Prepaid Expenses, Income earned but not received, Income received in advance, Depreciation, Bad debts, Provision for Bad and Doubtful Debts, Provision for Discount on Debtors, Provision for Discount on Creditors, Interest on Capital, Interest on Drawings)

UNIT-III

Financial Statement Analysis: Importance-Users - Ratio Analysis - Liquidity, Solvency, Turnover & Profitability Ratios.

UNIT-IV

Capital Budgeting: Meaning – Importance - Time Value of Money- Discounting - Compounding - Financial Appraisal of Project – Payback Period, ARR, NPV, PI, IRR (Simple problems)

UNIT-V

Financial System and Markets: Financial System - Financial Markets – Financial Institutions – Financial Instruments – Financial Intermediaries – RBI, SEBI and IRDA (Functions only).

Text Books:

1. Accountancy – I: Haneef & Mukarjee, Tata McGrahill Company
2. Accountancy – I: SP. Jain & KL. Narang, Kalyani Publishers
3. Advanced Accountancy – I: S.N. Maheshwari & V.L. Maheswari, Vikas Publishers
4. Financial Management – I.M. Pandey, Vikas Publishers
5. Financial Institutions & Markets – Prashanta Athma, PBP

Course Code	Course Title						Core/Elective
U21PCN02CS	**Software Engineering**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. To introduce the basic concepts of software development processes from defining a product to shipping and maintaining
2. To impart knowledge on various phases, methodologies and practices of software development
3. To understand the importance of testing in software development, study various testing strategies along with its relationship with software quality and metrics.

Course Outcomes:

Student will be able to:

1. Acquired working knowledge of alternative approaches and techniques for each phase of software development
2. Judge an appropriate process model(s) assessing software project attributes and analyze necessary requirements for project development eventually composing SRS
3. Creation of visual models to describe (non-) algorithmic solutions for projects using various design principles.
4. Acquire skills necessary as an independent or as part of a team for architecting a complete software project by identifying solutions for recurring problems exerting knowledge on patterns.
5. Concede product quality through testing techniques employing appropriate metrics by understanding the practical challenges associated with the development of a significant software system.

UNIT-I

Introduction to Software Engineering: Definition of Software Engineering, The Software Process, A Generic Process Model, Process Assessment and Improvement.

Prescriptive Process Models: The Waterfall Model, Incremental Process Models, Evolutionary Process Models, The Unified Process, Personal and Team Process Models

Agile Development: Agility, Agile Process, Agile Process Models (XP,Scrum)

UNIT-II

Software Engineering Principles: Core Principles, Communication principles, Planning principles, Modeling principles, Construction principles, Deployment principles.

Requirements Engineering: Identifying Stakeholders, Requirements Engineering Tasks, Eliciting Requirements, Developing Use-Cases, Building the Requirements Model, Negotiating Requirements, Validating Requirements.

UNIT-III

Building the Analysis Model: Requirements Analysis, Modeling Approaches, Scenario-based Modeling, Data Modeling Concepts, Class-based Modeling.

Design Engineering: Design within the context of SE, Design Process, Design Concepts, The Design Model.

UNIT-IV

Architectural Design: Software Architecture, Architectural Styles, Architectural Design.

Component-Level Design: Definition of Component, Designing Class-based Components, Conducting Component-level Design, Designing Traditional Components.

User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

UNIT-V

Software Quality: Definition, Quality Assurance, Six Sigma, ISO 9000 Quality Standards

Testing: Test Strategies for Conventional Software, Test Strategies for O-O Software, Validation Testing (Alpha and Beta Testing), System testing, White-Box Testing, Black-Box Testing

The Art of Debugging: Debugging Process, Debugging Strategies

Software Configuration Management: SCM Repository, SCM Process

Product Metrics: A Framework for Product Metrics, Metrics for Source Code, Metrics for Maintenance

Text Book:

1. Roger S. Pressman, Software Engineering: A Practitioner's Approach, 7th Edition, McGraw Hill, 2009

Reference Books:

1. Ali Behforooz and Frederick J. Hudson, Software Engineering Fundamentals, Oxford University Press, 1996
2. Pankaj Jalote, An Integrated Approach to Software Engineering, 3rd Edition, Narosa Publishing House, 2008

Course Code	Course Title						Core/Elective
U21BSN03MT	**Engineering Mathematics-III (Probability & Statistics) (Common to All Branches)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. To introduce the basic concepts of probability
2. To study the concepts of discrete and continuous probability distributions
3. To introduce and study the concepts of fitting of curves, Correlation and Regression
4. To study the concepts of testing of hypothesis for small samples.

Course Outcomes:

1. Solve the problems by using the concepts of probability and random variables.
2. Determine the statistical parameters for discrete probability distributions.
3. Determine the statistical parameters for continuous probability distributions.
4. Solve problems on curve fitting, correlation and lines of regression.
5. Test the hypothesis for small samples.

UNIT-I

Probability: Introduction to Probability, Conditional Probability, Theorem of Total probability, Bayes Theorem and its applications, Random variables, Types of random variables, Probability mass function and Probability density function, Mathematical expectation, variance. (12 hours)

UNIT-II

Discrete probability distributions: Introduction to Binomial and Poisson distributions, evaluation of statistical parameters -mean, variance, moment generating function, moments, skewness and kurtosis by central moments. (9 hours)

UNIT-III

Continuous probability distributions: Introduction to Uniform, Normal distributions, evaluation of statistical parameters - mean, variance, moment generating function, moments, skewness and kurtosis by central moments, Central limit theorem (without proof) (9 hours)

UNIT-IV

Correlation and Regression: Fitting of straight-line, second-degree Parabola and Power curves. Correlation, Regression and Rank correlation. (11 hours)

UNIT-V

Tests of significance: Small Samples-Introduction, Test of Hypothesis, t-test for single mean, difference of means, F-test for ratio of variances, Chi-square test for goodness of fit. (11 hours)

Text Books:

1. R. K. Jain & S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publications.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications.\S.C. Gupta & V. K. Kapoor, "Fundamentals of Mathematical Statistics", S. Chand Pub.

Reference Books:

1. N. P. Bali, &M. Goyal, "A text book of Engineering Mathematics", Laxmi publications, 2010.
2. P. G. Hoel, S. C. Port & C. J. Stone, "Introduction to Probability Theory", Universal Book Stall, 2003.
3. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. I, Wiley, 1968.

Practical/ Laboratory Courses

Course Code	Course Title						Core/Elective
U21PC481CT	**Computer Organization and Microprocessor Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
LST	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives:

1. Study 8085 Microprocessor Architecture.
2. Introduce ALP concepts and features.
3. Write ALP for arithmetic and logical operations in 8085 and 8051.
4. Differentiate Serial and Parallel Interface.
5. Interface different I/Os with Microprocessors.

Course Outcomes:

After completing this course, the student will be able to:

1. To define the basic concept of programmable device and structural arrangement of 8085 and its instructions.
2. To define the general idea for interfacing memory devices and I/O devices to ensure unique address for each device
3. Write ALP for Arithmetic and Logical operations
4. Interface Analog to digital and digital to analog convertors
5. Generate waveforms using Microprocessors

8085 Programs using Microprocessor 8085-Kits

1. Basic 8 bit arithmetic operations
2. Basic 16 bit arithmetic operations
3. Basic 8 bit Logical operations
4. Move a data block without overlap
5. Sorting Array of Data
6. Searching Largest and Smallest 8 bit number in the given array

Peripherals and Interfacing Experiments using Microprocessor 8085-Kits

7. Traffic light control
8. Stepper motor control
9. Analog to Digital Interface
10. Key board and Display
11. Digital to Analog interface and Waveform Generation

Text Book:

1. Ramesh S. Gaonkar - Microprocessor Architecture, Programming, and Applications with the 8085-Prentice Hall (2002)

Reference Books:

1. Fundamentals of Microprocessors and Microcontrollers by B Ram
2. Microprocessor principle and application by a Pal
3. 8085 Microprocessor Assembly Language Programming by Samir G. Pandya

Course Code	Course Title						Core/Elective
U21PC482CT	**Web Programming Lab**						**Core**
Prerequisite	Contact Hours perweek				CIE	SEE	Credits
	L	T	D	P			
Programming in C & C++, Object Oriented Programming using JAVA	-	-	-	**4**	**25**	**50**	**2**

Course Objectives:

1. Learn various client side technologies for developing web based applications.
2. Learn the concepts of JavaScript for adding dynamic content
3. To Know about XML applications with DTD and Schema.
4. To familiarize the concepts about Servlets and JSP in dynamic web applications.
5. To learn how to develop web applications using PHP.

Course Outcomes:

After completing this course, the student will be able to:

1. Understand the concepts of HTML and CSS.
2. Acquire the knowledge to build web based applications using Javascript.
3. Know how to configure XML documents in Web application development.
4. Understand and apply the concepts of servlet and JSP.
5. Develop Web application using PHP.

List of experiment groups:

I. Static Website Development

a. Create a static website using HTML tables.
b. Create Registration form using HTML forms.
c. Apply various CSS attributes and styles.
d. Develop a complete Static Website for any user application.

II. Dynamic Website Development

a. Develop a dynamic Web content using Javascript.
b. Develop a student registration from with Validation support using Javascript.
c. Develop a dynamic websites using Javascript Event Handling.

III. Database Connectivity

a. Implement CRUD operation on database.
b. Implementation of Scrollable and updatable Result Set.
c. Program to retrieve the Database Metadata information.

IV. Server Side Programming using Servlets

a. Implementation of doGet(), doPost() and Service() method.
b. Reading request Parameters from HTTP request.
c. Session Handling using Cookies.
d. Session handling using HttpSession object
e. Implementation of RequestDispatcher class methods.
f. Database programing with in Servlets

V. Server side programming using JSP

a. Demonstration of JSP implicit objects
b. Usage of Scripting Elements
c. Demonstrate JSP action tags
d. Creating Custom tags
e. Database programming using JSP

VI. Server side programming using PHP.

a. Simple web application using PHP.
b. Session Handling
c. Database programming

Reference Books:

1. Java Server Programming Java EE7 (J2EE 1.7): Black Book, (2014), Dreamtech Press
2. Professional Java Server Programming: J2EE 1.3 Edition, Allamaraju Subrahmanyam, Apress
3. Robert W.Sebesta: Programming the World Wide Web, 4th Edition, Pearson Education, 2009
4. J2EE: The complete Reference Paperback, Jim Keogh

Course Code	Course Title						Core/Elective
U21PCN82CS	**Software Engineering Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**2**	**25**	**50**	**1**

Course Objectives:

1. To understand the software engineering methodologies for project development.
2. To gain knowledge about open source tools for Computer Aided Software Engineering (CASE).
3. To develop test plans and test cases to perform various testing.

Course Outcomes:

Student will be able to:

1. Analyze and design software requirements in an efficient manner.
2. Use open source case tools to develop software, Implement the design , debug and test the code

I. Forward Engineering

Students have to form a team with a batch size of two or three and take up a **case study based project** to analyze, plan, design UML models and create a prototypical model (by identifying deliverables) by coding the developed designs and finally document considering any one example of the following domains:-

1. Academics (Eg: Course Registration System, Student marks analyzing system)
2. Health Care (Eg: Expert system to prescribe medicines for given symptoms, Remote Diagnostics, Patient/Hospital Management System)
3. Finance (Eg: Banking: ATM/Net Banking, UPI: PayTM/PhonePay, Stocks: Zerodha)
4. E-Commerce (Eg: various online shopping portals like FlipKart/Amazon/Myntra)
5. Logistics (Eg. Postal/Courier: India Post/DTDC/UPS/FedEx, Freight: Maersk)
6. Hospitality (Eg: Tourism Management: Telangana Tourism/Incredible India, Event Management: Mera Events/BookMyShow / Explara / Event Brite)
7. Social Networking (Eg: LinkedIn, Face Book, Shaadi.com, Bharat Matrimony, Tinder)
8. Customer Support (Eg. Banking Ombudsman, Indian Consumer Complaints Forum)
9. Booking/Ticketing (Eg. for Food: Zomato/Swiggy/BigBasket/Grofers/JioMart, Hotel: OYO/Trivago or Travel: {Cars:Uber/OLA/Zoom, Railways : IRCTC, Buses: OnlineTSRTC/RedBus/AbhiBus, Flights: MakeMyTrip/Goibibo, Ships: Lakport})

II. Reverse Engineering: Students have to refer any project repository:GitLab/GitHub, execute the code in order to observe its functionalities/features/requirements and by the help of any tool derive the designs from the code for understanding the relationships among various subsystems/classes/components and if the tool partially generates models then identify by associating elements to judge/mark the appropriate relationships.

III. Testing: Prepare Test Plan and develop Test Case Hierarchy to monitor or uncover/report errors using manual/automated testing tools

Software Required: *StarUML/Umbrello, NetBeans/Eclipse IDE, XAMPP/MEAN stack, JUnit, JMeter, Selenium, Bugzilla.*

Course Code	Course Title						Core/Elective
U21PW481CT	**Theme Based Project**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**2**	**25**	**50**	**1**

Course Objectives:

1. Develop an application in the relevant area of Computer Science and allied courses.
2. To be familiarized with tools and techniques of systematic documentation.
3. To expose the students to industry practices and teamwork.
4. To encourage students to work with innovative and entrepreneurial ideas.
5. Learn Contemporary technologies.

Course Outcomes:

On Completion of the course, Students will be able to

1. Demonstrate the knowledge of contemporary software tool/technology, used for project development
2. Design an application to meet the requirements within the scope of project
3. Demonstrate the work done in the project through presentation and documentation.
4. Evaluate different solutions based on economic and technical feasibility.
5. Effectively work in a team to plan a project and understand all aspects of project management.

The main objective is to provide students an exposure to the latest advancements in various programming languages, tools, and technologies widely used for application development by computer science engineers.

Students are encouraged to learn new software/API which is beyond curriculum and then demonstrate their knowledge by building an application. The project could be classified as hardware, software, modeling, and simulation etc.

Some of the suggested areas to carry out a theme-based project are:

- Mobile/Web/Cloud Application Development, Cloud Application,
- Game Development,
- IoT Applications,
- Data Engineering
- Use of APIs in the areas of Robotics, Natural Language Processing, Blockchain, Cyber Security, Image Processing etc.

These projects can be applied to various domains not limited to Agriculture, Banking & Finance, Customer Relationship Management, Defense, Education, Environment & Sustainability, Government-related Applications, Healthcare, Humanities, Sports, Travel & Tourism, Transport etc. Problem Statements are suggested to be taken from portals like Smart India Hackathon (SIH) invited from the Ministries / PSUs / MNCs / NGOs.

Students are required to submit a report and PPT on the project at the end of the semester.
The department will appoint a project coordinator who will coordinate the following:

- Grouping of students (maximum of 3 students in a group)
- Allotment of projects and project guides.
- Conduct periodical reviews to check the progress
- Consolidate sessional marks awarded by the monitoring committee.

