

DAYANANDA SAGAR UNIVERSITY

SCHOOL OF ENGINEERING



SCHEME & SYLLABUS
FOR
BACHELOR OF TECHNOLOGY (B.Tech.) - 2020

COMPUTER SCIENCE & ENGINEERING

(CYBER SECURITY)

(CSE - CS)

(WITH EFFECT FROM 2020-21)

(I to VIII SEMESTERS)



**DAYANANDA SAGAR
UNIVERSITY**

DAYANANDA SAGAR UNIVERSITY

(A State Private University under the Karnataka Act No. 20 of 2013)

Approved By UGC & AICTE, New Delhi.

VISION

To be a centre of excellence in education, research & training, innovation & entrepreneurship and to produce citizens with exceptional leadership qualities to serve national and global needs.

MISSION

To achieve our objectives in an environment that enhances creativity, innovation and scholarly pursuits while adhering to our vision.

VALUES

The Pursuit of Excellence

A commitment to strive continuously to improve ourselves and our systems with the aim of becoming the best in our field.

Fairness

A commitment to objectivity and impartiality, to earn the trust and respect of society.

Leadership

A commitment to lead responsively and creatively in educational and research processes.

Integrity and Transparency

A commitment to be ethical, sincere and transparent in all activities and to treat all individuals with dignity and respect.



SCHOOL OF ENGINEERING

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(Hosur Main Road, Kudlu Gate, Bengaluru-560 068)

Approved By UGC & AICTE, New Delhi.

VISION

To transform life through Excellence and Innovation in Engineering Education and Research with an emphasis on Sustainable, Inclusive Technology and Global needs.

MISSION

To Develop School of Engineering at Dayananda Sagar University, as Center of Excellence by imparting Quality Education and Research to generate highly Competent, Skilled and Humane manpower to face emerging Technological, Scientific and Social challenges with Ethics, Integrity, Credibility and Social concern.

LEADERSHIPS

Sl. No	Name	Position
1	Dr. D. Hemachandra Sagar	Chancellor, DSU
2	Dr. D. Premachandra Sagar	Pro Chancellor, DSU
	Mr. Galiswamy	Secretory
3	Dr. K.N.Balasubramanya Murthy	Vice Chancellor, DSU
4	Prof. Janardhan R	Pro Vice Chancellor, DSU
5	Dr. Amith R Bhatt	Pro Vice Chancellor, DSU
6	Dr. Puttamadappa C	Registrar, DSU
7	Dr. Uday Kumar Reddy	Dean, SOE, DSU
8	Dr. Banga M K	Dean - Research, DSU
9	Dr. B V N Ramakumar	Professor and Chairman Department of Aerospace Engineering
10	Dr. Jayavrinda Vrindavanam	Professor and Chairman, Department of CSE (Artificial Intelligence and Machine Learning)
11	Dr. Girisha G S	Professor and Chairman, Department of Computer Science and Engineering
12	Dr. Kiran B. Malagi	Professor and Chairman, Department of CSE (Cyber Security)
13	Dr. Shaila S G	Professor and Chairman, Department of CSE (Data Science)
14	Dr M Shahina Parveen	Professor and Chairperson Department of Computer Science & Technology
15	Dr. Theodore Chandra S	Professor and Chairman, Department of ECE
16	Dr. Vinayak B Hemadri	Professor and Chairman Department of Mechanical Engineering
17	Dr. Vasanthi Kumari P	Chairperson & Professor Department of Computer Applications

GOVERNING REGULATIONS FOR BACHELOR OF TECHNOLOGY (B. TECH) – 2021

PREAMBLE

The School of Engineering under Dayananda Sagar University (DSU) provides Science & Technology based education leading to the development of high caliber engineers suitable for Industry and Scientific Organization. The curriculum focuses on knowledge-based course work integrated with skill development as a part of training. It equally helps in inculcating the scientific temper for the lifelong processes of learning. At the Under Graduate level, a candidate goes through the foundation courses in Science, Humanities & Engineering. Each department ensures that the courses cover both the core & electives courses, as required. Provision for Institutional elective help the candidates to acquire interdisciplinary knowledge base or specialize significantly in an area outside the parent discipline

DEFINITIONS OF KEY WORDS

- (i) **Academic Year:** Two consecutive odd, even semesters and a summer term for make up if required.
- (ii) **Course:** Usually referred to as a subject, a course may consist of any of Lecture/Tutorials/Practical /Seminar/Mini project/Project work.
- (iii) **Credit:** A unit by which the course work is measured. One credit is equivalent to one hour of lecture or one hour of tutorial or two hours of laboratory/practical/ workshop practice per week.
- (iv) **Credit Point:** It is the product of grade point and number of credits per course.
- (v) **Cumulative Grade Point Average (CGPA):** It is the measure of overall cumulative performance over all semesters. It is expressed upto two decimal places.
- (vi) **First Attempt:** If a candidate has completed all formalities of academic requirement in a term and become eligible to attend the examinations and attend all the end semester examinations, such attempt shall be considered as first attempt.
- (vii) **Grade Point:** It is a numerical weight allotted to each letter grade on a 10-point scale.
- (viii) **Letter Grade:** It is an index of the performance in a said course. Grades are denoted by alphabets.
- (ix) **Programme:** An educational activity leading to award a Degree or Certificate.
- (x) **Semester Grade Point Average:** It is a measure of performance during a semester. It shall be expressed up to two decimal places.
- (xi) **Transcript:** Based on the grades earned, a grade certificate shall be issued after every semester to the candidate registered
- (xii) **Failure:** It is the case of appearing for Semester End Examinations, but fails to obtain minimum passing marks in Semester End Examinations.
- (xiii) **Detain:** It is the case of not satisfying the eligibility criteria w.r.t Attendance /Internal Assessment in each course to appear for Semester End Examination.
- (xiv) **Audit Course:** A course to be taken by the student without benefit of a grade or a credit.
- (xv) **Not Fit For The Program (NFFTP):** It is the failure of satisfying the criteria laid down by regulations to continue the program of study, which leads to the termination from the University

RULES AND REGULATIONS

- UG 1** All B.Tech programmes offered by the University shall be governed by the DSU B.Tech Rules and Regulations – 2021.
- UG 2** The B. Tech. rules and regulations shall be applicable to any new discipline(s) that may be introduced in future.
- UG 3** A candidate shall become eligible for the award of the B.Tech. Degree after fulfilling all the academic requirements as prescribed by the B.Tech. Rules and Regulations of DSU.

UG 4. ELIGIBILITY FOR ADMISSION

- UG 4.1.** Admission to First Year Bachelor of Technology shall be open to candidates who have passed the second year Pre-University or XII standard or equivalent examination recognized by the University.
- UG 4.2.** The candidate shall have studied and passed English as one of the courses and secured not less than forty five percent (45%) marks in aggregate with Physics and Mathematics as compulsory courses, along with any one of the following courses, namely, Chemistry, Bio- Technology, Computer Science, Biology and Electronics. Eligibility shall be 40% in optional courses in case of candidates belonging to SC/ST and OBC candidates from Karnataka.
- UG 4.3.** Admission to II year /III Semester Bachelor of Technology under Lateral entry shall be open to the candidates who have passed diploma or equivalent
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- UG 4.5.** Diploma candidates seeking admission under Lateral entry shall take up bridge courses as prescribed in the Scheme of Teaching.
- UG 4.6.** Admission to II year /III Semester Bachelor of Technology shall be open to candidates who have passed B. Sc. degree from a recognized University or equivalent as recognized by the University and secure not less than 45% marks in aggregate (including all semesters). Eligibility shall be 40% in case of candidates belonging to SC/ST and OBC candidates from Karnataka.
- UG 4.7.** B.Sc. Graduates seeking admission under Lateral entry shall take up bridge Courses as prescribed in the Scheme of Teaching.

UG 5. ACADEMIC SESSION

- UG 5.1.** Each academic session is divided into two semesters of approximately sixteen Weeks duration and a summer term: an odd semester (August -December), an even semester (January - May) and summer term (Make-up term) June-July.

- UG 5.2.** The approved schedule of academic activities for a session, inclusive of dates for registration, mid-semester and end-semester examinations, vacation breaks, shall be laid down in the Academic Calendar for the session.

UG 6. CHANGE OF BRANCH

- UG 6.1.** Normally a candidate admitted to a particular branch of the undergraduate programme will continue studying in that branch till completion.
- UG 6.2.** However, in special cases, the University may permit a candidate to change from one branch of studies to another after the first two semesters. Such changes will be permitted, in accordance with the provisions laid down hereinafter.
- UG 6.3.** Only those candidates will be considered eligible for change of branch after the second semester, who have completed all the credits required in the first two semesters of their studies in their first attempt, without having to pass any course requirement in the summer term examination.
- UG 6.4.** Applications for a change of branch must be made by intending eligible candidates in the prescribed form. The academic section will call for applications at the end of second semester of each academic year and the completed forms must be submitted by the last date specified in the notification.
- UG 6.5.** Candidates may enlist their choices of branch, in order of preference, to which they wish to change over. It will not be permissible to alter the choices after the application has been submitted.
- UG 6.6.** Change of branch shall be made strictly in the order of merit of the applicants. For this purpose, the CGPA obtained at the end of the second semester shall be considered. In case of a tie, SGPA of second semester followed by SGPA of first semester shall decide the tie.
- UG 6.7.** The applicants may be allowed a change in branch, strictly in order of merit, course to the limitation that the strength of a branch should not fall below the existing strength by more than ten percent and should not go above the sanctioned strength by more than ten percent. The minimum class strength of 75% should be maintained, while considering the change of branch.
- UG 6.8.** All changes of branch made in accordance with the above rules shall be effective from the third semester of the applicants concerned. No change of branch shall be permitted after this.

UG 7. COURSE STRUCTURE

- UG 7.1.** Medium of instruction, examination and project reports shall be in English except in case of any language audit courses.
- UG 7.2.** Teaching of the courses shall be reckoned in credits: Credits are assigned to the Courses based on the following general pattern:
- (a) One credit for each lecture period.
 - (b) One credit for each tutorial period.

- (c) One credit per two hours for each Laboratory or Practical or work shop session.
- (d) Credits for seminar, mini project, project as indicated in the scheme/curriculum of teaching.

UG 7.3. In order to qualify for a B. Tech. degree of the University, a candidate is required to complete the credit requirement as prescribed in the scheme/curriculum for a particular programme.

UG 7.4. The program of a study consists of the following components:
(i) Humanities and Social Sciences including Management courses
(ii) Basic Science courses
(iii) Engineering Science courses
(iv) Professional core courses
(v) Open Electives
(vi) Project work, seminar and internship
(vii) Mandatory/Audit Courses

UG 7.5. Every B. Tech. Programme shall have a curriculum and syllabi for the courses approved by the Board of Governors. Board of Studies will discuss and recommend the syllabi of all the under graduate courses offered by the department from time to time before sending the same to the Academic Council. Academic Council will consider the proposals from the Board of Studies and make recommendations to the Board of Management and Board of Governors for consideration and approval. For all approved courses, the copyright shall be with DSU.

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UG 8. REGISTRATION

UG 8.1. Every candidate is required to register for approved courses through the assigned Faculty Advisor at the end of previous semester or first week of the current semester, as notified by the Academic Calendar.

UG 8.2. The Dean may cancel the registration of one or more courses if they are found to violate some rules or if there are restrictions imposed due to disciplinary reasons.

UG 8.3. The student is permitted to drop a course/s from the registered courses, within 4 weeks after the start of the Semester/Year as notified in the academic calendar, with the permission of Faculty Advisor and Chairperson / Dean / Principal of the respective School/College and no mention will be made in the grade card for dropped courses.

- UG 8.4.** The student is permitted to withdraw course/s from the registered courses, within 4 weeks before the start of the Semester/Year End Examinations as notified in the academic calendar, with the permission of Faculty Advisor and Chairperson / Dean / Principal of the respective School / College and Grade “W” will be awarded for course/s that were withdrawn.
- UG 8.5.** For the courses with “W” grade, the students should re-register subsequently when offered, either in MOOCS or in-class or summer term and fulfil the passing criteria to secure a grade in that course for change from “W” grade.
- UG 8.6.** Only those candidates shall be permitted to register who have:
- (a) The academic eligibility to move to higher semesters (UG 9 & UG 11)
 - (b) Cleared all University, Hostel and Library dues and fines (if any) of the previous semesters,
 - (c) Paid all required advance payments of University and Hostel dues for the current semester,
 - (d) Not been debarred from registering on any specific ground.
 - (e) A minimum CGPA of 4 in the previous semesters

UG 9. EXAMINATION: ASSESSMENT CRITERIA & ELIGIBILITY FOR PROGRESSION

Every student shall be assessed for eligibility to higher semester through Continuous Internal Assessment (CIA) and Semester End Examination (SEE) as prescribed.

- UG 9.1.** The Continuous Internal Assessment (CIA), shall normally be conducted by the assessment components spread through the running semester; the components of CIA may be tests, mid-term exam, quiz, term paper, simulation-based problem solving, open-book test, solving open-end problems, mini-projects, seminars, viva-voce, awarding marks for attendance and such activities that enhance original thinking of students. The Course instructor shall announce the detailed methodology for conducting the various components of CIA together specifying component-wise weightages right in the commencement of each semester.
- UG 9.2.** The Semester End Examinations (SEE), shall be conducted at the end of each semester. The SEE components may be a closed or open book examination, project demo, viva-voce, and/or a portfolio presentation.
- UG 9.3.** CIA and SEE shall respectively have 60:40 percent weightage. The Vice-Chancellor, on the recommendations of the Dean of Faculty and Department Chair, in exceptional cases, may approve the variation in this weightage ratio.
- UG 9.4.** The performance of a student with respect to a course in a semester shall be the combined score of marks/points, he/she secures in CIA and SEE, put together. A minimum of securing 40% marks, combining both the CIA with SEE marks secured with respect to a course, shall entail the student a PASS in the course. The Vice-Chancellor, in such cases where the entire class has fared poorly in the course, upon receiving a representation by the students / department, and based on the recommendations of the committee constituted for the purpose, may review the criterion of 40%.

UG 9.5. ATTENDANCE ELIGIBILITY

- UG 9.5.1.** Candidates are required to attend all the classes (Lectures, Tutorials, Practical, Workshop Practice, etc.) for which they have been registered.
- UG 9.5.2.** The candidate shall not be allowed to appear for the end semester examination if his/her attendance falls below 85% in each course and shall be awarded a “NE” grade in that course.
- UG 9.5.3.** A provision for condonation of 10% of the attendance by the Vice-Chancellor on the specific recommendation of the chairman of the department and Dean, showing reasonable cause such as:
- (a) Any medical emergencies/ illness where the candidate requires rest for the specified number of days certified by a Government Doctor only /any death in the family (near and dear ones).
 - (b) If the student represents the University in Sports/ Cultural Activities/Extra-curricular activities/Co-curricular activities.
 - (c) If a student presents a Paper in National/ International Conferences or attends any recognized Workshops/Seminars.
- UG 9.5.4.** If the period of leave is for a short duration (less than two weeks), prior application for leave shall have to be submitted to the Chairman of the Department concerned stating fully the reasons for the leave requested for along with supporting document(s). Such leave will be granted by the Chairman of the Department. However, the student shall comply with 9.5.2 and 9.5.3. of regulations.
- UG 9.5.5.** If the period of absence is likely to exceed two weeks, a prior application for grant of leave will have to be submitted through the Chairman of the Department to the Dean with supporting documents in each case. The decision to grant leave shall be taken by the Dean on the recommendation of the Chairman of the Department. However, the student shall comply with 9.5.2 and 9.5.3. of regulations.
- UG 9.5.6.** It shall be the responsibility of the candidate to intimate the concerned course instructor(s) regarding his/her absence before availing the leave.

UG 9.6. CONTINUOUS INTERNAL ASSESSMENT

- UG 9.6.1.** Candidate shall participate in all components of Continuous Internal Assessment (CIA) to become eligible to take up the Semester End Examination or else ‘NE’ grade shall be awarded. However, the Vice-Chancellor, under exceptional circumstances on the recommendations of Dean of Faculty and Department Chair, may exempt a student from participation in CIA component/s and permit taking up SEE.
- UG 9.6.2.** There shall be no marks improvement of Continuous Internal Assessment; however, the withdrawal and re-registering of the course shall be permitted.
- UG 9.6.3.** Continuous Evaluation consists of:
- UG 9.6.3.1.** Under normal circumstances for theory courses, total CIA weightage shall be a total of 60%, put together all components with varying weightages; Under exceptional

circumstances with the approval of the Vice-Chancellor on the recommendation of Dean of the School, the weightage of CIA may be lower/higher than 60%.

The components of CIA may be tests, mid-term exam, quiz, term paper, simulation-based problem solving, open-book test, solving open-end problems, mini-projects, seminars, viva-voce, awarding marks for attendance and such activities that enhance original thinking of students.

- UG 9.6.3.2.** Under normal circumstances for the practical courses (laboratory, workshops, and any such hands-on activity), total CIA weightage shall be a total of 60%, put together all components with varying weightages; Under exceptional circumstances with the approval of the Vice-Chancellor on the recommendation of Dean of the School, the weightage of CIA may be lower/higher than 60%.

CIA may have components such as conduction of an experiment, record writing, viva-voce, tests, simulation, mid-term exam, quiz, demo, term paper, mini-projects, seminars, marks for attendance and activities which enhances original thinking of students.

UG 10. GRADING

- UG 10.1.** There shall be continuous assessment of a candidate's performance throughout the semester and grades shall be awarded by the concerned course instructor and/or the appropriate committee appointed for this purpose on the following basis.
- UG 10.2.** The grading will normally be based on CIA and SEE.
- UG 10.3.** Practical Courses/ Work Shop Practice: The evaluation will be based on instructor's continuous internal assessment, a test and end semester examination.
- UG 10.4.** The weightage assigned to different components of continuous internal assessment will be announced by the concerned instructor(s) in the beginning of the semester
- UG 10.5.** The results of performance of the candidates in the Continuous Internal assessment Test shall be announced by the instructors.
- UG 10.6.** In case of seminar, evaluation will be as determined by the grade awarding Committee (as per the Program scheme).
- UG 10.7.** Mini project /projects will be based on Continuous evaluation by Guide(s) and Semester End Examination (as per the Program scheme)
- UG 10.8.** The results of performance of the candidates shall be announced by the Controller of Examinations.

UG 10.9. METHOD OF AWARDING LETTER GRADES

- UG 10.9.1.** Relationships among Grades, Grade points and % of marks are listed in Table1.

UG 10.10. DESCRIPTION OF GRADES

- UG 10.10.1.** Table 1 shows the relationships among the grades, grade points and percentage of marks.

Table 1: Grade, Points, Grade Description and % of marks

GRADE	GRADE POINTS	DESCRIPTION	% MARKS
O	10	Outstanding	90 to 100
A+	9	Excellent	80 to 89
A	8	Very Good	70 to 79
B+	7	Good	60 to 69
B	6	Above Average	55 to 59
C	5	Average	50 to 54
P	4	Pass	40 to 49
F	0	Fail	< 40
AP	-	Audit Pass	-
AF	-	Audit Fail	-
IC	-	In Complete	-
NE	-	Not Eligible	-
W	-	Withdrawn	-

- UG 10.10.2.** A student will have to ensure a minimum CGPA of 4, to become eligible for the award of the degree.
- UG 10.10.3.** A candidate shall have to repeat all courses in which he/she obtains 'F' Grades until a passing grade is obtained.
- UG 10.10.4.** An IC grade denotes incomplete performance in any Theory and/or Practical Assessment. It may be awarded in case of absence on medical grounds or other special circumstances for SEE. Requests for IC grade should be made at the earliest but not later than the last day of SEE.
- UG 10.10.5.** The student can appear for the course/s with IC grade, when exams are conducted subsequently by the University for those Courses.

UG10.11. EVALUATION OF PERFORMANCE

- UG10.11.1.** The performance of a candidate shall be evaluated in terms of the Semester Grade Point Average (SGPA) which is the Grade Point Average for a semester, Cumulative Grade Point Average (CGPA) which is the Grade Point Average for all the completed semesters.
- UG 10.11.2.** The Earned Credits (EC) are defined as the sum of course credits for courses in which candidates have been awarded grades between O to P. (Table 1)
- UG 10.11.3.** Points earned in a semester = (Course credits X Grade point) for Grades O - P
- UG 10.11.4.** The SGPA is calculated on the basis of grades obtained in all courses, except audit courses and courses in which F grade or below, registered for in the particular semester.

$$\text{SGPA} = \frac{\text{Points secured in the semester (O – P Grades)}}{\text{Credits registered in the semester, excluding audit}}$$

UG 10.11.5. The CGPA is calculated on the basis of all pass grades, except audit courses.
Cumulative points secured in all the passed courses (O – P Grades)
$$\text{CGPA} = \frac{\text{Cumulative points secured in all the passed courses (O – P Grades)}}{\text{Cumulative registered credits, excluding audit}}$$

UG 10.12. WITHHOLDING OF GRADES

UG 10.12.1. Grades shall be withheld when the candidate has not paid his/her dues or when there is a disciplinary action pending against him/her

UG 10.13. CONVERSION OF CGPA INTO PERCENTAGE

UG 10.13.1. Conversion formula for the conversion of CGPA into percentage is
Percentage of Marks Scored = (CGPA Earned – 0.75) × 10

UG 11. PROMOTION CRITERIA AND ENROLLMENTS TO HIGHER SEMESTERS

UG 11.1. During registration to the higher semesters, the following criteria/conditions for promotion, shall be satisfied.

UG 11.1.1. A student shall 'Not Eligible' (NE) for writing SEE if he/she does not comply to the minimum prescribed attendance in any course that carry a credit.
Students shall register afresh for such course/s, whenever offered next, to meet the attendance requirements and secure a pass grade, subsequently in that course/s.

UG 11.1.2. In a semester (ODD / EVEN), a student is deemed to be Not Eligible (NE) if he/she does not satisfy minimum attendance requirements criteria in a credit course.
If this course happens to be a prerequisite to a connected course in the subsequent semester, then the student shall not be permitted to register for that connected course until he / she secures pass grade in the prerequisite course by complying to the minimum attendance requirement when the prerequisite course is offered next (either during summer term or regular semester).

UG 11.1.3. A student shall be permitted to register for FOUR credited courses or to a total of 16 credits whichever is higher along with pending audit courses, if any, during a summer term by paying the prescribed course registration fee per credit notified by the university from time to time.

UG 11.1.4. A student shall be permitted to register for FOUR credited courses or to a total of 16 credits whichever is higher along with pending audit courses, if any, during a summer term by paying the prescribed course registration fee per credit notified by the university from time to time.

UG 11.1.5. Candidates who secure 'F' grade in any courses in regular semester or summer term shall secure PASS grade in such course/s either in the subsequent summer term examination or shall repeat in the next appropriate semester whenever it is/they are offered, i.e. odd semester courses during odd semesters examinations and even semester courses during even semester examinations, respectively.

- UG 11.2.** In case of failure in Practical/Workshop practice course the candidate in any semester may clear it in the subsequent summer term examination or semester examination.
- UG 11.3.** In case a candidate fails in Practical/ Workshop practice he/she shall register when it is offered next either in the summer term or subsequent semester, as the case may be.
- UG 11.4.** Candidates may add and drop course(s) with the concurrence of the Faculty Advisor, and under intimation to the concerned course instructors and the academic section provided this is done within the date mentioned in the Academic Calendar.

UG 11.5. SUMMER TERM & MAKEUP EXAMINATIONS

- UG 11.5.1.** A summer term program may be offered by a department and with the approval of the Dean.
- UG 11.5.2.** Summer term courses will be announced by the Academic Affairs Office at the end of the even semester and before the commencement of the end semester examination. A candidate will have to register for summer term courses by paying the prescribed fees within the stipulated time in the announcement.
- UG 11.5.3.** The total number of contact hours in any summer term program will be the same as in the regular semester course. The assessment procedure in a summer term course will also be similar to the procedure for a regular semester course.
- UG 11.5.4.** Candidates granted semester drop by the Board of Governors, on medical ground, shall be allowed to clear the concerned courses in summer term course and subject to conditions as stated under clauses 11.5.1, 11.5.2.and 11.5.3.
- UG 11.5.5.** The Candidates with “NE” grade shall register for summer term by paying the prescribed fees.
- UG 11.5.6.** Candidates who are awarded ‘F’ grades in regular semester examinations have the option to register for the concerned courses in summer term examinations to the conditions as stated under clauses 11.5.1, 11.5.2.and 11.5.3above, or they can re-sit for subsequent semester/summer term examination only.
- UG 11.5.7.** Provision for make-up exam shall be available to the students who might have missed to attend the Semester / Annual end examinations of one or more courses for exceptional cases arising out of natural calamities / medical emergencies / death of a member in the family, with the permission of Faculty Advisor and Chairperson / Dean / Principal of the respective School/College. All such cases have to be exclusively to be approved by the Vice-Chancellor and ratified in the Academic Council / BOM / BOG. All such courses approved for makeup examinations are awarded a transitory grade “IC” (incomplete grade)
- UG 11.5.8.** The makeup examinations shall be held as notified in the academic calendar or through an exclusive notification duly approved by the Vice-chancellor.

UG 12. DURATION OF THE PROGRAMME

- UG 12.1.** Normally a candidate should complete all the requirements for under graduate programme in four years. However, academically weaker candidates who do not fulfil some of the requirements in their first attempt and have to repeat them in subsequent semesters may be permitted up to eight consecutive years (from the first year of registration) to complete all the requirements of the degree.
- UG 12.2.** Normally a candidate under lateral entry should complete all the requirements for undergraduate programme in three years. However, academically weaker candidates who do not fulfil some of the requirements in their first attempt and have to repeat them in subsequent semesters may be permitted up to six consecutive years (from the second year registration) to complete all the requirements of the degree.

UG 13. TERMINATION FROM THE PROGRAMME

- UG 13.1.** A candidate may also be compelled to leave the Program in the University on disciplinary grounds.
- UG 13.2.** On having been found to have produced false documents or having made false declaration at the time of seeking admission.
- UG 13.3.** On having been found to be pursuing regular studies and/or correspondence courses (leading to degree or diploma) in any other college, university or an educational institution simultaneously.
- UG 13.4.** On having been found to be concurrently employed and performing duty or carrying out business in contravention to academic schedules of the University and without seeking approval from the University.
- UG 13.5.** If a student fails to earn a pass grade even after 4 attempts such a student is terminated from the university on the grounds of NOT FIT FOR THE PROGRAM (NFFTP).
- UG 13.6.** If a student secures a CGPA less than 4.0, 4 times during entire duration of the program of study, such a student is terminated from the university on the grounds of NOT FIT FOR THE PROGRAM (NFFTP).
- UG 13.7.** However, if the student appeals for reconsideration of termination from the university under NFFTP rule by providing the genuine reasons to the Vice-Chancellor through the Dean of Faculty, then the Vice-Chancellor may consider constituting a committee for the purpose of review and provide 2 additional attempts on the recommendations of the committee.

UG 14. TEMPORARY WITHDRAWAL FROM THE UNIVERSITY

- UG 14.1.1.** He/she applies to the University within at least 6 weeks of the commencement of the semester or from the date he last attended his/her classes whichever is later, stating fully the reasons for such withdrawal together with supporting documents and endorsement of his/her guardian.
- UG 14.1.2.** The University is satisfied that, counting the period of withdrawal, the candidate is likely to complete his/her requirements of the B. Tech. Degree within the time limits specified in Clause 12.1 or 12.2 above.

- UG 14.1.3.** There are no outstanding dues or demands in the University/Hostel/Department/Library.
- UG 14.1.4.** Normally, a candidate will be permitted only one such temporary withdrawal during his/her tenure as a candidate of the undergraduate programme.

UG 15. TRANSFER OF CANDIDATES

- UG 15.1.** Transfer of candidates from higher education institutions outside University shall be considered at the beginning of Third and Fifth Semesters but subject to confirmation of equivalence.
- UG 15.2.** The candidates shall apply for equivalence with the No-objection for admission to DSU from the University where they are perusing their study.
- UG 15.3.** The candidates must have passed in all courses in the earlier semesters prior to transfer.

UG 16. ELIGIBILITY FOR THE AWARD OF B. TECH. DEGREE

A candidate shall be declared to be eligible for the award of B. Tech. degree if he/she has:

- UG 16.1.** Completed all the credit requirements for the degree with a CGPA 4.0 or higher at the end of the programme.
- UG 16.2.** Satisfactorily completed all the mandatory audit courses.
- UG 16.3.** No dues to the University, Department, Hostels.
- UG 16.4.** No disciplinary action pending against him/her.

UG 17. AWARD OF DEGREE

The award of B. Tech. degree must be recommended by the Academic Council and approved by the Board of Management and Board of Governors of the DSU.

UG 18. CONDUCT AND DISCIPLINE

- UG 18.1.** Candidates shall conduct themselves within and outside the precincts of the University in a manner befitting the candidates of an institution of national importance. The University has a separate ordinance Code and Conduct of Candidates which is applicable to all candidates of the University.