B.E. (Computer Science and Information Technology) V – SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/ week	CIE	SEE	Duration of SEE (Hrs.)	
Theory Courses										
1	U21PC501CT	Design and Analysis of Algorithms	3	-	-	3	30	70	3	3
2	U21PCN04CS	Operating Systems	3	-	-	3	30	70	3	3
3	U21PCN05CS	Automata Languages and Computation	3	-	-	3	30	70	3	3
4	U21PCN06CS	Computer Networks	3	-	-	3	30	70	3	3
5	U2XPE51XXX	Professional Elective - I	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
6	U21PC581CT	Design and Analysis of Algorithms Lab	-	-	2	2	25	50	3	1
7	U21PC582CT	Full Stack Development Lab	-	-	4	4	25	50	3	2
8	U21PCN84CS	Operating Systems Lab	-	-	2	2	25	50	3	1
9	U21PCN86CS	Computer Networks Lab	-	-	2	2	25	50	3	1
10	U21PW581CT	Mini Project	-	-	4	4	25	50	3	2
		Total	**15**	**-**	**14**	**29**	**275**	**600**	**-**	**22**

Professional Elective – I		
S.No.	**Course Code**	**Course Title**
1	U21PE511CT	Fundamentals of Data Science
2	U21PE512CS	Advanced Algorithms
3	U22PE513AL	Image Processing
4	U21PE514CS	Cyber Security, Ethics & Laws
5	U22PE515DS	Game Development

Course Code	Course Title						Core/Elective
U21PC501CT	**Design and Analysis of Algorithms**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Concepts of Data Structures	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. Determine performance of algorithms using asymptotic notations.
2. Formulate methodologies to solve recursive algorithms using recurrence relations.
3. Interpret algorithms using standard paradigms like: Greedy, Divide and Conquer, Dynamic programming, Backtracking, Branch & Bound
4. Understand NP class problems and formulate solutions using standard approaches.
5. Apply algorithm design principles to derive solutions for real life problems and comment on complexity of solution.

Course Outcomes:

After successful completion of this course, student will be able to:

1. Compare complexities of algorithms written in pseudo code notation using asymptotic notation
2. Identify efficient data structures for various problems and demonstrate a suitable design technique or computing model.
3. Apply suitable algorithm design paradigm such as Divide & Conquer, Greedy etc. for the given problem.
4. Apply design paradigms Dynamic Programming, Backtracking, and Branch and Bound for the given optimization problem
5. Analyze a problem to verify if it belongs to NP complete.

UNIT–I

Introduction & Elementary Data Structures: Introduction, Fundamentals of algorithm (Line Count, Operation Count), Analysis of algorithms (Best, Average, Worst case), Asymptotic Notations(O,Ω,Θ) Recursive Algorithms, Analysis using Recurrence Relations, Master's Theorem. Review of elementary data structures–Graphs: BFS, DFS, Bi-Connected Components. Sets: representation, UNION, FIND operations.

UNIT–II

Divide-and-Conquer Method: The general method, Binary search, Finding maximum and minimum, Merge sort, Quick sort.

Brute Force: Knapsack, Traveling salesman problem, Convex-Hull

UNIT–III

Greedy Method: Knapsack problem, Minimum spanning trees, Single source shortest path, Job sequencing with deadlines, Optimal storage on tapes, Optimal merge pattern

Dynamic programming method: All pairs shortest paths, Optimal binary search tress, 0/1 Knapsack problem, Reliability design, Traveling salesman problem,

UNIT–IV

Back tracking: N-queens problem, Graph coloring, Hamiltonian cycles

Branch-and-bound: FIFO & LC branch and Bound methods, 0/1 Knapsack problem, Traveling sales person

UNIT–V

NP-hard and NP-complete problems: Non Deterministic algorithms, The classes: P, NP, NP Complete, NP Hard, Satisfiability problem, Proofs for NP Complete Problems: Clique, Vertex Cover.

Parallel Algorithms: Introduction, models for parallel computing.

Text Book:

1. Horowitz E, Sahni S, Fundamentals of Computer Algorithms, 2ndEdition, Universities Press, 2007

References:

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012
2. Michael T. Goodrich, Roberto Tamassia, Algorithm Design: Foundations,Analysis and Internet Examples, John Wiley & Sons,2002
3. https://archive.nptel.ac.in/courses/106/106/106106131/

Course Code	Course Title						Core/Elective
U21PCN04CS	**Operating Systems**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Good knowledge of C, Computer Organization and Architecture, DataStructures	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. Analyze the trade-offs inherent in operating system design.
2. Summarize various approaches to solve the problem of process concurrency in an operating system.
3. Evaluate the memory usage trade-offs in terms of size (main memory, auxiliary memory) and processor speed.
4. Understand disk storage strategies and file strategies with protection and security issues.

Course Outcomes:

After successful completion of this course, student will be able to: -

1. Understand System calls and evaluate process scheduling criteria of OS
2. Develop procedures for process synchronization and scheduling services of an OS
3. Discuss Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock.
4. Describe the role of paging, segmentation, and virtual memory in operating systems.
5. Distinguish disk access, file systems supported by an OS and extend operating systems protection& security aspects.

UNIT-I

Computer System and Operating System Overview: Overview of Computer System hardware, Operating System Objectives and functions, Evolution of operating System, Example Systems. Operating System Services, System Calls, System Programs.

UNIT-II

Process Management: Process Description, Process Control Block, Process States

Threads: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads.

Process Scheduling: Scheduling Queues, Schedulers, Scheduling Criteria, Scheduling algorithms, Multiprocessor Scheduling. Case Studies: Linux, Windows.

UNIT-III

Process Synchronization: Inter-process Communication - Background, The Critical Section Problem, Race Conditions, Mutual Exclusion, Peterson's solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization - Bounded Buffer Problem, The Producer/ Consumer Problem, Reader's & Writer's Problem, Dinning Philosopher Problem, Event counters, Monitors, Message passing.

Deadlocks: Deadlocks - System Model, Deadlock Characterization - Necessary and sufficient conditions for Deadlock, Methods for Handling Deadlocks - Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock.

UNIT-IV

Memory Management: Basic concepts, Swapping, Contiguous memory allocation, Paging, Segmentation, Virtual memory, Demand paging, Page-replacement algorithms, Thrashing.
Secondary storage structure: Disk structure; Disk scheduling, Disk management, Swap- space Management, RAID structure, Stable-storage Implementation, Tertiary-Storage Structure

UNIT -V

File Management: Concept of File - Attributes, operations, file types, internal structure, access methods, Directory structure, file protection, file system structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.
Protection: System Protection, Goals of Protection, Principles of Protection.

Text Books:

1. Abraham Silberschatz, Peter B.Galvin and Greg Gagne, Operating System Concepts, 9th Edition,Wiley Asia Student Edition.
2. William Stallings, Operating Systems: Internals and Design Principles, 5th Edition, Prentice Hallof India.

Reference Books:

1. Charles Crowley, Operating System: A Design-oriented Approach, 1st Edition, Irwin Publishing.
2. Gary J. Nutt and Addison, Operating Systems: A Modern Perspective, 2nd Edition, Wesley.
3. Maurice Bach, Design of the UNIX Operating Systems, 8th Edition, Prentice Hall of India.
4. Daniel P. Bovet and Marco Cesati, Understanding the Linux Kernel, 3rd Edition, O'Reilly and Associates.

Course Code	Course Title						Core/Elective
U21PCN05CS	**Automata Languages and Computation**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Logic and Switching Theory, Data Structures	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. Understand the relationships among machines, languages and computational problems.
2. Design abstract models for formal languages.
3. Determine the decidability of computational problems.

Course Outcomes:

After successful completion of this course, student will be able to: -

1. Design Finite Automata for Regular languages.
2. Apply formal mathematical methods to prove properties of languages, grammars and automata.
3. Analyze the language and Design pushdown automata.
4. Design Turing machines for simple problems.
5. Describe and determine the undecidability of a problem

UNIT I:

Automata: Introduction to Finite state automata, Central Concepts of Automata theory.

Finite Automata: Deterministic finite Automata, Non-deterministic finite state automata, Finite Automata with Epsilon -Transitions, Applications of Finite Automata.

Regular Expressions and Languages: Regular expressions, Applications of Regular expressions, Algebraic Laws for Regular expressions,

UNIT-II

Properties of Regular Languages: Properties of regular sets, Pumping Lemma, Closure properties of Regular languages, Decision Properties of Regular languages, Myhill-Nerode Theorem, Minimization of Finite Automata.

Context Free Grammars and Languages: Context Free Grammars, Derivations, Parse-Trees, Applications of Context Free Grammars, Ambiguity in Grammars and Languages.

UNIT-III

Pushdown Automata: Definitions, The languages of aPDA,Equivalence of PDA's and CFG's, Deterministic Pushdown Automata.

Properties of Context Free Languages: Normal Forms for Context Free Grammars, Pumping Lemma for Context free languages, Closure Properties of CFL's, Deterministic Context free Languages, Decision properties of CFL's.

UNIT-IV

Turing Machines: Introduction, Computational Languages and Functions, Programming Techniques for construction of Turing machines, Modifications of Turing Machine, Turing machine as Enumerator, Restricted Turing machine.

UNIT-V

Undecidability: Recursive and Recursively Enumerable languages, Universal Turing machine and Undecidable problems, Rice Theorem, Post's Correspondence problem. Chomsky's Hierarchy-Regular grammars, Unrestricted grammar, CSL, Relationship between classes of languages.

Suggested Readings:

1. John. E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automata Theory, Languages and Computation, 3rd edition (2009), Pearson Education.
2. John C.Martin, Introduction to Languages and the Theory of Computation, 3rd Edition (2003) Tata McGraw Hill.
3. Michael Sipser, Introduction to Theory of Computation, 3rd Edition (2012), Course Technology

Course Code	Course Title						Core/Elective
U21PCN06CS	**Computer Networks**						**CORE**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Operating System, Engineering Mathematics, Computer Organization and Programming Languages	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. To develop an understanding of communication in modern network architectures from a design and performance perspective.
2. To understand Data Transmission standards and MAC protocols.
3. To introduce the protocol's functionalities in Network Layer and Transport Layer.
4. To understand DNS and supportive application protocols.
5. To provide basic concepts of Network security.

Course Outcomes:

After successful completion of this course, student will be able to: -

1. Explain the functions of the different layers of the OSI and TCP/IP Protocol.
2. Understand wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.
3. Illustrate network layer and transport layer protocols. For a given problem related TCP/IP protocol developed the network programming.
4. Configure DNS, EMAIL, SNMP, Bluetooth, Firewalls using open source available software and tools.
5. Apprehend the fundamentals of Network Security.

UNIT – I

Data communication Components: Representation of data and its flow Networks, Layered architecture, OSI and TCP/IP model, Transmission Media.

Techniques for Bandwidth utilization: Line configuration, Multiplexing - Frequency division, Time division and Wave division, Asynchronous and Synchronous transmission, XDSL, spread spectrum.

LAN: Wired LAN (802.3), Wireless LANs (802.11x), connecting virtual LANs.

UNIT – II

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC.

Flow Control and Error control protocols: Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggy backing.

Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA.

UNIT – III

Network Layer: Switching techniques (circuit and packet), Logical addressing – IPV4, IPV6, subnetting concepts.

Internetworking: Tunneling, Fragmentation, Congestion control.

Internet control protocols: ARP, RARP, BOOTP and DHCP, Delivery, Forwarding and Unicast Routing protocols, Gateway protocols.

UNIT – IV

Transport Layer: Process to Process Communication, Elements of transport protocol, Transmission policy.

Internet Transport Protocols: UDP, TCP, SCTP; Quality of Service.

QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

UNIT – V

Socket Programming: Socket address, Elementary socket system calls, Advanced socket system calls, Reserved ports, Socket options, Asynchronous I/O, Input/output Multiplexing, Out-of-Band data, Sockets and Signals, Internet Super Server.

Application Layer: Domain Name Space (DNS), EMAIL, SNMP, Bluetooth, VOIP, firewalls.

An introduction to Network Security: Security Components and Threats, Security Policy and Issues, Types of Malware and Attacks, Security Mechanisms.

Text books:

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGrawHill.
2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.
3. W. Richard Stevens, Unix Network Programming, Prentice Hall / Pearson Education, 2009.AICTE Model Curriculum for Undergraduate degree in Computer Science and Engineering (Engineering & Technology).

References:

1. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.
2. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.
3. TCP/IP Illustrated, Volume 1, W. Richard Stevens and Addison -Wesley, United States of America.

Professional Elective - I

Course Code	Course Title						Core/Elective
U21PE511CT	**Fundamentals of Data Science**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Mathematics	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. Develop relevant programming abilities.
2. Demonstrate proficiency with statistical analysis of data.
3. Develop the ability to build and assess data-based models.
4. Execute statistical analyses with professional statistical software.
5. Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively.

Course Outcomes:

After successful completion of this course, student will be able to:

1. Describe the significance of data science and understand the Data Science process.
2. Explain how data is collected, managed and stored for data science.
3. Build, and prepare data for use with a variety of statistical methods and models.
4. Analyze Data using various Visualization techniques.
5. Choose contemporary models, such as machine learning, AI, techniques to solve practical problems.

UNIT-I

Introduction To Data Science: Definition, Big Data and Data Science Hype, Datafication, Data Science Profile, Meta-Definition, Data Scientist, Statistical Inference, Populations and Samples, Populations and Samples of Big Data, Big Data Can Mean Big Assumptions, Modeling, Philosophy of Exploratory Data Ana lysis, The Data Science Process, A Data Scientist's Role in this Process Case Study: Real Direct

UNIT –II

Mathematical Preliminaries: Probability, Descriptive Statistics, Correlation Analysis.
Data Munging: Properties of Data, Languages for Data Science, Collecting Data, Cleaning Data, Crowdsourcing.

UNIT – III

Scores and Rankings: Developing Scoring Systems, Z-scores and Normalization, Advanced Ranking Techniques
Statistical Analysis: Sampling from Distributions, Statistical Distributions, Statistical Significance, Permutation Tests and P-values

UNIT- IV

Visualizing Data: Exploratory Data Analysis, Developing a Visualization Aesthetic, Chart Types, Great Visualizations.
Mathematical Models: Philosophies of Modeling, A Taxonomy of Models, Baseline Models, Evaluating Models, Evaluation Environment.

UNIT-V

Supervised Learning: Linear Regression, Better Regression Models, Regression as Parameter Fitting, Simplifying Models through Regularization Classification and Logistic Regression, Issues in Logistic Classification, Naive Bayes, Decision Trees Classifiers.

Text Books:

1. Steven S. Skiena, "The Data Science Design Manual", Springer 2017.
2. Rachel Schutt & O'neil, "Doing Data Science", Straight Talk from The Frontline O'REILLY, ISBN: 978-1-449-35865-5, 1st edition, October 2013.

Reference Books

1. Joel Grus," Data Science from Scratch" First Edition, April 2015
2. Gareth James, Daniela Witten, Trevor Hatie, RoberstTibhirani, "An Introduction to Statistical Learning-with Applications in R", 2013
3. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1,
4. Cambridge University Press. 2 edition (30 September 2014)
5. R Programming for Data Science, Roger D. Peng, LeanPub, 2015.

Web References:

"Data science for engineers" https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs28/

Course Code	Course Title						Core/Elective
U21PE512CS	**Advanced Algorithms**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
2. Students should be able to understand the necessary mathematical abstraction to solve problems.
3. To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
4. Student should be able to come up with analysis of efficiency and proofs of correctness.

Course Outcomes:

After successful completion of this course, student will be able to: -

1. Understand the implementation of symbol table using hashing techniques.
2. Discuss Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists.
3. Develop and analyze algorithms furred-black trees, B-trees and Splay trees.
4. Develop algorithms for text processing applications.
5. Identify suitable data structures and develop algorithms for computational geometry problems.

UNIT-I

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries. **Hashing:** Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

UNIT-II

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists

UNIT-III

Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3Trees, B-Trees, Splay Trees.

UNIT-IV

Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.

UNIT-V

Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quad trees, k-D Trees. Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem

Suggested Readings:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.
2. M T Goodrich, Roberto Tamassia, Algorithm Design, JohnWiley,2002.

Course Code	Course Title						Core/Elective
U22PE513AL	**Image Processing**						**Elective**
Prerequisite	Contact Hours per week				CIE	SEE	Credits
	L	T	D	P			
Introduction to Linear Algebra, Signals and Systems	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. To introduce basics of visual perception, sampling, quantization and representation ofdigital images.
2. To introduce spatial and frequency Domain filtering techniques necessary for Image processing operations.
3. To learn image analysis methods like image restoration, image compression and segmentation.
4. To introduce color image processing fundamentals and models.

Course Outcomes:

At the end of the course, students will be able to:

1. Distinguish sampling and quantization processes in obtaining digital images from continuously sensed data and describe the steps in image processing.
2. Apply Fourier transformation and other transformation techniques to enhance digital image.
3. Apply different techniques in spatial domain and frequency domain to enhance andsegment digital images.
4. Describe different methods to encode raw image data into standard compressed image format.
5. Demonstrate most commonly applied image restoration and color models and their use in basic image processing.

UNIT-I

Introduction to Digital Image Processing: Origins and Applications of Digital Image Processing. Fundamental Steps in Digital Image Processing, Components of Digital Image Processing System. Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, basic relationship between pixels.

UNIT-II

Filtering in the Frequency Domain: Preliminary Concepts, Sampling and the Fourier Transform of Sampled Functions, The Discrete Fourier Transform (DFT) of One Variable, Extension to Function of Two Variables, Image Smoothing and Sharpening using Frequency Domain Filters.

UNIT-III

Intensity Transformations and Spatial Filtering: Histogram Processing, Fundamental of Spatial Filtering, Smoothing and Sharpening Spatial Filters. Image Segmentation: Point, Line and Edge Detection, Thresholding, Region-Based Segmentation.

UNIT-IV

Image Compression: Fidelity Criteria, Image Compression Models, Image Formats, Containers and Compression Standards, Compression Methods: Huffman Coding, Golomb Coding, Arithmetic Coding, LZW Coding, Run-Length Coding.

UNIT-V

Restoration: Noise Models, Inverse filtering, Least squares Filtering.

Color Image Processing: Color fundamentals, color models, Pseudo color Image Processing, Basics of full color image processing.

Suggested books:

1. Gonzalez R.C., Woods R.E, Digital Image Processing, Third Edition 2007, Prentice Hall, USA.
2. Jayaraman S, Esakkirajan S, Veerakumar T, Digital image processing, 13th reprint 2014,McGraw Hill Education, New Delhi.

Reference Books:

1. William K. Pratt, Digital Image Processing, 3rd Edition 2001 , John Wiley & Sons Inc, UK.
2. Mc Andrew, Introduction to Digital Image Processing, Cengage Learning 2004.
3. Sonka, Hlavac, Boyle, Digital Image Processing and Computer Vision, Cengage Learning 2008.
4. Rosenfeld A. Kak AC, Digital Picture Processing Vol .I & II Acad, Press, 2nd

E-Learning Resources

1. https://archive.nptel.ac.in/courses/117/105/117105135/

Course Code	Course Title						Core/Elective
U21PE514CS	**Cyber Security, Ethics & Laws**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. To understand various types of cyber-attacks and cyber-crimes
2. To have an overview of the cyber laws & concepts of cyber forensics
3. To familiarize various cyber laws and IT Acts
4. To give cyber security regulation and forensics
5. To Study the risk management and the code of ethics.

Course Outcomes:

After successful completion of this course, student will be able to: -

1. Analyze and evaluate the cyber security needs of an organization.
2. Understand Cyber Security Regulations and Roles of International Law.
3. Understand various cyber laws and IT Acts
4. Learn the cyber security regulation and forensics
5. Analyze the risk management and the code of ethics.

UNIT – I

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, Comprehensive Cyber Security Policy.

UNIT – II

Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy.

Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics.

UNIT – III

Legal, Ethical and Professional Issues on information Security ethical component in Information system, codes of ethics, certification security analysis: Risk management, Identifying and assessing risk, and controlling risk. Introduction to Cybercrime in Mobile and Wireless Devices.

UNIT – IV

Cyber Security: Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations

UNIT – V

Security Risk ad perils for organization, social computing and the associated challenges for organization. Cybercrime and cyber terrorism: Introduction, Intelligence property in the cyberspace, the ethical dimension of Cybercrimes the psychology, mindset and skill of the hackers and the other cyber-criminal.

References:

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crime, Computer forensics and legal perspective, Wiley 2017
2. B.B Gupta, D.P Agrawal, Haoxing wang, Computer and Cyber Security: Principles, Algorithm,Applications, and the perspective, CRC Press, 2018.
3. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
4. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group.

Course Code	Course Title						Core/Elective
U22PE515DS	**Game Development**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Computer Graphics, Software Engineering, Mathematics	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

The student should be made to:

1. Understand the concepts of Game design and development.
2. Learn the processes, mechanics and issues in Game Design.
3. Be exposed to the Core architectures of Game Programming.
4. Know about Game programming platforms, frame works and engines.
5. Learn to develop games.

Course Outcomes:

Upon completion of the course, students will be able to

1. Discuss the concepts of Game design and development.
2. Design the processes, and use mechanics for game development.
3. Explain the Core architectures of Game Programming.
4. Use Game programming platforms, frame works and engines.
5. Create interactive Games

UNIT-I

Graphics for Game Programming: Coordinate Systems, Ray Tracing, Modeling in Game Production, Vertex Processing, Rasterization, Fragment Processing and Output Merging, Illumination and Shaders, Parametric Curves and Surfaces, Shader Models, Image Texturing, Bump Mapping, Advanced Texturing, Character Animation, Physics-based Simulation.

UNIT-II

Gaming Engine Design: Game engine architecture, Engine support systems, Resources and File systems, Game loop and real-time simulation, Human Interface devices, Collision and rigid body dynamics, Game profiling

UNIT-III

Game Programming: Application layer, Game logic, Game views, managing memory, controlling the main loop, loading and caching game data, User Interface management, Game event management.

UNIT-IV

Gaming Platforms and Frameworks Flash, DirectX, OpenGL, Java, Python, XNA with Visual Studio, Mobile Gaming for the Android, iOS, Game engines - Adventure Game Studio, DX Studio, Blender, Unity.

UNIT-V

Game Development Developing 2D and 3D interactive games using OpenGL, **DirectX**– Isometric and Tile Based Games, Puzzle games, Single Player games, multi-Player games.

Text Books:

1. David H. Eberly, "3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics" Morgan Kaufmann, 2nd Edition, 2006.
2. JungHyun Han, "3D Graphics for Game Programming", Chapman and Hall/CRC, 1st Edition, 2011.
3. Mike McShaffrfy, "Game Coding Complete", Third Edition, Charles River Media, 2009.
4. Jonathan S. Harbour, "Beginning Game Programming", Course Technology PTR, 3rd Edition, 2009.

References:

1. Mike Mc Shaffrfy and David Graham, "Game Coding Complete", Fourth Edition, Cengage Learning, PTR, 2012.
2. Jason Gregory, "Game Engine Architecture", CRC Press / A K Peters, 2009.
3. David H. Eberly, "3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics" 2 nd Editions, Morgan Kaufmann, 2006.

Practical/ Laboratory Courses

Course Code	Course Title						Core/Elective
U21PC581CT	**Design and Analysis of Algorithms Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives:

1. Implement given algorithm using a programming language and compute the execution time.
2. Demonstrate the rate of growth of execution time of a program with increase in input size.
3. Differentiate between the design approaches for solving a given optimization problem.
4. Formulate a suitable algorithm for addressing graph based problems such as spanning tree, traversal etc.
5. Understand the importance of designing an algorithm in an effective way by considering space and time complexity.

Course Outcomes:

1. Implement divide & conquer based sorting algorithms and analyze performance of algorithms
2. Implement optimization algorithms using greedy, dynamic programming for specific applications.
3. Solve graph problems using algorithm design strategies such as greedy, dynamic programming etc.
4. Test backtracking strategy for solving problems with constraints
5. Compare across various algorithmic solutions of a given problem

List of programs:

1. Print all the nodes reachable from a given starting node in a digraph using BFS method and Check whether a given graph is connected or not using DFS method.
2. Sort a given set of elements and determine the time required to sort the elements using following algorithms:
   a) Merge Sort
   b) Quick Sort
3. Implement Knapsack problem using
   1. Brute Force Approach
   2. Greedy Method
   3. Dynamic Programming
4. Find Minimum Cost Spanning Tree of a given undirected graph using
   a) Kruskal's algorithm
   b) Prim’s algorithm
5. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
6. Implement Travelling Salesperson Problem using
   a) Brute Force Approach
   b) Dynamic Programming

7. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm.
8. Implement the following using Back Tracking
    a) N Queen's problem
    b) Hamiltonian Cycle
    c) Graph Coloring

References:

1. Horowitz E, Sahni S, Fundamentals of Computer Algorithms, 2ndEdition, Universities Press, 2007
2. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012
3. Michael T. Goodrich, Roberto Tamassia, Algorithm Design: Foundations,Analysis and Internet Examples, John Wiley & Sons,2002
4. https://archive.nptel.ac.in/courses/106/106/106106131/

Course Code	Course Title						Core/Elective
U21PC582CT	**Full Stack Development Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
OS, CN, OOP, DBMS, WP	**-**	**-**	**-**	**4**	**25**	**50**	**2**

Course Objectives:

1. Understand the Principles of Building Dynamic User Interfaces with ReactJS.
2. Comprehend Server-side Development with Flask.
3. Demonstrate Integration of React, Flask, and MySQL in Full Stack Applications.
4. Grasp Asynchronous Programming Concepts in Node.js
5. Acquire Skills in Developing MERN Stack Applications.

Course Outcomes:

1. Build single page user interfaces with ReactJS.
2. Design Robust Server-Side Applications with Flask.
3. Develop Full Stack Applications with React, Flask, and MySQL.
4. Outline configurations for APIs with NodeJS and ExpressJS.
5. Construct MERN stack applications.

List of Experiments:

1. Building UI with ReactJS
   - 1.1. Render HTML, Coding JSX
   - 1.2. Reusable UI Components: Class, Props, Events
   - 1.3. Conditional Rendering
   - 1.4. Lists
   - 1.5. Forms
   - 1.6. Router
   - 1.7. Hooks
2. Server-side programming using Flask
   - 2.1. Setting up a web app
   - 2.2. Routes
   - 2.3. Form Handling
   - 2.4. Static Files
   - 2.5. Templating with Jinja
   - 2.6. Connecting MySQL
   - 2.7. CRUD with MySQL.
3. Develop a full stack application using React, Flask, MySQL
4. Server-side asynchronous programming using Node.js
   - 4.1. Built-in Modules
     - 4.1.1. HTTP Module
     - 4.1.2. File System Module
     - 4.1.3. URL Module

- 4.2. ExpressJS
  - 4.2.1. Static Files
  - 4.2.2. Basic Routes
  - 4.2.3. Form Handling
  - 4.2.4. Templating with EJS
- 4.3. Mongoose
  - 4.3.1. Connecting MongoDB
  - 4.3.2. CRUD with MongoDB

5. Develop a full stack application using MERN

Textbooks:

1. Learning React: A Hands-On Guide to Building Web Applications Using React and Redux" by Kirupa Chinnathambi
2. "React Up & Running: Building Web Applications" by Stoyan Stefanov

References:

1. "Fullstack React: The Complete Guide to ReactJS and Friends" by Accomazzo, Murray, Lerner
2. React Quickly: Painless Web Apps with React, JSX, Redux, and GraphQL" by Azat Mardan
3. "The Road to React: Your Journey to Master React.js in JavaScript" by Robin Wieruch
4. React Router Quick Start Guide: Routing in React Applications Made Easy" by Sasan Seydnejad
5. "React Hooks in Action: With Suspense and Concurrent Mode" by John Larsen
6. "Flask Web Development: Developing Web Applications with Python" by Miguel Grinberg
7. "Mastering Flask Web Development" by Jack Stouffer

Course Code	Course Title						Core/Elective
U21PCN84CS	**Operating Systems Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Good knowledge of C, Computer Organization and Architecture, Data Structures	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives:

1. Learn different types of CPU scheduling algorithms
2. Demonstrate the usage of semaphores for solving synchronization problem
3. Understand memory management techniques and different types of fragmentation that occur in them and various page replacement policies
4. Understand Banker's algorithm used for deadlock avoidance
5. Learn various disk scheduling algorithms.

Course Outcomes:

1. Evaluate the performance of different types of CPU scheduling algorithms
2. Implement producer-consumer problem, reader-writers problem, Dining philosopher's problem
3. Simulate Banker's algorithm for deadlock avoidance
4. Implement paging replacement and disk scheduling techniques.
5. Use different system calls for writing application programs.

List of Experiments:

I. **CASE STUDY:** Perform a case study by installing and exploring various types of operating systems on a physical or logical (virtual) machine

II. **List of Programs to be implemented (Preferred Programming Language Is C)**

1. Write a C programs to implement UNIX system calls and file management
2. Write C programs to demonstrate various process related concepts.
3. Write C programs to demonstrate various thread related concepts.
4. Write C programs to simulate CPU scheduling algorithms: FCFS, SJF, Round Robin
5. Write C programs to simulate Intra & Inter-Process Communication (IPC) techniques: Pipes, Messages Queues, Shared Memory.
6. Write C programs to simulate solutions to Classical Process Synchronization Problems: Dining Philosophers, Producer-Consumer, Readers-Writers
7. Write a C program to simulate Bankers Algorithm for Deadlock Avoidance.
8. Write C programs to simulate Page Replacement Algorithms: FIFO, LRU
9. Write C programs to simulate implementation of Disk Scheduling Algorithms: FCFS,SSTF

Course Code	Course Title						Core/Elective
U21PCN86CS	**Computer Networks Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Engineering Mathematics, Programming for problem solving, Operating Systems	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives:

1. Learn to communicate between two desktop computers.
2. Learn to implement the different protocols
3. Be familiar with socket programming.
4. Be familiar with the various routing algorithms
5. Be familiar with simulation tools.