UG 19. REPEAL AND SAVINGS

Notwithstanding anything contained in these Regulations, the provisions of any guidelines, orders, rules or regulations in force at the University shall be inapplicable to the extent of their inconsistency with these Regulations. The Academic Council, Board of Management and Board of Governors of Dayananda Sagar University may revise, amend or change the regulations from time to time.

UG 20. INTERPRETATION

Any questions as to the interpretation of these Regulations shall be decided by the University, whose decision shall be final. The University shall have the powers to issue clarifications to remove any doubt, difficulty or anomaly which may arise during the implementation of the provisions of these regulations

Department of Computer Science and Engineering (Cyber Security)

VISION

Ignite and nurture young learners to provide a sustainable, humane, and research-centric educational platform in the domain of cybersecurity for building a robust, resilient, and attack-free digital universe.

MISSION

1. Provide committed and competent faculty and educational infrastructure to impart the theoretical and practical foundation of cybersecurity in the emanating youth.
2. Establish MoUs and Centre of Excellences (CoEs) with Information Technology Sector to provide industry-ready cybersecurity graduates with research instinct imbibed for the sustainable development of young learners
3. Build collaborative and teamwork-centric project-oriented learning environment, to address global challenges whilst preserving human and ethical values.
4. Encourage young minds to educate society to restore nationwide human safety and security in digital world.

FACULTY LIST

Sl No	Name of the Faculty	Designation
1	Dr. Kiran B. Malagi	Associate Professor and Chairperson CSE (Cyber Security)
2	Dr. Durbadal Chattaraj	Associate Professor
3	Naveen Kulkarni	Assistant Professor
4	Sharanabasappa Tadkal	Assistant Professor
5	Ranjima P	Assistant Professor

PROGRAM OUTCOMES (PO'S):

A graduate of Computer Science and Engineering (Cyber Security) program will demonstrate:

- **PO1. Engineering knowledge:** Apply the information of arithmetic, science, engineering fundamentals, associate degree and an engineering specialization to the answer of advanced engineering issues.
- **PO2. Problem analysis:** Identify, formulate, review analysis literature, and analyse complicated engineering issues reaching corroborated conclusions mistreatment initial principles of arithmetic, natural sciences, and engineering sciences.
- **PO3. Design/development of solutions:** Design solutions for advanced engineering issues and style system elements or processes that meet the required wants with applicable thought for the general public health and safety, and therefore the cultural, societal, and environmental concerns.
- **PO4. Conduct investigations of complex problems:** Use analysis-based information and research ways as well as style of experiments, analysis and interpretation of information, and synthesis of the knowledge to supply valid conclusions.
- **PO5. Modern tool usage:** Create, select, and apply acceptable techniques, resources, associate degree fashionable engineering and IT tools as well as prediction and modelling to advanced engineering activities with an understanding of the restrictions.
- **PO6. The engineer and society:** Apply reasoning familiar by the discourse information to assess social group, health, safety, legal and cultural problems and therefore the resulting responsibilities relevant to the skilled engineering apply.
- **PO7. Environment and sustainability:** Understand the impact of the skilled engineering solutions in social and environmental contexts, and demonstrate the information of, and want for property development.

- **PO8. Ethics:** Apply moral principles and decide to skilled ethics and responsibilities and norms of the engineering follow.
- **PO9. Individual and team work:** Function effectively as a private, and as a member or leader in numerous groups, and in multidisciplinary settings.
- **PO10. Communication:** Communicate effectively on advanced engineering activities with the engineering community and with society at giant, such as, having the ability to grasp and write effective reports and style documentation, build effective shows, and provides and receive clear directions.
- **PO11. Project management and finance:** Demonstrate information and understanding of the engineering and management principles and apply these to one's own work, as a member AND leader in an passing team, to manage comes and in multidisciplinary environments.
- **PO12. Life-long learning:** Recognize the necessity for, and have the preparation and talent to interact in freelance and life-long learning within the broadest context of technological amendment.

PSOs

1. Ability to understand, analyse and develop computer programs in the areas related to networking, cryptography, web development and database management by adhering software development life cycle.
2. Graduate students will be able to develop data, resource, and asset protection strategies for organizations, processes, peoples, and individuals through Cybersecurity-centric skills.

SCHEME - B.TECH – 2020-21 ONWARDS

I SEM - CHEMISTRY CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	101-105 & 121-123	20EN1101	ENGINEERING MATHEMATICS – I	CR	03	01	--	--	04	*	***
2	101-105 & 121-123	20EN1102	ENGINEERING CHEMISTRY	CR	03	--	02	--	04	*	***
3	101-105 & 121-123	20EN1103	FUNDAMENTALS OF PROGRAMMING	CR	03	--	04	--	05	*	***
4	101-105 & 121-123	20EN1104	BASIC ELECTRICAL ENGINEERING	CR	03	--	--	--	03	*	***
5	101-105 & 121-123	20EN1105	ENVIRONMENTAL STUDIES	CR	02	--	--	--	02	*	***
6	101-105 & 121-123	20EN1106	ELEMENTS OF MECHANICAL ENGINEERING	CR	02	--	02	--	03	*	***
					16	01	08	--	21		
7	101-105 & 121-123	20AU0004	CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS	AU	02	--	--	--	--	*	***

CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits

SCHEME - B.TECH – 2020-21 ONWARDS

I SEM - PHYSICS CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	101-105 & 121-123	20EN1101	ENGINEERING MATHEMATICS – I	CR	03	01	--	--	04	*	***
2	101-105 & 121-123	20EN1107	ENGINEERING PHYSICS	CR	03	--	02	--	04	*	***
3	101-105 & 121-123	20EN1108	BASIC ELECTRONICS	CR	03	--	02	--	04	*	***
4	101-105 & 121-123	20EN1109	BIOLOGICAL SCIENCES	CR	02	--	--	--	02	*	***
5	101-105 & 121-123	20EN1110	TECHNICAL COMMUNICATION	CR	02	--	02	--	03	*	***
6	101-105 & 121-123	20EN1111	ENGINEERING GRAPHICS & DESIGN	CR	01	--	04	--	03	*	***
7	101-105 & 121-123	20EN1112	DESIGN THINKING & INNOVATION	CR	--	--	02	--	01	*	***
					14	01	12	--	21		
8	101-105 & 121-123	20AU0021	KANNADA KALI – II	AU	02	--	--	--	--	*	***
		20AU0025	KANNADA MANASU – II	AU	02	--	--	--	--	*	***

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SCHEME - B.TECH – 2020-21 ONWARDS

II SEM - PHYSICS CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	101-105 & 121-123	20EN1201	ENGINEERING MATHEMATICS – II	CR	03	01	--	--	04	*	***
2	101-105 & 121-123	20EN1107	ENGINEERING PHYSICS	CR	03	--	02	--	04	*	***
3	101-105 & 121-123	20EN1108	BASIC ELECTRONICS	CR	03	--	02	--	04	*	***
4	101-105 & 121-123	20EN1109	BIOLOGICAL SCIENCES	CR	02	--	--	--	02	*	***
5	101-105 & 121-123	20EN1110	TECHNICAL COMMUNICATION	CR	02	--	02	--	03	*	***
6	101-105 & 121-123	20EN1111	ENGINEERING GRAPHICS & DESIGN	CR	01	--	04	--	03	*	***
7	101-105 & 121-123	20EN1112	DESIGN THINKING & INNOVATION	CR	--	--	02	--	01	*	***
					14	01	12	--	21		
9	101-105 & 121-123	20AU0021	KANNADA KALI	AU	02	--	--	--	--	*	***
		20AU0025	KANNADA MANASU	AU	02	--	--	--	--	*	***

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SCHEME - B.TECH – 2020 -21 ONWARDS

II SEM - CHEMISTRY CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	101-105 & 121-123	20EN1201	ENGINEERING MATHEMATICS – II	CR	03	01	--	--	04	*	***
2	101-105 & 121-123	20EN1102	ENGINEERING CHEMISTRY	CR	03	--	02	--	04	*	***
3	101-105 & 121-123	20EN1103	FUNDAMENTALS OF PROGRAMMING	CR	03	--	04	--	05	*	***
4	101-105 & 121-123	20EN1104	BASIC ELECTRICAL ENGINEERING	CR	03	--	--	--	03	*	***
5	101-105 & 121-123	20EN1105	ENVIRONMENTAL STUDIES	CR	02	--	--	--	02	*	***
6	101-105 & 121-123	20EN1106	ELEMENTS OF MECHANICAL ENGINEERING	CR	02	--	02	--	03	*	***
					16	01	08	--	21		
7	101-105 & 121-123	20AU0004	CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS	AU	02	--	--	--	--	*	***

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SCHEME - B.TECH – 2020-21 ONWARDS

III SEM - COMPUTER SCIENCE & ENGINEERING (CYBER SECURITY)

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	123	20CS2301	DISCRETE MATHEMATICAL STRUCTURES	CR	3	-	-	-	3	*	***
2	123	20CS2302	DATA STRUCTURES	CR	3	-	-	-	3	I/II	20EN1103
3	123	20CS2303	DIGITAL ELECTRONICS & LOGIC DESIGN	CR	3	-	-	2	4	*	***
4	123	20CS2304	DATABASE MANAGEMENT SYSTEMS	CR	3	-	-	-	3	*	***
5	123	20CS2305	COMPUTATIONAL THINKING WITH PYTHON	CR	3	-	-	-	3	*	***
6	123	20CS2306	AGILE SOFTWARE ENGINEERING	CR	2	-	-	2	3	*	***
7	123	20CS2307	DATA STRUCTURES LAB	CR	-	-	2	-	1	*	***
8	123	20CS2308	DATABASE MANAGEMENT SYSTEMS LAB	CR	-	-	2	-	1	*	***
9	123	20CS2309	MANAGEMENT AND ENTREPRENEURSHIP	CR	2	-	-	-	2	*	***
10	123	20CS2310	LIBERAL STUDIES - I	CR	1	-	-	-	1	*	***
					20	-	04	04	24		

CR - CREDIT, AU - AUDIT, L - LECTURE, T - TUTORIAL, P - PRACTICAL, S/P - SEMINAR/PROJECT, C - NO. OF CREDITS

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SCHEME - B.TECH – 2020-21 ONWARDS

IV SEM - COMPUTER SCIENCE & ENGINEERING (CYBER SECURITY)

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	123	20CS2401	PROBABILITY AND STATISTICS	CR	3	-	-	-	3	*	***
2	123	20CS2402	OBJECT ORIENTED DESIGN AND PROGRAMMING	CR	3	-	-	-	3	*	***
3	123	20CS2403	PRINCIPLES OF MICROPROCESSORS AND COMPUTER ORGANIZATION	CR	4	-	-	-	4	*	***
4	123	20CS2404	FINITE AUTOMATA & FORMAL LANGUAGES	CR	3	-	-	2	4	*	***
5	123	20CS2405	INTRODUCTION TO NETWORKS & CYBERSECURITY	CR	3	-	-	-	3	*	***
6	123	20CY2401	INTRODUCTION TO ETHICAL HACKING	CR	3	-	-	-	3	*	***
7	123	20CS2407	OBJECT ORIENTED PROGRAMMING LAB	CR	-	-	2	-	1	*	***
8	123	20CS2408	MICROPROCESSORS LABORATORY	CR	-	-	2	-	1	*	***
9	123	20CS2409	SPECIAL TOPICS - I	CR	-	-	-	4	2	*	***
10	123	20CS2410	LIBERAL STUDIES - II	CR	1	-	-	-	1	*	***
					20	-	04	06	25		

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V SEM - COMPUTER SCIENCE & ENGINEERING (CYBER SECURITY)

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	123	20CS3501	COMPUTER NETWORKS	CR	3	-	2	-	4	*	***
2	123	20CS3502	DESIGN AND ANALYSIS OF ALGORITHMS	CR	3	-	-	-	3	*	***
3	123	20CS3503	OPERATING SYSTEMS	CR	3	1	-	-	4	*	***
4	123	20CY3501	MACHINE LEARNING FOR CYBER SECURITY	CR	3	-	2	-	4	*	***
5	123	20CY35XX	PROFESSIONAL ELECTIVE-1	CR	3	-	-	-	3	*	***
6	123	20OE00XX	OPEN ELECTIVE-1	CR	3	-	-	-	3	*	***
7	123	20CS3505	DESIGN AND ANALYSIS OF ALGORITHMS LAB	CR	-	-	2	-	1	*	***
8	123	20CS3506	OPERATING SYSTEMS LAB	CR	-	-	2	-	1	*	***
9	123	20CS3507	SPECIAL TOPICS -II	CR	-	-	-	4	2	*	***
					18	1	8	4	25		

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CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits

V SEM-PROFESSIONAL ELECTIVE – I

S L	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING				
			L	T	P	S/ P	C
1	20CY3502	PATTERN RECOGNITION	03	-	-	-	03
2	20CY3503	DISTRIBUTED COMPUTING	03	-	-	-	03
3	20CY3504	INFORMATION WARFARE	03	-	-	-	03
4	20CS3512	INTERNET OF THINGS	03	-	-	-	03
5	20CS3510	MICROCONTROLLERS AND EMBEDDED SYSTEMS	03	-	-	-	03

CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits

VI SEM - COMPUTER SCIENCE & ENGINEERING (CYBER SECURITY)

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	123	20CY3601	CRYPTOGRAPHY AND NETWORK SECURITY	CR	3	1	-	-	4	*	***
2	123	20CY3602	DATA PRIVACY	CR	3	-	-	-	3	*	***
	123	20CS3603	CLOUD APPLICATION DEVELOPMENT	CR	3	-	-	-	3	*	***
4	123	20CY36XX	PROFESSIONAL ELECTIVE-2	CR	3	-	-	-	3	*	***
5	123	20CY36XX	PROFESSIONAL ELECTIVE-3	CR	3	-	-	-	3	*	***
6	123	20OE00XX	OPEN ELECTIVE-2	CR	3	-	-	-	3	*	***
7	123	20CY3604	CRYPTOGRAPHY AND NETWORK SECURITY LAB	CR	-	-	2	-	1	*	***
8	123	20CY3605	DATA PRIVACY LAB	CR	-	-	2	-	1	*	***
					18	01	04	-	21		

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CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits

VI SEM-PROFESSIONAL

ELECTIVE – II

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING				
			L	T	P	S/P	C
1	20CY3606	OPERATING SYSTEM SECURITY	3			-	03
2	20CY3607	PROACTIVE SECURITY TOOLS	3			-	03
3	20CS3602	SECURE PROGRAMMING	3			-	03

VI SEM-PROFESSIONAL

ELECTIVE – III

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING				
			L	T	P	S/P	C
1	20CY3608	DATA MINING AND ANALYSIS	3			-	03
2	20CY3609	CYBER SECURITY PROGRAMS AND POLICIES	3			-	03
3	20CY3610	MOOC Course	3			-	03

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SCHEME - B. TECH – 2020-21 ONWARDS
VII SEM - COMPUTER SCIENCE & ENGINEERING (CYBER SECURITY)

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	123	20CY47XX	PROFESSIONAL ELECTIVE – 4	CR	3	-	-	-	3	*	AS INDICATED IN ELECTIVE LIST
2	123	20CY47XX	PROFESSIONAL ELECTIVE – 5	CR	3	-	-	-	3	*	
3	123	200EXXXX	OPEN ELECTIVE-3	CR	3	-	-	-	3	*	***
4	123	20CY4701	PROJECT PHASE – I / INTERNSHIP	CR	-	-	-	6	3	*	***
					09			06	12		

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VII SEM-PROFESSIONAL

ELECTIVE – IV

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING				
			L	T	P	S/P	C
1	20CY4702	VULNERABILITY ANALYSIS AND PENETRATION TESTING	3	-	-	-	03
2	20CY4703	QUANTUM CRYPTOGRAPHY AND COMMUNICATION	3	-	-	-	03
3	20CY4704	WIRELESS NETWORK SECURITY	3	-	-	-	03

VII SEM-PROFESSIONAL

ELECTIVE – V

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING				
			L	T	P	S/P	C
1	20CY4705	CYBER FORENSICS AND CYBER LAW	3	-	-	-	03
2	20CY4706	EMBEDDED SYSTEMS SECURITY	3	-	-	-	03
3	20CY4707	BIOMETRIC SECURITY	3	-	-	-	03

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SCHEME - B. TECH - 2020-21 ONWARDS
VIII SEM - COMPUTER SCIENCE & ENGINEERING (CYBER SECURITY)

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	123	20CY48XX	Professional Elective – 6	CR	3	-	-	-	3	*	AS INDICATED IN ELECTIVE LIST
2	123	20CY4801	Project Phase – II	CR	-	-	-	12	6	*	***
3	123	20CY4802	Internship	CR	-	-	-	06	3	*	***
					03	-	-	18	12		

CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits

VIII SEM-PROFESSIONAL

ELECTIVE – VI

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING				
			L	T	P	S/P	C
1	20CY4803	IOT AND BIG DATA SECURITY	3	-	-	-	03
2	20CY4804	RISK MANAGEMENT	3	-	-	-	03
3	20CY4805	MOBILITY SECURITY	3	-	-	-	03

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OPEN ELECTIVES LIST - B.TECH PROGRAMME – 2020-21 Batch

SL.No	COURSE CODE	COURSE TITLE	OFFERING DEPARTMENT
1	20OE0001	ARTIFICIAL INTELLIGENCE	CSE
2	20OE0002	DATA STRUCTURES & ALGORITHMS	CSE
3	20OE0003	WEB TECHNOLOGIES	CSE
4	20OE0004	SOCIAL NETWORKS & ANALYTICS	CSE
5	20OE0005	MANAGEMENT INFORMATION SYSTEM	CSE
6	20OE0006	FUNDAMENTALS OF CLOUD COMPUTING	CSE
7	20OE0007	MACHINE LEARNING WITH PYTHON	CSE
8	20OE0008	BUSINESS INTELLIGENCE	CSE
9	20OE0009	EVOLUTION OF TELECOM	ECE
10	20OE0010	SENSORS AND TRANSDUCERS	ECE
11	20OE0011	DIGITAL SYSTEM DESIGN	ECE
12	20OE0012	SENSORS, NETWORKS AND PROTOCOLS	ECE
13	20OE0013	IMAGE PROCESSING AND COMPUTER VISION	ECE
14	20OE0014	AUTOMOTIVE EMBEDDED SYSTEMS	ECE
15	20OE0015	AUTOMOBILE ENGINEERING	MECH
16	20OE0016	RAPID MANUFACTURING TECHNOLOGIES	MECH
17	20OE0017	ROBOTICS ENGINEERING	MECH
18	20OE0018	PRODUCT DESIGN & MANUFACTURING	MECH
19	20OE0019	RENEWABLE ENERGY SOURCES	MECH
20	20OE0020	MICRO ELECTRO MECHANICAL SYSTEMS (MEMS)	MECH
21	20OE0021	PRODUCT ENGINEERING AND ENTREPRENEURSHIP	CST
22	20OE0022	SMALL BUSINESS LAUNCH	CST
23	20OE0023	INTRODUCTION TO AEROSPACE ENGINEERING	ASE
24	20OE0024	AIRCRAFT SYSTEMS AND INSTRUMENTATION	ASE
25	20OE0025	FOUNDATIONS OF DATA SCIENCE	CSE
26	20OE0026	CALCULUS II	MATH
27	20OE0027	IDEA GENERATION AND VALIDATION	CST
28	20OE0037	FUNDAMENTALS OF NETWORK SECURITY	CSE(CS)

SEMESTER/YEAR : I SEM
COURSE CODE : 20EN1101
TITLE OF THE COURSE : ENGINEERING MATHEMATICS – I
L: T/A: P: C : 3 : 1 : 0 : 4

Course Objectives

1. Understanding basic concepts of linear algebra to illustrate its power and utility through applications to science and Engineering.
2. Apply the concepts of vector spaces, linear transformations, matrices and inner product spaces in engineering.
3. The course is discussed with algebraic as well as geometric perspectives.
4. Solve problems in cryptography, computer graphics and wavelet transforms.

Course Outcomes

At the end of this course the students are expected to learn

1. the abstract concepts of matrices and system of linear equations using decomposition methods
2. the basic notion of vector spaces and subspaces
3. apply the concept of vector spaces using linear transforms which is used in computer graphics and inner product spaces
4. applications of inner product spaces in cryptography

Student Learning Outcomes

1. Having an ability to apply knowledge or Mathematics in Science and Engineering
2. Having a clear understanding of the subject related concepts and of contemporary issues
3. Having computational thinking

Module: 1 LINEAR EQUATIONS

8 hours

Introduction - The Geometry of Linear Equations - Row reduction and echelon forms- Gaussian Elimination - Solution sets of linear equations – LU decomposition - Inverse of a matrix by Gauss Jordan method.

Self Learning Component : Algebra of Matrices.

Module: 2 VECTOR SPACES AND SUBSPACES

8 hours

Linear spaces – Subspaces - Linear independence – Span - Bases and Dimensions -Finite dimensional vector space.

Self Learning Component : Examples of vector spaces and subspaces, Rank of a matrix.

Module3 LINEAR TRANSFORMATIONS AND ORTHOGONALITY 8 hours

Linear transformations – Basic properties - Invertible linear transformation - Matrices of linear transformations - Vector space of linear transformations – change of bases – Orthogonal Vectors

- Projections onto Lines - Projections and Least Squares - The Gram- Schmidt Orthogonalization process.

Self-Learning Component: Inner Products

Module 4 EIGEN VALUES AND EIGEN VECTORS

10 hours

Introduction to Eigen values and Eigen vectors - Diagonalization of a Matrix-Diagonalization of symmetric matrices - Quadratic forms - Singular Value Decomposition - QR factorization.

Self-Learning Component: Determinant and Properties of Eigen values and Eigen vectors

Module 5 APPLICATIONS OF LINEAR EQUATIONS

6 hours

An Introduction to coding - Classical Cryptosystems –Plain Text, Cipher Text, Encryption, Decryption and Introduction to Wavelets from Raw data – curve fitting Contemporary Issues Industry Expert Lecture

Tutorial • Variety of minimum 10 problems to be worked out by students in every Tutorial Class

Another set of 5 problems per Tutorial Class to be given for self-solving. **12 hours**

Text Book(s)

1. D C Lay, S R Lay and J J McDonald, Linear Algebra and its Applications, Pearson India, Fifth edition.
2. Linear Algebra and its Applications by Gilbert Strang, 4 th Edition, Thomson Brooks/ Cole, Second Indian Reprint 2007.
3. Introductory Linear Algebra- An applied first course, Bernard Kolman and David, R. Hill, 9th Edition, Pearson Education, 2011.

Reference Books

1. Introduction to Linear Algebra, Gilbert Strang, 5th Edition, Cengage Learning (2015).
2. Higher Engineering Mathematics by B S Grewal, 42 nd Edition, Khanna Publishers.
3. Elementary Linear Algebra, Stephen Andrilli and David Hecker, 5th Edition, Academic Press(2016)
4. Contemporary linear algebra, Howard Anton, Robert C Busby, Wiley 2003

SCILAB components

There will be a computational component to the course, using a mix of computational packages like SCILAB to solve engineering problems using the mathematical concepts developed in the course:

1. Gaussian Elimination
2. The LU Decomposition
3. Inverse of a Matrix by the Gauss- Jordan Method, curve fitting
4. The Span of Column Space of a Matrix
5. Fundamental Subspaces
6. Projections by Least Squares
7. The Gram-Schmidt Orthogonalization

8. Eigen values and Eigen Vectors of a Matrix
9. The Largest Eigen Value of a Matrix by the Power Method
10. Singular value decomposition

Course Objectives

- ### Expected Course Outcomes

1. apply single variable differentiation and integration to solve applied problems in engineering and find the maxima and minima of functions
2. evaluate partial derivatives, limits, total differentials, Jacobians, Taylor series and optimization problems involving several variables with or without constraints
3. evaluate multiple integrals in Cartesian, Polar, Cylindrical and Spherical coordinates.
4. understand gradient, directional derivatives, divergence, curl and Greens', Stokes, Gauss theorems

1. Having an ability to apply mathematics and science in engineering applications
2. Having a clear understanding of the subject related concepts and of contemporary issues
3. Having problem solving ability- solving social issues and engineering problems

Differentiation- Extrema on an Interval-Rolle's Theorem and the Mean Value Theorem - Increasing and Decreasing functions and First derivative test-Second derivative test- Maxima and Minima-Concavity. Integration-Average function value - Area between curves - Volumes of solids of revolution - Beta and Gamma functions.

Functions of two or more real variables, Partial derivatives of second and higher order, Euler's theorem on homogenous function, Total derivatives, Differentiation of composite and implicit functions, Change of variable, Jacobians, Maxima and minima of functions of two or more variable, Lagrange's method of undetermined multipliers, Taylor's formula for two variables

Double integrals, Triple integrals, Change of order of integration in a double integral, Change of variables in double and triple integrals, Area as a double integral, Volume as a triple integral,

Line integrals, Vector Fields and Line integrals.

Module 4

VECTOR CALCULUS

10 hours

Scalar and vector valued functions – gradient, tangent plane–directional derivative divergence and curl–scalar and vector potentials-Simple problems Line integral- Surface integral - Volume integral - Path independence- Green's theorem-Stoke's Theorem- Divergence Theorem

Module 5 LAPLACE TRANSFORM

6 hours

Basic concepts, Linearity and First shifting theorem, Laplace transforms of derivatives and integrals, Second shifting theorem, Initial and Final value theorems, Some basic transforms, Inverse Laplace transform, Convolution theorem, Applications to differentialequations.

Tutorial • Variety of minimum 10 problems to be worked out by students in every Tutorial Class
• Another set of 5 problems per Tutorial Class to be given for self-solving.

Text Book(s)

1. Thomas' Calculus, George B. Thomas, D. Weir and J. Hass, 2014, 13th edition, Pearson.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 2015, 10th Edition, Wiley India.

Reference Books

1. Higher Engineering Mathematics, B.S. Grewal, 2015, 43rd Edition, Khanna Publishers.
2. Higher Engineering Mathematics, John Bird, 2017, 6th Edition, Elsevier Limited.
3. Calculus: Early Transcendentals, James Stewart, 2017, 8th edition, Cengage Learning.
4. Engineering Mathematics, K.A. Stroud and Dexter J. Booth, 2013, 7th Edition, Palgrave Macmillan.

SCILAB components

There will be a computational component to the course, using a mix of computational packages like SCILAB to solve engineering problems using the mathematical concepts developed in the course:

1. Plotting and visualizing curves
2. Plotting and visualizing surfaces
3. Evaluating Extremum of a single variable function
4. Evaluating maxima and minima of functions of several variables
5. Tracing of curves
6. Applying Lagrange multiplier optimization method
7. Line integral Surface integral
8. Volume integral
9. Solving Differential equation using Laplace transform

SEMESTER/YEAR : I/II SEM
COURSE CODE : 20EN1102
TITLE OF THE COURSE : ENGINEERING CHEMISTRY
L: T/A: P: C : 3: 0: 2: 4

Course learning objectives:

The Theory Course intends to provide chemical concepts most relevant to engineering students and demonstrate them in an applied context. The student is exposed to the principles required to understand important contemporary topics like alternate energy sources, corrosion control, polymer technology, phase equilibria nanomaterials and green chemistry and catalysis. The underlying theme is to emphasize on applications of these concepts to real world problems

Course outcome:

1. Appreciate the basic principles of electrochemistry, use of different types of electrodes in analysis and evaluate cell potential for different cell reactions.
2. Know construction, working and applications of various energy storage devices such as batteries, fuel cells and super capacitors.
3. Understand basic principles of corrosion and apply suitable techniques for corrosion control. Also know the technological importance and processes involved in metal finishing.
4. Understand and interpret phase equilibria of one and two-component systems.
5. Know the synthesis, structure –property relationship and applications of commercially important polymers and polymer composites. Understand properties and applications of nanomaterials. Also learn the principles of green chemistry for a sustainable and eco-friendly world.

Module 1

Chemical Energy Source Engineering Chemistry

Introduction to energy; Fuels - definition, classification, importance of hydrocarbons as fuels; Calorific value-definition, Gross and Net calorific values (SI units). Determination of calorific value of a solid / liquid fuel using Bomb calorimeter. Numerical problems on GCV & NCV. Petroleum cracking-fluidized catalytic cracking. Reformation of petrol. octane number, cetane number, anti-knocking agents, power alcohol, Biodiesel & Biogas-Dry gas harvesting and its efficiency.

Note: Video lecture on

- (i) Fractional distillation of crude petroleum
- (ii) Biogas
- (iii) Biodiesel

Solar Energy:

Thermal energy: Photovoltaic cells- Introduction, definition, importance, working of PV cell. Solar grade silicon physical and chemical properties relevant to photo- voltaics, doping of silicon by diffusion technique.