Course Outcomes:

1. Implement various protocols using TCP and UDP.
2. Program using sockets.
3. Use simulation tools to analyze the performance of various network protocols.
4. Implement and analyze various routing algorithms.
5. Implement RPC.

List of Experiments:

1. To use simulation tools to analyze the performance of various network protocols
2. Running and using services/commands like tcpdump, netstat, ifconfig, nslookup, FTP, TELNET and traceroute. Capture ping and trace route PDUs using a network protocol analyzer and examine.
3. Configuration of router, switch. (Using real devices or simulators)
4. Socket programming using UDP and TCP (e.g., simple DNS, data & time client/server, echo client/server, iterative & concurrent servers)
5. Network packet analysis using tools like Wireshark, tcpdump, etc.
6. Network simulation using tools like Cisco Packet Tracer, NetSim, OMNeT++, NS2, NS3, etc.
7. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS. Performance evaluation of Routing protocols using Simulation tools.
8. Programming using raw sockets.
9. Programming using RPC.

Note: The instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

Course Code	Course Title						Core/ Elective
U21PW581CT	**Mini Project**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	**4**	**4**	**25**	**50**	**2**

Course Objectives:

1. Develop an application in the relevant area of Computer Science and allied courses.
2. Learn Contemporary tools and technologies
3. Expose the students to industry practices and teamwork.
4. Encourage students to work with innovative and entrepreneurial ideas.
5. Familiarize students with all the aspects of technical documentation.

Course Outcomes:

On Completion of the course, Students will be able to

1. Evaluate different solutions based on economic and technical feasibility.
2. Effectively plan a project and confidently perform all aspects of SDLC.
3. Design a model to address the proposed problem.
4. Adapt to contemporary technologies.
5. Demonstrate the work done in the project through presentation and documentation.

Students are required to use emerging tools and technologies of CSE to solve a real-world problem in the various domains of Banking & Finance, Customer Relationship Management, Defence, Education, Environment & Sustainability, Government-related Applications, Healthcare, Humanities, Sports, Travel & Tourism, Transport etc.

A group of 2-3 students are formed as a team, and a faculty member is assigned to mentor the team. A problem statement which is relevant to the current trends must be formulated with clear scope and deliverables.

Team must build and demonstrate a software-based application adopting all the phases of software development lifecycle. Students must acquire the skills necessary to work as a team and to effectively present the project orally and in the form of a document. Students are required to submit a report and PPT on the project at the end of the semester.

The department will appoint a project coordinator who will coordinate the following:

- Grouping of students (maximum of 3 students in a group)
- Allotment of projects and project guides. Project allotments to be completed by the 3rd week of the semester so that the students get sufficient time for completion of the project.
- Disseminate guidelines given by monitoring committee comprising of senior faculty members to the students and their guides.
- Sessional marks to be awarded by the monitoring committee.

B.E. (Computer Science and Information Technology) VI – SEMESTER

S. No.		Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	Pr/ Drg	Contact Hrs/ week	CIE	SEE	Duration of SEE (Hrs.)	
Theory Courses										
1	U21PC601CT	Embedded Systems and IoT	3	-	-	3	30	70	3	3
2	U21PC601CS	Compiler Construction	3	-	-	3	30	70	3	3
3	U21PC602CS	Artificial Intelligence and Machine Learning	3	-	-	3	30	70	3	3
4	U2XPE62XXX	Professional Elective -II	3	-	-	3	30	70	3	3
5	U2XPE63XXX	Professional Elective -III	3	-	-	3	30	70	3	3
6	U21OE61XXX	Open Elective – I	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
7	U21PC681CT	Embedded Systems and IoT Lab	-	-	2	2	25	50	3	1
8	U21PC682CS	Artificial Intelligence and Machine Learning Lab	-	-	4	4	25	50	3	2
9	U22PC683AL	DevOps Lab	-	-	4	4	25	50	3	2
		*Summer Internship	* To be conducted after the VI Semester in the summer vacation and to be evaluated in VII Semester.							
		Total	**18**	**-**	**10**	**28**	**255**	**570**	**-**	**23**

Professional Elective – II		
S. No.	**Course Code**	**Course Title**
1	U21PE621CT	Distributed Databases
2	U21PE622CT	Graph Theory
3	U21PE623CT	Agile Software Development
4	U22PE621DS	Object Oriented System Development
5	U22PE623CB	Wireless Sensor Networks

Professional Elective – III		
S. No	**Course Code**	**Course Title**
1	U21PE631CT	Computer Vision
2	U21PE632CT	Robotic Process Automation
3	U22PE631DS	Human Computer Interaction
4	U22PE632CB	Software Project Management
5	U22PE635CB	Natural Language Processing

Open Elective –I		
S.No.	**Code**	**Course Title**
1	U21OE611AE	Automobile Engineering
2	U21OE611CE	Disaster Mitigation
3	U21OE611CS	Fundamentals of Data Structures
4	U21OE611EC	Principles of Electronic Communications
5	U21OE612EC	Electronic Instrumentation
6	U21OE611EE	Electrical Energy Conservation and Safety
7	U21OE611IT	Database Systems
8	U21OE611ME	Operation Research and Techniques
9	U21OE612ME	Industrial Robotics
10	U21OE611EG	Soft skills and Interpersonal Skills

Course Code	Course Title						Core/Elective
U21PC601CT	**Embedded Systems and IoT**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
CO & MP	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. Understand Embedded and IoT Fundamentals: Learn core IoT concepts and design principles.
2. Develop Arduino Proficiency: Master Arduino setup, IDE use, and device interfacing.
3. Master Sensors, Actuators, and IoT Technologies: Understand sensors, actuators, and IoT protocols.
4. Raspberry Pi Programming and Interfacing: Learn Raspberry Pi hardware and Python interfacing.
5. Analyze IoT Applications and Trends: Study IoT applications and future trends.

Course Outcomes:

On completion of this course, the student will be able to-

1. Describe the concepts of Embedded and IoT along with its applications.
2. Build a prototype using Arduino Uno.
3. Identify different types of sensors, actuators and communication Protocols.
4. Build a prototype using Raspberry pi.
5. Analyze real world IoT solutions using case study

UNIT-I

Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification of Embedded Systems, Major application areas, Purpose of Embedded Systems. Microcontroller 8051- Microprocessor Vs Microcontroller, Organization and Architectural features of microcontroller 8051, Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing.

UNIT - II

The Typical Embedded System: Core of the Embedded System, Memory, Sensors and Actuators, Communication Interface, Embedded Firmware

Introduction to IoT: Definition of IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT.

UNIT – III

IOT with ARDUINO: Introduction to the Arduino, Creating an Arduino programming Environment, Using the Arduino IDE, Creating an Arduino program, Using Libraries, Working with Digital Interfaces, Interfacing with Analog devices, Adding Interrupts, Communicating with devices, Using sensors, Working with Motors, Using an LCD.

UNIT-IV

Technologies used in IoT: Bluetooth, Bluetooth Low Energy (BLE), WiFi, LiFi, Cellular Networks, Z-Wave,X-10,Sig fox, ZigBee, LoRaWAN, 6LowPAN, 5-G, LPWAN, RFID and NFC,WSN. Communication protocols: CoAP, MQTT, XMPP, DDS,AMQP, REST,HTTP.

UNIT-V

IoT with Raspberry Pi : IoT Physical Devices & Endpoints: Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces, Programming Raspberry Pi with Python, Controlling LED with Raspberry Pi, Interfacing an LED and Switch with Raspberry Pi, Interfacing a Light Sensor (LDR) with Raspberry Pi.

Textbooks:

1. Vijay Madisetti and Arshdeep Bahga, Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2016.
2. Shibu K V, "Introduction to Embedded Systems", Second Edition, Mc Graw Hill
3. Richard Blum,Arduino Programming in 24 Hours, Sams Teach Yourself, Pearson Education, 2017.
4. Jain, Prof. Satish, Singh, Shashi, Internet of Things and its Applications, 1st Edition, BPB, 2020.
5. Sudip Misra, Anandarup Mukherjee, Arijit Roy, "Introduction to IoT", Cambridge University Press 2021.

References:

1. Donald Norris, Internet of things_ do-it-yourself projects with Arduino, Raspberry Pi, and Beagle Bone Black, 1st Edition, McGraw-Hill,2015.
2. Adeal Javed Lake Zurich, Illinois, Building Arduino Projects for the Internet: Experiments with Real-World Applications, 1st Edition, USA, A press,2016.
3. Yashavant Kanetkar, Shrirang Korde, 21 IOT Experiments, 1st Edition, BPB Publications, 2018.
4. Rajkamal, Embedded Systems Architecture, Programming and Design, Tata McGraw-Hill.

Web References:

1. https://www.arduino.cc/reference/en
2. https://create.arduino.cc/projecthub
3. https://maker.pro/raspberry-pi/tutorial
4. https://projects.raspberrypi.org/en/projects
5. https://www.digikey.com/en/maker/blogs/2019/how-to-use-mqtt-with-the-raspberry-pi

Course Code	Course Title						Core/Elective
U21PC601CS	**Compiler Construction**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Data Structures, Automata Languages and Computation	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. Analyze various Phases of a Compiler and design a Compiler for generic machine
2. Design Top-Down and Bottom-Up Parsers.
3. Identify Synthesized and Inherited attributes.
4. Develop Syntax Directed Translation schemes.
5. Build efficient Target Code by applying various Code Optimization Techniques.

Course Outcomes:

On completion of this course, the student will be able to-

1. Compare different Language Processors and design Lexical Analyzer for a given Language.
2. Design Parsers using Top-Down and Bottom-Up parsing techniques.
3. Develop Syntax Directed Translation Schemes.
4. Generate Intermediate Code for a given set of instructions.
5. Generate efficient Target Code for a target machine.

UNIT – I

Introduction: Programs related to Compilers, Translation Process, Major Data Structures, Other issues in Compiler Structure, Bootstrapping and Porting.

Lexical analysis: The role of Lexical Analyzer, Input Buffering, Specification of Tokens. Recognition of Tokens, the Lexical-Analyzer Generator LEX.

UNIT – II

Syntax Analysis: Introduction, Top-Down Parsing- Recursive Descent, LL(1), Bottom- Up Parsing, Introduction to LR Parsing, More Powerful LR Parsers SLR, CALR, LALR, Error Recovery in Top-Down and Bottom-Up Parsers, Parser Generators -YACC.

UNIT - III

Syntax-Directed Translation: Syntax Directed Definitions, Evaluation Orders for SDDs, Applications of Syntax Directed Translation.

Symbol Table Organization: Structure of Symbol table, Operations, Implementation and Management.

UNIT – IV

Intermediate Code Generation: Variants of Syntax Trees, Three-Address Code, Types and Declarations, Translation of Expressions, Type Checking. Control Flow, Back Patching, Switch statements, Intermediate Code for Procedures.

Run-Time Environments: Storage Organization, Stack Allocation of Space, Access to Non local Data on the Stack, Parameter Passing.

UNIT – V

Code Generation: Issues in the Design of a Code Generator, the Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs.

Code Optimization: Optimization of Basic Blocks. Peephole Optimization, Register Allocation and Assignment.

Machine Independent Optimizations – The Principal Sources of Optimizations, Introduction to Data Flow Analysis.

Textbooks:

1. Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D Ullman, Compilers: Principles, Techniques & Tools, 2nd Edition (2007), Pearson Education.
2. Kenneth C Louden, Compiler Construction: Principles and Practice, 2nd Edition (2005), Cengage Learning.

References:

1. P. Trembley and P.S.Sorenson, The Theory and Practice of compiler writing, TMH-1985.
2. Keith d Cooper & Linda Tarezon, Engineering a Compiler,2nd Edition(2011), Morgan Kafman.
3. JohnRLevine, TonyMason, Doug Brown Lex &Yacc,3rd Edition (2007), Shroff Publisher .
4. John R Levine, Lex&Yacc, 2nd Edition(2009), Oreilly Publishers.

Web References:

1. http://nptel.ac.in/courses/106108052/1.
2. http://freevideolectures.com/Course/3051/Compiler-Design

Course Code	Course Title						Core/Elective
U21PC602CS	**Artificial Intelligence and Machine Learning**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Data Structures, Linear algebra, Probability and Statistics	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. Understand the importance of AI & ML, history and various applications.
2. Learn about one of the basic applications of A.I, search state formulations.
3. Learn methods of expressing knowledge by a machine with appropriate reasoning and how to reason when an agent has only uncertain information about its task.
4. Know various supervised and unsupervised learning algorithms.
5. Explore basics of neural networks.

Course Outcomes:

On completion of this course, the student will be able to-

1. Formalize a problem in the language/framework of different AI and ML methods
2. Illustrate basic principles of AI in solutions that require problem solving, search, inference
3. Represent natural language/English using Predicate Logic to build knowledge through various representation mechanisms
4. Demonstrate understanding of steps involved in building of intelligent agents, expert systems, Bayesian networks
5. Differentiate between learning paradigms to be applied for an application and apply relevant supervised/unsupervised algorithms.

UNIT – I

Introduction- What is intelligence? Foundations of artificial intelligence (AI). History of AI, Structure of Agents.

Problem Solving - Formulating problems, problem types, states and operators, state space. **Search strategies** - Informed Search Strategies- Best first search, A* algorithm, heuristic functions, Iterative deepening A*.

Adversarial Search/ Game playing - Perfect decision game, imperfect decision game, evaluation function, alpha-beta pruning.

UNIT – II

Reasoning-Knowledge based agent, Propositional Logic, Inference, Predicate logic (first order logic), Resolution.

Expert System and Applications: Introduction, Phases in Building Expert Systems, Expert System Architecture, Applications.

Uncertainty - Basic probability, Bayes rule, Belief networks, Inference in Bayesian Networks.

UNIT – III

Supervised learning

Types of Machine-Learning Algorithms: Parametric and Nonparametric, Supervised, Unsupervised, Semi Supervised and Reinforcement Learning.

Regression: Least squares, Single variable cost function, gradient descent for linear regression.

Logistic regression: Discriminative Classification, Hypothesis Representation, Decision Boundary, Cost function.

Classification: Naive Bayes, Decision Tree, K-Nearest Neighbors, Support vector machine.

UNIT – IV

Neural Networks: Perceptron, Multilayer neural network, activation functions, network training – gradient descent optimization, back propagation.

Evaluation: SSE, RMSE, S2, Confusion matrix, Accuracy, Precision, Recall, F-score, ROC, cross-validation, hold -out.

UNIT – V

Unsupervised learning: Similarity measures, K-means, Hierarchical, Gaussian mixture models, and Expectation maximization.