Module 2

Energy Science and Technology

Single electrode potential - Definition, origin, sign conventions. Standard electrode potential- Definition-Nernst equation expression and its Applications. EMF of a cell-Definition, notation and conventions. Reference electrodes– Calomel electrode, Ag/AgCl electrode. Measurement of standard electrode potential. Numerical problems on electrode potentials and EMF. Ion-selective electrode- glass electrode- Derivation electrode potential of glass electrode

Battery technology: Basic concepts including characteristics of anode, cathode, electrolyte and separator. Battery characteristics. Classification of batteries– primary, secondary and reserve batteries. State of the art Batteries-Construction working and applications of Zn-air, Lead acid battery, Nickel-Metal hydride and Lithium ion batteries. Introduction to fuel cells, types of fuel cells. Construction, working and application of Methanol-Oxygen fuel cell.

Module3

Corrosion Science:

Definition, Chemical corrosion and Electro-chemical theory of corrosion, Types of corrosion, Differential metal corrosion, Differential aeration corrosion (pitting and water line corrosion), Stress corrosion. Factors affecting the rate of corrosion, Corrosion control: Inorganic coatings-Anodization. Metal coatings-Galvanization, Tinning and its disadvantages. Cathodic protection of Corrosion: Sacrificial anode method and current impression method.

Surface Modification Techniques:

Definition, Technological importance of metal finishing. Significance of polarization, decomposition potential and over-voltage in electroplating processes. Electroplating of Chromium. Electroless Plating. Distinction between electroplating and Electroless plating, advantages of electroless plating. Electroless plating of copper.

Note: Video lecture on surface modification using polymer

Module: 4

High Polymers:

Introduction to polymers, Glass transition temperature, structure and property relationship. Synthesis, properties and applications of Teflon. PMMA. Elastomers - Deficiencies of natural rubber and advantages of synthetic rubber. Synthesis and application of silicone rubber, conducting polymers-Definition, mechanism of conduction in polyacetylene. Structure and applications of conducting Polyaniline.

1. **Nanotechnology:** Introduction, properties, synthesis by sol-gel. Fullerenes, Carbon nanotubes, dendrimers and nano-composites-metal oxide-polymer nano-composite

Note: Video lecture on metal oxide-polymer nano-composite.

2. **Advances in engineering chemistry:** Synthesis of carbon and sulphur containing compounds.

Module: 5

Water Technology: Impurities in water. Hardness of Water: Types of Hardness and determination of total hardness of water by using disodium salt of ethylenediaminetetraacetic acid method. Alkalinity. Potable water treatment by Electro dialysis and Reverse Osmosis. Water analysis- Biochemical oxygen demand and Chemical oxygen demand. Determination of COD. Numerical problems on COD. Sewage treatment, problems on quantity of flocculent required in sewage treatment. Principle and applications of green chemistry Instrumental Methods of

Analysis:

Instrumental methods of analysis, Principles of spectroscopy-Beer's Lambert's law, Difference between spectrometer and spectrophotometer, Potentiometry, Conductometry (Strong acid against strong base, weak acid against strong base, mixture of strong acid and a weak acid against strong base) and viscometer.

Text Books

1. Dr. S. Vairam, Engineering Chemistry, Wiley-India Publishers, 2017,
2. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015

Reference Books

1. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
2. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

ENGINEERING CHEMISTRY- LABORATORY

Volumetric Analysis and Preparations

1. Evaluation of quality of water in terms of total hardness by Complexometric titration.
2. Determination of Chemical Oxygen Demand (COD) of the given industrial waste water sample.
3. Determination of Alkalinity of the given water sample
4. Preparation of MgO nanoparticles by solution combustion method (Demonstration experiment) and spectrometric analysis.
5. Electroless plating of copper (Demo experiment)
6. Preparation of Polyaniline (Demo experiment)

Instrumental methods of Analysis

1. Potentiometric titration–Estimation of FAS using standard $K_2Cr_2O_7$ solution.
2. Conductometric estimation of hydrochloric acid using standard sodium hydroxide solution
3. Determination of viscosity coefficient, surface tension, density of a given liquid
4. Colorimetric estimation of copper in a given solution
5. Determination of P_{ka} of given weak acid.
6. Determination of calorific value of coal/oil using Bomb calorimeter (Group experiment)

Reference books:

1. Dayanada Sagar University laboratory manual.
2. J. Bassett, R.C. Denny, G.H. Jeffery, Vogels, Text book of quantitative inorganic analysis, 4th Edition.

SEMESTER/YEAR	: I/II SEM
COURSE CODE	: 20EN1103
TITLE OF THE COURSE	: FUNDAMENTALS OF PROGRAMMING
L: T/A: P: C	: 3: 0: 4: 5

Course objective:

To develop student competence in writing clear, correct, and maintainable programs that implement known algorithms.

Course outcomes:

After completing this course, students will be able to:

- **Express** algorithms learned implicitly in school explicitly in algorithmic form and Calculate the number of basic operations (exact or upper bound)
- **Trace** the execution of short programs/code fragments involving fundamental programming constructs
- **Explain** what a short program/code fragment involving fundamental programming constructs does
- **Determine** whether code meets consistent documentation and programming style standards, and **make changes** to improve the readability and maintainability of software using a modern IDE
- **Write** a short program/code fragment for a given task using fundamental programming constructs
- **Rewrite** a short program/code fragment with fundamental programming constructs using more appropriate programming constructs
- **Debug** a short program/code fragment with fundamental programming constructs manually, and debug more complex code using a modern IDE and associated tools
- **Add/modify** functionality and decompose monolithic code into smaller pieces
- **Design** a large program, conduct a personal code review, and contribute to a small-team code review focused on common coding errors and maintainability using a provided checklist
- **Use** appropriate tools to build source code for testing and deployment
- **Identify** potential computing ethics issues in a given programming task and **suggest** Ways to address these issues

Course Content:

Module 1 - 14 Hours

The primary focus is on code comprehension. Simple expressions, operator precedence, integer issues (overflow, integer division), floating point issues, implicit and explicit typecasting, conditionals, Boolean expressions, lazy evaluation.

Module 2. 14 Hours

The primary focus will be on debugging (gdb) and code rewriting. Simple recursion (factorial and GCD), functions with variables, functions with loops (e.g., Taylor series), switch statements, command line arguments.

Module 3. 14 Hours

The primary focus is on writing code for given specifications. Functions with constarray arguments (e.g., linear search, binary search), arrays and pointers, library functions (especially strings), functions with side-effects (non-const arrays, pointers), structs as arguments and return value, global variables.

Module 4. 14 Hours

The primary focus is on managing heap memory (malloc, free, realloc), memory leaks (valgrind).

Module 5. 14 Hours

Header files and multiple implementations (e.g., using dictionary ADT and array-based implementations), file I/O.

Note: The hours include 4 Hours of Lab per week.

Textbook:

Brian W. Kernigham and Dennis M. Ritchie, (2012) “The C Programming Language”, 2nd Edition, PHI.

SEMESTER/YEAR	: I/II SEM
COURSE CODE	: 20EN1108
TITLE OF THE COURSE	: BASIC ELECTRONICS
L: T/A: P: C	: 3: 0: 2: 4

COURSE OBJECTIVE:

1. Imparting knowledge of fundamentals of semiconductor devices
2. Understanding electronic circuits

COURSE OUTCOME:

1. Analyze and design the basic electronic circuits containing Semiconductor devices
2. Identify the need of Integrated Circuits and use them in realizing circuit applications.
3. Analyze and implement basic Digital Electronic circuits for a given application.
4. Identify the applications and significance of electronics in interdisciplinary engineering domains.

Module 1: Semiconductors

Semiconductor diodes, Diode types, Bipolar junction transistors BJT, FET characteristics, Packages and coding, Integrated circuits

Power supplies: Rectifiers, Reservoir and smoothing circuits, improved ripple filters Full-wave rectifiers, Voltage regulators, Practical power supply circuits, Related Problems.

Module 2: Amplifiers

Types of amplifier, Gain, Class of operation, Input and output resistance, Frequency response, Bandwidth, Phase shift, Negative feedback, Transistor amplifiers Bias, Predicting amplifier performance, Practical amplifier circuits

Oscillators: Positive feedback, conditions for oscillation, types of oscillators, practical oscillator circuits. , Related Problems.

Module 3: Operational Amplifiers

Symbols and connections, Operational amplifier parameters, Operational amplifier characteristics, Operational amplifier applications, Related Problems Circuit simulation: Introduction, types of analysis, net lists and component models.

Module 4: Logic Circuits

Logic functions, Switch and lamp logic, logic gates, combinational logic, bistables/flipflops, Integrated circuit logic devices, Logic simulation using SPICE **Microprocessors:** Microprocessor and microcontrollers, Microprocessor systems, architecture, operation, microcontroller systems, Related Problems.

Module 5: Radio

The radio frequency spectrum, Electromagnetic waves, a simple CW transmitter and receiver, Modulation, Demodulation, Types of transmitters and receivers, aerials, Related Problems.

Text book(s)

1. Electronic Circuits: Fundamentals and Applications by Michael Tooley BA Elsevier Ltd., Third Edition, 2006.
2. Electronic Devices and Circuits, Allan Mottershead, PHI.

Reference book(s)

1. Robert. L. Boylestad and L.Nashelsky, Electronic Devices and circuit Theory, Pearson Education, 9th edition, 2005.
2. David A Bell, Electronic Devices and Circuits, PHI, 5th edition 2007.
3. Millman & Halkias, Electronics Devices and Circuits, McGraw Hill.

SEMESTER/YEAR : I/II SEM
COURSE CODE : 20EN1112
TITLE OF THE COURSE : DESIGN THINKING & INNOVATION
L: T/A: P: C : 1: 0: 0: 1

Course Summary

The course 'Design Thinking and Innovation' gives an overview of design thinking to help students in understanding design thinking as a problem-solving approach. Ideas are developed through these processes and then applied to a basic approach to understand their value in the market place.

This course integrates the laboratory component into the theory enabling students to understand different phases of Design thinking by creating models using various workbenches from Autodesk Fusion 360 platform.

This course also aims at developing skillsets by using different design approaches to create components that can provide solutions to various engineering problems. It also enables students to use the tool proficiently to create their engineering models independently.

Course Objectives

Theory Component:

The objectives of the Course are to:

- Introduce students to a discipline of design thinking that enhances innovation activities in terms of value creation, speed, and sustainability
- Understand the importance and phases of design thinking and innovation
- Discuss key concepts and principles related to design process
- Examine approaches to innovation practiced by various organizations
- Explain the fundamental principles that guide design thinking
- Explain design thinking practices, their applications and importance.
- Enable students to use basic presentation techniques.
- Come up with new ideas and potential innovations.
- Understand the significance of Team Work and roles of individuals within a team.

Lab Component:

To impart knowledge and skills to use various workbenches in Autodesk Fusion360.

To provide hands-on training on different commands to create part models in Autodesk Fusion 360.

Course Outcomes (CO):

After undergoing this course students will be able to:

- **Apply** the design thinking principles and recognize the significance of innovation
- **Explain** the importance of approaching innovation projects with concept development
- **Discuss** both individual and contextual factors that are linked to creativity
- **Discuss** the need for and significance of adopting a design thinking mind set
- **Develop** creative ideas through design criteria & brainstorming sessions
- **Design** various part models related to engineering field using Autodesk Fusion 360

Module 1: Introduction to Design Thinking & Innovation

Design Thinking Phases, Scoping, and Importance of storytelling. Design brief and visualization, Creativity and Idea Generation.

Module 2: Scope of Design Process

Introduction, Steps of Design Process, Design Components, Product and Process design, Ethnography and Identifying Insights, Requirements of a good product, Customer Satisfaction and Profitability

Module 3: Morphology of Design Process

Establishing design criteria, Design Morphology, Creative Design & Engineering Design, Product life cycle, Concept Development, Testing and Prototyping, Brainstorming & decisionmaking.

Module 4: Analysis of Design Problem

Design inputs and outputs, Constraints in Design, Tools for Preliminary Design- Prescriptive and Descriptive Design, Market & Technology driven process.

Module 5: Communication & Presentation

Types of design communications, Qualities of a Good Poster & Presenter, Barriers & Difficulties in Communication, Effective Communication, Presentation Skills, Professional Ethics in Engineering.

Text Book(s)

1. C. L. Dym and Patrick Little, Engineering Design- A Project Based Introduction, John Wiley, 1995.

2. N. Cross, Engineering Design Methods: Strategies for Product Design, John Wiley, 1995.

References(s)

1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation (Harper Business, 2009)
2. Bruce Hannington and Bella Martin, Universal Methods of Design: 100 Ways to Research Complex Problems, Develop Innovative Ideas, and Design Effective Solutions (Rockport Publishers, 2012)
3. Ian C. Wright, Design Methods in Engineering & Product Design, McGraw-Hill, 1998.
4. M. A. Parameswaran, an Introduction to Design Engineering, Narosa, 2004.

SEMESTER/YEAR : I/II SEM
COURSE CODE : 20EN1106
TITLE OF THE COURSE : ELEMENTS OF MECHANICAL ENGINEERING
L: T/A: P: C : 2: 0:2: 3

Course Summary

The course 'Elements of Mechanical Engineering' aims at introducing principles of energy resources, thermodynamics, prime movers, pumps, materials science & composites, mechanical design, power transmission, manufacturing techniques (metal cutting, joining & foundry), mechatronics, 3D printing, robotics, electric mobility and applications.

This course integrates the laboratory component into the theory enabling students to understand the working and application of various mechanical systems. Students belonging to all branches of engineering are introduced to fundamental topics related to mechanical engineering.

This course also aims at developing skills by using workshop tools, equipment's and materials to create various physical models. The course deals with basic manufacturing processes like fitting, sheet metal work, welding, soldering, machining, carpentry, casting and smithy useful for industries.

Course Objectives:

The objectives of the Course are to:

- Explain the basic concepts of renewable & non-renewable energy resources
- State first and second laws of thermodynamics
- Describe Carnot, Otto, diesel, Brayton, Rankine & refrigeration cycles
- Discuss 4 stroke petrol & diesel engines, turbines and pumps
- Study materials types, properties and stress- strain diagram
- Explain simple stresses, strains, elastic constants and power trains
- Discuss the operations of lathe, drilling, shaper, milling, and grinding machines
- Describe Joining Processes and foundry
- Explain mechatronics, PLC, instrumentation & control systems
- Explain robot anatomy, configurations, sensors and applications
- Discuss rapid prototyping, 3D printing and electric mobility Lab Component:
 - To impart knowledge and skills to use tools, machines, equipment, and measuring instruments
 - To cultivate safety aspects in handling of tools and equipment's
 - To provide hands-on training on fitting, sheet metal, carpentry, casting , smithy, machining operations
 - To provide hands-on training on soldering and welding processes

Course Outcomes (CO):

1. Explain various energy resources, laws of thermodynamics, gas and vapour cycles, prime movers and pumps
2. Discuss fundamentals of materials and mechanical design aspects
3. Describe basics of machine tools, joining processes and foundry
4. Explain advanced topics in mechanical engineering
5. Construct different types of fitting, welding, sheet metal, turning models
6. Demonstrate working of engines, turbines, pumps, 3D printing; wood working, foundry & smithy operations Course content.

Module 1: Energy Conversion

Renewable & Nonrenewable energy resources – Introduction to Steam, Hydro & Nuclear power plants, solar, wind and biomass energy based power plants, Effect of power generation on environment

Thermodynamics- First and second laws of thermodynamics, Efficiency, COP, Carnot theorem, Numericals

Module 2: Prime Movers & Pumps Gas and Vapour cycles

Carnot, Otto, Diesel, Brayton, Rankine & Refrigeration cycles Prime movers- 4 stroke- petrol and Diesel engines, Gas turbines-open and closed Cycle, steam turbines-Impulse and reaction, Numerical.

Introduction to pumps-working of centrifugal and reciprocating

Module 3: Materials & Mechanical Design Materials

Introduction to ferrous, non-ferrous & composites, Stress-strain diagrams, Mechanical Properties for materials. Mechanical Design-Introduction, Simple Stresses and strains, Elastic constants. Power Transmission- Gear & Belt Drives, Numerical problems.

Module 4: Manufacturing Processes Metal cutting:

Introduction, classification of machine tools, basic operations on lathe, drilling, shaper, milling, grinding, introduction to CNC machining. Joining Processes- Welding- classification, gas, arc, laser & friction welding, brazing and soldering Foundry- Basic terminology, Types of patterns, sand moulding.

Module 5: Advanced Technologies in Mechanical Engineering

Mechatronics - Introduction, Mechatronics, PLC, Instrumentation & control systems Robotics- Introduction, Robot anatomy, configurations, Sensors, applications. Rapid prototyping & 3D Printing- Introduction & applications, powder-based additivemanufacturing processes. Electric Mobility - Introduction, electric, hybrid and autonomous vehicles

Lab Component

1. Fitting Shop- Simple exercises involving fitting work-Dove tail.
2. Welding Shop- Simple butt and Lap welded joints using arc welding
3. Sheet-metal Shop- Fabrication of tray, Making Funnel complete with soldering
4. Lathe machining on plain and step turning

Demonstration of

1. Pelton wheel, and Francis turbine
2. 4 stroke petrol and diesel engines
3. Lathe, milling, drilling, grinding & CNC milling machines and wood turning lathe
4. Foundry and smithy operations
5. 3D printing

Text book(s)

1. Nag P K, Basics and applied thermodynamics, Second edition, Tata McGraw Hill, New Delhi -2017.
2. P.N. Rao-Manufacturing Technology-Foundry, Forming and Welding, Volume 1, 4 Edition, Tata McGraw Hill Publishing Co Ltd, 2018.
3. P.N. Rao-Manufacturing Technology- Metal Cutting and Machine Tools, Volume 2, 4 Edition, Tata McGraw Hill Publishing Co Ltd, 2018.

Reference(s)

1. El-Wakil M M, Power plant technology, Tata McGraw Hill edition, New Delhi -2017. Larminie J,Lowry J, Electric vehicle technology explained, John Wiley and &sons Ltd. USA
2. William D. Callister and David G. Rethwisch-Fundamentals of Materials Science and Engineering: An Integrated Approach, John Wiley & Sons; 4th Edition edition, 2011

SEMESTER/YEAR : I/II SEM
COURSE CODE : 20EN1107
TITLE OF THE COURSE : ENGINEERING PHYSICS
L: T/A: P: C : 3: 0:2: 4

Course learning objectives:

This course will enable students to learn the basic concepts in Physics which are very much essential in understanding and solving problems in engineering.

Course Objectives:-

The Objectives of the Course are:

- To introduce the basic concepts of Quantum mechanics which are essential in understanding and solving problems in engineering.
- To review different types of Engineering materials –Electronic, electrical, mechanical and Magnetic materials Properties and their applications in Science and Engineering.
- To understand Band structure of solids, Semiconductors and electrical conductivity of SC's, and their applications.
- To explain semiconductor devices like LED, Photodiode and Solar cell and Semiconductor BJT.
- To learn how to find Lattice parameters of different crystalline solids by using X-ray diffraction methods
- To explain Principle and working of LASERS, Different types of Lasers. and Applications of Lasers in defence, engineering and medicine.
- To introduce Polar and non-polar dielectrics, dielectric constant, electronic, ionic and orientation polarization mechanisms.
- Lorentz field in cubic materials, Clausius-Mossotti equation, Ferro, Piezo and Pyro electric materials and their applications in engineering.
- To explain Thin-film Phenomena, Thin-film fabrication Process and their applications in engineering.
- To learn how to fabricate Nano materials by using Top-down and Bottom –up approach

To review Nano science and technology and its practical applications in science and engineering.

Course Outcomes (CO's):

On completion of the Course the Students are able to

- Describe the concepts of Quantum mechanics, basics of Quantum computing and select for solving problems in engineering.
- Discuss the different engineering materials such as Electronic, electrical and mechanical materials properties and their applications in engineering
- Illustrate Semiconductors , Semiconductor devices like Photo diode, LED, Solarcell and BJT and its applications
- Classify Lattice parameters of different crystalline solids by using X-ray diffraction methods and Summarize theoretical background of laser, construction and working of different types of lasers and its applications in science and engineering
- Interpret Basic concepts of Thin films and Thin film deposition processes and their applications leads to Sensors and engineering devices
- Discuss Nano materials, Properties and fabrication of Nano materials by using Top-down and Bottom –up approach's-Applications for Science and technology

Module 1: Introduction to Basics of Classical mechanics

Quantum Mechanics 1: Foundations of quantum theory, Wave function and its properties, One dimensional time independent Schrodinger wave equation, Eigenvalues and Eigen functions, Uncertainty principle, Applications: one dimensional motion of an electron in a potential-well.

Quantum Mechanics 2: Matrix formulation: Linear & matrix algebra, Dirac's bra & ket notation, matrix representation of vectors & operators, Expectation values, Basics of quantum computing - Concepts of Superposition, entanglement, Interference and Qubit

Module 2: Introduction to Engineering materials

Introduction to Principles of Electromagnetic theory (Maxwell's Equations). Classification of Engineering Materials such as Conductors, Semiconductors, Insulators and Magnetic materials ; Electrical conductivity of metals and Semiconductors. Effect of temperature, composition on resistivity/conductivity of materials.

Mechanical Engineering materials – mechanical properties: stress- strain curve for different materials. Introduction to Tensile strength, Compressive strength, Ductility, Malleability, Toughness, Brittleness, Impact strength, Fatigue, Creep. Testing of engineering materials: Hardness Tests: Brinell, Rockwell and Vickers hardness test-Numericals **Dielectrics:** polar and non-polar dielectrics, internal fields in a solid, Different Polarization techniques. Clausius-Mossotti equation, applications of dielectrics. Ferro, Piezo and Pyroelectric materials and their applications.

Module 3: Semiconductor Physics

Band structure, Fermi level in intrinsic and extrinsic semiconductors, Density of energy states in

conduction and valence bands of a semiconductor (Mention the expression), Expression for concentration of electrons in conduction band (Derivation), Hole concentration in valence band (Mention the expression), Intrinsic carrier concentration Conductivity of semiconductors, Measurement of Electrical resistivity using 4 probe method.

Semiconducting devices of interest for optoelectronics applications: Principle and working of LED, photodiode, and solar cell. BJT, FET-JFET and MOSFET

Module 4: LASER PHYSICS

Einstein's coefficients (expression for energy density). Requisites of a Laser system. Conditions for laser action. Principle, Construction and working of Nd-YAG, Semiconductor Laser and CO₂ Lasers. Application of Lasers in Defense (Laser range finder), Engineering (Data storage) and Applications of Lasers in medicine [6 hours] **Crystallography:** Lattice, unit cell, lattice parameters, crystal systems, Bravais lattices, Introduction to Miller Indices. Determination of Crystal structure by Miller Indices. X-ray diffraction, Bragg's law and Powder method.

Module 5: Thin films technology

Introduction to thin-films-Advantages of thin-films over bulk materials. Thin film deposition processes- Physical vapour deposition (Thermal evaporation technique, and sputtering technique) process, Applications of Thin film.

Nano Science & technology: Introduction to Nano materials, Classification of nano materials, Scaling laws in miniaturization electrical systems, Size dependent properties of materials, Top-down and Bottom-up approach- Ball milling, self-assembly process. Fundamental Principles of Bio-Physics and Applications of Nano technology in Biology and Engineering.

Introduction to Micro machining techniques: Silicon micromachining techniques- Etching (isotropic and anisotropic etching)-Numerical

Lab component

1. I-V characteristics of a Zener Diode

I-V Characteristics of a Zener diode in forward and reverse bias condition

2. Four probe technique

Measurement of resistivity of a semiconductor using Four probe technique

3. Newton's Rings

Measurement of radius of curvature of a plano-convex lens using Newton's Rings

4. Dielectric constant

Determination of dielectric constant of a dielectric material

5. Torsional Pendulum

Determination of moment of inertia of a circular disc using torsional pendulum

6. Band gap energy

Determination of energy gap of an intrinsic semiconductor

7. Diffraction grating

Determination of wavelength of a laser light using diffraction grating

8. Planck's constant

Measurement of Planck's constant using LED

9. LCR series and parallel resonance

Study the frequency response of a series and parallel LCR circuit

10. Transistor characteristics

Input and output characteristics of a NPN transistor in C-E configuration

Text Book(s)

1. M N Avadhanulu, P G Kshirsagar, TVS Arun Murthy (2018), A textbook of Engineering Physics, S Chand, New Delhi.
2. Materials Science and Engineering by V S Raghavan
3. Engineering Physics (2019), DSU Pearson, New Delhi
4. Engineering Physics (2017), DSU WILEY Publications
5. Engineering Physics Laboratory manual, DSU

Reference Book(s)

1. M. Young (1977), Optics & Lasers an Engineering Physics approach, Springer, Verlag
2. S. O. Pillai (2018), Solid State Physics, revised edition, New Age International Publishers, New Delhi.
3. Thin-Films Phenomena-K L Chopra, McGraw -Hill Publishing
4. K. Thyagarajan, A.K. Ghatak (1981), Lasers: Theory & Applications, Plenum Press, New York.

SEMESTER/YEAR : I/II SEM
COURSE CODE : 20EN1104
TITLE OF THE COURSE : BASIC ELECTRICAL ENGINEERING
L: T/A: P: C : 3: 0:0: 3

COURSE OBJECTIVE:

1. Imparting Knowledge of basic circuits.
2. Understanding analysis of circuits.
3. Basics of electric and magnetic fields.
4. Working principles of machines, measuring equipments.

COURSE OUTCOME:

1. Able to get the basic knowledge about the Electric and Magnetic circuits.
2. Able to understand the AC fundamentals.
3. Able to understand the working of various Electrical Machines.
4. Able to get the knowledge about various measuring instruments and house wiring.

Module 1: Introduction to Electrical Engineering

Introduction to Electrical Engineering: General structure of electrical power systems, Electric current, ohm's law, Resistance, Inductance and capacitance parameter, Kirchoff's laws, node voltage and mesh current methods, Series and parallel combinations, current division, voltage division rule, Electrical power and energy. Related Numerical problems. Domestic Wiring: Earthing-significance and types, two way & three way control of lamps, basic protective devices like MCB's and Fuses.

Module 2: Magnetic Circuits

Faradays laws of electromagnetic induction, Lenz's law, Magnetic circuit- concept and analogies, Force on a current carrying conductor placed in a magnetic field, Dynamically induced emf, Fleming's rules and its applications. Self and mutual inductance. Related Numerical Problems.

Module 3: Alternating Quantities

Average and effective values of periodic functions, solution of R,L,C series circuits, the j operator, complex representation of impedances, phasor diagram, instantaneous and average power, power factor, power in complex notation, response of series, parallel and series – parallel circuits. Related numerical problems. Necessity and advantages of Three phase supply, delta and Y – connections, line and phase quantities, solution of balanced three phase circuits, phasor diagram, Three phase three wire and four wire circuits.

Module 4: DC Machines

Construction, Working principle and analysis of DC motor and generator, EMF and Torque equations, Connections and working of DC generators and motors- series and shunt, back emf. Related numerical problems.

Module 5: Transformers

Principle of operation, Construction, Equivalent circuit, EMF equation, ratings, losses, Efficiency and voltage regulation, and related simple problems. Induction motors: brief idea about construction, concept of rotating magnetic field. Slip and its significance, Ratings and applications, Problems on slip calculation

Text Book(s)

1. M. Maria Louis, Elements of Electrical Engineering, fifth edition, PHI Publications, 2014.
2. D.P.Kothari and I.J. Nagrath, Basic Electrical Engineering, TataMcGraw Hill.

Reference book(s)

1. S.S. Parker Smith and NN Parker Smith, Problems in Electrical Engineering.
2. Rajendra Prasad, “Fundamentals of Electrical, PHI Publications, 3rd Edition.

SEMESTER/YEAR : I/II SEM
COURSE CODE : 20EN1109
TITLE OF THE COURSE : BIOLOGICAL SCIENCES
L: T/A: P: C : 2: 0:0:2

Biology in the 21st century: The new world in the post genome era. Past, present and future of our society, industry and life style: Impact of discoveries and technological innovations in biology. Challenges and excitement of research in biology and bioengineering. Bioengineering as an emerging science at the intersection of biology, engineering, physics and chemistry.

Carrier opportunities in biotechnology, biomedical engineering, pharmaceutical industry, agro-biotechnology and in the diverse areas of basic science and medical research. Emerging trends of collaboration between industry and academia for development of entrepreneurship in biotechnology.

Quantitative views of modern biology. Importance of illustrations and building quantitative/qualitative models. Role of estimates. Cell size and shape. Temporal scales. Relative time in Biology. Key model systems - a glimpse.

Management and transformation of energy in cells. Mathematical view - binding, gene expression and osmotic pressure as examples. Metabolism. Cell communication.

Genetics. Eukaryotic genomes. Genetic basis of development. Evolution and diversity. Systems biology and illustrative examples of applications of Engineering in Biology

Text Book(s)

1. R. Phillips, J. Kondev and J. Theriot, Physical biology of the cell, Garland Science Publisher, 2008, 1st Edition.
2. J.B. Reece, L.A. Urry, M.L. Cain, S.A. Wasserman, P.V. Minorsky and R.B. Jackson. Campbell Biology, Benjamin Cummings Publishers, 2010, 9th Edition.

SEMESTER/YEAR	: I/II SEM
COURSE CODE	: 20EN1110
TITLE OF THE COURSE	: TECHNICAL COMMUNICATION
L: T/A: P: C	: 2: 0:2:3

Course Aim and Summary

The course ‘Technical Communication Skills’ aims at enhancing Communication skills of the students in dimensions of - Listening, Speaking, Reading, Writing, Grammar and Vocabulary. The course introduces Communication and types of Communication and deals in detail the listening, referencing, report writing and group discussions. The course covers team, team building skills and effective leadership skills. The course also deals with resume writing, covering letter, job application and e-mail etiquettes. The practical course is designed to acquire correct pronunciation and to enable students to get rid of stage fear and become a good orator.

Course Objectives

The objectives of the Course are:

- To improve students lexical, grammatical competence
- To enhance their communicative skills
- To equip students with oral and appropriate written communication skills
- To inculcate students with employability and job search skills
- To achieve proficiency in English
- To Develop professional communication skills
- To create interest among the students about a topic by exploring thoughts and ideas
- To enable students with good use of tenses
- To learn the use of body language and improve verbal message
- To equip with Types of Teams and Leadership styles -to develop managing skills in corporate world.
- To Acquire skills for placement

Course Outcomes

After undergoing this course students will be able to:

- Explain communication and types of Communication: Managerial, Corporate, Technical & Organizational Communication.
- Distinguish Listening and hearing. Demonstrate various aspects of speaking. Discuss Word formation and types.
- Write a report, essay. Minutes of Meeting. Evaluate current issues and debate
- Use Leadership skills and Team building. Solve Tense exercise.
- Write a job application and CV.

- Discuss E-Mail etiquettes.
- Discuss topic and speak on the spot. Interpret data

Course content

1. Communication; Types of Communication Managerial, Corporate, Technical & Organizational Communication. Listening Types & its Importance. Difference between hearing & listening. Speaking: Different aspects of Effective Speaking Word Formation and Types of Word Formation, Word Family.

2. Referencing Skills

Academic Writing: Definition & Tips for writing Report Writing: Importance. Steps for Report Writing. Group Discussion: Definition, How GD helps in Student Life & Corporate Life. Minutes of Meeting: Importance; Steps for writing MOM in Organizations.

3. TEAM & TEAM BUILDING

Definition, Importance, Types of Team; Team Building & Team Dynamics. Leadership: Styles of Leadership; Characteristics of a good leader, Influence of different forces on leadership.

4. JOB Application

Covering Letter; Resume/CV Writing; Difference between Job Application & Resume.

5. E-mail Etiquettes:

Definition, Rules for e-mail etiquettes, Business E-mail etiquettes, Tips for perfecting e-mail etiquettes.

6. ICE Breaking activity and JAM sessions

7. Situational Dialogues/ Role Play (Greetings, enquiring, complaining)

8. Tenses and Subject Verb Concord

9. Extempore, Public Speaking, Debates.

10. Data Interpretation.

Reference(s)

1. Chauhan, Gajendra S., L. Thimmesha and Smita, Kashiramka (2019) Technical Communication, Cengage Learning, New Delhi

SEMESTER/YEAR : I/II SEM
COURSE CODE : 20EN1111
TITLE OF THE COURSE : ENGINEERING GRAPHICS & DESIGN
L: T/A: P: C : 1: 0:4:3

Course Aim & Summary:

The course aims at introducing engineering graphics as a language of engineers for universal communication. This course covers orthographic projections of points, lines, planes and solids. It also deals with development of surfaces and isometric projections of planes and solids. Students solve problems using manual sketching and professional CAD software for modelling and assembly of simple engineering components from various engineering domains. They work in teams to develop conceptual designs for an identified need.

Course Objectives

The objectives of the Course are:

- To create awareness and emphasize the need for Engineering Graphics
- To follow basic drawing standards and conventions
- To Introduce free hand sketching as a tool for technical Communication
- To understand the principles of geometrical curves and construct manually
- To learn using professional CAD software for construction of geometry
- To understand the concepts of orthographic and isometric projections
- To construct orthographic projection of points, lines, planes and solids
- To develop the lateral surfaces of solids
- To construct isometric projections of planes and solids
- To create simple engineering 3D components and assembly
- To work in a team for creating conceptual design of products

Course Outcomes

After undergoing this course students will be able to:

- Explain usage of instruments, dimensioning & tolerances, conventions and standards related to working drawings
- Construct points, lines, planes and solids using orthographic projections principles
- Construct geometries of planes and solids using isometric projection principles
- Prepare the lateral surfaces of the given solid by applying the basic concepts
- Construct lateral surfaces of solids using geometry development principles
- Create associative models at the component and assembly levels for product design

Module 1:

Introduction: Fundamentals, Drawing standard - BIS, dimensioning, Lines, lettering, scaling of figures, symbols and drawing instruments, Introduction to orthographic & perspective projection.

Types of projections, Principles of Orthographic projection Plain & Miscellaneous Curves: Construction of ellipse, parabola, hyperbola, Construction of Tangent and Normal at any point on these curves. Construction of Cycloid, Epicycloid and Hypocycloid, Involute of a circle. Construction of Tangent and Normal at any point on these curves.

Module 2:

Projection of Points and Lines: Projections of points located in same quadrant and different quadrants. Projection of straight lines inclined to both the principal planes –Determination of true lengths and true inclinations by rotating line method.

Projection of planes: Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by change of position method.

Module 3:

Projection of Solids: Projection of solids such as prisms, pyramids, cone, cylinder, tetrahedron, Projections of solids with axis perpendicular and parallel to HP and VP, solids with axis inclined to one or both the planes, suspension of solids.

Module 4:

Sections of Solids: Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other, obtaining true shape of section.

Development of Surfaces: Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

Module 5:

Isometric Projection: Principles of isometric projection, isometric scale, Isometric projections of simple solids and truncated solids – Prisms, pyramids, cylinders, cones, combination of two solid objects in simple vertical positions, Conversion of orthographic views into isometric projection and vice versa

Module

6:

Computer Aided Design: Introduction to computer aided drafting and tools to make drawings. Layout of the software, standard tool bar/menus and description, drawing area, dialog boxes and windows, Shortcut menus, setting up and use of Layers, layers to create drawings, customized layers, create, zoom, edit, erase and use changing line lengths through modifying existing lines (extend/lengthen) and other commands

Demonstration of a simple team design project: Product Design- Introduction, stages, Design Geometry and topology of engineered components creation of engineering models and their presentation in standard 3D view. Use of solid-modeling software for creating associative

models at the component and assembly levels; include: simple mechanical components-bolts, nuts, couplings; simple civil

Text Book(s)

1. Gopalakrishna, K. R. (2005) Engineering Graphics, 32nd edition, Subash Publishers Bangalore, India
2. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House, Gujarat, India
3. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education, New Delhi.
4. DSU Text book, Wiley-India Publications, Bangalore

Reference(s)

1. Luzzader, Warren. J and Duff John M., (2005) ,Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi.
2. Basant Agarwal and Agarwal C.M., (2008), Engineering Drawing, Tata McGraw Hill Publishing Company Limited, New Delhi.

SEMESTER/YEAR : I/II SEM
COURSE CODE : 20EN1105
TITLE OF THE COURSE : ENVIRONMENTAL STUDIES
L: T/A: P: C : 2: 0:0:2

Course Aim

This course aims at creating awareness regarding preservation of environment for providing safe and healthy atmosphere. This course deals with concepts of ecosystem, renewable and non-renewable energy resources, environmental pollution, laws and regulations governing the environment.

Course Objectives

The objectives of the Course are:

- To explain the importance of this course
- To expose engineering students to the basic concepts and principles of environment;
- To have knowledge of the current issues of pollution endangering life on earth
- To educate about the environmental resources, energy, pollution, management, impact assessment and law

Course Outcomes

After undergoing this course students will be able to:

• Delineate basic concepts that govern environmental quality, atmospheric principles and environmental standards;
• Recognize and conversant with sources and nature of pollution types, control and management
• Explain Energy resource types and their environmental implications
• Apply the process of environmental impact assessment and implications of Indian Environment Laws

Course content

Module 1: Basic Concepts of Environment

Scope and importance of environmental studies, Definition of environment- comprehensive understanding of environment, Basic concepts: Xenobiotic, natural & anthropogenic; why are we concerned? Types of xenobiotics: Chemical, Physical, Biological pollutants; Hazard & Risk, Eco-kinetic & Bio-kinetic Properties of a xenobiotic, Dose-Response Relationships- chronic and acute effects, Environmental Standards: AAQS, TLV's, Appraisal, Assessment & Abatement (Recognition, Evaluation & Control) of pollutants- Structure of Atmosphere; Atmospheric inversions, Environmental System.

Air Pollution: Criteria pollutants – Ozone, Particulate Matter, Carbon Monoxide, Nitrogen, Oxides, Sulphur Dioxide, Lead; SMOG & Air-pollution episodes
Aerosols: Primary & Secondary pollutants, Acid Rain Cycle.

Module 2: Water Treatment

Hydrosphere, Lentic and Lotic Water Systems, Fresh Water as a resource; Rain Water Harvesting, Treatment of potable water, Waste water- Characteristics, Municipal Sewage Water and Treatment. Waste Management Types of Wastes: Municipal Solid Waste, Hazardous Waste, Nuclear Waste, Electronic Waste, Biomedical Waste, Solid Waste Management: Landfills, composting Water Standards

Module 3: Energy

Types of energy: Conventional sources of energy, fossil fuel, Coal, Nuclear based, Solar, wind, sea- Tidal Wave energy, Geo-Thermal, Non-conventional sources of Energy, Biofuels - biomass, biogas, Natural Gas; Hydrogen as an alternative future source of energy.

Module 4: Disasters & Management

Definition, origin and classification. Natural (Earthquakes, landslides, floods, Cyclones), Man-made disasters (biological, chemical, nuclear, radiological explosions) – definition, causes and management and/or mitigation strategies; Bhopal & Chernobyl Disasters, Environment & Health Occupational Health Hazards, Occupational Diseases, Epidemics, Pandemics, Endemics (Fluoride, Arsenic), Principles and Significance of Sanitation

Module 5: Environmental Impact Assessment (EIA) and Indian acts and regulations

Principles of EIA, Indian Acts and Rules, Wildlife (Protection) Act 1972. Water Act – 1974 (Rules 1975), Forest Conservation Act 1980 (Rules 2003), Air Act -1981 (Rules 1982, 1983), Environment Protection Act, 1986

Text Book(s)

1. R.C. Gaur, “Basic Environmental Engineering (2008)”, New age international (p)limited, publishers.
2. J. Glynn Henry and Gary. W. Heinke, “Environmental Science and Engineering (2004)”, Prentice Hall of India.
3. P. Venugopala Rao, “A Text Book of Environmental Engineering (2012)”, PHI Learning Pvt. Ltd.

Reference(s)

1. P.Aarne Vesilind, Susan M.Morgan, Thomson, “Introduction to Environmental Engineering” (2008), Thomson learning, Second Edition, Boston.
2. R Rajagopalan, “Environmental Studies – From Crisis to Cure” (2005) Oxford

University Press, New Delhi.

3. R J Ranjit Daniels and Jagadish Krishnaswamy, “Environmental Studies” (2014), Wiley India Pvt Limited, New Delhi.

SEMESTER/YEAR	: I SEM / I YEAR
COURSE CODE	: 20AU0004
TITLE OF THE COURSE	: CONSTITUTION OF INDIA & PROFESSIONAL ETHICS
L : T : P : S/P : C	: 2 : 0 : 0 : 0 : 0

Course objectives

1. To provide basic information about Indian constitution.
2. To identify individual role and ethical responsibility towards society.

Course outcomes

At the end of the course student will be able

- Understand state and central policies, fundamental duties
- Understand Electoral Process, special provisions
- Understand powers and functions of Municipalities, Panchayats and Cooperative Societies,
- Understand Engineering ethics and responsibilities of Engineers

Introduction to the Constitution of India, The Making of the Constitution and Sailable features of the Constitution. Preamble to the Indian Constitution Fundamental Rights & its limitations.

Directive Principles of State Policy & Relevance of Directive Principles State Policy fundamental Duties.

Union Executives – President, Prime Minister Parliament Supreme Court of India.
State Executives – Governor Chief Minister, State Legislature High Court of State.

Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th & 91st Amendments.

Special Provision for SC & ST Special Provision for Women, Children & Backward Classes Emergency Provisions.

Powers and functions of Municipalities, Panchayats and Co – Operative Societies.

Text Books:

1. Brij Kishore Sharma, "Introduction to the Constitution of India", PHI Learning Pvt. Ltd., New Delhi, 2011.
2. Durga Das Basu: "Introduction to the Constitution on India", (Students Edn.) PrenticeHall, 19th / 20th Edn., 2001

Reference Books:

1. M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.

SEMESTER/YEAR : I YEAR
COURSE CODE : 20AU0021
TITLE OF THE COURSE : KANNADA KALI –
IIL : T : P : S/P : C : 2 : 0 : 0 : 0 : 0

Course Learning Objectives:

1. Learners are Non – Kannadigas, so this course will make them
2. To Read and understand the simple words in Kannada language
3. To learn Vyavaharika Kannada (Kannada for Communication)
4. will create a some interest on Kannada Language and Literature

Lesson 1 : Introducing each other – 1. Personal Pronouns, Possessive forms, Interrogative words.

Lesson 2 : Introducing each other – 2. Personal Pronouns, Possessive forms, Yes/No Type Interrogation

Lesson 3 : About Ramanaya. Possessive forms of nouns, dubitative question, Relative nouns

Lesson 4 : Enquiring about a room for rent. Qualitative and quantitative adjectives.

Lesson 5 : Enquiring about the college. Predicative forms, locative case. Lesson

6 : In a hotel Dative case defective verbs.

Lesson 7 : Vegetable market. Numeral, plurals.

Lesson 8 : Planning for a picnic. Imperative, Permissive, hortative.

Lesson 9 : Conversation between Doctor and the patient. Verb- iru, negation – illa, non –past tense.

Lesson 10: Doctors advise to Patient. Potential forms, no – past continuous.

Lesson 11: Discussing about a film. Past tense, negation.

Lesson 12: About Brindavan Garden. Past tense negation.

Lesson 13: About routine activities of a student. Verbal Participle, reflexive form, negation.

Lesson 14: Telephone conversation. Past and present perfect past continuous and their negation.

Lesson 15: About Halebid, Belur. Relative participle, negation.

Lesson 16: Discussing about examination and future plan. Simple conditional and negative

Lesson 17: Karnataka (Lesson for reading)

Lesson 18: Kannada Bhaashe (Lesson for reading) Lesson

19: Mana taruva Sangati alla (Lesson for reading) Lesson

20: bEku bEDagaLu (lesson for reading)

1. Kannada Kali (ಕನ್ನಡ ಕಲಿ) – ಲಿಂಗದೇವರು ಹಳೆಮನೆ, A Text Book to Learn Kannada by Non – Kannadigas who come to study Diploma, Engineering and Health Sciences in Karnataka, ಪ್ರಕಟಣೆ: ಪ್ರಸಾರಾಂಗ ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ.
2. Spoken Kannada – ಮಾತನಾಡುವ ಕನ್ನಡ, ಪ್ರಕಟಣೆ – ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್ ಬೆಂಗಳೂರು.
3. Kannada Kirana - ಕನ್ನಡ ಕಿರಣ, ಪ್ರಕಟಣೆ – ಬೆಂಗಳೂರು ಇನ್ಸ್ಟಿಟ್ಯೂಟ್ ಆಫ್ ಲಾಂಗ್ವೇಜಸ್, ಬೆಂಗಳೂರು .

SEMESTER/YEAR : I SEM / I YEAR
 COURSE CODE : 20AU0025
 TITLE OF THE COURSE : KANNADA MANASU – II
 L : T : P : S/P : C : 2 : 0 : 0 : 0 : 0

COURSE OBJECTIVES:

1. To equip the native Kannada speaking students with advanced skills in Kannada communication and understanding
2. To enrich the students with creative writing

COURSE OUTCOMES:

1. Students will have better speaking and writing communication skills in Kannada

ಕನ್ನಡ ಭಾಷಾ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

- ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.
- ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಆಡಳಿತ ಕನ್ನಡದ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
- ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಒಲವು ಮತ್ತು ಆಸಕ್ತಿಯನ್ನು ಬೆಳೆಸುವುದು

1. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ
2. ವಿವಿಧ ರೀತಿಯ ಅರ್ಜಿ ಸಮಸ್ಯೆಗಳು
3. ಪತ್ರ ವ್ಯವಹಾರ - ಸರ್ಕಾರಿ ಅರೆಸರ್ಕಾರಿ ಪತ್ರಗಳು - ಆಹ್ವಾನ ಪತ್ರಿಕೆ, ಜಾಹೀರಾತು, ಪತ್ರಿಕಾ ಪ್ರಕಟಣೆ ಇತ್ಯಾದಿ ಪತ್ರಗಳು
4. ಭಾಷೆ ಮತ್ತು ಬರಹ - ಡಾ. ಎಂ. ಚಿದಾನಂದ ಮೂರ್ತಿ ರವರ ಭಾಷಾ ವಿಜ್ಞಾನದ ಮೂಲ ತತ್ವಗಳು ಪುಸ್ತಕದಿಂದ
5. ಭಾಷಾಭ್ಯಾಸ - ತತ್ವಮು ತದ್ಭವ, ಸಮಾನಾರ್ಥಕ ಪದಗಳು, ವಿರುದ್ಧಾರ್ಥಕ ಪದಗಳು, ನಾನಾರ್ಥಕ ಪದಗಳು, ನುಡುಗಟ್ಟುಗಳು, ಅನುಕರಣಾತ್ಮಕಗಳು (ದ್ವಿರುಕ್ತಿ) ಮತ್ತು ಜೋಡು ನುಡಿಗಳು, ಕನ್ನಡದ ದೇಶ್ಯ ಪದಗಳು, ಅನ್ಯದೇಶ್ಯ ಪದಗಳು.
6. ಭಾಷಾ ರಚನೆ - ಖಾಸಗಿ ಪದ್ಧತಿ ಮತ್ತು ಲೇಖನ ಚಿಹ್ನೆಗಳು, ಪತ್ರ ಲೇಖನ, ವರದಿ ಲೇಖನ, ಪ್ರಬಂಧ ಲೇಖನ.
7. ಶ್ರವಣ (ಕವನ) - ದ ರಾ ಬೇಂದ್ರೆ
8. ಡಾ. ವಿಶ್ವೇಶ್ವರಯ್ಯ - ವ್ಯಕ್ತಿ ಮತ್ತು ವಾಚನ (ವ್ಯಕ್ತಿ ಚಿತ್ರ) - ಎ ಎನ್ ಮೂರ್ತಿರಾವ್
9. ದೋಣಿ ಹರಿಗೋಲುಗಳಲ್ಲಿ (ಪ್ರವಾಸ ಕಥನ) - ಶಿವರಾಮ ಕಾರಂತ
10. ಅಣ್ಣಪ್ಪನ ರೇಷ್ಮೆ ಕಾಯಿಲೆ (ಪ್ರಬಂಧ) - ಕುವೆಂಪು
11. ನಮ್ಮ ಎಮ್ಮೆಗೆ ಮಾತು ತಿಳಿಯುವುದೇ? (ವಿನೋದ) - ಗೋರೂರು ರಾಮಸ್ವಾಮಿ ಅಯ್ಯಂಗಾರ್
12. ಆನೆಹಳ್ಳದಲ್ಲಿ ಹುಡುಗಿಯರು (ವಿಜ್ಞಾನ ಲೇಖನ) - ಬಿ ಜಿ ಎಲ್ ಸ್ವಾಮಿ
13. ಬೆಡ್ ನಂಬರ್ ಏಳು (ಕತೆ) - ತ್ರಿವೇಣಿ
14. ರೊಟ್ಟಿ ಮತ್ತು ಕೋವಿ (ಕವನ) - ಸು ರಂ ಎಕ್‌ಕುಂಡಿ
15. ಗುಬ್ಬಚಿಯ ಗೂಡು (ಅಂಕಣ ಬರಹ) - ಪಿ ಲಂಕೇಶ್

16. ಚೀಂಕ್ರ ಮೇಸ್ತ್ರಿ ಮತ್ತು ಅರಿಸ್ಟಾಟಲ್ (ಪರಿಸರ ಲೇಖನ) - ಕೆ ವಿ ಪೂರ್ಣಚಂದ್ರ ತೇಜಸ್ವಿ
17. ಗಾಂಧಿ (ಕತೆ) - ಬೆನಗರಹಳ್ಳಿ ರಾಮಣ್ಣ
18. ಬೆಲ್ಜಿಯ ಹಾಡು (ಕವನ) - ಸಿದ್ಧಲಿಂಗಯ್ಯ
19. ಎಲ್ಲ ಹುಡುಗಿಯರ ಕನಸು (ಕವನ) - ಸವಿತಾ ನಾಗಭೂಷಣ
20. ನೀರು (ಕತೆ) - ಬಸವರಾಜ ಕುಕ್ಕರಹಳ್ಳಿ
21. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿಯ ಒಂದು ಚಿತ್ರಣ (ಪರಿಚಯ ಲೇಖನ) - ರಹಮತ್ ತರೀಕೆರೆ
22. ವೃತ್ತಿ ಶಿಕ್ಷಣದಲ್ಲಿ ಕನ್ನಡ ಮಾಧ್ಯಮ (ತಂತ್ರಜ್ಞಾನ ಬರಹ) - ಎಸ್ ಸುಂದರ್
23. ಕೊಣವೇಗೌಡ (ಕಲವ್ಯ) - ಜಾನಪದ

ಪಠ್ಯಮುಸ್ತಕಗಳು

1. ಕನ್ನಡ ಮನಸು - ಇಂಜಿನಿಯರಿಂಗ್ ಪ್ರಥಮ ಪದವಿ ತರಗತಿ ಕನ್ನಡ ಪಠ್ಯ. ಪ್ರಕಟಣೆ: ಪ್ರಸಾರಾಂಗ ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ.
2. ಕನ್ನಡ - ಆಡಳಿತ ಕನ್ನಡ (ಪತ್ರಿಕೆ - 1, ಬ್ಲಾಕ್ 4) ಪ್ರಕಟಣೆ: ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮುಕ್ತ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಮೈಸೂರು.
3. ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮಟ್ಟದ ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಮತ್ತು ಭಾಷೆ ಕುರಿತಾದ ಉತ್ತಮ ಮುಸ್ತಕಗಳು.

SEMESTER	III					
YEAR	II					
COURSE CODE	20CS2301					
TITLE OF THE COURSE	DISCRETE MATHEMATICAL STRUCTURES					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	42	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- Solve problems using relations and generating functions.
- Understand and Construct mathematical arguments.
- Use propositional and predicate logic in knowledge representation and program verification.
- Develop recursive algorithms based on mathematical induction.
- Know essential concepts in graph theory and related algorithms.
- Apply knowledge of discrete mathematics in Elementary Number Theory and problem solving.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Classify functions, basic set theory relations.	L4
CO2	Demonstrate the correctness of an argument using propositional and predicate logic, laws and truth tables.	L2
CO3	Compare and differentiate graphs in different geometries related to edges.	L4
CO4	Apply mathematical induction, counting principles, recursion, elementary number theory.	L3
CO5	Apply and solve Euclidean Division Algorithm and Chinese Remainder Theorem.	L3

COURSE CONTENT:	
MODULE 1	9Hrs
RELATIONS AND FUNCTIONS: Relation and Types of relations, Closure Properties, Equivalence Relations, Partial Ordering Relations, n-ary relations, Functions: one-to-one, onto and invertible functions, sequences, indexed classes of sets, recursively defined functions, cardinality Counting Principles: Permutation, combination, the pigeon hole principle, inclusion-exclusion principle Self – Learning Component: Set theory definition and Properties	
MODULE 2	8Hrs
LOGIC: Propositions and truth tables, tautologies and contradictions, logical equivalence, algebra of propositions, logical implications, predicate logic, theory of inference for propositional logic and predicate logic. Introduction to Predicate Calculus.	

MODULE 3	9Hrs
NUMBER THEORY : Properties of Integers: Introduction, order and inequalities, absolute value, mathematical induction, division algorithm, divisibility, primes, greatest common divisor, Euclidean algorithm, fundamental theorem of arithmetic, congruence relation, congruence equations and Chinese Remainder Theorem (CRT).	
MODULE 4	7Hrs
GRAPH THEORY: Graphs and multi-graphs, sub-graphs, isomorphic and homomorphic graphs, paths, connectivity, Euler and Hamilton paths, labelled and weighted graphs, complete, regular and bipartite graphs, planar graphs.	
MODULE 5	9Hrs
TREES AND GRAPH COLORING: Trees: Definitions-properties - fundamental theorems of trees-rooted trees-binary trees-spanningtrees-Kruskal's Algorithm- Prim's Algorithm- Cut-Set, BFS and DFS. Coloring of planar graphs, Chromatic Number- Chromatic partitioning- The four ColorProblem-Five-color and Four-color theorem- Thickness and crossing.	

TEXT BOOKS :

1. K. H. Rosen, Discrete Mathematics & its Applications, 7th Ed., Tata McGraw-Hill, 2007.
2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall India (PHI).

REFERENCES:

1. M.Huth and M. Ryan, Logic in Computer Science, Cambridge University N.Press, 2004.

SEMESTER	III					
YEAR	II					
COURSE CODE	20CS2302					
TITLE OF THE COURSE	DATA STRUCTURES					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	42	3

Perquisite Courses (if any)

#	Sem/Year	Course Code	Title of the Course
1	I/II	20EN1103	FUNDAMENTALS OF PROGRAMMING

COURSE OBJECTIVES:

- To introduce the concept of data structure and its applications
- To introduce C language concepts required for data structures
- To design data structure operations to solve problems
- To introduce applications of data structures
- To introduce non-primitive data structures
- To analyse the complexity of a data structure
- To introduce static and dynamic memory allocation using C language
- To explain linear data structures – stack, queue, linked list
- To explain non-linear data structures – trees and graphs
- To train students to design an application as part of the course mini- project using their choice of data structure using C language.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Outline basic C program design for data structures	L2
CO2	Implement stack & queue data structure and their applications	L3
CO3	Apply concepts of dynamic memory allocation to real-time Problems	L3
CO4	Implement tree data structure and its applications	L3
CO5	Implement graph data structure and its applications	L3
CO6	Outline the concepts of file structures	L2

COURSE CONTENT:

MODULE 1		8Hrs
INTRODUCTION TO DATA STRUCTURES:		
Definition, Types, Algorithm Design, C Pointers, C Structure, Array Definition, Representation of Linear Array in Memory, Array Operations (Insertion, Deletion, Search and Traversal), Single Dimensional Arrays, Two Dimensional Arrays, Function Associated with Arrays, Arrays as Parameters, Recursive Functions.		

MODULE 2	9Hrs
INTRODUCTION TO STACK AND QUEUE: Stack: Definition, Array Representation of Stack, Operations Associated with Stacks- Push & Pop, Applications of Stack: Recursion, Polish expressions, Conversion of Infix to Postfix, Infix to Prefix, Postfix Expression Evaluation, Tower of Hanoi. Queue: Definition, Representation of Queues, Operations of Queues- QInsert, QDelete, Priority Queues, Circular Queue.	
MODULE 3	9Hrs
DYNAMIC DATA STRUCTURE: Linked List: Types, Introduction to Singly Linked lists: Representation of Linked Lists in Memory, Traversing, Searching, Insertion & Deletion from Linked List. Doubly Linked List, Operations on Doubly Linked List (Insertion, Deletion, Traversal). Applications: Polynomial Representation & Basic Operations, Stack & Queue Implementation using Linked Lists.	
MODULE 4	9Hrs
TREES & GRAPHS: Trees: Basic Terminology, Binary Trees and their Representation, Complete Binary Trees, Binary Search Trees, Operations on Binary Trees (Insertion, Deletion, Search & Traversal), Application: Expression Evaluation. Graphs: Terminology and Representations, Graphs & Multigraphs, Directed Graphs, Sequential Representation of Graphs, Adjacency Matrices, Graph Transversal, Connected Components and Spanning Trees.	
MODULE 5	7Hrs
FILE STRUCTURES: Physical storage media, File Organization, Linked Organization of File, Inverted File, Organization Records into Blocks, Sequential Blocks, Indexing & Hashing, Multilevel Indexing, Tree Index, Random File, Primary Indices, Secondary Indices.	