Reinforcement Learning: State and Action spaces, Learning from rewards, Action Selection, Policy, Active and Passive reinforcement Learning, Applications.

Applications: NLP - Text classification, Sentiment analysis, Computer Vision – Image classification, Object Recognition Speech – Speech recognition.

Textbooks:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2021.
2. Machine learning, T. Mitchell., McGraw-Hill New York, (1997).
3. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition.

References:

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2011.
2. Trevor Hastie Robert Tibshirani Jerome Friedman, The Elements of Statistical Learning, Data Mining, Inference, and Prediction, Springer Series in Statistics, 2009.
3. Saroj Kaushik, Artificial Intelligence, Cengage Learning, 1st Edition, 2011.
4. Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", McGraw Hill, 2008.
5. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013.

Professional Elective -II

Course Code	Course Title						Core/Elective
U21PE621CT	**Distributed Databases**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Basic concept of DBMS and RDBMS.	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. Introducing Distributed Database Management System and its Design issues
2. Exploring several algorithms for processing queries and be able to use them
3. Describe the methods to translate complex conceptual data models into logical and Physical database designs
4. Demonstrating query optimization and its algorithms
5. Enumerating the concepts behind distributed transaction processing

Course Outcomes:

On completion of this course, the student will be able to-

1. Identify the introductory distributed database concepts and its structures.
2. Describe terms related to distributed object database design and management.
3. Produce the transaction management and query processing techniques in DDBMS.
4. Relate the importance and application of emerging database technology.
5. Design distributed objects, address architectural issues, manage distributed object storage, and process object queries in a distributed environment.

UNIT-I

Introductory Concepts and Design of DDBMS: Data Fragmentation; Replication, and allocation techniques for DDBMS; Methods for designing and implementing DDBMS, designing a distributed relational database; Architectures for DDBMS: cluster federated, parallel databases and client server architecture.

UNIT-II

Query Processing & Transaction Management: Overview Of Query Processing: Query processing problem; Objectives of Query Processing; Complexity of Relational Algebra operations; characterization of Query processors; Layers of Query Processing Introduction to Transaction Management: Definition of Transaction, Properties of Transaction, types of transaction; Distributed Concurrency Control: Serializability theory; Taxonomy of concurrency control mechanisms; locking bases concurrency control algorithms.

UNIT-III

Distributed Object Database Management Systems: Fundamental Object concepts and Object models, Object distribution design, Architectural issues, Object management, Distributed object storage, object query processing.

UNIT IV

Distributed Object/component-based DBMS; Database Interoperability including CORBA; DCOM and Java RMI; Distributed document-based systems; XML and Workflow management

UNIT-V

Parallel Database Mobile database; Multimedia Database; Spatial Database and Web Databases.

Textbooks:

1. Distributed Databases - Principles and Systems; Stefano Ceri; Guiseppe Pelagatti; Tata McGraw Hill; 1985.
2. Fundamental of Database Systems; Elmasri & Navathe; Pearson Education; Asia.
3. Database System Concepts; Korth & Sudarshan; TMH.
4. Principles of Distributed Database Systems; M. Tamer Özsu; and Patrick Valduriez Prentice Hall.

Reference Books:

1. Data Base Management System; Leon & Leon; Vikas Publications
2. Introduction to Database Systems; Bipin C Desai; Galgotia.

Course Code	Course Title						Core/Elective
U21PE622CT	**Graph Theory**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. To introduce terminology and basic representation of graphs.
2. To understand the properties of Trees.
3. To explain graph coloring and its properties and understand directed graphs.
4. To understand the theorems of matchings and covers.
5. To understand the applications of graph theory in various real time scenarios.

Course Outcomes:

On completion of this course, the student will be able to-

1. Understand the basic concepts of graphs, types of graphs, matrix representations and the various operations of graphs.
2. Identify the properties of trees along with their applications.
3. Analyze and Illustrate concepts like graph coloring, chromatic number and directed graphs with suitable examples.
4. Explain theorems of matchings' and coverings in bipartite graphs. Summarize the consequences of theorems.
5. Analyze the properties of Euler graphs and planar graphs and relate the applications of graphs to real time scenarios like travelling salesman problem, Chinese postman problem.

UNIT-I

Introduction: Introduction, Matrix representations of graphs, Graph Sequence, Havel-Hakimi criterion, Graph Operations, Connectivity, Sub Graphs.

Graph Isomorphism: Necessary and sufficient conditions for isomorphism of graphs. Overview of Special Graphs: Euler Graphs, Hamilton Graphs , Bipartite Graphs, Planar Graphs, Line Graphs, Chordal Graphs.

UNIT-II

Trees– Properties of Trees, Distance and Centers in Tree , Rooted and Binary Trees.

Spanning Trees, Connectivity: Spanning Trees , Fundamental Circuits ,Spanning Trees in a Weighted Graph , Cut Sets , Properties of Cut Set ,All Cut Sets ,Fundamental Circuits and Cut Sets , Connectivity and Separability , Combinational and Geometric Graphs.

UNIT-III

Colouring and directed graph: Chromatic Number, Chromatic Partitioning, Chromatic Polynomial, Edge Coloring & Vertex Coloring , Gupta-Vizing theorem.

Directed graphs: Types of Directed Graphs , Digraphs and Binary Relations ,Directed Paths and Connectedness ,Directed Eulerian Graphs.

UNIT-IV

Matchings & covers: Matchings– Matchings& Coverings in Bipartite Graphs – Perfect Matching – Maximum Matching – Hall's Theorem & Consequences– Min – Max Theorems – Independent Sets & Edge Covers – Cuts & Connectivity.

UNIT-V

Euler, Hamiltonian graphs: Euler Graphs, Properties of Euler graphs Hamiltonian Graphs , paths and circuits, dirac's theorem, ore's theorem,Fleury's algorithm ,Chinese postman problem, traveling salesperson problem.

Planar graphs: Plane & Planar graphs – Dual Graphs – Euler Formula – Kuratowski's Theorem – The five-color theorem and four color conjecture.

Textbooks:

1. Douglas B. West, Introduction to Graph Theory, 2nd Edition, Prentice Hall of India,2015.
2. Rosen K.H., ―Discrete Mathematics and Its Applications, McGraw Hill, 2007.

References:

1. Narsingh Deo, Graph Theory: With Application to Engineering and Computer Science, 2nd Edition, Prentice Hall of India, 2003.
2. F. Harry, Graph Theory, Narosa Publications, 2001.

Course Code	Course Title						Core/Elective
U21PE623CT	**Agile Software Development**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Software Engineering	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. To introduce students to the fundamental principles and practices of Agile Methodology.
2. To provide an in-depth understanding of various agile processes and methodologies.
3. To explore the integration of agility with knowledge management.
4. To examine the impact of agile processes on requirements engineering.
5. To highlight the importance of quality assurance within agile product development.

Course Outcomes:

On completion of this course, the student will be able to-

1. Apply Agile Software Development practices and work small teams to create high-quality software.
2. Understand the concepts of software design and a set of software technologies and APIs.
3. Demonstrate agile development and testing techniques.
4. Assess the impact of agile practices on requirements engineering
5. Implement agile metrics for product development.

UNIT I

Agile Methodology: Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model – Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams – Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values

UNIT II

Agile Processes: Lean Production – SCRUM, Crystal, Feature Driven Development- Adaptive Software Development – Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.

UNIT III

Agility and Knowledge Management: Agile Information Systems– Agile Decision Making– Earl_S Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment, Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM).

UNIT IV

Agility and Requirements Engineering: Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.

UNIT V

Agility and Quality Assurance: Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance – Test Driven Development – Agile Approach in Global Software Development.

Text Books:

1. David J. Anderson and Eli Schragenheim, ―Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.
2. Hazza and Dubinsky, ―Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, 2009.

References:

1. Craig Larman, ―Agile and Iterative Development: A Managers Guide, Addison-Wesley, 2004.
2. Kevin C. Desouza, ―Agile Information Systems: Conceptualization, Construction, and Management, Butterworth- Heinemann, 2007.

Course Code	Course Title						Core/Elective
U22PE621DS	**Object Oriented System Development**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. The essentials and fundamental aspects of object-oriented concepts along with their applications
2. To analyze, design and implement object-oriented software systems by means of a mid- sized project.
3. Learn software development life cycle for Object-Oriented solutions for Real-World Problems.
4. Exposure to various modeling techniques to model different perspectives of object-oriented software design (UML).
5. Application of software architectures in various settings, including the application of design patterns, frameworks and toolkits.

Course Outcomes:

On completion of this course, the student will be able to-

1. Identify and select suitable Process Model for the given problem and have a thorough understanding of various Software Life Cycle models
2. Analyze the requirements of a given software project and produce requirement specifications (SRS)
3. Design the Use-Case Diagrams, Sequence Diagrams, Class Diagram, State Diagrams, and Deployment Diagrams by applying the UML Standards.
4. Apply the knowledge of object-oriented modeling concepts and design methods with a clear emphasis on Unified Modelling Language (UML) for a moderately realistic object-oriented system.
5. Apply various software architectures, including frameworks and design patterns, when developing software projects

UNIT – I

UML Introduction: Intro to Model and UML, Basic Modeling Classes, Relationships, Common mechanism, Diagrams, Class Diagrams.

UNIT – II

Basic Behavioural Modeling: Interactions, Use Cases, Use Case Diagrams, Interaction Diagrams, Activity Diagrams.

UNIT – III

Architectural Modeling: Artifacts, Deployment Collaborations, Patterns and Frameworks, Artifact diagrams, Deployment diagrams, Systems and models.

UNIT – IV

Unified Software Development Process: The Unified process, The Four Ps, A use-case – Driven Process.

UNIT – V

Core Workflows: Requirements Capture, Capturing Requirements as Use Cases, Analysis, Design, Implementation, Testing.

References:

1. "The Unified Modeling Language – User Guide" by Grady Booch, James Rumbaugh, Icor Jacobson.
2. Object Management Group(OMG) - The Unified Modeling Language Specification Version 2.5.1, December 2017 – https://www.omg.org/spec/UML, https://www.omg.org/spec/UML/2.5.1/PDF (OMG Doc.No.formal/2017-12-05)

Course Code	Course Title						Core/Elective
U22PE623CB	**Wireless Sensor Networks**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Data Communications and Computer Networks.	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. Understand the concept of wireless sensor networks, design and implementation issues and available solutions.
2. Demonstrate the routing mechanisms.
3. Understand the clustering mechanisms and different schemes that have been employed, e.g., hierarchical.
4. Explain sensor networks and their characteristics. This includes design of MAC layer protocols, understanding of power management, query processing, and sensor databases.
5. Demonstrate the designing and implementing wireless sensor network functionality using network simulation tools and Pocket PCs.

Course Outcomes:

On completion of this course, the student will be able to-

1. Understand characteristics of WSN, design issues and applications.
2. Classify WSNs, and understand different routing algorithms.
3. Demonstrate secure routing using key management techniques.
4. Identify challenges in sensor network programming to develop sensor network platforms and tools.
5. Create programs for Tiny OS, node level simulators using using nesC and TinyGALS

UNIT – I

Basics of Wireless Sensors and Applications: The Mica Mote, Sensing and Communication Range, Design Issues, Energy Consumption, Clustering of Sensors, Applications.

UNIT – II

Data Retrieval in Sensor Networks: Classification of WSNs, MAC Layer, Routing Layer, High-Level Application Layer Support, Adapting to the Inherent Dynamic Nature of WSNs.

UNIT – III

Security: Security in Wireless Networks, Key Management, Secure Routing, Intrusion Detection Systems

UNIT – IV

Sensor Network Platforms and Tools: Sensor network Hardware, Sensor Network Programming Challenges, and Node-Level Software Platforms.

UNIT – V

Operating System-Tiny OS: Imperative Language: nesC, Data flow style language: Tiny GALS, Node- Level Simulators, NS-2 and its sensors network extension, TOSSIM.

Textbooks:

1. Ad Hoc and Sensor Networks: Theory and Applications, Carlos de Morais Cordeiro and Dharma Prakash Agrawal, World Scientific Publications / Cambridge University Press,2006.
2. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science Imprint, Morgan Kauffman Publishers, 2005.

References:

1. Ad Hoc Wireless Networks: Architectures and Protocols, C. Siva Ram Murthy and B. S. Manoj, Pearson Education, 2004.
2. Guide to Wireless Ad Hoc Networks, Sudip Misra, Isaac Woungang, and Subhas Chandra Misra, Springer International Edition, 2011.
3. Guide to Wireless Sensor Networks, Sudip Misra, Isaac Woungang, and Subhas Chandra Misra, Springer International Edition, 2012.
4. Wireless Mesh Networking, Thomas Krag and Sebastin Buettrich, O'Reilly Publishers,2007.
5. Wireless Sensor Networks – Principles and Practice, Fei Hu, Xiaojun Cao, An Auerbach book, CRC Press, Taylor & Francis Group, 2010.
6. Wireless Ad hoc Mobile Wireless Networks-Principles, Protocols and Applications, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2008.
7. Wireless Ad hoc Networking, Shih-Lin Wu, Yu-Chee Tseng, Auerbach Publications, Taylor & Francis Group, 2007
8. Wireless Ad hoc and Sensor Networks–Protocols, Performance and Control, Jagannathan Sarangapani, CRC Press, Taylor & Francis Group, 2007, rp2010.
9. Security in Ad hoc and Sensor Networks, Raheem Beyah, et al., World Scientific Publications /Cambridge University Press, 2010.

e-Resources:

1. *Wireless Ad Hoc and Sensor Networks, IIT Kharagpur, Prof. Sudip Misra - https://nptel.ac.in/courses/106105160*

Professional Elective -III

Course Code	Course Title						Core/Elective
U21PE631CT	**Computer Vision**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. Understand the Fundamentals of Digital Image Acquisition
2. Analyze and Interpret Image Histograms.
3. Apply Geometric Transformations to Images.
4. Perform Edge Detection in Images.
5. Extract and Analyze Image Features and Patterns.
6. Understand Challenges in Video Processing.

Course Outcomes:

On completion of this course, the student will be able to-

1. Comprehend Digital Image Acquisition Processes
2. Generate and Analyze Histograms for Images.
3. Apply Geometric Transformations to Images.
4. Implement Edge Detection Techniques.
5. Extract Features and Patterns from Images.
6. Address Challenges in Video Processing.

UNIT I

Introduction: A Difficult Problem, The Vision System, Practical Application of Computer Vision, Image Sources: Cameras, Images, Color Images, Noise, Smoothing.

UNIT II

Histograms: 1D Histograms, 3D Histograms, Image Equalization, Histogram Comparison, Back Projetion, k-means Clustering. Binary Vision: Thresholding, Detection Methods, Variations, Mathematical Morphology, Connectivity.

UNIT III

Geometric Transformations: Problem Specification & Algorithm, Affine Transformation, Perspective Transformations, Specification of More Complex Transformations, Interpolation, Modelling, and Removing Distortion. Edges: Detection- First & Second Derivatives, Multispectral; Contour Segmentation- Edge Representation, Border Detection, Extracting Line Segments; Hough Transform.