TEXT BOOKS :

1. A M Tannenbaum, Y Langsam, M J Augentien “Data Structures using C”, Pearson, 2013
2. R.L. Kruse, B.P. Leary, C.L. Tondo, “Data Structure and Program Design in C” PHI

REFERENCES :

1. Horowitz Anderson-Freed, and Sahni, “Fundamentals of Data structures in C”, 2nd Edition, Orient Longman, 2008
2. Data Structures and Algorithm analysis in C by Mark Allen Weiss, Published by Addison Wesley (3rd Indian Reprint 2000).
3. D E Knuth, The Art of Computer Programming, Volume 1, Addison-Wesley Publishing, 2013

SEMESTER	III					
YEAR	II					
COURSE CODE	20CS2303					
TITLE OF THE COURSE	DIGITAL ELECTRONICS & LOGIC DESIGN					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	2	42	4

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES :

- To understand various number systems and conversion from one to other number systems
- To introduce basic postulates of Boolean algebra
- To manipulate expressions into POS or SOP form.
- To introduce the methods for simplifying Boolean expressions like K-Map and Quine Mclusky
- To understand the concept of don't care conditions and how they can be used to further optimize the logical functions
- To design simple combinational circuits such as multiplexers, decoders, encoders
- To understand the differences between combinational and sequential Logic circuits
- To familiar with basic sequential logic component-SR Latch
- To understand the basics of various types of memories.
- To present the working of various Flip- Flops (T flip-flop, D flip-flop, R-S flip-flop, JK flip-flop)
- To get familiarized with State Diagram, State Table, State Assignment
- To design combinational circuits using programmable logic devices.
- To design sequential circuits such as different types of Counters, Shift Registers

COURSE OUTCOMES :

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Demonstrate the knowledge of binary number systems, logic families, Boolean algebra and logic gates	L2
CO2	Analyze different methods used for simplification of Boolean expressions	L4
CO3	Design combinational logic circuits using combinational logic elements	L3
CO4	Design combinational circuits using Programmable Logic Devices	L3
CO5	Analyze sequential logic elements in the design of synchronous and asynchronous systems	L4
CO6	Design sequential systems composed of standard sequential modules, such as counters and registers	L3

COURSE CONTENT:	
MODULE 1	9Hrs
NUMBER SYSTEMS: BCD number representation, Unsigned and signed number representation, Binary arithmetic. BOOLEAN ALGEBRA AND SIMPLIFICATION: Laws of Boolean algebra, Theorems of Boolean algebra, Boolean/Switching functions and their implementation. SIMPLIFICATION OF BOOLEAN EXPRESSIONS AND FUNCTIONS: Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions. Product-of-sums Method, Product-of-sums simplifications, Simplification by Quine-McClusky Method.	
MODULE 2	8Hrs
DESIGN OF COMBINATIONAL LOGIC CIRCUITS: Modular combinational logic elements- Multiplexers and Demultiplexers, Decoders, Magnitude comparator, BCD converter, Encoders, Priority encoders.	
MODULE 3	7Hrs
PROGRAMMABLE LOGIC: Programmable Logic Arrays, Design of Combinational Circuits using Programmable Logic Devices (PLDs): Programmable Read Only Memories (PROMs), Programmable Logic Arrays (PLAs), Programmable Array Logic (PAL) devices.	
MODULE 4	9Hrs
INTRODUCTION TO SEQUENTIAL CIRCUITS : Introduction to Sequential Circuits. Combinational Vs sequential circuits, Clock, Clock Triggering, Memory elements and their excitation functions – Latches, T flip-flop, D flip-flop, R-S flip-flop. JK flip-flop and their excitation requirements, State diagram, state table and state equation, Design of synchronous sequential circuits like Sequence Detectors and binary counters.	
MODULE 5	9Hrs
APPLICATION OF LOGIC CIRCUITS SEQUENTIAL CIRCUITS (REGISTERS AND COUNTERS): Registers-Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In -Parallel Out, Universal Shift Register, Applications of Shift Registers, Asynchronous and Synchronous Counters	

TEXT BOOKS :

- 1 M. Morris Mano and Michael D. Ciletti, "Digital Design", 6th Edition, N. Pearson Education, 2018
- 2 Donald.P. Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015

REFERENCES :

- 1 D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2010.
- 2 Charles H. Roth: Fundamentals of Logic Design, Jr., 7th Edition, Cengage Learning, 2014
- 3 John M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.

SEMESTER	III					
YEAR	II					
COURSE CODE	20CS2304					
TITLE OF THE COURSE	DATABASE MANAGEMENT SYSTEMS					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	42	3

Perquisite Courses (if any)

#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES :

- To learn data models, conceptualize and depict a database system using ER diagram
- To understand the internal storage structures in a physical DB design
- To know the fundamental concepts of transaction processing techniques

COURSE OUTCOMES

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Demonstrate the basic elements of a relational database management system	L2
CO2	Identify the data models for relevant problems	L2
CO3	Apply normalization for the development of application software's	L3
CO4	Use Structured Query Language (SQL) for database manipulation.	L3
CO5	Understand transactions and their properties (ACID)	L2
CO6	Design and develop a large database with optimal query processing	L6

COURSE CONTENT:

MODULE 1	8Hrs
Introduction: Purpose of Database System—Views of data—data models, database management system, three-schema architecture of DBMS, components of DBMS. E/R Model - Conceptual data modeling - motivation, entities, entity types, attributes relationships, relationship types, E/R diagram notation, examples.	
MODULE 2	9Hrs
Relational Model: Relational Data Model - Concept of relations, schema-instance distinction, keys, referential integrity and foreign keys, relational algebra operators, SQL -Introduction, data definition in SQL, table, key and foreign key definitions, update behaviors. Querying in SQL, notion of aggregation, aggregation functions group by and having clauses. .	
MODULE 3	9Hrs
Database Design: Dependencies and Normal forms, dependency theory –functional dependencies, Armstrong's axioms for FD's, closure of a set of FD's, minimal covers, definitions of 1NF, 2NF, 3NF and BCNF, decompositions and desirable properties of them, algorithms for 3NF and BCNF normalization, 4NF, and 5NF	

MODULE 4	9Hrs
Transactions: Transaction processing and Error recovery - concepts of transaction processing, ACID properties, concurrency control, locking based protocols for CC, error recovery and logging, undo, redo, undo-redo logging and recovery methods.	
MODULE 5	7Hrs
Embedded SQL: triggers, procedures and database connectivity. Introduction to NoSQL	

TEXT BOOKS:

1. Silberschatz, Henry F. Korth, and S. Sudharshan, “Database System Concepts”, 5thEd, Tata McGraw Hill, 2006.
2. J. Date, A. Kannan and S. Swamynathan, “An Introduction to Database Systems”, 8thed, Pearson Education, 2006.

REFERENCES:

1. Ramez Elmasri and Shamkant B. Navathe, “Fundamentals of Database Systems”, Fourth Edition, Pearson/Addision Wesley, 2007
2. Raghu Ramakrishnan, “Database Management Systems”, Third Edition, McGraw Hill, 2003
3. S. K. Singh, “Database Systems Concepts, Design and Applications”, First T. Edition, Pearson Education, 2006

SEMESTER	III					
YEAR	II					
COURSE CODE	20CS2305					
TITLE OF THE COURSE	COMPUTATIONAL THINKING WITH PYTHON					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	42	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES :

- To understand basic concepts of computational thinking.
- To introduce python programming for problem solving.
- To introduce different debugging and unit testing tools.
- To solve real world problems using python data structures.
- Learn to handle files and exception handling in python.
- To explore Python's object-oriented features.
- To build Web services and Networked programs in python.
- To train students to design an application as part of the course mini- project using computational thinking with python.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's TaxonomyLevel
CO1	Understand basic concepts of computational thinking.	L2
CO2	Outline basic python programming for problem solving.	L2
CO3	Apply computational thinking to solve real world programs using Python	L3
CO4	Build python programs using core data structures like list, dictionaries and tuples	L3
CO5	Implement object oriented concepts using python	L3
CO6	Design applications related to web services and network Programming.	L3

COURSE CONTENT:	
MODULE 1	8Hrs
INTRODUCTION TO COMPUTATIONAL THINKING AND PYTHON: Introduction to computational thinking: Stages of Computational thinking, Design using Flowcharts, Implementation, Testing Python Basics: Values, expressions and statements, Conditional execution, Functions Iterations	
MODULE 2	9Hrs
PYTHON ENVIRONMENT AND DATA STRUCTURES: Python Environment: Usage of Debugging and Unit Testing tools in python, Introduction to Github, Executing the python programs using Jupyter notebooks, Python Data Structures: Strings, Arrays, Lists, Tuples, Sets and Dictionaries	

MODULE 3	9Hrs
PYTHON FILES AND EXCEPTION HANDLING: Files: File types, modes, File functions, File attributes, File positions, Looping over file, Exception Handling: Try-Except, Exception syntax, examples, Types of exception with except, multiple exceptions with except, Try-Finally, Raise exceptions with arguments, Python built-in exceptions, User-defined exceptions, Assertions	
MODULE 4	9Hrs
PYTHON OBJECTS : Classes and Objects: Creating classes, Using Objects, Accessing attributes, Classes as Types, Introduction to Multiple Instances, Inheritance.	
MODULE 5	7Hrs
Applications of Python Applications: Networked Programs, Using web services	

TEXT BOOKS:

1. “Python for Everybody-Exploring Data Using Python 3”, Dr. Charles R. Severance,
2. “Introduction to Computing & Problem Solving with Python”, Jeeva Jose, P. Sojan Lal, Khanna Book Publishing; First edition (2019).

REFERENCES :

1. “Computer Science Using Python: A Computational Problem- Solving Focus”, Charles Dierbach, Introduction John Wiley, 2012.
2. “Introduction to Computation and Programming Using Python”, John V Guttag, Prentice Hall of India, 2015.
3. "How to think like a Computer Scientist, Learning with Python", Allen Downey, Jeffrey Elkner and Chris Meyers, Green Tea Press, 2014.
4. “Learning to Program with Python”, Richard L. Halterman, 2011.

SEMESTER	III					
YEAR	II					
COURSE CODE	20CS2306					
TITLE OF THE COURSE	AGILE SOFTWARE ENGINEERING					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	-	-	2	42	3

Perquisite Courses (if any)

#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES :

- Agile methodology, Scrums, Sprints.
- Agile testing, test automation, DevOps.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Compare and contrast the differences between Agile and other project management methodologies	L4
CO2	Interpret and apply various principles, phases and activities of the Scrum methodology	L3
CO3	Define the benefits of using an Agile approach to managing projects	L2
CO4	Understand Agile Testing principles for real life situations and learn the basics of SAFe for scaled agile	L2
CO5	Identify and use various tools for Agile development and DevOps principles for CI/CD	L3

COURSE CONTENT:

MODULE 1		9Hrs
INTRODUCTION TO AGILE : Introduction to Software engineering, SDLC, Software process models- waterfall, V model, Iterative model, Spiral model; Introduction to Agile: Agile versus traditional method comparisons and process tailoring; Introduction to Agile, Various Agile methodologies -Scrum, XP, Lean, and Kanban, Agile Manifesto.		
MODULE 2		9Hrs
SCRUM AND SPRINT: Scrum: Scrum process, roles - Product Owner, Scrum Master, Team, Release manager, Project Manager, product manager, architect, events, and artifacts; Product Inception: Product vision, stakeholders, initial backlog creation; Agile Requirements – User personas, story mapping, user stories, 3Cs, INVEST, acceptance criteria, sprints, requirements, product backlog and backlog grooming; Test First Development; Pair Programming and Code reviews;		

MODULE 3	9Hrs
AGILE PROJECT MANAGEMENT: Sprint Planning, Sprint Reviews, Sprint Retrospectives, Sprint Planning - Agile release and iteration (sprint) planning, Develop Epics and Stories, Estimating Stories, Prioritizing Stories (WSJF technique from SAE), Iterations/Sprints Overview. Velocity Determination, Iteration Planning Meeting, Iteration, Planning Guidelines, Development, Testing, Daily Stand-up Meetings, Progress Tracking, Velocity Tracking, Monitoring and Controlling: Burn down Charts, Inspect & Adapt (Fishbone Model), Agile Release Train	
MODULE 4	7Hrs
AGILE TESTING : Testing: Functionality Testing, UI Testing(Junit, Sonar), Performance Testing, Security Testing, A/Btesting; Agile Testing: Principles of agile testers; The agile testing quadrants, Agile automation, Test automation pyramid; Test Automation Tools - Selenium, Traceability matrix;	
MODULE 5	8Hrs
DEVOPS: DevOps: Continuous Integration and Continuous Delivery; CI/CD: Jenkins, Git/Github Creating pipelines, Setting up runners Containers and container orchestration (Dockers and Kubernetes) for application development and deployment; Build tools - maven; Checking build status; Configuration management - puppet, chef, ansible; Fully Automated Deployment; CM - Continuous monitoring with Nagios; Introduction to DevOps on Cloud	

List of Laboratory/Practical Experiments activities to be conducted (if any) :
1. Setting up Devops Environment
2. Writing Requirements Document, Requirement Analysis (user stories)
3. Estimation and Scrum Planning
4. Implementation and Testing Using Iterative Sprint Model
5. Test Automation using Selenium
6. Unit Testing using Junit or Sonar or Python Test framework
7. CI/CD using Jenkins as Orchestrion platform
8. Containerzation using Docker or Kubernetes

TEXT BOOKS :

1. Essential Scrum: A Practical Guide to the Most Popular Agile Process Kenneth S.Rubin 2012, published by Addison-Wesley Professional
2. Agile Software Development: The Cooperative Game Alistair Cockburn 2nd Edition, 2006, Addison-Wesley Professional

REFERENCES :

- 1 Scrum and XP from the Trenches Henrik Kniberg 2nd Edition, 2015, Published by C4Media, publisher of InfoQ.com
- 2 Agile Project Management: Creating Innovative Products, Second Edition By Jim Highsmith, Addison-Wesley Professional, 2009
- 3 Agile Project Management: Managing for Success, By James A. Crowder, Shelli Friess, Springer, 2014

- 4 Learning Agile: Understanding Scrum, XP, Lean, and Kanban, By Andrew Stellman, Jennifer Greene, 2015, O Reilly
- 5 DevOps: Continuous Delivery, Integration, and Deployment with DevOps: Dive ...
By Sricharan Vadapalli, Packt, 2018
- 6 Agile Testing: A Practical Guide For Testers And Agile Teams, Lisa Crispin, Janet Gregory, Pearson, 2010
- 7 More Agile Testing: Learning Journeys for the Whole Team By Janet Gregory, Lisa Crispin, Addison Wesley, 2015
- 8 DevOps: Puppet, Docker, and Kubernetes By Thomas Uphill, John Arundel, Neependra Khare, Hideto Saito, Hui-Chuan Chloe Lee, Ke-Jou Carol Hsu, Packt, 2017

SEMESTER	III					
YEAR	II					
COURSE CODE	20CS2309					
TITLE OF THE COURSE	MANAGEMENT & ENTREPRENEURSHIP					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2		-	-	30	2

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES :

- Identify and analyze the factors that contribute to the process of successfully launching an entrepreneurial venture and managing a new business.
- Learn the entrepreneurial process from idea generation to implementation.
- Acquaint with special problems of starting new ventures, finding products and services, which can support new enterprises, and raising capital.
- Discuss how to start own business and also to work in or with small business or are involved with entrepreneurship.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Demonstrate knowledge of the key elements of the entrepreneurial process	L2
CO2	Employ strategies to generate new ideas for startups	L2
CO3	Outline how to protect IP legally	L2
CO4	Examine different ways of generating funding	L2
CO5	Explain organizing managing people, finance and customers	L2

COURSE CONTENT:	
MODULE 1	
	6Hrs
OVERVIEW OF ENTREPRENEURSHIP: THE ENTREPRENEURIAL PERSPECTIVE : Nature and Development of Entrepreneurship. Defining Manager, Entrepreneur, Entrepreneurship and Entrepreneurship. Key Elements of Entrepreneurship. Personality Characteristics of Successful Entrepreneurs. Common Myths about Entrepreneurs. Ethics and Social Responsibility of Entrepreneurs. Types of Start-Up Firms. Process of New Venture Creation. Role of Entrepreneurship in Economic Development. Emerging Trends and Issues in Entrepreneurship. Case Study: Successful Entrepreneurs Narayana Murthy Infosys	
MODULE 2	
	6Hrs
THE ENTREPRENEURIAL AND ENTREPRENEURIAL MIND: The Entrepreneurial Process: Identify and Evaluate the Opportunity, Develop a Business Plan, Determine the Resources Required, Manage the Enterprise. Managerial Versus Entrepreneurial	

Decision Making: Strategic Orientation, Commitment to Opportunity, Commitment of Resources, Control of Resources, Management Structure, Entrepreneurial Venturing inside a Corporation, Causes for Interest in Entrepreneurship, Climate for Entrepreneurship, Entrepreneurial Leadership Characteristics.	
Case study: How to develop effective Business Plan	
MODULE 3	6Hrs
CREATIVITY AND BUSINESS IDEA : Identify and Recognizing Opportunities: Observing Trends and Solving Problems. Creativity: Concept, Components and Types of Creativity, Stages of Creative Process. Sources of New Venture Ideas. Techniques for Generating Ideas. Stages of Analyzing and Selecting the Best Ideas. Protecting the Idea: Intellectual Property Rights and its Components. Linking Creativity, Innovation and Entrepreneurship. Case study : Application of Design Thinking in New business ideas generation in particular sector (Health care, Water Saving, Energy saving)	
MODULE 4	6Hrs
PREPARING THE PROPER ETHICAL AND LEGAL FOUNDATION: Initial Ethical and Legal Issues Facing a New Firm, Establishing a Strong Ethical Culture, Choosing an attorney (Lawyer), Drafting a founder's agreement, Avoiding legal disputes, Choosing a form of business organization, Obtaining business licenses and permits, Choosing a Form of Business Ownership (Sole, Proprietorship, Partnership, Corporation & Limited Liability Company) Case study: Startup Law A to Z IP https://techcrunch.com/2019/02/25/startup-law-a-to-z-intellectual-property/	
MODULE 5	6Hrs
MANAGING EARLY GROWTH AND CHALLENGES Recruiting and Selecting Key Employees. Lenders and Investors. Funding Requirements: Sources of Personal Financing. Venture Capital. Commercial Banks. Sources of Debt Financing. Key Marketing Issues for New Ventures. Why marketing is critical for Entrepreneurs. Entrepreneurs face unique Marketing Challenges. Guerrilla Marketing. Business Growth: Nature of Business Growth, Planning for Growth, Reasons for Growth. Managing Growth: Knowing and Managing the Stages of Growth, Challenges of Growing a Firm. Strategies for Firms Growth: Internal and External Growth Strategies. Implications of Growth for the Firm and Entrepreneur. Entrepreneurial Skills and Strategies to Overcome Pressures On: Financial Resources (Financial Control, Managing Inventory and Maintaining Good Records). Human Resources, Management of Employees, Time Management. Case study: 9 ways to get startups funded https://www.quicksprout.com/how-to-get-your-startup-funded/	

TEXT BOOKS :

1. Barringer, Ireland, "Entrepreneurship: Successfully Learning New Ventures", Pearson, Latest Edition.
2. Hisrich, Peters, Shepherd, "Entrepreneurship", Mc Graw Hill, Sixth Edition.

SEMESTER	III					
YEAR	II					
COURSE CODE	20CS2307					
TITLE OF THE COURSE	DATA STRUCTURES LAB					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	30	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	**	**	***

COURSE OBJECTIVES:

- ☐ To introduce C language concepts required for data structures
- ☐ To design data structure operations to solve problems
- ☐ To introduce applications of data structures
- ☐ To implement linear data structures – stack, queue, linked list
- ☐ To implement non-linear data structures – trees and graphs

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Design and develop the programs in C to understand the different concepts of data structures.	L3
CO2	Implement stack & queue data structure and their applications, Analyze the output based on the given input data.	L3
CO3	Implement Conversions of Polish and reverse polish expressions and Record Experimental process and results	L4
CO4	Apply and implement concepts of dynamic memory allocation	L3
CO5	Use the concepts of file structures and communicate results effectively	L3

List of Laboratory/Practical Experiments activities to be conducted

- Writing C programs:
1. To perform arithmetic storage/operations using arrays
 2. To Implement C programs with concepts of pointers, structures
 3. To implement multidimensional array Matrix Multiplication
 4. To search element(s) in a multidimensional array
 5. To search elements in data structure with different search methods
 6. To implement stack, queue and their variations using arrays
 7. To implement stack, queue and their variations using linked lists
 8. To Implement Linked Lists and variations and use them to store data.
 9. To implement graph & binary tree traversal techniques
 10. To evaluate/convert infix/prefix/postfix expressions
 11. To perform basic file operations

Open-Ended Experiments

1. A man in an automobile search for another man who is located at some point of a certain road. He starts at a given point and knows in advance the probability that the second man is at any given point of the road. Since the man being sought might be in either direction from the starting point, the searcher will, in general, must turn around many times before finding his target. How does he search to minimize the expected distance travelled? When can this minimum expectation be achieved?
2. The computing resources of a cloud are pooled and allocated according to customer demand. This has led to increased use of energy on the part of the service providers due to the need to maintain the computing infrastructure. What data structure will you use for allocating resources which addresses the issue of energy saving? Why? Design the solution.
3. Mini-Project on applying suitable data structure to a given real-world problem

Textbooks

1. A M Tannenbaum, Y Langsam, M J Augentien “Data Structures using C”, Pearson, 2013
2. R.L. Kruse, B.P. Leary, C.L. Tondo, “Data Structure and Program Design in C” PHI

Reference Books

1. Horowitz Anderson-Freed, and Sahni, “Fundamentals of Data structures in C”, 2nd Edition, Orient Longman, 2008
2. Data Structures and Algorithm analysis in C by Mark Allen Weiss, Published by Addison Wesley (3rd Indian Reprint 2000).
3. D E Knuth, The Art of Computer Programming, Volume 1, Addison-Wesley Publishing, 2013

SEMESTER	III					
YEAR	II					
COURSE CODE	20CS2308					
TITLE OF THE COURSE	DATABASE MANAGEMENT SYSTEMS LAB					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	30	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	**	**	****

COURSE OBJECTIVES :

- Understand the fundamental concepts of database management. These concepts include aspects of database design, database languages, and database-system implementation.
- To provide a strong formal foundation in database concepts, recent technologies and best industry practices.
- To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
- To learn the SQL and NoSQL database system.
- To learn and understand various Database Architectures and its use for application development.
- To programme PL/SQL including stored procedures, stored functions, cursors and packages

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Install and configure database systems.	L3
CO2	Analyze database models & entity relationship models.	L3
CO3	Design and implement a database schema for a given problem-domain	L3
CO4	Understand the relational and document type databasesystems.	L2
CO5	Populate and query a database using SQL DML/DDl commands.	L3

List of Laboratory/Practical Experiments activities to be conducted
1. Design any database with at least 3 entities and relationships between them. Apply DCL and DDL commands. Draw suitable ER/EER diagram for the system.
2. Design and implement a database and apply at least 10 different DML queries for the following task. For a given input string display only those records which match the given pattern or a phrase in the search string. Make use of wild characters and LIKE operator for the same. Make use of Boolean and arithmetic operators wherever necessary.
3. Execute the aggregate functions like count, sum, avg etc. on the suitable database. Make use of built in functions according to the need of the database chosen. Retrieve the data from the database based on time and date functions like now (), date (), day (), time () etc. Use group by and having clauses.
4. Implement nested sub queries. Perform a test for set membership (in, not in), set comparison (<some, >=some, <all etc.) and set cardinality (unique, not unique).

5. Write and execute suitable database triggers .Consider row level and statement level triggers.
6. Write and execute PL/SQL stored procedure and function to perform a suitable task on the database. Demonstrate its use.
7. Write a PL/SQL block to implement all types of cursor.
8. Execute DDL statements which demonstrate the use of views. Try to update the base table using its corresponding view. Also consider restrictions on updatableviews and perform view creation from multiple tables.
9. Mini project.

TEXT BOOKS :

1. Ramon A. Mata-Toledo, Pauline Cushman, Database management systems, TMGH, ISBN: IS978-0-07-063456-5, 5th Edition.

REFERENCES :

1. Dr. P. S. Deshpande, SQL and PL/SQL for Oracle 10g Black Book, DreamTech.
2. Ivan Bayross, SQL, PL/SQL: The Programming Language of Oracle, BPB Publication.
Dalton Patrik, SQL Server – Black Book, DreamTech Press.

SEMESTER	IV					
YEAR	II					
COURSE CODE	20CS2401					
TITLE OF THE COURSE	PROBABILITY AND STATISTICS					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	42	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- Understand probability, random variable and random process concepts and their importance in Computer Engineering course.
- Calculate statistics related to Random variables and process such as mean, variance, etc.
- Evaluate standard distribution functions such as Poisson's, Normal distributions
- Apply functions of random variables such as characteristic function, moment generating function to calculate statistics.
- Understand probability, random variable and random process concepts and their importance in Computer Engineering course.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Compute and interpret descriptive statistics using numerical and graphical techniques.	L4
CO2	Understand the basic concepts of random variables and find an appropriate distribution for analyzing data specific to an experiment.	L2
CO3	Extend the concepts to multiple random variables and apply them to analyze practical problems.	L2
CO4	Make appropriate decisions using statistical inference that is the central to experimental research.	L4

COURSE CONTENT:	
MODULE 1	6 Hrs
INTRODUCTION TO PROBABILITY THEORY : Basic Notions of Probability, Axiomatic definition, properties, Conditional Probability and Independence – Baye's Theorem.	
MODULE 2	7 Hrs
DISCRETE PROBABILITY DISTRIBUTIONS: Discrete random variables and its properties - Bernoulli trials – Binomial Distribution and its properties – Poisson Distribution and its properties.	
MODULE 3	10 Hrs
CONTINUOUS PROBABILITY DISTRIBUTIONS Continuous random variables and its properties - Gamma Distribution and its properties – Exponential Distribution and its properties - Normal Distribution and its properties.	

BIVARIATE DISTRIBUTIONS: Bivariate random variables – Joint – Marginal - Conditional distribution.	
MODULE 4	9 Hrs
RANDOM PROCESS AND QUEUING THEORY Classification – Stationary process – Markov process – Markov chain – Poisson process – Random telegraph process. Auto correlation functions – Cross correlation functions – Properties – Power spectral density – Cross spectral density – Properties. Queuing Models, Methods for generating random variables and Validation of random numbers	
MODULE 5	10 Hrs
TESTING OF HYPOTHESIS Testing of hypothesis – Introduction-Types of errors, critical region, procedure of testing hypothesis- Large sample tests- Z test for Single Proportion - Difference of Proportion, mean and difference of mean - Small sample tests- Student's t-test, F-test-chi-square test- goodness of fit - independence of attributes.	

TEXT BOOKS:

1. A First Course in Probability, S. Ross, Pearson International Edition, 9th Edition.
2. Fundamentals of Mathematical Statistics, S. C. Gupta and V. K. Kapoor, Sultan Chand & Sons, 11th Edition.

REFERENCES:

1. K. S. Trivedi, Probability and Statistics with Reliability, Queuing, and L.Computer Science Applications, 2nd Ed., Wiley, 2001.
2. Robert V. Hogg, J.W. McKean, and Allen T. Craig: Introduction to Mathematical Statistics, Seventh Edition, Pearson Education, Asia.
3. Rohatgi, V K. and Saleh, A. K. Md. Ehsanes, "An Introduction to Probability and Statistics", (John Wiley and Sons), (2nd edition) (2000)
4. Higher Engineering Mathematics by B S Grewal, 42nd Edition, Khanna Publishers.
5. Probability and Statistics for engineers and scientists, R.,E.Walpole, R.H.Myers, S.L.Mayers and K.Ye, 9th Edition, Pearson Education (2012).
6. An Introduction to Probability Theory and its Applications, W. Feller, Vol. 1, 3rd Ed., Wiley, 1968

SEMESTER	IV					
YEAR	II					
COURSE CODE	20CS2402					
TITLE OF THE COURSE	OBJECT ORIENTED DESIGN AND PROGRAMMING					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	3	-	-	-	42	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- Understand the basic concepts of object-oriented design techniques.
- Understand the fundamentals of object-oriented programming with Java.
- Draw UML diagrams for the software system.
- Impart basics of multi-threading and database connectivity.
- Develop GUI using event handling techniques in Java.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Apply the concepts of object-oriented programming in software design process.	L3
CO2	Develop Java programs using Java libraries and construct to solve real-time problems.	L3
CO3	Understand, develop and apply various object-oriented features using Java to solve computational problems	L2
CO4	Implement exception handling and JDBC connectivity in Java.	L3
CO5	Build an event-oriented GUI (graphical user interface).	L6

COURSE CONTENT:	
MODULE 1	09 Hrs
An Overview of Object-Oriented Systems Development: Introduction; Two Orthogonal Views of the Software; Object-Oriented Systems Development Methodology; Why an Object-Oriented? Overview of the Unified Approach. Object Basics: Introduction; An Object-Oriented Philosophy; Objects; Objects are Grouped in Classes; Attributes: Object State and Properties; Object behaviour and Methods; Object Respond to Messages; Encapsulation and Information Hiding; Class Hierarchy: Inheritance; Multiple Inheritance; Polymorphism; Object Relationships and Associations: Consumer-Producer Association; Aggregation and Object Containment; Case Study - A Payroll Program; Object-Oriented Systems Development Life Cycle: Introduction; Software Development Process; Building High- Quality Software; Object-Oriented Systems Development: A Use Case Driven Approach; Reusability.	

MODULE 2	08 Hrs
Unified Modelling Language :Introduction; Static and Dynamic models; Why Modeling? Introduction to the UML; UML Diagrams; UML Class Diagram; Use-Case Diagram. Introduction to Java : Java's Magic: The Bytecode; JVM; Object-Oriented Programming; Simple Java programs; Two Control Statements; Lexical Issues; Data Types; Variables, Arrays and String constructors; Operators; Control Statements; Introducing Classes : Class Fundamentals; objects; methods; constructors; this Keyword; Garbage Collection; finalize() method; Parameter Passing; Overloading; Access Control Keywords. Inheritance basics; method overriding; abstract classes; Packages and interfaces. Exception handling fundamentals; multiple catch; nested try statements.	
MODULE 3	09 Hrs
Multi-Threaded Programming :Multi-Threaded Programming: Java Thread Model; The mainThread; Creating a thread and multiple threads; Extending threads; Implementing Runnable;Synchronization; Inter Thread Communication; producer consumer problem. Input/Output :I/O Basic; Reading console input Writing Console output.	
MODULE 4	08 Hrs
Event and GUI Programming : Introducing Swing; The Origins of Swing; Swing Is Built on theAWT; Two Key Swing Features; The MVC Connection; Components and Containers; The Swing Packages; A Simple Swing Application; Event Handling; JLabel; JTextField; JButton	
MODULE 5	08 Hrs
Database Access: The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet.	

TEXT BOOK:

1. Bahrami A.; Object Oriented Systems Development using the Unified Modeling Language; McGraw Hill; 1999.
2. Schildt; Herbert. Java The Complete Reference; 8th Edition. US: McGraw-Hill Osborne Media; 2011.
3. Jim Keogh; J2EE: The Complete Reference; McGraw Hill Education in 2002.

REFERENCES:

1. Barclay K., J. Savage, Object Oriented Design with UML and Java, Elsevier, 2004.
2. Y. Daniel Liang, Introduction to Java Programming, 7th edition, Pearson, 2013.

SEMESTER	IV					
YEAR	II					
COURSE CODE	20CS2403					
TITLE OF THE COURSE	PRINCIPLES OF MICROPROCESSORS & COMPUTER ORGANIZATION					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	4	-	-	-	52	4

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	III	20CSXXXX	DELD

COURSE OBJECTIVES:

- ☐ To introduce the architecture of 8086
- ☐ To understand the importance and function of each pin of 8086 Microprocessor
- ☐ To familiarize with the architecture of 8086 microprocessor and its operation
- ☐ To understand the various addressing modes required for assembly language
- ☐ Programming and to calculate the physical address.
- ☐ To learn the 8086 instruction set and write 8086 Assembly level programs
- ☐ To understand the importance of different peripheral devices and their interfacing to 8086
- ☐ Understand the concepts of Hardwired control and micro programmed control.
- ☐ To explain the current state of art in memory system design
- ☐ Discuss the concept of memory organization.
- ☐ Summarize the types of memory.
- ☐ Learn about various I/O devices and the I/O interface.
- ☐ Learn the different types of serial communication techniques.
- ☐ To understand DMA technique
- ☐ To provide the knowledge on Instruction Level Parallelism
- ☐ To understand the concepts of pipelining techniques.

COURSE OUTCOMES:

CO No	Outcomes	Bloom's Taxonomy Level
CO1	Identify the basic building blocks of 8086 microprocessor and use the addressing modes for executing programs efficiently	L2
CO2	Develop 8086 assembly language programs using modern assembler tools	L3
CO3	Discuss the computer arithmetic and design algorithms for various Arithmetic operations.	L2
CO4	Design data part and control part of a processor	L3
CO5	Analyze the performance of various classes of Memories	L4
CO6	Understand pipeline & parallel processing	L2

COURSE CONTENT:	
MODULE 1	8Hrs
Introduction to Microprocessor & its Architecture: Introduction-Evolution of Microprocessor, The Microprocessor-Based Personal Computer Systems, Internal Microprocessor Architecture, Real mode memory addressing, Memory paging, 8086 pin diagram, Internal Architecture of 8086, Registers, Addressing Modes-Immediate addressing, Register addressing, direct addressing, indirect addressing, relative addressing, Instruction formats	
MODULE 2	12 Hrs
Programming 8086: Assembler directives, Data Movement Instructions, String Data Transfers, Miscellaneous Data Transfer Instructions, Arithmetic and Logic Instructions, BCD and ASCII Arithmetic, Basic Logic Instructions, Shift and Rotate, String Comparisons. Program Control Instructions: The Jump Group, Assembly language programming with 8086, macros, procedures	
MODULE 3	12 Hrs
Processor Organization: Basic organization of computers, Block level description of the functional units as related to the execution of a program; Fetch, decode and execute cycle. Execution cycle in terms machine instructions. Information representation, Floating point representation (IEEE754), computer arithmetic and their implementation; Data Part Design: Fixed-Point Arithmetic-Addition, Subtraction, Multiplication and Division, Arithmetic Logic Units control and data path, data path components, design of ALU and data-path, Control Part Design: Control unit design; Hardwired and Micro programmed Control unit. Discussions about RISC versus CISC architectures.	
MODULE 4	12 Hrs
Memory Technology: Memory hierarchy, static and dynamic memory, RAM and ROM chips, Memory address map, Auxiliary Memory, Associative Memory, Cache Memory and organization. Input/Output Organization: Peripheral devices, Input-Output Interface; I/O Bus and Interface Modules, Isolated versus Memory-Mapped I/O, Example of an I/O interface unit, keyboard interface, Modes of Transfer; Programmed I/O, Interrupt-initiated I/O, Direct memory access (DMA)	
MODULE 5	12Hrs
Pipelining: Basic Concepts, Arithmetic Pipeline, Instruction Pipeline; Four-Segment Instruction Pipeline, Pipeline hazards and their resolution, Parallel Processing; Flynn's classification, Multicore architectures, Introduction to Graphics Processing Units, Example: NVIDIA GPU Architecture	

TEXT BOOK:

1. Barry B Brey: The Intel Microprocessors, 8th Edition, Pearson Education, 2009
2. Mano, Morris M. Computer system architecture. Dorling Kindsley Pearson, 2005.

REFERENCES:

1. Krishna Kant, "MICROPROCESSORS AND MICROCONTROLLERS Architecture, programming and system design using 8085, 8086, 8051 and 8096". PHI 2007.
2. Douglas V Hall, "MICROPROCESSORS AND INTERFACING, PROGRAMMING AND HARDWARE" TMH, 2006.
3. Kenneth J. Ayala, "The 8086 Microprocessor: Programming & Interfacing The PC", Delmar Publishers, 2007
4. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Danny Causey, The x86 PC Assembly Language Design and Interfacing, 5th Edition, Pearson, 2013.
5. V. Carl Hamacher, Safwat G. Zaky and Zvonko G. Vranesic , Computer Organization ,McGraw-Hillseries 2002
6. Hayes, J.P , Computer Architecture and Organization, McGraw-Hill, 1998
7. Vincent P. Heuring and Harry F. Jordan , Computer Systems Design and Architecture (2nd Edition),Dec, 2003
8. David Patterson and John Hennessey , Computer Organization and Design, Elsevier. 2008
9. Comer, Douglas. Essentials of computer architecture. Chapman and Hall/CRC, 2017.
10. Hord, R. Michael. Parallel supercomputing in MIMD architectures. CRC press, 2018.
11. Tanenbaum, Andrew S. Structured computer organization. Pearson Education India, 2016.
12. William Stallings-Computer Organization and Architecture, Seventh Edition, Pearson Education

SEMESTER	IV					
YEAR	II					
COURSE CODE	20CS2404					
TITLE OF THE COURSE	FINITE AUTOMATA AND FORMAL LANGUAGES					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ ProjectsHours	Total Hours	Credits
	3	-	-	2	50	4

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	*	**	***

COURSE OBJECTIVES:

- ☐ To learn general theory of automata, properties of regular sets and regular expressions.
- ☐ To understand basics of formal languages.
- ☐ To know push-down automata, context- free languages, Turing machines.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand the concept of Automata	L1
CO2	Explain the concept of Regular Expression, languages and abstract machines to recognize them	L2
CO3	Know the generalized computation model and different types Computation	L2

COURSE CONTENT:	
MODULE 1	9Hrs
Introduction to Finite Automata: Study and Central concepts of automata theory, An informal picture of finite automata, deterministic and non-deterministic finite automata, applications of finite automata, finite automata with epsilon – transitions.	
MODULE 2	12Hrs
Regular expression and languages: Regular expressions, finite automata and regular expressions, algebraic laws of regular expressions. applications of regular expressions such as Grep, and Lex etc.. Properties of Regular Languages: closure properties of regular languages, Pumping Lemma, equivalence and minimization of automata	
MODULE 3	10Hrs
Context – free Grammars and Languages: Context free grammars, Context-free languages, Parse trees, Ambiguity in grammars and languages Pushdown Automata: Pushdown automation (PDA), the language of PDA, equivalence of PDA's and CFG's, Deterministic Pushdown Automata,	
MODULE 4	9Hrs
Properties of Context – Free Languages: Normal forms of context free grammars, pumping lemma for context free languages, closure properties of context free languages. Applications of CFG - such as spec of programming languages, parsing techniques, and Yacc	

MODULE 5	10Hrs
Introduction to Turing Machine- The Turing machine, programming techniques for Turing machine, extensions to the basic Turing machine, restricted Turing Machines, Turing Machines and Computers. Chomsky hierarchy	

TEXT BOOKS :

1. Daniel I. A. Cohen, Introduction to Computer Theory, 2nd Edition, Wiley India Student Edition, 2008.
2. J.E. Hopcroft, R. Motwani, and J. D. Ullman, Introduction to Automata Theory, Languages and Computation, 3rd Edn. Pearson Education, New Delhi 2008

REFERENCES :

1. K.L.P. Misra and N. Chandrashekar. Theory of Computer Science- Automata, Languages and Computation, 3rd Edn. PHI, New Delhi, 2007
2. C. Martin - Introduction to Languages and the Theory of Computation 2nd Edn, TMH, New Delhi, 2000.

SEMESTER	IV					
YEAR	II					
COURSE CODE	20CS2405					
TITLE OF THE COURSE	INTRODUCTION TO NETWORKS AND CYBERSECURITY					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	42	3

Prerequisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- ☐ To introduce the fundamental aspects of various types of computer networks.
- ☐ To demonstrate the TCP/IP and OSI models with merits and demerits.
- ☐ Understand the basic concepts of cyber security, how it has evolved, and some key techniques used today.
- ☐ Have an insight view of Security, Cryptography, Malware, IDS, Secure Programming etc
- ☐ Explore the subject through prescribed book, case studies, seminars and Assignments.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand and explore the basics of Computer Networks and working principles.	L2
CO2	Understand the concepts of Network security corresponding to various Internet Layers.	L2
CO3	Determine appropriate mechanisms for protecting the Network.	L2

COURSE CONTENT:	
MODULE 1	9Hrs
Overview of the Internet: Protocol, Layering Scenario, TCP/IP Protocol Suite: The OSI Model, Internet Architecture; Comparison of the OSI and TCP/IP reference model. Top- down approach Cybersecurity: Basics of Cyber Security-Attacks, Vulnerabilities and Threats. Need for Network Security, Data Security and physical security.	
MODULE 2	9 Hrs
Application Layer- Introduction, providing services, Applications layer paradigms, Client server model, Standard client-server application-HTTP, DNS, SSH. Malware Detection System, Types of Malware, Viruses & Counter Measures, Worms, Bots. E-mail Security: PGP, S/MIME. Secure socket programming using UDP and TCP.	

MODULE 3	9 Hrs
Transport Level Security: Functionality and services, TCP and UDP basics, Principles of Cryptography, Web Security Considerations, Secure Sockets Layer (SSL), Transport Layer Security, Data/Message Integrity and Digital Signatures.	
MODULE 4	9 Hrs
Network Layer Security: Network Security and Services, IP Security Overview, IP Security Policy, Encapsulation Security Payload (ESP), Internet Key Exchange. Virtual Private Network(VPN), Wireless Networks Security.	
MODULE 5	9 Hrs
Data Link Layer: LLC and MAC Sublayer services, Error detection and correction Techniques. Physical Layer: Introduction to Guided transmission media and wireless transmission media. Transmission mode, Classification of networks. Firewall, Intrusion Detection System (IDS)	

TEXT BOOK:

1. Computer Networking- A top-down approach- James F Kurose and Keith W Ross, 6th Edition, Pearson Education.
2. Computer Security- Principles and Practice, William Stalling, Laurie Brown 4th Edition, Pearson

REFERENCES:

1. Behrouz A. Forouzan, Data Communications and Networking -, Fifth Edition TMH, 2013.
2. Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education.
3. James Graham, Richard Howard, Ryan Olson- Cyber Security Essentials CRC Press.

SEMESTER	IV					
YEAR	II					
COURSE CODE	20CY2401					
TITLE OF THE COURSE	INTRODUCTION TO ETHICAL HACKING					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	42	3

COURSE OBJECTIVES:

- To understand and analyze Information security threats & countermeasures
- To perform security auditing & testing
- To understand issues relating to ethical hacking
- To study & employ network defense measures
- To understand penetration and security testing issues

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand vulnerabilities, mechanisms to identify vulnerabilities/threats/attacks	L2
CO2	Perform penetration & security testing	L2
CO3	Become a professional Ethical hacker and Network Defender	L2

COURSE CONTENT:

MODULE 1- ETHICAL HACKING OVERVIEW & PENETRATION TESTING		9 Hrs
Understanding the importance of security, Concept of ethical hacking and essential Terminologies Threat, Attack, Vulnerabilities, Target of Evaluation, Exploit. Phases involved in hacking. Penetration Test – Vulnerability Assessments versus Penetration Test – Pre-Engagement – Rules of Engagement - Penetration Testing Methodologies – OSSTMM – NIST – OWASP – Categories of Penetration Test – Types of Penetration Tests – Vulnerability Assessment Summary -Reports.		
MODULE 2- FOOTPRINTING & PORT SCANNING		8 Hrs
Foot printing - Introduction to foot printing, Understanding the information gathering methodology of the hackers, Tools used for the reconnaissance phase. Port Scanning - Introduction, using port scanning tools, ping sweeps, Scripting Enumeration-Introduction, Enumerating windows OS & Linux OS		
MODULE 3- SYSTEM HACKING		8 Hrs
Aspect of remote password guessing, Role of eavesdropping, Various methods of password cracking, Keystroke Loggers, Understanding Sniffers, Comprehending Active and PassiveSniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing.		

MODULE 4- HACKING WEB SERVICES & SESSION HIJACKING	10 Hrs
Web application vulnerabilities, application coding errors, SQL injection into Back-end Databases, cross-site scripting, cross-site request forging, authentication bypass, web services and related flaws, protective http headers Understanding Session Hijacking, Phases involved in Session Hijacking, Types of Session Hijacking, Session Hijacking Tools.	
MODULE 5- HACKING WIRELESS NETWORKS	7 Hrs
Introduction to 802.11, Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless DOS attacks, WLAN Scanners, WLAN Sniffers, Hacking Tools, Securing Wireless Networks.	

TEXT BOOKS:

1. Kimberly Graves, "Certified Ethical Hacker", Wiley India Pvt Ltd, 2010
2. Michael T. Simpson, "Hands-on Ethical Hacking & Network Defense", Course Technology, 2010

REFERENCES:

1. Rajat Khare, "Network Security and Ethical Hacking", Luniver Press, 2006
2. Ramachandran V, BackTrack 5 Wireless Penetration Testing Beginner's Guide (3rd ed.). Packt Publishing, 2011
3. Thomas Mathew, "Ethical Hacking", OSB publishers, 2003

SEMESTER	IV					
YEAR	II					
COURSE CODE	20CS2407					
TITLE OF THE COURSE	OBJECT ORIENTED PROGRAMMING LAB					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	30	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	**	**	*****

COURSE OBJECTIVES :

- To learn an object oriented way of solving problems using java.
- To write Java programs using multithreading concepts and handle exceptions
- To write Java programs that connects to a database and be able to perform various operations.
- To create the Graphical User Interface using AWT Components & Swing Components.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Develop simple java programs that make use of classes and objects	L3
CO2	Write Java application programs using OOP principles and proper program structuring.	L3
CO3	Make use of inheritance and interfaces to develop java application	L3
CO4	Model exception handling, multi-threading concepts in java	L3
CO5	Create the Graphical User Interface based application programs by utilizing event handling features and Swing in Java	L3
CO6	Develop Java program that connects to a database and be able to perform various operations.	L3

List of Laboratory/Practical Experiments activities to be conducted
1. Basic programs using data types, operators, and control statements in Java.
2. Basic programs using Arrays, , Strings in java
3. Object Oriented Programming Concepts: Problem on the use of constructors, inheritance, method overloading & overriding, polymorphism and garbage collection
4. Programs involving: Exception handling, Multi-threading in Java
5. Programs involving: Packages, Interfaces in Java

6. Programs involving: Input and Output in Java
7. GUI Programming in Java
8. Programs involving : Database connectivity in Java
9. Mini Project

TEXT BOOKS :

1. Bahrami A.; Object Oriented Systems Development using the Unified ModelingLanguage; McGraw Hill; 1999.
2. Schildt; Herbert. Java The Complete Reference; 8th Edition. US: McGraw-HillOsborne Media; 2011.
3. Jim Keogh; J2EE: The Complete Reference; McGraw Hill Education in 2002.

SEMESTER	IV					
YEAR	II					
COURSE CODE	20CS2408					
TITLE OF THE COURSE	MICROPROCESSORS LABORATORY					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	30	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	**	**	****

COURSE OBJECTIVES :

- To develop and execute variety of assembly language programs of Intel 8086 including arithmetic and logical, sorting, searching, and string manipulation operations
- To develop and execute the assembly language programs for interfacing Intel 8086 with peripheral devices.

COURSE OUTCOMES :

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Implement 8086 assembly language programs for microprocessor application using 8086 training boards	L3
CO2	Implement 8086 assembly language programs for microprocessor application using assembler and debuggers	L3
CO3	Design interfacing of various peripherals with 8086 microprocessor for simple applications	L3
CO4	Use Macros and Procedures in 8086 Programs	L3
CO5	Use assembly language and debugging tools when writing programs for a microprocessor	L3
CO6	Communicate effectively on the work done in the laboratory using formal report	L3

List of Laboratory/Practical Experiments activities to be conducted
Part-A: Software Programs Using Microprocessor Trainer Kit i) Programs involving : arithmetic operations, sorting ii) Programs on : code conversion (BCD TO HEX, Binary to ASCII, Binary to Gray) iii) Programs involving - Bit manipulation like checking: 1. Whether given data is positive or negative 2. Whether given data is odd or even 3. Logical 1's and 0's in a given data

Part- B: Software Programs Using MASM/TASM software

- i) Programs on : searching and sorting
- ii) Programs on : palindrome, string comparison
- iii) Programs on : current time display, Decimal up-counter display

Part-C: Hardware Programs to interface microprocessor with various peripherals Using Microprocessor Trainer Kit

- i) DC Motor Interface
- ii) Stepper Motor Interface
- iii) Matrix Keypad Interface
- iv) 7 Segment Display Interface

TEXT BOOKS :

1. Microprocessor and Interfacing - Douglas V Hall, SSSP Rao, 3rd edition TMH, 2012.
2. The Intel Microprocessor, Architecture, Programming and Interfacing - Barry B. Brey, 6e, Pearson Education / PHI, 2003.

SEMESTER	V					
YEAR	III					
COURSE CODE	20CS3501					
TITLE OF THE COURSE	COMPUTER NETWORKS					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	2	-	39+26	4

Perquisite Courses (if any)			
#	Sem /Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To introduce the fundamental aspects of various types of computer networks.
- To demonstrate the TCP/IP and OSI models with merits and demerits.
- To Understand the working principle of layering structure and basic network components
- To explore the features of each layer by various approach and methods

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand and explore the basics of Computer Networks and physical layer	L2
CO2	Understand about data link layer and its protocols	L2
CO3	Understand about routing mechanisms and different routing protocols	L2
CO4	Identify the issues of Transport layer to analyse the congestion control mechanism	L2
CO5	Explain principles of application layer protocols	L2

COURSE CONTENT	
MODULE 1: Overview of Networks	9 Hrs
Network Components- Network Physical Structure, Classification of networks (LAN-MAN- WAN), Protocols and Standards, Data representation and data flow, Layered Architecture – Comparison of the OSI and TCP/IP reference model. Physical Layer: Introduction to wired and wireless transmission media. Transmission mode (Serial/Parallel signals, Analog/Digital Signals and Periodic/Aperiodic Signals), Line coding Schemes.	
MODULE 2: Data Link Layer	9 Hrs
Data Link Layer – MAC (Media Access Control) and LLC (Logical Link Control) sublayer	

Functionalities– Design Issues: Framing – Flow control (Simplest protocol, Stop and wait, sliding window) – Error control (CRC, Hamming code) — Ethernet Basics-Multi Access Protocols:ALOHA, CSMA/CD, Connecting Devices: Hubs, Bridges, Switches, Routers, and Gateways	
MODULE 3: Data Link Layer	9 Hrs
Network Layer Design issues, Routing Protocol Basics, Routing Algorithm (Distance Vector Routing, Link State Routing and Hierarchical Routing). IP addressing, IP Packet format IPV4, IPV6 and IP Tunneling. Congestion control algorithms, QoS (Traffic Shaping, Packet Scheduling).	
MODULE 4: Transport Layer	7 Hrs
Transport Layer functions- Multiplexing and Demultiplexing. Introduction to TCP and UDP, The TCP Service Model, The TCP Segment Header, The TCP Connection Management, TCP FlowControl-Sliding Window, TCP Congestion Control, User Datagram Protocol	
MODULE 5: Application Layer	6 Hrs
Principles of Network Applications, WEB and HTTP, FTP, E-MAIL(SMTP, POP3), TELNET, DNS, SNMP	

List of Laboratory/Practical Experiments activities to be conducted	
PART A	
1. Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped. 2. Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion. 3. Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination. 4. Implement simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets. 5. Implement and study the performance of GSM on NS2/NS3 (Using MAC layer) orequivalent Environment. 6. Implement and study the performance of CDMA on NS2/NS3 (Using stack calledCall net) or equivalent environment.	
PART B	
Implement the following in Java:	
7. Write a program for error detecting code using CRC. 8. Write a program to find the shortest path between vertices using bellman-fordalgorithm. 9. Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present. Implement the above program using as message queues or FIFOs as IPC channels. 10. Write a program on datagram socket for client/server to display the messages on client side, typed at the server side. 11. Write a program for simple RSA algorithm to encrypt and decrypt the data. 12. Write a program for congestion control using a leaky bucket algorithm.	

TEXT BOOKS:

1. Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013.
2. Computer Networks - Andrew S Tanenbaum, 5th Edition, Pearson Education.

REFERENCES:

1. James F. Kurose, Keith W. Ross, “Computer Networking: A Top-Down Approach”, Seventh Edition, Pearson Education, 2017.
2. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers Inc., 2011.
3. William Stallings, “Data and Computer Communications”, Tenth Edition, Pearson Education, 2014.

SEMESTER	V					
YEAR	III					
COURSE CODE	20CS3502					
TITLE OF THE COURSE	DESIGN AND ANALYSIS OF ALGORITHMS					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	**	***	***

COURSE OBJECTIVES:

- To introduce and implement various techniques for designing algorithms and advanced data structures
- To learn space and time complexity analysis of algorithms.
- To understand the Divide and conquer design strategy and the Greedy Technique
- To understand the concepts of Dynamic Programming Applications
- Synthesize efficient algorithms in common engineering design situations

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Outline the overview of Data structures and Algorithms	L1
CO2	Understand the different Algorithmic Design strategies	L2
CO3	Apply the Design principles and concepts to Algorithmic design	L3
CO4	Describe the DAA paradigms and when an Algorithmic Design situation calls for it.	L6
CO5	Analyse the efficiency of Algorithms using Time and Space complexity theory	L4
CO6	Implement an existing algorithm to improve the run time efficiency	L3

COURSE CONTENT:	
MODULE 1: INTRODUCTION	8 Hrs
The role of Algorithms in Computing, Running time analysis -- recall of asymptotic notation, big-oh, theta, big-omega, and introduce little-oh and little-omega. Worst case and average case complexity	
MODULE 2: DIVIDE AND CONQUER	9 Hrs
Recursive algorithms, Divide-and-Conquer recurrences, Methods for solving recurrences: substitution method, recursion tree method and the Master method. Examples-Binary search, Quick sort, Merge sort, Strassen's Matrix Multiplication. GREEDY METHOD, Minimum cost spanning tree, Knapsack problem, Fractional knapsack.	

MODULE 3: DYNAMIC PROGRAMMING	9 Hrs
Integral knapsack (contrasted with the fractional variant: 0/1 knapsack), longest increasing subsequence, All pair shortest path in graph, Matrix chain multiplication, Travelling salesman Problem	
MODULE 4: APPLICATION OF GRAPH TRAVERSAL TECHNIQUES	7 Hrs
Recall representation of graphs, BFS, DFS, connected components, Strongly-connected components of DAGs, Kosaraju's algorithm 1 and 2, Applications.	
MODULE 5: REASONING ABOUT ALGORITHMS	6 Hrs
Complexity Analysis (Polynomial vs Non-Polynomial time complexity), P, NP-hard and NP-Completeness, Reductions.	

TEXT BOOK:

1. T. H. Cormen, Leiserson, Rivest and Stein, "Introduction of Computer algorithm," 3rd Edition, The MIT Press, 2015

REFERENCES:

1. Anany Levitin, —Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012
2. Sara Basse, A. V. Gelder, "Computer Algorithms: Introduction Design & Analysis", 3rd Edition, Addison Wesley.
3. J.E Hopcroft, J.D Ullman, "Design and analysis of Computer algorithms", Pearson Education, 2009.
4. Steven S. Skiena, "The Algorithm Design Manual", Second Edition, Springer, 2008

SEMESTER	V					
YEAR	III					
COURSE CODE	20CS3503					
TITLE OF THE COURSE	OPERATING SYSTEMS					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	1	-	-	52	4

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	***	***	****

COURSE OBJECTIVES:

- To understand the basic concepts and functions of operating systems.
- To understand Processes and Threads
- To analyze Scheduling algorithms.
- To understand the concept of Deadlocks.
- To analyze various Memory and Virtual memory management, File system and storage techniques.
- To discuss the goals and principles of protection in a modern computer system.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO 1	Demonstrate need for OS and different types of OS	L2
CO 2	Analyze the performance of scheduling algorithms for the given problems	L4
CO 3	Demonstrate Process Coordination and synchronization techniques.	L2
CO 4	Apply the deadlock handling mechanisms to solve the given problem	L3
CO 5	Apply suitable techniques for management of different Resources	L3
CO 6	Understand the principles of protection and security Mechanisms	L2

COURSE CONTENT:	
MODULE 1: OS Overview and System Structure	10 Hrs
Introduction to operating systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Computing environments. Operating System Services: User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines;	

MODULE 2: Process Management	12 Hrs
Process Management: Process concept; Process scheduling; Operations on processes. Multi-threaded Programming: Overview; Multithreading models; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms.	
MODULE 3: Process Coordination	10 Hrs
Process Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors Deadlocks: Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.	
MODULE 4: Memory Management	10Hrs
Memory Management Strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation. Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.	
MODULE 5: File System and Secondary Storage Structure	10 Hrs
File System, Implementation of File System: File system: File concept; Access methods; Directory structure; File system mounting; File sharing. Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management. Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection and Security: Protection: Goals of protection, Principles of protection, System Security: The Security Problem, Program Threats, System and Network Threats.	

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 8th edition, Wiley-India, 2010

REFERENCES:

1. Operating Systems-Internals and Design Principles, William Stallings, 6th Edition, Pearson Education, 2009.
2. Operating Systems: A Modern Perspective, Gary J. Nutt, Addison-Wesley, 1997

SEMESTER	V					
YEAR	III					
COURSE CODE	20CY3501					
TITLE OF THE COURSE	MACHINE LEARNING FOR CYBER SECURITY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	2	-	39+26	4

COURSE OBJECTIVES:

- Understand the basic concepts of machine learning and artificial intelligence.
- Implementation of machine learning algorithms in cyber security applications.
- Enable students to understand the need for AI in cyber security.
- To solve real world problems regarding anomaly detection techniques.