UNIT IV

Features: Corner Detection Techniques, SIFT, Other Detectors. Recognition: Template Matching, Chamfer Matching, Statistical Pattern Recognition, Cascade of Haar Classifiers, Performance.

UNIT V: Video: Moving Object Detection- Object of Interest, Common Problems, Difference Images, Background Models, Shadow Detection; Tracking-Exhaustive Search, Mean Shift, Dense & Feature Bases Optical Flow; Performance.

Textbook:

1. A Practical Introduction to Computer Vision WithOpencv, Kenneth Dawson-Howe, 1st Edition, Wiley.

Reference Books:

1. Computer Vision: Algorithms and Applications, Richard Szeliski, Springer-Verlag London Limited.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education.

Course Code	Course Title						Core/Elective
U21PE632CT	**Robotic Process Automation**						**Elective**
Prerequisite	Contact Hours per week				CIE	SEE	Credits
	L	T	D	P			
Basic Programming Concepts	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. To introduce students to the fundamentals of Robotic Process Automation.
2. To provide an understanding of workflow sequencing, decision-making processes.
3. To explore various plugins and extensions for enhancing RPA capabilities.
4. To provide comprehensive knowledge on exception handling, debugging, and logging techniques.
5. To equip students with the skills required for deploying, managing, and maintaining bots.

Course Outcomes:

On completion of this course, the student will be able to-

1. Understand Robotic process Automation Technology
2. Apply Uipath Programming techniques to deploy robot configurations.
3. Explore various data extraction techniques and perform integrations with various popular applications
4. Design and develop a programmed robot that includes logging and exception handling.
5. Deploy and control Bots with Uipath orchestrator.

UNIT-I

Introduction: What is Robotic Process Automation (RPA), Scope & techniques of Automation, Benefits of RPA, Components of RPA, RPA Platforms, UiPath Studio, Installation of UiPath Studio, Learning UiPath Studio.

UNIT - II

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, and Control Flow for Decision making.

Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations

Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events

Recording and advanced UI Interaction: Basic recording, Desktop recording, Web recording, Citrix, Screen Scraping, When to use OCR, Types of OCR available, How to use OCR Avoiding typical failure points.

UNIT-III

Plugins and Extensions: Terminal plugin, Java plugin, Java plugin with UiPath Studio, Citrix automation, Citrix environment, Mail plugin, PDF plugin, Web integration, Excel and Word plugins, Credential management Extensions

Handling User Events and Assistant Bots: What are assistant bots, Monitoring system event triggers: Hotkey trigger, Mouse trigger, System trigger, Monitoring image and element triggers, launching an assistant bot on a keyboard event

UNIT-IV

Exception Handling, Debugging, and Logging: Exception handling, Common exceptions and ways to handle them, Logging and taking screenshots, Debugging techniques, Setting breakpoints, Slow step, Highlighting, Break, Collecting crash dumps: Enabling crash dumps, Disabling crash dumps, Error reporting: Enterprise Edition customers, Community Edition users.

Managing and Maintaining the Code: Project organization, Picking an appropriate layout for each workflow, Breaking the process into smaller parts, Using exception handling, Making your workflow readable, Keeping it clean, Nesting workflows, Reusability of workflows, Templates, Commenting techniques, State Machine, When to use Flowcharts State Machines or Sequences.

UNIT-V

Deploying and Maintaining the Bot: Publishing using publish utility, Overview of Orchestration Server, Using Orchestration Server to control bots, Using Orchestration Server to deploy bots, License management, Activating and uploading a license to Orchestrator, Publishing and managing updates, Packages, Managing packages

Learning Resources:

1. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: OReilly Publishing, 2018, ISBN: 9781788470940
2. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018
3. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018
4. Srikanth Merianda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation, 1st Edition, Consulting Opportunity Holdings LLC, 2018
5. https://www.uipath.com/rpa/robotic-process-automation
6. https://www.udemy.com/robotic-process-automation/

Course Code	Course Title						Core/Elective
U22PE631DS	**Human Computer Interaction**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

The course will introduce the students to

1. Gain an overview of Human-Computer Interaction (HCI), with an understanding of user interface design in general, and alternatives to traditional "keyboard and mouse" computing
2. Become familiar with the vocabulary associated with sensory and cognitive systems as relevant to task performance by humans
3. Be able to apply models from cognitive psychology to predicting user performance in various human-computer interaction tasks and recognize the limits of human performance as they apply to computer operation
4. Appreciate the importance of a design and evaluation methodology that begins with and maintains a focus on the user
5. Be familiar with a variety of both conventional and non-traditional user interface paradigms, the latter including virtual and augmented reality, mobile and wearable computing, and ubiquitous computing; and understand the social implications of technology and their ethical responsibilities as engineers in the design of technological systems.

Course Outcomes:

After successful completion of the course the students will be able to

1. Explain the capabilities of both humans and computers from the viewpoint of human information processing.
2. Describe typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms.
3. Apply an interactive design process and universal design principles to designing HCI systems.
4. Describe and use HCI design principles, standards and guidelines.
5. Analyze and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems.

UNIT - I

Introduction: Importance of user Interface – definition, importance of good design, Benefits of good design. A brief history of Screen design.

The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.

UNIT - II

Design process – Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions.

Screen Designing: Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.

UNIT- III

Windows – New and Navigation schemes selection of window, selection of devices based and screen- based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors.

UNIT- IV

HCI in the software process, The software life cycle Usability engineering Iterative design and prototyping Design Focus: Prototyping in practice Design rationale Design rules Principles to support usability Standards Golden rules and heuristics HCI patterns Evaluation techniques, Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method. Universal design, Universal design principles Multi-modal interaction

UNIT- V

Cognitive models Goal and task hierarchies Design Focus: GOMS saves money Linguistic models The challenge of display-based systems Physical and device models Cognitive architectures Ubiquitous computing and augmented realities Ubiquitous computing applications research Design Focus: Ambient

Wood – augmenting the physical Virtual and augmented reality Design Focus: Shared experience Design Focus: Applications of augmented reality Information and data visualization Design Focus: Getting the size right.

Text Books:

1. The essential guide to user interface design, Wilbert O Galitz, Wiley Dream Tech. Units 1, 2, 3
2. Human – Computer Interaction. Alan Dix, Janet Fincay, Gre Goryd, Abowd, Russell Bealg, Pearson Education Units 4,5

Reference Books:

1. Designing the user interface. 3rd Edition Ben Shneidermann, Pearson Education Asia.
2. Interaction Design Prece, Rogers, Sharps. Wiley Dreamtech.
3. User Interface Design, Soren Lauesen , Pearson Education.
4. Human –Computer Interaction, D. R. Olsen, Cengage Learning.
5. Human –Computer Interaction, Smith - Atakan, Cengage Learning

Course Code	Course Title						Core/Elective
U22PE632CB	**Software Project Management**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Software Engineering	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. To highlight the importance of software project management and understand the Software Project Planning and Evaluation techniques.
2. To discuss various processes in Software Project Management and manage projects at each stage of the software development life cycle.
3. To Provide Tools and Techniques for Project Monitoring and learn about the activity planning and risk management.
4. To expose different Project Management Lifecycles and manage software project deliverables.
5. To develop skills to manage the various phases involved in project management and people management.

Course Outcomes:

Upon completion of the course, the students will be able to:

1. Design a project management plan using different project management lifecycles.
2. Acquire the ability to track project execution and knowledge about software effort estimation techniques.
3. Analyze the risks associated with the Projects and identify the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.
4. Gain extensive knowledge about the basic project management concepts, framework and the process models.
5. Understand staff selection process and the issues related to people management.

UNIT-I

Conventional Software Management, Evolution of Software Economics, Improving Software Economics, Old Way & New.

UNIT-II

Life – Cycle phases, Artifacts of the process, Model Based Software Architectures, Workflows of the Process, Check points of the process.

UNIT-III

Iterative Process Planning, Project Organizations & Responsibilities, Process Automation, Project Control of Process Instrumentation, Tailoring the Process.

UNIT-IV

Modern Project profiles, Next Generation Software Economics, Modern process Transitions, Managing Contacts, Managing People & Organizing Terms.

UNIT-V

Process improvement & mapping to the CMM, ISO 12207 – an overview, programme management.

Text Books:

1. Walker Royce, Software Project Management – A Unified frame work, Pearson Education, Addison, 1998, Sixth Printing November 2000

Reference Books:

1. Bob Hughes and Mike Cotterell, Software Project Management, Tata McGraw Hill, 3rd Edition, 2010.
2. Watt.S. Humphery, Managing Software Process, Addison - Wesley, 2008.

e-Resources:

1. Software Project Management, IIT Kharagpur, Prof. Rajib Mall, Prof. Durga Prasad Mohapatra - https://nptel.ac.in/courses/106105218

Course Code	Course Title						Core/Elective
U22PE635CB	**Natural Language Processing**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Linguistics basics Probability & Statistics Machine learning	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. Learn NLP tasks in syntax, semantics, pragmatics, and understand machine learning, probability, and N-gram models.
2. Understand morphology, finite state transducers, POS tagging, including HMMs and Maximum Entropy Models (MEMs).
3. Overview grammar formalisms, treebanks, CFG parsing, probabilistic CFGs (PCFGs), and lexicalized PCFGs.
4. Learn meaning representation, lexical semantics, word sense disambiguation, compositional semantics, SRL, and semantic parsing.
5. Study discourse segmentation, coherence, reference, anaphora resolution, lexical resources, and Named Entity Recognition (NER).

Course Outcomes:

On completion of this course, the student will be able to-

1. Understand NLP tasks in syntax, semantics, and pragmatics, along with the application of machine learning in various contexts.
2. Apply morphological analysis and POS tagging techniques using rule-based, statistical, and probabilistic models.
3. Implement syntax parsing using CFGs and statistical methods for efficient natural language understanding.
4. Analyze meaning representation, word sense disambiguation, and semantic role labeling for deeper comprehension of language.
5. Apply discourse analysis techniques and utilize lexical resources for tasks like NER, relation extraction, and machine translation.

UNIT-I

Introduction to Natural Language Processing (NLP) tasks in syntax, semantics, and pragmatics. Overview of applications and the role of machine learning. Basics of probability and information theory. N-gram language models and evaluation methods.

UNIT-II

Morphology and Part of Speech (POS) Tagging: Linguistic essentials, morphology, and finite state transducers. POS tagging methods including rule-based, Markov models, Hidden Markov Models (HMMs), and Maximum Entropy Models (MEMs).

UNIT-III

Syntax Parsing: Overview of grammar formalisms and treebanks. Parsing with Context Free Grammars (CFGs) and statistical parsing techniques such as probabilistic CFGs (PCFGs) and lexicalized PCFGs.

UNIT-IV

Semantic Analysis: Representation of meaning, lexical semantics, word sense disambiguation, and compositional semantics. Introduction to Semantic Role Labeling (SRL) and Semantic Parsing.

UNIT-V

Discourse Analysis and Lexical Resources: Discourse segmentation, coherence, and reference phenomena. Anaphora resolution methods and resources including Porter Stemmer, Lemmatizer, Penn Treebank, WordNet, PropBank, FrameNet, and corpora like the Brown Corpus and British National Corpus (BNC). Introduction to Named Entity Recognition (NER), Relation Extraction, and Machine Translation (MT) applications in NLP.

Text Books:

1. Daniel Jurafsky and James H. Martin Speech and Language Processing (2nd Edition), Prentice Hall; 2 edition,2008
2. Foundations of Statistical Natural Language Processing by Christopher D.Manning and Hinrich Schuetze, MIT Press,1999
3. Steven Bird, Ewan Klein and Edward Loper Natural Language Processing with Python, O'Reilly Media; 1 edition,2009 Roland R. Hausser, Foundations of Computational Linguistics: Human-Computer Communication in Natural Language, Paperback, MIT Press,2011

Reference Books:

1. Pierre M. Nugues, An Introduction to Language Processing with Perl and Prolog: An Outline of Theories, Implementation, and Application with Special Consideration of English, French, and German (Cognitive Technologies) Softcover reprint,2010
2. James Allen, Natural Language Understanding, Addison Wesley; 2nd Edition 1994, NLTK – Natural Language ToolKit-http://www.nltk.org/

e-Resources:

1. *Natural Language Processing, IIT Kharagpur, Prof. Pawan Goyal - https://nptel.ac.in/courses/106105158*

Open Elective - I

Course Code	Course Title						Core/Elective
U21OE611AE	**Automobile Engineering**						**Elective**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	3	-	**30**	**70**	3

Course Objectives:

It is intended to make the students to

1. Understand the Working of Fuel, Ignition, and cooling Systems
2. Understand the Working of Lubrication and Electrical Systems.
3. Understand the Working of transmission, Suspension, Steering and Braking Systems.
4. To provide broad introduction to Alternative Energy Sources, Euronorms and Bharat Norms

Course Outcomes:

After completing this course, the student will be able to

1. Generalize the different types of automobiles and engine components,
2. Differentiate the Fuel system and electrical system.
3. Describe and differentiate the Transmission Systems
4. To identify different components and working of Steering, Brakesand Suspension systems
5. Adapt techniques, skills and modern engineering tools necessary tocontrol the pollution

Unit-I

Vehicle Structure and Engines: Types of Automobiles, Vehicle Construction, Chassis, Frame and Body , Components of Engine , Cooling and Lubrication systems in Engine, Turbo Chargers, Engine Emission Control by 3 Way Catalytic Controller, Electronic Engine Management System.

Unit-II

Engine Auxiliary Systems: Carburettor working principle, Electronic fuel injection system, single-point and Multi-Point Injection Systems, Electrical systems, Battery, generator, Starting Motor and Lighting and Ignition.

Unit-III

Transmission Systems-Clutch: Types and Construction, Gear Boxes-Manual and Automatic, , Over Drives, Transfer Box Fluid flywheel Torque convertors, Propeller shaft – Slip Joint – Universal Joints, Differential and Rear Axle, Hotchkiss Drive and Torque Tube Drive.

Unit-IV

Steering, Brakes and Suspension: Wheels and Tires – Wheel Alignment Parameters, Steering Geometry and Types of steering gear box, Power Steering, Types of Front Axle – Suspension systems. Braking Systems, Types and Construction, Antilock Braking System.

Unit-V

Alternative Energy Sources: Use of Natural Gas, LPG, Biodiesel, Gasohol and Hydrogen in Automobiles, Electric and Hybrid Vehicles, Fuel Cells. Euro and Bharat Norms. Recent trends.

Suggested Readings:

1. Crouse & Anglin, 'Automotive Mechanics' Tata McGraw Hill, Publishing Co., Ltd., New Delhi, Tenth edition - 2004.
2. Kirpal Singh, "Automobile Engineering", Vol I & II Standard Publishers, Delhi.
3. Joseph Heitner, 'Automotive Mechanics', Affiliated East West Pvt., Ltd.,
4. C.P. Nakra, "Basic Automobile Engineering", Dhanpat Rai Publishing Co.(P) Ltd., New Delhi, 2003

Course Code	Course Title						Core/Elective
U21OE611CE	**Disaster Mitigation**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	
	L	T	D	P			Credits
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives: The objective of this course is to impart knowledge on

1. Basic principles of disaster management.
2. Various types of disasters
3. Disaster management cycle and framework
4. Disaster management systems in India.
5. Applications of the latest technologies in disaster management.

Course Outcomes: After completing this course, the students will be able to

1. Define and explain the terms, concepts related to disaster, and categories of disasters.
2. Describe the various Hydro – Metrological based disasters and their specific characteristics.
3. Describe the various Geographical based disasters and their specific characteristics
4. Describe the various Human induced and Human Made hazards and Biological based disasters and their specific characteristics
5. List and explain the various technological applications to aid disaster management.

UNIT – I

Introduction: Understanding the Concepts and definitions of Disaster, Hazard, vulnerability and risk and Capacity, Types of disasters, Disaster and Development, and disaster management.

UNIT-II

Natural Disasters - Hydro- Meteorological based disasters: Floods, drought, cold and heat waves and desertification zones - Causes, Types, effects and Mitigation measures.

UNIT – III

Natural Disasters Geographical based disasters: Earthquake, Tsunamis, Landslides mining andavalanches - Causes, Types, effects and Mitigation measures.

UNIT – IV

Human induced and Human Made hazards: Chemical industrial hazards, Technological hazards, traffic accidents. - Causes, Types, effects and Mitigation measures.

Biological Disasters: Epidemics, pest attacks, forest fire- Causes, Types, effects and Mitigation measures.

UNIT-V

Role of Remote Sensing and Geographical Information Systems (GIS) in Disaster Management: Introduction to remote sensing and GIS, its applications in disaster management. Disaster management cycle, Disaster management act, Disaster management in India. Progress of disaster management in world.

Text Books:

1. Pradeep Sahni, "**Disaster Risk Reduction in South Asia**", Prentice Hall, 2004.
2. Singh B.K., "**Handbook of Disaster Management: Techniques & Guidelines**", Rajat Publication, 2008.
3. Ghosh G.K., "**Disaster Management**", APH Publishing Corporation, 2006.

Reference Books:

1. Rajib, S and Krishna Murthy, R.R., "Disaster management Global Challenges and Local Solutions", Universities Press, Hyderabad, 2012.
2. Navele, P & Raja, C.K., "**Earth and Atmospheric Disasters Management, Natural and Manmade"**, B.S. Publications, Hyderabad, 2009.
3. Battacharya, T., "**Disaster Science and Management**", Tata McGraw Hill Company, New Delhi, 2012.

Course Code	Course Title						Core/Elective
U21OE611CS	**Fundamentals of Data structures**						**Elective**
Prerequisites	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**3**	**30**	**70**	**3**

Course Objectives

1. To learn how to write algorithms and analyze.
2. To learn the linear and non-linear data structures.
3. To explore the applications of linear and non-linear data structures.
4. To learn to represent data using graph data structure.
5. To learn the basic sorting and searching algorithms.

Course Outcomes: Upon completion of the course, the students will be able to:

1. Implement linear and non-linear data structure operations using a computer language.
2. Suggest appropriate linear / non-linear data structure for any given data set.
3. Apply hashing concepts for a given problem.
4. Modify or suggest new data structure for an application.
5. Appropriately choose the sorting and searching algorithm for an application.

Unit –I

Introduction: Algorithm Specifications, Recursive algorithms, Performance Analysis (Time and space analysis of algorithms - Average, best and worst case analysis), Data structure-Definition, classification.

Unit-II

Linear Data structures

Arrays: Representation of arrays, Applications of arrays-Polynomial representation. **Stacks:** Introduction to Stack, Definition, Stack Operations, Applications of stacks.

Queues: Introduction to Queue, Definition, Queue Operations, Applications of queues.

Unit-III

Linear Data structures

Linked Lists: Introduction, Representation and Operations of Linked Lists, Singly Linked List, Application: stack, queue-Operations, Polynomial representation, Doubly Linked List, Circular Linked List.

Unit-IV

Non-Linear Data structures

Trees: Tree Terminology, Binary Tree, Strictly Binary Tree, Complete Binary Tree, Tree traversals, Binary Search Tree and operations Set representations – Union and Find operations.

Graphs: Representations, traversals.

Unit-V

Linear Search, Binary Search., Bubble Sort, Insertion sort, Merge sort, Quick sort, Hashing– Overflow handling.

Text Books:

1. Fundamentals of Data Structures in C-Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed Second Edition, University Press, 2008.
2. Data Structures Using C and C++ - Yedidyah Langsam, Moshe J. Augenstein, Aaron M.Tanenbaum- 2nd Edition,PHI Publications.
3. Fundamentals of Computer Algorithms- Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran-2nd edition,University Press ,2008

References:

1. Data Structures Through C- Yashwant Kanetkar, 2nd edition, BPB Publications Data Structures and Algorithms in C++ - Adam Drozdek.

Course Code	Course Title						Core / Elective
U21OE611EC	**Principles of Electronic Communication**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

1. Provide an introduction to fundamental concepts in the understanding ofcommunications systems.
2. Provide an introduction to fundamental concepts in the understanding of Analog andDigital modulation techniques.
3. Provide an introduction to satellite communications with orbitals and different communication satellites.
4. Provide an introduction to the optical communications in understanding different sources, detectors and losses.
5. Provide an introduction to the evolution of GPS in understanding orbital mechanics anddifferent augmentation systems.

Course Outcomes

1. Understand the working of basic communication systems
2. Understand the working of different analog and digital communication systems.
3. Understand the evolution of satellite communication technologies from orbital mechanics to communication satellites.
4. Understand the evolution of optical communication technologies along with optical laws and different losses.
5. Understand the evolution of GPS communication system and different augmentation systems.

UNIT – I

Introduction to communication systems: Electromagnetic Frequency Spectrum, Signal and its representation, Elements of Electronic Communications System, Types of Communication Channels.

Communication Parameters: Transmitted power, Channel bandwidth and Noise.

Signal Radiation and Propagation: Principle of electromagnetic radiation, Qualitative treatment of parabolic reflector, Micro strip antennas.

UNIT – II

Analog and Digital Communications: Need for Modulation, Amplitude modulation and demodulation, FM modulation and demodulation, Analog to Digital Conversion, Digital modulation schemes – ASK, FSK, PSK, Digital demodulation.

UNIT – III

Satellite Communication: Introduction to Satellite Communication, geosynchronous and geo-stationary satellites, Kepler's laws, LEO, MEO, GEO, Link-power budget equation, Indian scenario in communication satellites.

UNIT – IV

Optical Communications: Optical Principles, block diagram of Optical Communication System, advantages and disadvantages, Optical sources and detectors, Fiber–Optic Cables, bending losses and propagation losses.

UNIT – V

GPS Fundamentals: GPS Constellation, Principles of operation, GPS Orbits, Orbital mechanics and satellite position determination.

Qualitative treatment of Wide Area Augmentation System (WAAS) architecture and Local Area Augmentation System (LAAS), GPS Aided GEO Augmented Navigation (GAGAN).

Textbooks:

1. Louis E. Frenzel, "Principles of Electronic Communication Systems", 3e, McGraw Hill, 2008.
2. Kennady, Davis, "Electronic Communications systems", 4e, McGraw Hill, 1999.

References:

1. Timothy Pratt and Charles Bostian, "Satellite Communications", John Wiley, 1986.
2. Basudeb Bhatta," Global Navigation Satellite Systems: Insights into GPS,GLONASS, Galileo, Compass", B.S. Publications.

Course Code	Course Title						Core/Elective
U21OE612EC	**Electronic Instrumentation**						**Open Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
----	**3**	-	-	-	**30**	**70**	**3**

Course Objectives:

1. Understand the different standards of measurements.
2. Study different types of transducers.
3. List various types of measurements and thermometers
4. Learn the design of digital voltmeters
5. Study various types of bio-medical instruments

Course Outcomes:

1. Describe characteristic of an instrument and state different standards of measurements
2. Identify and explain different types of Transducers.
3. Draw and Interpret types of transducers.
4. Design and analyse the digital voltmeters and prioritize the instruments.
5. Identify and classify types of Biomedical instruments.

UNIT – I

Electronic Measurement fundamentals: Accuracy, Precision, Resolution and Sensitivity. Errors and their types. Standards of measurement, classification of standards, IEEE standards.

UNIT - II

Transducers: Classification, factors for selection of a transducer, transducers for measurement of velocity, acceleration. Passive electrical transducers- Strain gauges and strain measurement, Linear Variable Differential Transformer (LVDT). Active electrical transducers: Piezo-electric, photo conductive, photo voltaic and photo emissive transducers.

UNIT - III

Electronic Instruments for Measuring Basic Parameters: Voltmeters, Ammeters, Ohmmeters, Digital Meters.

Digital multimeters: Block diagram and specifications and different types of DVMs like Ramp type, Integrating type and Successive approximation type. Advantages of Digital volt Meters (DVM) over other Voltmeters.

UNIT – IV

Oscilloscopes: Cathode Ray Tube, Vertical and Horizontal Deflection Systems, Specification of an Oscilloscope. Measurement of Amplitude, Frequency and Phase measurement. Special Oscilloscopes – Storage Oscilloscope, Sampling Oscilloscope.

UNIT – V

Biomedical Instrumentation:

Human physiological systems and related concepts. Qualitative treatment of Electrocardiography (ECG), Electroencephalography (EEG), Electromyography (EMG), Comparison of ECG, EEG and EMG. Introduction to X- ray machines and Computed Tomography (CT) scanners.

Text Books:

1. H.S. Kalsi, "Electronic Instrumentation", TMH.
2. Khandpur R.S., "Handbook of Bio-Medical Instrumentation", TMH.

Reference Books:

1. David A. Bell, "Electronic Instrumentation & Measurements", PHI.
2. Albert D. Helfric, and William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", PHI.

Course Code	Course Title						Core/Elective
U21OE611EE	**Electrical Energy Conservation and Safety**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

1. To understand the concepts of basic energy and various forms of energy.
2. To understand the energy management and need of energy audit.
3. To understand the energy efficiency technologies.

Course Outcomes

At the end of the course students will be able to

1. Demonstrate the current energy scenario and importance of energy conservation.
2. Make use of the concepts of energy management.
3. Analyze the methods of improving energy efficiency in different electrical systems.
4. Choose different energy efficient devices.
5. Apply electrical safety

UNIT–I

Energy Scenario: Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment,energysecurity,energyconservationanditsimportance,restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. EnergyConservationAct-2001anditsfeatures.

UNIT-II

Basics of Energy and its various forms: Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity& heat transfer, units and conversion.

UNIT-III

Energy Efficiency in Electrical Systems: Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.

UNIT-IV

Energy Efficient Technologies in Electrical Systems: Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver,

variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology.

UNIT-V

Electrical Safety: Physiological effects of Electricity, Important Susceptibility parameters, Distribution of Electric Power, Macro shock hazards, Micro Shock hazards, Electrical - Safety codes and Standards, Basic Approaches to protection against shock , Protection: Power distribution, Protection: Equipment Design, Electrical Safety Analyzers, Testing the Electrical System. Test of Electric Appliances.

Text Books:

1. Guide books for National Certification Examination for Energy Manager /Energy Auditors Book-1, General Aspects (available online).
2. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-3, Electrical Utilities (available online).
3. S.C.Tripathy, Utilization of Electrical Energy and Conservation, McGrawHill, 1991.

Reference Books:

1. Success stories of Energy Conservation by BEE 8, 9 New Delhi (www.bee-india.org).

Course Code	Course Title						Core/Elective
U21OE611IT	**Database Systems**						**Elective**
Pre requisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives :

The student will be able

1. To understand the basic concept of DBMS.
2. To understand basics of SQL.
3. To learn to design develop and query the database.
4. To learn data base administration and transaction processing.
5. To understand security aspects related to database.

Course Outcomes :

After completing this course the student will be able to:

1. Understand the concepts related to database.
2. Understand basics of structured query language.
3. Design, Develop and Query the database.
4. Learn data base administration and transaction processing.
5. Understand security aspects related to database.

UNIT– I

Data and Data Management: Role of Data and Databases

Database and Database Management System: Key Data base concepts-Basic Data base Models-Database Components

Data Modeling: Database Design-Relational Database Models-Relationships-Comparing Data Models

UNIT– II

SQL language: SQL features-command basics-SELECT Fundamentals- Operators and Functions-DDL Commands – DML Commands.

Data Access and Manipulation: SELECT statement Advanced Syntax- Joins and Sub Queries.

SQL Procedures: SQL procedures and Functions-Triggers

UNIT– III

Designing a Database: Designing Relational Tables-Comparing Relational Designs– Normalizing Data.

Implementing a Database: Physical Design and Implementation – Adjusting Design to the Real World-Implementing Data base Objects.

UNIT– IV

Improving Data Access: Performance Rollbacks-Using Indexes and Views-Using Programmable objects.

Database Administration: Need for Administration-Administration Responsibilities – Management Task.

UNIT– V

Transactions and Locking: Transaction Basics – Managing Concurrency control-SQL server transaction management.

Database Access and Security: Database Connections-Managing Access Control – Protecting data.

Text Books:

1. Mark L. Gillenson, Paulraj Ponniah., ―Introduction to Database Management‖, John Wiley & Sons Ltd, 2008.
2. LeeChao, "DatabaseDevelopmentandManagement", Auerbach Publications, 2006.
3. RobCoronel,"Database Systems:Design, Implementation & Management" Thomson Course Technology, 2000.

Course Code	Course Title						Core / Elective
U21OE611ME	**Operations Research & Techniques**						**Elective**
Prerequisite	Contact Hours per week				CIE	SEE	Credits
	L	T	P	D			
Engineering Mathematics	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

The objective of this course are to

1. Use variables for formulating complex mathematical models in management science, industrial engineering and transportation models.
2. Use the basic methodology for the solution of linear programming problems.
3. Understand the mathematical tools that are needed to solve optimization problems like Transportation models and Assignment models.
4. Understand the replacement models with change in money value considering with time and without time.
5. Model a system as a queuing model and compute important performance measures.

Course Outcomes

Upon completion of course, students will be able to

1. Paraphrase the real time problem and develop a graphical or analytical linear programming model for maximization or minimization condition.
2. Categorize complex linear programming problem and apply duality concept for developing optimum Solution model.
3. Construct cost minimization model for transportation and resource allocation situations.
4. Recommend optimum criteria for maintenance and conflict situations by implementing suitable models
5. Analyse waiting line, resource scheduling situations and develop optimum solution.

UNIT-I

Introduction: Definition, Scope, applications of Operations Research& Techniques

Linear Programming: Introduction, formulation of linear programming problems, graphical method of solving LP problem, simplex method, maximization and minimization.