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Illustrate the usage of various machine learning algorithms providing solutions for cyber security problem	L2
CO2	Detect anomalies, including breaches, fraud and impending system failure	L3
CO3	Discover attackers within the network by finding patterns inside datasets.	L3
CO4	Interpret network traffic analysis and build predictive model to classify network attacks	L3

COURSE CONTENT:	
MODULE 1	08 Hrs
Machine Learning and Security: The Cyber Attacker's Economy, Machine Learning in security, Real-World Uses of Machine Learning in Security, Spam Fighting: An Iterative Approach, Limitations of Machine Learning in Security. Classifying and Clustering: Machine Learning in Practice, A Worked Example, Supervised Classification Algorithms, Practical Considerations in Classification, Clustering.	
MODULE 2	08 Hrs
Anomaly Detection Versus Supervised Learning, Intrusion Detection with Heuristics, Data-Driven Methods, Feature Engineering for Anomaly Detection, Anomaly Detection with Data and Algorithms, Unsupervised Machine Learning Algorithms, Challenges of Using Machine Learning in Anomaly Detection.	
MODULE 3	07 Hrs
Network Traffic Analysis, Theory of Network Défense, Machine Learning and Network Security, building a Predictive Model to Classify Network Attacks, Monetizing the Consumer Web, Types of Abuse and the Data, Supervised Learning for Abuse Problems, Clustering Abuse.	

MODULE 4	07 Hrs
Machine Learning System Maturity and Scalability, Data Quality, Problem: Bias in Datasets Problem, Performance, Model Quality Problem: Hyperparameter Optimization, Maintainability, Monitoring and Alerting, Security and Reliability, Feedback and Usability, Terminology.	
MODULE 5	09 Hrs
ARTIFICIAL INTELLIGENCE IN CYBER-SECURITY: AI systems support for cybersecurity, AI malicious uses, ethical considerations related to AI in cybersecurity, asymmetries in the interplay of AI and cybersecurity, trustworthy versus reliable AI, cybersecurity risks associated with anthropomorphizing AI. Machine learning systems do indeed have a larger attack surface, a high-level view of the threat landscape, an AI threat model, safety and security	

List of Laboratory/Practical Experiments activities to be conducted
1. Design and develop payment fraud detection model using logistic regression. 2. Develop a program for spam E-mail detection using Naïve Bayes algorithm. 3. Write a program for spam E-mail detection using Blacklist. Consider the required dataset. 4. Perform Anomaly detection using Elliptic Envelope Fitting for simple normally distributed datasets. 5. Know the difference between Compiled Execution and Interpreted Execution with Malware Analysis Code program execution.

TEXT BOOK:

1. Chio, Clarence_Freeman, David - Machine learning and security_ protecting systems with data and algorithms - O'Reilly Media (2018)
2. Artificial Intelligence and Cyber Security Technology, Governance and Policy Challenges by Rapporteurs, Lorenzo Pupillo, Stefano Fantin, Afonso Ferreira, Carolina Polito, Centre for European Policy Studies (CEPS) Brussels ,May 2021

REFERENCES:

1. Hands-On Machine Learning for Cybersecurity: Safeguard Your System by Making Your Machines Intelligent Using the Python Ecosystem Book by Sinan Ozdemir and Soma Halder.

SEMESTER	V					
YEAR	III					
COURSE CODE	20CS3505					
TITLE OF THE COURSE	DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	-	-	2	-	26	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	****	****	****

COURSE OBJECTIVES:

- To learn mathematical background for analysis of algorithm
- To understand the concept of designing an algorithm.
- To analyze the algorithms using space and time complexity.
- To learn dynamic programming and greedy method.
- To acquire knowledge of various applied algorithms.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Design and develop the Algorithms to understand the different concepts.	L3
CO2	Apply the Design principles and concepts to Algorithmic design	L3
CO3	Describe the DAA paradigms and when an Algorithmic Design situation calls for it.	L6
CO4	Analyse worst-case and best – case running times of algorithms using asymptotic analysis.	L4
CO5	Implement an existing algorithm to improve the run time efficiency	L3

List of Laboratory/Practical Experiments activities to be conducted
1. Design a C program to solve the Tower of Hanoi. Compute the time complexity. 2. Apply divide and conquer method and Design a C program to search an element in a given array and Compute the time complexity. Binary search - recursive method 3. Apply Divide and Conquer method Design a C program to sort an array using Merge sort algorithm and compute its time complexity 4. Apply Divide and Conquer method Design a C program to sort an array using Quick sort algorithm and compute its time complexity. 5. Apply Greedy method and Design a C program to find the minimum cost spanning tree using Prim's and Kruskal's Algorithm and compute its complexity

6. Design a C program to find the optimal solution of 0-1 knapsack problem using dynamic programming and Compute the time complexity
7. Design a C program to solve the Travelling Salesman Problem using dynamic programming and compute its time complexity.
8. Design a C program to find the longest common subsequence using dynamic programming and compute its time complexity
9. Mini project proposal should be submitted and Implementation should be done based on the problem stated in the proposal

TEXT BOOK:

1. Levitin A, “Introduction to the Design And Analysis of Algorithms”, Pearson Education, 2008.
2. T. H. Cormen, Leiserson, Rivest and Stein, “Introduction of Computer algorithm,” , 3rd Edition, The MIT Press, 2015

REFERENCES:

1. E. Horowitz, S. Sahni, and S. Rajsekar, “Fundamentals of Computer Algorithms,” Galgotia Publication, 2015.
2. Goodrich M.T., R Tomassia, “Algorithm Design foundations Analysis and Internet Examples”, John Wiley and Sons, 2006.
3. Sara Basse, A. V. Gelder, “Computer Algorithms : Introduction Design & Analysis”, 3rd Edition, Addison Wesley.

SEMESTER	V					
YEAR	III					
COURSE CODE	20CS3506					
TITLE OF THE COURSE	OPERATING SYSTEMS LAB					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	26	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	**	***	****

COURSE OBJECTIVES:

- To learn creating process and Threads
- To implement various CPU Scheduling Algorithms
- To implement Process Creation and Inter Process Communication.
- To implement Deadlock Avoidance and Deadlock Detection Algorithms
- To implement Page Replacement Algorithms
- To implement File Organization and File Allocation Strategies

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Implement System Calls	L2
CO2	Compare the performance of various CPU Scheduling Algorithms	L3
CO3	Analyze Deadlock avoidance and Detection Algorithms	L3
CO4	Implement Semaphores	L2
CO5	Analyze the performance of the various Page Replacement Algorithms	L3
CO6	Implement File Organization and File Allocation Strategies	L2

List of Laboratory/Practical Experiments activities to be conducted		
Exp. No	Division of Experiments	List of Experiments
1	System Calls	Write a C program to create a new process that exec a new program using system calls fork(), execlp() & wait()
2		Write a C program to display PID and PPID using system calls getpid () & getppid ()
3		Write a C program using I/O system calls open(), read() & write() to copy contents of one file to another file

4	Process Management	Write a C program to implement multithreaded program using pthreads
5		Write C program to simulate the following CPU scheduling algorithms a) FCFS b) SJF c) Priority d) Round Robin
6	Process synchronization	Write a C program to simulate producer-consumer problem using semaphores
7	Deadlock	Write a C program to simulate Bankers algorithm for the purpose of deadlock avoidance.
8		Write a C program to simulate deadlock detection.
9	Memory Management	Write a C program to simulate paging technique of memory management
10		Write a C program to simulate page replacement algorithms a) FIFO b) LRU c) LFU
11	I/O System	Write a C program to simulate the following file organization techniques a) Single level directory b) Two level directory
12		Write a C program to simulate the following file allocation strategies. a) Sequential b) Indexed

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 8th edition, Wiley-India, 2010

REFERENCES:

1. Operating Systems-Internals and Design Principles, William Stallings, 6th Edition, Pearson Education, 2009.
2. Operating Systems: A Modern Perspective, Gary J. Nutt, Addison-Wesley, 1997

SEMESTER	V					
YEAR	III					
COURSE CODE	20CY3502					
TITLE OF THE COURSE	PATTERN RECOGNITION					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To understand the fundamentals of parameter estimation techniques
- To learn the basics of classification and clustering methods
- To understand various learning algorithms and risk minimization factors.
- To identify the different kernel methods useful in lassification

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Interpret basic, intermediate and advanced techniques to analysis the data	L2
CO2	Outline different learning algorithm techniques for Pattern Recognition	L2
CO3	Identify the incomplete data present in the pattern	L3
CO4	Construct and formulate different kernel methods for classification	L3

COURSE CONTENT:	
MODULE 1	8Hrs
Parameter Estimation Maximum Likelihood Estimation, Maximum A-Posteriori (MAP) Estimation, Maximum Entropy Estimation, Minimum Relative Entropy Estimation, Maximum Mutual Information Estimation (MMIE); Model Selection, Akaike Information Criterion (AIC) Bayesian Information Criterion (BIC)	
MODULE 2	9 Hrs
Classification Linear Models for Classification, Discriminant Functions, Two classes, Multiple classes, Least squares for classification, Fisher's linear discriminant, Relation to least squares, Fisher's discriminant for multiple classes, The perceptron algorithm; Probabilistic Generative Models, Continuous inputs, Maximum likelihood solution, Discrete features, Exponential family;	

Probabilistic Discriminative Models, Fixed basis functions, Logistic regression, Iterative reweighted least squares, Multiclass logistic regression, Probit regression, Canonical link functions.	
MODULE 3	7 Hrs
Learning Learning Algorithms, Risk Minimization, Empirical Risk Minimization, Capacity and Bounds on Risk, Structural Risk Minimization; Decision and Regression Trees, Vector Quantization (VQ);	
MODULE 4	7 Hrs
Clustering Basic Clustering Techniques, Standard k-Means (Lloyd) Algorithm, Generalized Clustering, Over-partitioning, Merging, Modifications to the k-Means Algorithm, k-Means Wrappers, Rough k-Means, Fuzzy k-Means, k-Harmonic Means Algorithm, Hybrid Clustering Algorithms; Estimation using Incomplete Data, Expectation Maximization (EM); Semi-Supervised Learning.	
MODULE 5	8 Hrs
Kernel Methods and Support Vector Machines The Two-Class Problem, Dual Representation, Soft Margin Classification; Origins of Kernel methods, Kernel Mapping, The Kernel Trick; Constructing Kernels Formulation and Computation; Radial Basis Function Networks; Positive Semi-Definite Kernels, Linear Kernel, Polynomial Kernel, Gaussian Radial Basis Function (GRBF) Kernel, Cosine Kernel, Fisher Kernel, GLDS Kernel, GMM- UBM Mean Interval (GUMI) Kernel.	

TEXT BOOK:

1. Homayoon Beigi, Fundamentals of Speaker Recognition, Springer, 2011
2. K.P. Soman, R. Loganathan, V. Ajay, Machine Learning with SVM and other Kernel methods, PHI Learning Private Limited, 2009

REFERENCES:

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006
2. Tom Mitchell, Machine Learning, McGraw Hill, 1997.
3. Petra Pernert. Machine Learning and Data Mining In Pattern Recognition, Springer Science & Business Media, 2009.

SEMESTER	V					
YEAR	III					
COURSE CODE	20CY3503					
TITLE OF THE COURSE	DISTRIBUTED COMPUTING					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To understand the phases of distributed computing
- To be aware of the transaction models and deadlocks.
- To build concepts regarding the fundamental principles of distributed systems
- To learn the design issues and distributed system concepts

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Outline introduction to distributed computing Environment -Networking and internetworking	L2
CO2	Infer the design and development principles of distributed operating systems in the construction of distributed middleware components.	L2
CO3	Create a distributed system through the integration of heterogeneous applications and web services using appropriate tools and technologies.	L3
CO4	Demonstrate the understanding of need for distributed systems and their applications.	L3

COURSE CONTENT:	
MODULE 1	8 Hrs
Introduction:- Distributed Computing systems- Evolution of DCS-Characterization of distributed systems - Examples - Resource sharing and the web - Challenges – System models - Architectural and fundamental models –Distributed Operating System – Issues in designing a DOS –Introduction to distributed computing Environment -Networking and internetworking.	
MODULE 2	8 Hrs
Message Passing and Synchronization:- Inter-process communication - The API for the internet protocols - External data representation and marshalling - Client-Server communication - Group communication - Desirable features message passing system- Issues in message passing- Synchronization- Clock synchronization- Event ordering- Mutual exclusion- Deadlock- Election	

Algorithm - Buffering.	
MODULE 3	9 Hrs
Remote Procedure Call:-RPC model - Transparency of RPC- Implementing RPC mechanism- Stub generation- Marshaling arguments and results- Server management- Parameter passing semantics - Call semantics- Communication protocols for RPCs- Complicated RPC client server binding- Exception handling- Security- Special types of RPCs- RPCs in heterogeneous environments- Lightweight RPC.	
MODULE 4	7 Hrs
Distributed Shared Memory:-General architecture of DSM systems- Design and implementation of DSM- Granularity- Structure of shared memory space- Consistency models- Replacement strategy- Thrashing- Other approaches to DSM- Heterogeneous DSM and advantages of DSM.	
MODULE 5	7 Hrs
Distributed Naming:-Introduction- Desirable features of naming system- Fundamental concepts- System oriented names-Object locating mechanisms-Human oriented names- Name caches - Naming and security.	

TEXT BOOK:

1. George Coulouris, Jean Dollimore and Tim Kindberg, Distributed Systems Concepts and Design, Pearson Education, 2009.
2. Pradeep K Sinha, Distributed Operating Systems : Concepts and design, IEEE computer society press, 2007.

REFERENCES:

1. M.L.Liu, Distributed Computing Principles and Applications, Pearson Education, 2004.
2. Andrew S Tanenbaum, Maarten van Steen, Distributed Systems –Principles and Paradigms, Pearson Education, 2002.
3. Hadoop: The Definitive Guide, 3rd Edition - O'Reilly Media

SEMESTER	V					
YEAR	III					
COURSE CODE	20CY3504					
TITLE OF THE COURSE	INFORMATION WARFARE					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- Introduce to the Unique and emerging policies, doctrine, strategy, and operational requirements of conducting cyber warfare at the nation-state level.
- Enable learners to appreciate unified battle-space perspective and enhances their ability to manage and develop operational systems and concepts in a manner that results in the integrated, controlled, and effective use of cyber assets in warfare.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Summarize the theory of data, information and knowledge as they pertain to information warfare.	L2
CO2	Discuss the social, legal and ethical implications of information warfare.	L2
CO3	Evaluate contemporary information warfare and Trusted recovery models.	L3
CO4	Experiment with Computer Break-Ins and Hacking-Accounts.	L3

COURSE CONTENT	
MODULE 1	9Hrs
Concepts and Theories: Doctrines, Information warfare: definitions, models (The information environment, Definitions and models for information warfare), Information warfare or data warfare? (Defining data, Some theories about data, Visualization, Data warfare?)	
MODULE 2	7 Hrs
Defensive Information Warfare: Introduction, Background and traditional system recovery, Trusted recovery models (Modelling Databases, Modelling IW Attack and Defense, Database Trusted Recovery Models)	

MODULE 3	7Hrs
Trusted Recovery by Syntactic approaches: The Repair Model, On-the-Fly Repair Based on In-Log Read Information, Extracting Read Information from Transaction Profiles, Trusted Recovery System Development.	
MODULE 4	8Hrs
Trusted Recovery by Rewriting Histories: The Model, Basic Algorithm to Rewrite a History, Saving Additional Good Transactions, Pruning Rewritten Histories, Relationships between Rewriting Algorithms, Implementing the Repair Model on Top of Sagas	
MODULE 5	8Hrs
Trusted Recovery in distributed systems: Introduction, The Damage Assessment and Repair Algorithm, Performance Issues, Discussion, Future Research.	

TEXT BOOKS:

1. Daniel Ventre, Information Warfare, Wiley - ISTE (2009) (ISBN 9781848210943).
2. Peng Liu, Sushil Jajodia, Trusted Recovery and Defensive Information Warfare, Springer Science + Business Media, LLC (ISBN 978-1-4419-4926-4 ISBN 978-1-4757-6880-0 (eBook)).

REFERENCES:

- 1 Information Warfare and Security, Dorothy E. Denning, Denning Edition 1, 1998 Addison Wesley.
2. Cyberwar and Information Warfare, edited by Daniel Ventre, Wiley – ISTE, 2011

SEMESTER	V					
YEAR	III					
COURSE CODE	20CS3510					
TITLE OF THE COURSE	MICROCONTROLLERS AND EMBEDDED SYSTEMS					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	**	***	***

COURSE OBJECTIVES:

- Explain the architectural features and instructions of 32 bit microcontroller -ARM Cortex M3.
- Develop Programs using the various instructions of ARM Cortex M3 and C language for different applications.
- Identify and understand the unique characteristics and components of embedded systems
- Understand how can we interfacing different input and output devices/components to cortex M3 microcontroller
- Understanding of how Arduino Uno & Raspberry Pi work

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Describe the architectural features and instructions of 32 bit microcontroller ARM Cortex M3.	L2
CO2	Apply the knowledge gained for Programming ARM Cortex M3for different applications	L3
CO3	Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.	L2
CO4	Develop an embedded application with Cortex M3 architecture	L3
CO5	Design embedded systems using Arduino board and RaspberryPi	L3

COURSE CONTENT:	
MODULE 1: ARM-32 bit Microcontroller	8Hrs
Microprocessors versus Microcontrollers, Different Microcontroller Architectures (CISC, RISC, ARISC), Microcontroller Types: PIC, AVR, ARM, Background of ARM and ARM Architecture: A Brief History, Architecture Versions, The Thumb-2 Technology and Instruction Set Architecture, Cortex-M3 Processor Applications, Overview of the Cortex- M3: What Is the ARM Cortex-M3 Processor, Architecture of ARM Cortex M3, Various Units in the architecture, General Purpose Registers, Special Registers, Exceptions and Interrupts	
MODULE 2: ARM Cortex M3 Instruction Sets and Programming:	8Hrs
Assembly basics, Instruction List, Instruction Descriptions: Moving Data, LDR and ADR Pseudo-Instructions, Processing Data, Call and Unconditional Branch, Decisions and Conditional Branches, Combined Compare and Conditional Branch, Conditional Execution Using IT Instructions, Instruction Barrier and Memory Barrier Instructions, MSR and MRS, More on the IF-THEN Instruction Block, SDIV and UDIV, REV, REVH, and REVSH, Reverse Bit, SXTB, SXTB, UXTB, and UXTH.	
MODULE 3: Cortex-M3 Programming	8Hrs
A Typical Development Flow, Using C, CMSIS: Background of CMSIS, Organization of CMSIS, Using CMSIS, Using Assembly: The Interface between Assembly and C, The First Step in Assembly Programming, Producing Outputs, The “Hello World” Example, Using Data Memory, Simple programming exercises	
MODULE 4: Embedded System Design Concepts	8Hrs
Introduction: Definition of Embedded System, Embedded Systems Vs General Computing Systems, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems, Core of the Embedded System: General Purpose and Domain Specific Processors, Embedded system architecture.	
MODULE 5: Embedded System Design using Raspberry Pi	7 Hrs
Introduction to Raspberry Pi, About the Raspberry Pi board and programming (on Linux) Hardware Layout, Operating systems on Raspberry Pi, Configuring raspberry Pi, Programming raspberry Pi with Python libraries.	

TEXT BOOK:

1. Joseph Yiu, “The Definitive Guide to the ARM Cortex-M3”, 2nd Edition, Newnes,(Elsevier),2010.
2. Shibu K V, “Introduction to Embedded Systems”, Tata McGraw Hill Education Private Limited, 2nd Edition.

REFERENCES:

1. Muhammad Tahir, Kashif Javed, ARM Microprocessor Systems: Cortex-M Architecture, CRC Press 2017
2. Richard Blum, “Arduino Programming in 24 Hours”, Sams Teach Yourself, Pearson Education, 2017.
3. Vijay Madiseti and Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2016
4. Srinivasa K G, Internet of Things, CENGAGE Learning India, 2017

SEMESTER	V					
YEAR	III					
COURSE CODE	20CS3512					
TITLE OF THE COURSE	INTERNET OF THINGS					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To learn the building blocks of the Internet of Things (IoT) and their characteristics.
- To introduce the students to the programming aspects of the Internet of Things with a view toward rapid prototyping of IoT applications.
- To learn communication protocol for IoT.
- To learn Reference architectures for different levels of IoT applications.
- To learn IoT data analytics and Tools for IoT.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
1	Identify various protocols for IoT and Secure the elements of anIoT device	L1
2	Understand the building blocks of the Internet of Things and the application areas of IoT	L2
3	Apply IoT technologies in practical domains of society	L3
4	Analyze a suitable IoT data analytics and a tool for IoT	L4
5	Design an IoT device to work with a Cloud Computing infrastructure and program IoT devices	L6

COURSE CONTENT:	
MODULE 1: INTRODUCTION TO IOT	8 Hrs
Introduction: Concepts behind the Internet of Things, Definition, Characteristics of IoT, IoT Conceptual framework, Physical design of IoT, Logical design of IoT, Application of IoT, IoT and M2M, IoT System Management with NETCONF-YANG.	
MODULE 2: IOT ARCHITECTURE AND SECURITY	8 Hrs
M2M high-level ETSI architecture, IETF architecture for IoT, IoT reference model, IoT 3 Tier, and 5 tier architecture IoT Security: IoT and cyber-physical systems, IoT security (vulnerabilities, attacks, and countermeasures), Security engineering for IoT development, IoT security lifecycle	

MODULE 3 : IOT PROTOCOLS	7 Hrs
IoT Access Technologies: Physical and MAC layers, Web Communication Protocols for connected devices, SOAP, REST, HTTP Restful, and Web Sockets. Internet Connectivity Principles: Internet Connectivity, Internet-based communication, Network Layer: IP versions, IP addressing in IoT, Zigbee, 6LoWPAN, Routing over Low Power and Lossy Networks.	
MODULE 4 : HARDWARE AND DEVELOPMENT TOOLS FOR IOT	8 Hrs
Sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, and participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IoT supported Hardware platforms such as Arduino, Raspberry Pi, NodeMCU, Programming with Arduino, NodeMCU, and Raspberry Pi	
MODULE 5 : CASE STUDY AND REAL-WORLD APPLICATION	8 Hrs
Case Studies: Smart Agriculture, IoMT, Smart Cities (Smart Parking, Smart Lighting, Smart Road, Health and Lifestyle), Data Analytics for IoT, Cloud Storage Models & Communication APIs, Cloud for IoT, Amazon Web Services for IoT	

TEXT BOOK:

1. Arshdeep Bahga and Vijay Madisetti, Internet of Things - A Hands-On Approach
2. Rajkamal, "Internet of Things", Tata McGraw Hill publication

REFERENCES:

1. Hakima Chaouchi "The Internet of Things: Connecting Objects", Wiley publication.
2. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, by David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry by CISCO
3. Donald Norris "The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and Beagle Bone Black", McGraw Hill publication

SEMESTER	VI					
YEAR	III					
COURSE CODE	20CY3601					
TITLE OF THE COURSE	CRYPTOGRAPHY AND NETWORK SECURITY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	3	1	-	-	52	4

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- Understand the need for, and the concepts of various cryptographic algorithms.
- Illustrate key management issues in security and their solutions.
- Familiarize with standard security Protocols.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Discuss cryptography and its need for various applications.	L2
CO2	Illustrate novel security solutions for various cyber security issues.	L2
CO3	Identify right protocols at different layers of security	L3
CO4	Utilize the technologies available for Web Services, WS- Security, SAML, Other Standards.	L3

COURSE CONTENT:	
MODULE 1	09 Hrs
INTRODUCTION- Cyber Attacks, Defense Strategies, and Techniques, Guiding Principles, Mathematical Background for Cryptography – Modulo Arithmetic's, The GCD, Useful Algebraic Structures, Basics of Cryptography – Preliminaries, Elementary Substitution Ciphers, Elementary Transport Ciphers, Other Cipher Properties, Secret key Cryptography – Product Ciphers, DES Construction	
MODULE 2	08 Hrs
RSA Operations, Performance, Applications, Practical Issues, Public Key Cryptography Standard (PKCS), Cryptographic Hash - Introduction, Properties, Construction, Applications and Performance, The Birthday Attack, Discrete Logarithm and its Applications - Introduction, Diffie-Hellman Key Exchange, Other Applications.	
MODULE 3	08 Hrs
Introduction, Digital Certificates, Public Key Infrastructure, Identity-based Encryption, Authentication-I - One way Authentication, Mutual Authentication, Dictionary Attacks, Authentication – II – Centralized Authentication, The Needham-Schroeder Protocol, Kerberos, Biometrics	

MODULE 4	7 Hrs
IPSec- Security at the Network Layer – Security at Different layers: Pros and Cons, IPSec in Action, Internet Key Exchange (IKE) Protocol, Security Policy and IPSEC, Virtual Private Networks, Security at the Transport Layer - Introduction, SSL Handshake Protocol, SSL Record Layer Protocol, OpenSSL.	
MODULE 5	7 Hrs
IEEE 802.11 Wireless LAN Security - Background, Authentication, Confidentiality and Integrity, Viruses, Worms, and Other Malware, Firewalls – Basics, Practical Issues, Intrusion Prevention and Detection	

TEXT BOOK:

1. Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition

REFERENCES:

1. William Stallings - Cryptography and Network Security 5th edition
2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill Edition

SEMESTER	VI					
YEAR	III					
COURSE CODE	20CY3602					
TITLE OF THE COURSE	DATA PRIVACY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	

COURSE OBJECTIVES:

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

- Learn about keeping data private with classical cryptography, modern cryptography, Steganography.
- Understand different types of Ciphers.
- Use various algorithms of public key cryptography.
- Identify the methods for data hiding in different types of images and videos.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Compare different types of Ciphers	L2
CO2	Infer various methods and algorithms of public key cryptography.	L2
CO3	Experiment the methods for data hiding in different types of images.	L3
CO4	Identify data hiding processes for video files.	L3

COURSE CONTENT:	
MODULE 1	08 Hrs
Monoalphabetic Substitution Ciphers: Letter Distributions, Breaking a Monoalphabetic Cipher, The Pigpen Cipher, Polybius's Monoalphabetic Cipher, Extended Monoalphabetic Ciphers, The Playfair Cipher, Homophonic Substitution Ciphers. Polyalphabetic Substitution Ciphers: Self-Reciprocal Ciphers, The Porta Polyalphabetic Cipher, The Beaufort Cipher, The Trithemius Cipher, The Vigenere Cipher, Breaking the Vigenere Cipher, Long Keys, A Variation on Vigenere, The Gronsfeld Cipher, Generating Permutations, The Eyraud Cipher, The Hill Cipher, The Jefferson Multiplex Cipher, Strip Ciphers, Polyphonic Ciphers and Ambiguity, Polybius's Polyalphabetic Cipher	
MODULE 2	08 Hrs
Public-Key Cryptography:- Diffie-Hellman-Merkle Keys, Public-Key Cryptography, Rabin Public-Key Method, El Gamal Public-Key Method, Pretty Good Privacy, Sharing Secrets: Threshold Schemes, The Four Components, Authentication, Elliptic Curve Cryptography. Data Hiding in Text: Basic Features, Applications of Data Hiding, Watermarking, Intuitive Methods, Simple Digital Methods, Data Hiding in Text, Innocuous Text, Mimic Functions	
MODULE 3	08 Hrs
Data Hiding in Images: LSB Encoding, BPCS Steganography, Lossless Data Hiding, Spread	

Spectrum Steganography, Data Hiding by Quantization, Patchwork, Signature Casting in Images, Transform Domain Methods, Robust Data Hiding in JPEG Images, Robust Frequency Domain ,Steganography, Data Hiding by Quantization, Patchwork, Signature Casting in Images, Transform Domain Methods, Robust Data Hiding in JPEG Images, Robust Frequency Domain	
MODULE 4	09 Hrs
Data Hiding in Images with Watermarking: Watermarking, Detecting Malicious Tampering Wavelet Methods, Kundur-Hatzinakos Watermarking: Kundur-Hatzinakos Watermarking: II Data Hiding in Binary Images, The Zhao-Koch Method, The Wu-Lee Method, The CPT Method, The TP Method, Data Hiding in Fax Images	
MODULE 5	09 Hrs
Data Hiding: [Other Methods] Protecting Music Scores, Data Hiding in MPEG-2 Video, Digital Audio, The Human Auditory System, Audio Watermarking in the Time Domain, Echo Hiding, The Steganographic File System, Ultimate Steganography, Public-Key Steganography, Current Software	

TEXT BOOK:

1. Data Privacy and Security, David Salomon, 2003 Springer-Verlag New York, Inc.

REFERENCES:

1. William Stallings - Cryptography and Network Security 5th edition
2. Cryptography and Network Security : Atul Kahate, Mc Graw Hill Edition

SEMESTER	VI					
YEAR	III					
COURSE CODE	20CS3603					
TITLE OF THE COURSE	CLOUD APPLICATION DEVELOPMENT					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ ProjectsHours	Total Hours	Credits
	3	-	-	-	39	3

Prerequisite Courses (if any)			
#	Sem/Year	CourseCode	Title of theCourse
***	***	***	***

COURSE OBJECTIVES:

- To give insights into the Cloud computing Technology, Service Oriented Architecture (SOA) and Virtualization.
- To recognize the basic programming for building the Cloud Application and to be familiar with version control tool.
- To understand the design and development framework for Cloud Applications.
- To deploy the cloud infrastructure using different methods from the scratch.
- To apply and map theoretical knowledge to practical through case studies and tutorials.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Explain the cloud architecture, different cloud delivery and deployment models and the idea of Virtualization	L2
CO2	Construct the Cloud Application and work with the version control tool.	L3
CO3	Select the appropriate cloud framework for the development of cloud applications.	L5
CO4	Implement cloud-based application by exploring realtime methods and tools.	L6
CO5	Examine the cloud services offered by various vendors and emerging technologies.	L4

COURSE CONTENT:	
MODULE 1: Introduction	8Hrs
Introduction- Cloud Computing Architecture – The Cloud Reference Model – Cloud Characteristics – Cloud Deployment Models: Public, Private, Community, Hybrid Clouds- Cloud Delivery Models: IaaS, PaaS, SaaS Virtualization: Introduction, Characteristics of Virtualized Environments, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Paravirtualization, Full Virtualization	

MODULE 2: Understanding Cloud Programming	8Hrs
Introduction to Cloud development using HTML5-Tag and Structural elements, Input elements and Data Attributes, Management and support and scripting. CSS3-Styling HTML, JavaScript- Variables and control statement, functions and API's Client side Javascript	
MODULE 3: Design and Developing cloud Application	9 Hrs
Building Native Cloud Application: REST APIs and JSON - Using RESTAPI's with WatsonAI Services. JSON Data types-Arrays, objects, Parse, Server and HTML Developing Cloud Applications with Node.js and React: Create server-side applications using Node.js and develop the front-end using React.	
MODULE 4: Deploying Cloud Applications and services	7 Hrs
Cloud Application deployment models: Amazon Web Services- Compute Services, Storage Services, Communication Services, Google AppEngine- Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations. Microsoft Azure- Azure Core Concepts	
MODULE 5: CASE Study	7 Hrs
Introduction to Emerging technologies supported by Cloud: AI, IoT, Blockchain, Analytics. Cloud Infrastructure: -Dockers and Containers. Cloud Storage: Direct Attached-File Storage-Block Storage-Object Storage-Content Delivery Networks (CDN). Cloud Native and Emergent Cloud Trends: Hybrid Multicloud-Serverless-Microservices-Cloud Native-DevOps-Application Modernization. Need for Cloud Security.	