UNIT-II

Inventory Control: Importance of inventory control, types of inventory models Inventory costs deterministic inventory models Basic EOQ models, production model without shortages, Purchase model with instantaneous replenishment and with shortages production model with shortages.

UNIT-III

Assignment Problems: Hungarian method of Assignment problem, travelling salesman problem.

Sequencing Models: Introduction, General assumptions, processing 'n' jobs through 2 machines, processing 'n' jobs through 3 machines.

UNIT-IV

Game Theory: Introduction, Two-person zero sum games, Maximin – Minimax principle, Principle of Dominance, Solution for mixed strategy problems.

Replacement Models: Introduction, replacement of items that deteriorate ignoring change in money value, replacement of items that deteriorate considering change in money value with time

UNIT-V

Project Management: Project management: Network fundamentals, difference between PERT/CPM Scheduling the activities, Fulkerson's rule, Earliest and latest times, Determination of ES and EF in the forward path, LS and LF in backward path, Determination of critical path. Free float, independent float, Total float, Program Evaluation and Review Technique.

Text Books:

1. Operations Research – An Introduction, Hamdy, A. Taha, 6th Edition, Prentice Hall of India Pvt. Ltd., 1997.
2. Operations Research, S.D. Sharma, Kedarnath, Ramnath & Co., Meerut, 2009.
3. Operations Research, S. Kalavathy, 4th Edition, Vikas Publishing House Pvt. Ltd., 2018.

Reference Books:

1. Operations Research, P. Sankara Iyer, Tata McGraw-Hill Publishing Company Ltd., 2009.
2. Operations Research, V.K. Kapoor, S. Chand Publishers, New Delhi, 2004.
3. Operations Research, R. Panneer Selvam, 2nd Edition, Prentice Hall of India (P) Ltd., New Delhi, 2008.

Course Code	Course Title						Core / Elective
U21OE612ME	**Industrial Robotics**						**Elective**
Prerequisite	Contact Hours per week				CIE	SEE	Credits
	L	T	P	D			
Applied Physics, Applied Mechanics, Engineering Mathematics	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

To create awareness on types of robots and their working functions through various physical systems and related mechanics.

Course Outcomes

Upon completion of course, students will be able to

1. Demonstrate knowledge of the relationship between mechanical structures of industrial robots and their operational workspace characteristics and have an understanding of the functionality and limitations of robot actuators and sensors.
2. Demonstrate an ability to apply special transformation to obtain forward / inverse kinematics equation of robot manipulators using analytical / numerical / simulation tools.
3. Apply knowledge and choose the best & economically suitable sensors / end effectors required for specific applications.
4. Analyse the importance of robot vision and apply the learnt techniques to get the required information from input images.
5. Design an industrial robot for a given purpose economically.

UNIT-I

Introduction to Robotics

Brief history, types of robots, overview of robot subsystems, resolution, repeatability and accuracy, degrees of freedom of robots, robot configurations and concept of workspace,

End effectors, Grippers: Mechanical grippers, pneumatic and hydraulic grippers, magnetic grippers, vacuum grippers, RCC grippers, two fingered and three fingered grippers, internal grippers and external grippers, selection and design considerations.

UNIT-II

Requirements of a Sensor

Principles and Applications of the following types of sensors – Position of sensors (Piezo electric screw, LVDT, Resolvers, optical encoders, Pneumatic position sensors), Range sensors (Triangulation principle, Structured, Lighting approach, Time of flight range finders, Laser range meters), Proximity sensors (Binary sensors, Analog sensors), Wrist sensors, Compliance sensors, Slip sensors.

UNIT-III

Kinematic Analysis of Robots

Rotation matrix. Homogeneous transformation matrix, Denavit & Hartenberg representation,

Euler and RPY angles representation, Representation of absolute position and orientation in terms of joint parameters, direct kinematics of manipulators, Inverse kinematics of Robot arm for position and orientation. Redundancy in Robots, Static force analysis.

UNIT-IV

Introduction to Techniques used in Robot Vision

Image acquisition, illumination techniques, imaging geometry, basic relationship pixels, preprocessing, segmentation & description of 3 dimensional structures, their recognition and interpretation. Types of Camera, frame grabbing, sensing and digitalizing image data, Signal conversion, image storage, lighting, techniques, image processing and analysis, data reduction, segmentation, feature extraction, object recognition and various algorithms, applications, inspection, identification, visual and navigation.

UNIT-V

Robot Programming Languages

Characteristics of robot level languages, task level languages. Teach pendant programming, lead through programming, robot programming languages, VAL programming, Motion commands, sensor commands. End effecter commands, simple programs. RGV&AGV, implementation of robots in industries, various steps, safety considerations for robot operations. Economic analysis of robots, pay back method, EUAC method and Rate of return method.

Text Books:

1. Industrial Robotics, Groover M P, McGraw Hill Publications, 1999.
2. Robot Dynamics & Control, Spong and Vidyasagar, John Wiley and Sons, Ed., 1990
3. Industrial Robotics, Mittal and Nagrath, Tata McGraw Hill Publications, 2004.

Reference Books:

1. Robotics Control-sensing Vision and Intelligence, Fu K.S., Gonzalez R.C., Lee C.S.G., McGraw Hill, Int. Ed., 1987.

Course Code	Course Title						Core / Elective
U21OE611EG	**Soft Skills and Interpersonal Skills**						**Elective**
Prerequisite	Contact Hours per week				CIE	SEE	Credits
	L	T	P	D			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

1. To train the students in effective listening skills required for professional communication.
2. To enable the students to develop the required speaking skills for professional communication.
3. To equip the students with appropriate reading strategies required professionally.
4. To develop professional writing skills among students.
5. To equip the students with the right attitude and coping techniques required professionally.

Course Outcomes:

By the end of the course students will be able to:

1. Listen to a variety of speakers and texts and will be able to comprehend and perform required tasks.
2. Speak and respond appropriately as per the task requirement.
3. Read a variety of texts, comprehend, summarize them and perform the required tasks.
4. Write and publish a variety of documents such as letters, memos, emails, blogs, reports, cover letters and resume.
5. Demonstrate the right attitude and skills to cope with organizing and communicating professionally.

UNIT-1 Introduction and Skills of Listening

Definition, Nature and scope of Soft Skills, Importance of soft skills, Need for soft skills in academic and workplaces, Aptitude for Standardized tests

a) Listening Skills: Types of Listening, Active listening, Non-Verbal symbols of active listening, Importance of Listening in academic and professional communication
b) Listening Skills through varied activities: Ted talks, Professional Lectures on YouTube, TV, Radio, Classroom lectures – Note taking, IELTS/TOEFL based activities

UNIT 2 – Skills of Speaking

Presentation Skills Communication within Teams – Johari Window, Tuck's Model, Participating in GDs – Negotiation Skills, Interview Skills.

UNIT 3 – Skills of Reading for Communication

Effective Reading -Sub Skills of Reading- skimming, scanning, Inference Vocabulary Development- Synonyms & Antonyms- Idiomatic Expressions – One Word Substitute-Words often Confused Reading different genres of texts – Ranging from Newspapers to Philosophical treaties -Short stories & Novels, Auto Biographies/Biographies, Plays (conversational

skills), Personality Development Skills, Graphic Organizers and summarizing skills

UNIT 4 – Skills of Effective Writing

Writing Types –Free Writing, Expository, Descriptive, Narrative, Persuasive Writing for different purposes – publications, letters (formal -informal) , emails, blogs, cover letters & resume building, Punctuation Barriers of writing skills -Noise, lack of effective tools, training for writing, scope ofmotivation, writer's block.

UNIT 5 – Specific Soft Skills

Time Management, Emotional intelligence, Spiritual Quotient (ethics), Motivation and goal setting, Stress Management, Creative and Critical Thinking, Decision Making, Leadership Skills, Learning styles and strategies.

Suggested Reading

1. Andrea J. Rutherford. Basic Communication Skills for Technology. Pearson Education, Inc.New Delhi, 2001.
2. Anne Dannellon. Team Talk: The Power of Language in Team Dynamics. Harvard Business School Press, Boston, Massachusetts, 1996.
3. Antony Jay and Ros Jay. Effective Presentation: How to be a Top Class Presenter. Universities Press (India) Limited, 1999.
4. Ashraf.M. Rizvi, Effective Technical Communication. Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2005
5. Daniel Goldman. Emotional Intelligence. New York, Bantam Books, 1995.
6. Friedrike Klippel. Keep Talking. Cambridge University Press, London, 1984.
7. K.K. Sinha Business CommunicationGalgotia Publishing Company GPC,New Delhi, 1999.
8. Lewis.HedwigBody Language: A Guide for Professionals.Response Books (a division ofSage Publications India, Pvt. Ltd.,) New Delhi., 1998.
9. Hari Mohan Prasad and Rajnish Mohan. How to prepare for Group Discussion and Interview. 2nd Edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2005
10. Mitra, Barun. Personality Development and Soft Skills
11. Goodheart and Willcox. Soft Skills at Workplace.

Practical/ Laboratory Courses

Course Code	Course Title						Core/Elective
U21PC682CS	**Artificial Intelligence and Machine Learning Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Linear Algebra, Probability and Statistics, Data structures	**-**	**-**	**-**	**4**	**25**	**50**	**2**

Course Objectives:

1. To apply programming skills to formulate the solutions for computational problems.
2. To study implementation first order predicate calculus using Prolog
3. To understand python library scikit-learn for building supervised machine learning models.
4. To understand python library scikit-learn for implementing clustering algorithms.
5. To enrich knowledge to select and apply relevant AI tools for the given problem.

Course Outcomes:

On completion of this course, the student will be able to-

1. Design and develop solutions for informed and uninformed search problems in AI.
2. Demonstrate reasoning in first order logic using Prolog.
3. Select and apply python libraries to synthesize information and develop supervised learning models.
4. Evaluate and compare classifier models using relevant measures.
5. Apply unsupervised learning algorithms and interpret the results.

List of Experiments

1. Write a program to implement Uninformed Search Techniques
    a. BFS
    b. DFS
2. Write a program to implement Informed Search Techniques
    a. Greedy Best First Search
    b. A* algorithm
3. Study of Prolog, its facts, and rules
    a. Write simple facts for the statements and query them.
    b. Write a program for family tree.
4. **Regression**
    a. Write a program to build a Linear regression model and estimate output using the model.
5. **Classification**: Write a program to demonstrate the following classifiers. Use an appropriate dataset for building the model and classify a new instance.
    a. Logistic Regression
    b. Naïve Bayes

c. Decision Tree
d. kNN
e. SVM
f. Multi-Layer Perceptron (MLP)

6. Evaluate various classification algorithms performance on a dataset using measures such as True positive rate, False positive rate, F-score, Accuracy etc.
7. Write a program to demonstrate the following algorithms
    a. K means Clustering
    b. Hierarchical (Agglomerative)
    c. Expectation Maximization (Gaussian Mixture)

Course Code	Course Title						Core/Elective
U21PC681CT	**Embedded Systems and IoT Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives:

1. Identify the vision and understand the basics of Embedded and IoT.
2. Impart necessary and practical knowledge over various components of IoT.
3. Develop skills required to build real-time IoT based projects.
4. Learn to integrate sensors with Arduino and Raspberry Pi for data acquisition and processing.
5. Understand the process of sending sensor data to the cloud using different communication protocols like HTTP and LoRaWAN.

Course Outcomes:

On completion of this course, the student will be able to-

1. Ability to develop applications using Arduino and Raspberry Pi for Embedded and IoT projects.
2. Competence in interfacing hardware components and sensors with open-source platforms.
3. Proficiency in utilizing communication modules for data transmission and control in IoT systems.
4. Skill in integrating IoT devices with cloud platforms for data storage and processing.
5. Understanding of IoT architecture and protocols for efficient cloud processing and analytics.

List of Experiments

1. Install IDE of Arduino and write a program using Arduino IDE to blink LED.
2. Interface LED and buzzer with Arduino to buzz for a period of time.
3. Interface RGB LED with Aurdino to obtain different colours and brightness using PWM.
4. Control Relay using Arduino with an input given through a push button
5. Write a program to read the data from the Sliding switch and display the information on the display board using Arduino and control LED
6. Write a program to read the data from the Sliding switch and display the information on serial monitor using Arduino and control LED
7. Interface analog/digital sensors with Arduino and analyse the corresponding readings. (Sensors like temperature, alcohol, humidity, pressure, gas, level, flow, proximity, LDR etc..)
8. Demonstration of setup & working of Raspberry Pi.
9. Interface RGB LED with Raspberry Pi to obtain different colours and brightness using

PWM.

10. Interface an ultrasonic sensor with Raspberry pi to print distance readings on the monitor when the sensor changes its position.
11. Control any two actuators connected to the Arduino/Raspberry Pi using Bluetooth/Wifi.

Suggested Software/Tools:

1. IOT Hardware Kit. Simulators: CISCO Packet tracer, TinkerCAD, Wokwi, MicroPython, Wyliodrin,
2. Cloud Services: Blynk, Thingspeak, Heroku, AwardSpace, 000WebHost, PythonAnyWhere.

Reference Books:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything",1st Edition, Apress Publications, 2013.
3. Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493-9357-1.

Course Code	Course Title						Core/Elective
U21PC683AL	**DevOps Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Software Engineering	**-**	**-**	**-**	**4**	**25**	**50**	**2**

Course Objectives:

1. How to create simple web apps and manage code with Git and GitHub.
2. To install, set up, and use Jenkins for automating software development.
3. Hands-on experience with Docker to containerize and manage applications.
4. To integrate Docker with Kubernetes for automated deployment and scaling of applications.
5. To write and run automated tests using Selenium to ensure software quality.

Course Outcomes:

On completion of this course, the student will be able to-

1. Apply Git and GitHub commands to manage and collaborate on source code.
2. Analyze and set up Jenkins to demonstrate continuous integration and development processes.
3. Deploy a simple application using Docker and integrate it with Kubernetes to automate deployment and scaling.
4. Write JavaScript programs and develop test cases for containerized applications using Selenium for automated testing.
5. Integrate GitHub, Jenkins, Docker, Kubernetes, and Selenium to develop a complete, automated DevOps pipeline.

List of Programs:

1. Write code for a simple user registration form for an event.
2. Explore Git and GitHub commands.
3. Practice Source code management on GitHub. Experiment with the source code written in program 1.
4. Jenkins installation and setup, explore the environment.
5. Demonstrate continuous integration and development using Jenkins.
6. Explore Docker commands for content management.
7. Develop a simple containerized application using Docker.
8. Integrate Kubernetes and Docker
9. Automate the process of running containerized application developed in program 7 using Kubernetes.
10. Install and Explore Selenium for automated testing.
11. Write a simple program in JavaScript and perform testing using Selenium.
12. Develop test cases for the above containerized application using selenium.

Text Books:

1. Joakim Verona. Practical Devops, Second Edition. Ingram short title; 2nd edition (2018). ISBN-10: 1788392574
2. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952

References:

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-10.