TEXTBOOKS:

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud Computing McGraw Hill Education
2. Deitel, Deitel and Neito, "Internet and World Wide Web – How to program", Pearson Education Asia, 5th Edition, 2011

REFERENCES:

1. Tom Marrs, "JSON at Work - Practical Data Integration for the Web", O'REILLY, First edition, 2017
2. Guo Ning Liu, Qiang Guo Tong, Harm Sluiman, Alex Amies, "Developing and Hosting Applications on the Cloud", IBM Press (2012)
3. Dan Marinescu, "Cloud Computing: Theory and Practice", M K Publishers, 1st Edition, 2013
4. A.Srinivasan, J.Suresh, "Cloud Computing, A practical approach for learning and implementation", Pearson, 2014

SEMESTER	VI					
YEAR	III					
COURSE CODE	20CY3604					
TITLE OF THE COURSE	CRYPTOGRAPHY AND NETWORK SECURITY LAB					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	26	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

Course objectives: This course will enable students to

1. Exemplify Encryption and Decryption algorithm.
2. Illustrate security software's and Tools.
3. Demonstrate Virtual box, Root kits.

Course Outcomes:

1. Install necessary software and setup the environment to work with cryptography and network security.
2. Implement various Encryption and Decryption algorithm
3. Demonstrate the working of security tools and perform audits.

Lab Experiments:
PART A 1. Implement the encryption and decryption of 8-bit data using 'Simplified DES Algorithm' 2. Configure a mail agent to support Digital Certificates, send a mail and verify the correctness of this system using the configured parameters. 3. Implement the Euclid Algorithm to generate the GCD 4. Using Java Cryptography, encrypt the text "Hello world" using BlowFish. Create your own key using Java key tool 5. Implementation of Advanced Encryption Standard (AES)
PART B 1. Learn to install Wine/Virtual Box/ or any other equivalent s/w on the host OS 2. Perform an experiment to grab a banner with telnet and perform the task using Netcat 3. Perform an experiment how to use DumpSec. 4. Perform a wireless audit of an access point / router and decrypt WEP and WPA (software's netstumbler or aircrack-ng). 5. Install IPCop on a Linux system and learn all the function available on the software. Install Rootkits and study variety of opt.

REFERENCES:

1. Build Your Own Security Lab: A field guide for network Testing, Michael Gregg, Wiley India edition, ISBN: 9788126516919.

SEMESTER	VI					
YEAR	III					
COURSE CODE	20CY3605					
TITLE OF THE COURSE	DATA PRIVACY LAB					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	26	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

Course objectives:

This course will enable students to

1. To Understand the Security tools.
2. To Implement various data privacy algorithms.

Course Outcomes:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Illustrate the working of Security Tools	L2
CO2	Design and Develop data privacy algorithms.	L3
CO3	Optimize the solution given for an existing problem.	L3

Lab Experiments:
PART A 1. Encryption and Decryption program for Caesar Cipher without input. 2. Program to generate Pseudo Random numbers in a range 3. Program for XOR Encryption and Decryption 4. Program for Vernam Cipher 5. Program for RSA Algorithm by inputting value of two prime numbers 6. Implement the encryption and decryption of 8-bit data using 'Simplified DES Algorithm'
PART B 1. Commands for Data and Network Security "ipconfig, ping, tracert, nbtstat, telnet, netstat, tasklist, getmac, hostname, pathping, route, fc, sfc, recimg, cipher, arp, net view" [More Commands can be Discussed] 2. Introduction to CRYPTOOOL 3. Implement Digital Signature Visualization 4. Implement on Hash Value Creation 5. Implement on HMAC Calculation

REFERENCES:

1. Build Your Own Security Lab: A field guide for network Testing, Michael Gregg, Wiley India edition, ISBN: 9788126516919.
2. William Stallings - Cryptography and Network Security 5th edition
3. Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition

SEMESTER	VI					
YEAR	III					
COURSE CODE	20CY3606					
TITLE OF THE COURSE	OPERATING SYSTEM SECURITY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES

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

- Outline the models of protection and techniques to enforce security in operating systems.
- Describe the impact of security features and access control mechanisms used in secure operating systems.
- Summarizes a variety of ways that commercial operating systems have been extended with security features by using case studies.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Identify and explain preliminaries related to operating system resource security and protection for access control.	L2
CO2	Survey the major, distinct approaches to building secure operating systems and retrofitting security into a commercial operating system.	L2
CO3	Examine secure capability systems and how capability semantics are made secure virtual machine systems.	L3
CO4	Experiment with Separation Kernels, VAX VMM Security Kernel, Security in Other Virtual Machine Systems.	L3

COURSE CONTENT

MODULE 1	9Hrs
Operating System Resource Security and Protection: Access and Flow Control – Introduction, Preliminaries, The access Matrix Model, Implementation of Access Matrix, Safety in the Access Matrix Model, Advanced Models of Protection, Case Studies: The UNIX operating System, The Hydra Kernel, Amoeba, Andrew. Text Book 1: Ch.14.1 to Ch.14.7	
MODULE 2	7Hrs
Access Control Fundamentals: Secure Operating Systems, Security Goals, Trust Model, Threat Model, Protection System, Lampson's Access Matrix, Mandatory Protection Systems, Reference Monitor, Secure Operating System Definition, Assessment Criteria, Multics History, The Multics System, Multics	

Security, Multics Vulnerability Analysis. Text Book 2: Ch. 1.1 Ch 1.4, Ch. 2.1 to 2.4 and Ch.3.1 to 3.4	
MODULE 3	7Hrs
Security in Ordinary Operating Systems, Verifiable Security Goals, Security Kernels: System Histories, UNIX Security, Windows Security, Information Flow, Information Flow Secrecy Models, Information Flow Integrity Models, Covert Channels, The Security Kernel, Secure communications processor, Gemini Secure operating system. Text Book 2: Ch. 4.1 to Ch. 4.3, Ch 5.1 to Ch 5.4 and Ch. 6.1 to Ch. 6.3	
MODULE 4	9Hrs
Securing Commercial Operating Systems, Case Studies: Retrofitting Security into a Commercial OS, History of Retrofitting Commercial OS's, Commercial Era, Microkernel Era, UNIX Era, Case Study1: Solaris Trusted Extensions, Case Study2: Building a Secure Operating System for Linux. Text Book 2: Ch. 7.1 to 7.5, Ch. 8.1 to 8.8 and Ch.9.1 to Ch. 9.3	
MODULE 5	8Hrs
Secure Capability & Virtual Machine Systems: Capability System Fundamentals, Capability Security, Challenges in Secure Capability Systems, Building Secure Capability Systems, Separation Kernels, VAX VMM Security Kernel, Security in Other Virtual Machine Systems. Text Book 2: Ch. 10.1 to Ch. 10.4 and Ch. 11.1 to 11.3	

TEXT BOOKS:

1. Mukesh Singhal and Niranjana Shivaratri, Advanced Concepts in Operating Systems, McGraw-Hill, 2011.
2. Trent Jaeger, Operating System Security, Morgan & Claypool Publishers, 2008.

REFERENCES:

1. Michael J. Palmer, "Guide To Operating Systems Security", 1st Edition, Cengage Learning, 2004.
2. Gerard Blokdyk, "Security-focused operating system: Master the Art of Design Patterns", CreateSpaceIndependent Publishing Platform, 2017.

SEMESTER	VI					
YEAR	III					
COURSE CODE	20CY3607					
TITLE OF THE COURSE	PROACTIVE SECURITY TOOLS					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To understand the fundamentals of risk management
- To identify the threat assessment process and its input to risk assessment
- To learn the different vulnerability issues and its assessment for hazards, disaster, threats
- To understand various tools, types of risk assessment and processes of risk management

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Infer basic, intermediate and advanced techniques to analyze the data	L2
CO2	Analyze the output generated by the process of Risk Management	L3
CO3	Build risk assessment tools and techniques	L2
CO4	Assess the different vulnerability issues for disasters, hazards and threats	L5

COURSE CONTENT:	
MODULE 1	7Hrs
An Introduction to Risk Management: Introduction to the Theories of Risk Management; The Changing Environment; The Art of Managing Risks.	
MODULE 2	7 Hrs
The Threat Assessment Process: Threat Assessment and its Input to Risk Assessment; Threat Assessment Method; Example Threat Assessment;	
MODULE 3	9 Hrs
Vulnerability Issues: Operating System Vulnerabilities; Application Vulnerabilities; Public Domain or Commercial Off-the-Shelf Software; Connectivity and Dependence; Vulnerability assessment for natural disaster, technological hazards, and terrorist threats; implications for emergency response, vulnerability of	

critical infrastructures;	
MODULE 4	8 Hrs
The Risk Process: What is Risk Assessment? Risk Analysis; Who is Responsible?	
MODULE 5	8 Hrs
Tools and Types of Risk Assessment: Qualitative and Quantitative risk Assessment; Policies, Procedures, Plans, and Processes of Risk Management; Tools and Techniques; Integrated Risk Management; Future Directions: The Future of the Risk Management.	

TEXT BOOK:

1. Malcolm Harkins, Managing Risk and Information Security, Apress, 2012.
2. Daniel Minoli, Information Technology Risk Management in Enterprise Environments, Wiley, 2009.

REFERENCES:

1. Andy Jones, Debi Ashenden ,Risk Management for Computer Security: Protecting Your Network & Information Assets, , 1st Edition, Butterworth-Heinemann, Elsevier, 2005.
2. Andreas Von Grebmer, Information and IT Risk Management in a Nutshell: A pragmatic approach to Information Security, 2008, Books On Demand Gmbh.

SEMESTER	VI					
YEAR	III					
COURSE CODE	20CS3602					
TITLE OF THE COURSE	SECURE PROGRAMMING					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ ProjectsHours	Total Hours	Credits
	3	-	-	-	39	3

COURSE OBJECTIVES:

- To enhance and understand student competence on basic concepts of cyber security and code protection.
- To understand and analyze the importance of Secure Programming Design Principles.
- To develop competence in Robust secure programming concepts.
- To gain insights to maintain a secure repository.
- To develop competence in cryptography algorithms to be used to protect the data.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand the Basic concepts of SecureProgramming	L1
CO2	Understand and Demonstrate SecureProgramming Principles	L2
CO3	Apply concepts of secure programmingconcepts for Software Development	L3
CO4	Analyze and conclude requirements, importance,and need of secure programming.	L4
CO5	Develop secure crypto systems for Data baseManagement	L5

COURSE CONTENT:

MODULE 1: Introduction to Secure Programming		8 Hrs
Fundamentals of secure programming in C. Various security vulnerabilities (e.g., buffer overflows) in C. Introduction; Definitions (policy, mechanism, enforcement, property), Definitions (safety, liveness, and CIA properties); Best practices (e.g., coding standards). Unenforceability; Threats; Tradeoffs; Secure design; Access control; Authentication; Authorization; Memory segmentation; Buffer overflows;		
MODULE 2: Secure Programming Design Principles		8Hrs
Secure Programming Design Principles Overview; Principle of Least Privilege; Fail-Safe Defaults; Principle of Economy of Mechanism;		
MODULE 3: Robust Programming		7Hrs
Robust Programming Overview; Robust Programming Basic Principles; An Example of Fragile Code; Error Handling; Cohesion, New Interfaces		
MODULE 4: Databases		7Hrs
Client-state manipulation, Databases; Information management; SQL queries, SQL injection attacks, Code injections; XSS;		
MODULE 5: Cryptography		9Hrs
Symmetric cryptography Asymmetric cryptography; Diffie-Hellman; RSA; Signatures; MACs; Password management		

TEXT BOOKS:

1. Foundations of Security: Neil Daswani, Christoph Kern, and Anita Kesavan. Apress, 2007 (1st ed). ISBN-10: 1590597842; ISBN-13: 978-1590597842
2. Secure Coding: Principles and Practices: Mark Graff and Kenneth Wyk

REFERENCES:

1. The C Programming Language: Brian Kernighan and Dennis Ritchie., 2nd Edition.
2. Computer Systems: A Programmer's Perspective: Randy Bryant's and David R. O'Halloran. 2nd Edition.
3. Hacking: The Art of Exploitation: Jon Erickson., 2nd Edition.
4. Secure Coding in C and C++: Robert Seacord., 1st Edition.
5. Programming. A Modern Approach: K. N. King, Published by W. W. Norton & Company.
6. Building Secure and Reliable Systems: Heather Adkins, Betsy Beyer, Paul Blankinship and 3 more published by O'Reilly
7. Fundamentals of Information Security Systems: David Kim and Michael Solomon

SEMESTER	VI					
YEAR	III					
COURSE CODE	20CY3608					
TITLE OF THE COURSE	DATA MINING AND ANALYSIS					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To understand the basic concepts of Data Mining and Data-ware Housing
- To identify different Classification, clustering and association algorithms
- To learn the challenges and tasks of data mining process
- To understand various methods and techniques for implementing Data Ware-house

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Find the Data Warehousing models and Measures for Categorization and computation.	L1
CO2	Outline basic, intermediate and advanced techniques to analysis the data	L2
CO3	Identify different association and clustering techniques	L3
CO4	Apply different operations for Data mining and analysis.	L3

COURSE CONTENT:	
MODULE 1	9Hrs
Data Warehousing & modeling Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading, Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations	
MODULE 2	8Hrs
Data warehouse implementation& Data mining Efficient Data Cube computation: An overview, Indexing OLAP Data: Bitmap index and join index, Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP. : Introduction: What is data mining, Challenges, Data Mining Tasks, Data: Types of Data,	

Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity.	
MODULE 3	8Hrs
Association Analysis Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FPGrowth Algorithm, Evaluation of Association Patterns.	
MODULE 4	7Hrs
Classification Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers.	
MODULE 5	7 Hrs
Clustering Analysis Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph-Based Clustering, Scalable Clustering Algorithms.	

TEXT BOOK:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson, Firstimpression, 2014.
2. Jiawei Han, Micheline Kamber, Jian Pei: Data Mining -Concepts and Techniques, 3rd Edition, MorganKaufmann Publisher, 2012.

REFERENCES:

1. Sam Anahory, Dennis Murray: Data Warehousing in the Real World, Pearson, Tenth Impression, 2012.
2. Michael.J.Berry, Gordon.S.Linoff: Mastering Data Mining , Wiley Edition, second edition, 2012.

SEMESTER	VI					
YEAR	III					
COURSE CODE	20CY3609					
TITLE OF THE COURSE	CYBER SECURITY PROGRAMS AND POLICIES					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

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

- Know the importance of policies and governance in information security and cybersecurity.
- Maintaining confidentiality and integrity of information.
- Understand Asset Management and Data Loss Prevention and access controls
- Summarize Cybersecurity Framework Reference Tool.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Find Cybersecurity Policies, their life cycle, format, organization, hierarchy, writing style and techniques.	L1
CO2	Infer NIST's Cybersecurity Framework, Cybersecurity risk.	L2
CO3	Outline the importance of Data Asset Management and Data Loss Prevention	L2
CO4	Make use of NIST Cybersecurity Framework Reference Tool for Investigation and Evidence Handling, Data Breach	L3

COURSE CONTENT:	
MODULE 1	08 Hrs
Cybersecurity Policy and Governance: Information Security vs. Cybersecurity Policies, Looking at Policy Through the Ages, Cybersecurity Policy, Cybersecurity Policy Life Cycle Policy Cybersecurity Policy Organization, Format, and Styles: Policy Hierarchy, Writing Style and Technique, Policy Format	
MODULE 2	07 Hrs
Confidentiality, Integrity, and Availability, NIST's Cybersecurity Framework, Understanding Cybersecurity Policies, Cybersecurity Risk.	
MODULE 3	09 Hrs
Asset Management and Data Loss Prevention, Information Assets and Systems, Information Classification, Labeling and Handling Standards, Information Systems Inventory, Understanding Data Loss Prevention Technologies, Employee life cycle, Employee learning during orientation, The Importance of Employee Agreements, The Importance of Security Education and Training, Understanding the secure Facility layered Défense Model, Protecting Equipment, Access Control	

Fundamentals, Infrastructure Access Controls, User Access Controls.	
MODULE 4	07 Hrs
Incident Response, Investigation and Evidence Handling, Data Breach Notification Requirements.	
MODULE 5	08Hrs
Protecting Cardholder Data, PCI Compliance, Introduction to NIST Cybersecurity Framework Components, Framework Implementation Tiers, Further Improvement of Cybersecurity Program, NIST Cybersecurity Framework Reference Tool.	

TEXT BOOK:

1. Developing Cybersecurity Programs & Policies, OMAR SANTOS, Pearson Education

REFERENCES:

1. Cyber Law: The law of the Internet”, Jonathan Rosenoer, Springer-Verlag, 1997.

SEMESTER	VII					
YEAR	IV					
COURSE CODE	20CY4702					
TITLE OF THE COURSE	VULNERABILITY ANALYSIS AND PENETRATION TESTING					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)

#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- Gain a comprehensive understanding of different types of network vulnerabilities.
- Applying industry standards and frameworks like OWASP.
- Discuss implications of common vulnerabilities and recommend ways to rectify or mitigate them.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Summarize the significance of risk, security and vulnerability assessment.	L2
CO2	Analyze penetration testing strategies for diagnosing security of web application using OWASP standards.	L4
CO3	Identify the types of vulnerability assessment policies to evaluate system security.	L5
CO4	Apply modern tools and techniques like Metasploit, RouterSploit, Backdoor, remote access to gather active and passive information of a system.	L3
CO5	Apply web application security concepts to design application portfolio for reducing risk and vulnerabilities.	L3

COURSE CONTENT:

MODULE 1	8Hrs
Vulnerability Management Governance: Security basics, Identification, Authentication, Authorization, Auditing, Accounting. Non-repudiation, Vulnerability, Threats, Exposure, Risk, Safeguards, Attack vectors. Understanding the need for security assessments: Types of security tests: Security testing, Vulnerability assessment versus penetration testing, Security assessment, Security audit.	
MODULE 2	7Hrs
Penetration testing standards, Penetration testing lifecycle, industry standard, Open Web Application Security Project (OWASP) testing guide. Security Assessment Prerequisites: Target scoping and planning. Gathering requirements: checklist of test requirements, time frame and testing hours, Identifying stakeholders.	
MODULE 3	8Hrs
Types of vulnerability assessment: based on location, based on knowledge about environment/ infrastructure, Announced and Unannounced Automated Testing, Manual Testing, Estimating the resources and deliverables,	

preparing a test plan, getting approval and signing NDAs, Confidentiality and Nondisclosure Agreements.	
MODULE 4	9Hrs
Information Gathering: Passive information gathering, Active information gathering. Enumeration: Enumeration Services. Gaining Network Access: Gaining remote access, cracking passwords, creating backdoors using Backdoor Factory, exploiting remote services using Metasploit, Hacking embedded devices using RouterSploit, Social engineering using SET.	
MODULE 5	7Hrs
Assessing Web Application Security: Importance of web application security testing, Application profiling, Common web application security testing tools, Authentication, Authorization, Session management, Input validation, Security misconfiguration.	

TEXT BOOKS:

1. Sagar Rahalkar, Network Vulnerability Assessment, Packt Publishing Inc, 2018.

REFERENCES:

1. Abhishek Singh, Baibhav Singh and Hirosh Joseph, Vulnerability Analysis and Defense for the Internet, Springer Publishing Inc, 2008.
2. Wil Allsopp, Unauthorized Access: Physical Penetration Testing For IT Security, Wiley Publishing Inc, 2009.
3. Kimberly Graves, Vulnerability Analysis and Defense for the Internet, Wiley Publishing Inc.; 2007.
4. Shakeel Ali and Tedi Heriyanto, Backtrack -4: Assuring security by penetration testing”, PACKT Publishing; 2011

SEMESTER	VII					
YEAR	IV					
COURSE CODE	20CY4703					
TITLE OF THE COURSE	QUANTUM CRYPTOGRAPHY AND COMMUNICATION					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To apply techniques of linear algebra to quantum mechanics
- To analyze basic quantum circuits
- To explore the techniques of quantum communication
- To study the protocols of quantum cryptography

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Examine the tools and techniques of linear algebra to the quantum mechanics problems	L4
CO2	Design and analyze basic quantum circuits and quantum computing algorithms	L5
CO3	Develop the quantum communication tools using quantum gates	L6
CO4	Design quantum cryptography protocol using quantum mechanics	L6

COURSE CONTENT:	
MODULE 1: LINEAR ALGEBRA REVIEW	
	8 Hrs
Bases and Linear Independence, Linear Operators and Matrices, Inner Products Eigen Vectors and Eigen Values, Adjoint and Hermitian Operators, Tensor Products, Operator Functions, Commutator and Anti-Commutator	
MODULE 2: QUANTUM MECHANICS	
	8 Hrs
State Space, Evolution, Measurement, Distinguishing Quantum States, Projective Measurements and POVMs	
MODULE 3: QUANTUM GATES AND ALGORITHMS	
	7 Hrs
Universal set of gates, quantum circuits, Solovay-Kitaev theorem, Deutsch-Jozsa algorithm, Shor's factoring, Grover Algorithm and HHL Algorithm	
MODULE 4: QUANTUM COMMUNICATION	
	8 Hrs
Overview of Quantum Operations, Quantum Noise, Distance Between Quantum States, Accessible Information, Data Compression, Classical Information Over Quantum Channels, Quantum Information Over Quantum Channels, Entanglement as a Physical Resource	

MODULE 5 : QUANTUM CRYPTOGRAPHY	8 Hrs
Private Key Cryptography, Privacy Amplification, Quantum Key Distribution, Privacy and Coherent Information, Security of Quantum Key Distribution	

TEXT BOOKS:

1. Nielsen, M. A., & Chuang, I. (2002). Quantum computation and quantum information.

REFERENCE BOOKS:

1. Phillip Kaye, Raymond Laflamme et. al., An introduction to Quantum Computing, Oxford University press, 2007.
2. Chris Bernhardt, Quantum Computing for Everyone, The MIT Press, Cambridge, 2020

SEMESTER	VII					
YEAR	IV					
COURSE CODE	20CY4704					
TITLE OF THE COURSE	WIRELESS NETWORKS SECURITY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

COURSE OBJECTIVES:

1. Understanding the fundamentals and architecture of wireless sensor networks, enabling students to evaluate and comprehend their structure and components.
2. Explore different security architectures and protocols used in wireless networks.
3. Students will be able analyze the OSI model, evaluate wireless LAN security protocols, apply cryptographic techniques, and assess security considerations in wireless networks.
4. Gaining knowledge of identity-based cryptography and countermeasures against attacks, identifying and mitigating wireless threats,
5. Studying hacking techniques, familiarizing with wireless security tools, and developing skills in creating effective wireless security policies.

CO No.	Outcomes	Bloom's Taxonomy Level
CO 1	Summarize the WSN applications, history, architecture, routing challenges, and security countermeasures.	L2
CO 2	Compare different wireless security architectures and assess their strengths and weaknesses.	L2
CO 3	Interpret the OSI model, wireless LAN security protocols, cryptography, and security considerations.	L2
CO 4	Analyze symmetric, asymmetric key systems, PKI, and identity-based cryptography.	L3
CO 5	Utilize scanning, sniffing, denial-of-service, and access point attacking tools to identify wireless threats, employ hacking techniques, and develop a comprehensive wireless security policy.	L3

COURSE CONTENT:

MODULE 1	8 HRS
Introduction To Wireless Sensor Networks: Introduction-WSN Applications, History of WSN, WSN Architecture, Architecture of Sensor Nodes, The Protocol Stack in WSN; MANET Versus WSN, Challenges in WSN, The Routing Problem in WSN, Broadcasting and Multicasting.	
Security in Wireless Sensor Networks: Introduction, Attacks on WSN, Countermeasures to Attacks in WSN.	
MODULE 2	8 HRS
Wireless Security Architectures: Static WEP Wireless Architecture, VPN, Wireless VPN Architecture Overview, Wireless VPN Architecture Overview, VPN Policy Aspect, Wireless Gateway Systems ,802.1x, Comparing Wireless Security Architectures.	

Introduction to Wireless Security Protocols and Cryptography: Removing the FUD, OSI Model, Wireless Local Area Network (LAN) Security Protocols, Cryptography, Secure Sockets Layer/Transport Layer Security (SSL/TLS), Man-in-the-Middle (MITM) of SSL/TLS and SSH, Security Considerations for Wireless Security-wireless device security issues.	
MODULE 3	8 HRS
Identity-Based Cryptography: Introduction-Symmetric Key Cryptographic Systems, Asymmetric Key Cryptographic Systems, Public Key Infrastructure- Single-Certificate Authority Model, A Hierarchy of Certificate Authorities, Pros and Cons of PKI, Identity-Based Cryptography-Computational Problems, Identity-Based Encryption Schemes, Hierarchical Identity-Based Encryption Scheme, Identity-Based Authentication Schemes, Key Distribution in IBC, Key Escrow Problem, Threshold Signature Scheme	
MODULE 4	8 HRS
Wireless Threats: The Uncontrolled Terrain, Eavesdropping, Communications Jamming, Injection and Modification of Data, Rogue Client, Attacker Equipment, Covert Wireless Channels, Roaming Issues, Cryptographic Threats. Breaking Wireless Security: The Hacking Process, Wireless Network Compromising Technique, Access Point Compromising Techniques	
MODULE 5	7 HRS
Wireless Tools: Scanning Tools., Sniffing Tools, Hybrid Tools, Denial-of-Service Tools, Denial-of-Service Tools, Access Point Attacking Tools, Other Wireless Security Tools. Wireless Security Policy: Policy Overview, The Policy-Writing Process, Risk Assessment, Impact Analysis, Wireless Security Policy Areas.	

TEXT BOOK:

1. Harsh Kupwade Patil Stephen A. Szygenda, "Security for Wireless Sensor Networks using Identity-Based Cryptography", CRC Press, Taylor & Francis Group-2013
2. Merritt Maxim and David Pollino, "Wireless Security", McGraw-Hill publication,2002
3. Aaron E. Earle, "Wireless Security Handbook", Published in 2006 by Auerbach Publications Taylor & Francis Group

REFERENCE BOOKS:

1. "MOBILE AND WIRELESS NETWORKS SECURITY", Maryline Laurent-Maknavicius, Hakima Chaouchi, France Proceedings of the MWNS 2008 Workshop Singapore 9 April 2008.
2. "Wireless Network Security", by YANG XIAO, XUEMIN SHEN, and DING-ZHU DU, Springer Series, 2007, ISBN-10 0-387-28040-5.

SEMESTER	VII					
YEAR	IV					
COURSE CODE	20CY4705					
TITLE OF THE COURSE	CYBER FORENSICS AND CYBER LAW					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To introduce the fundamentals cyber forensics.
- To Learn forensic tools and techniques used for Forensic Investigations
- To Provide an overview of the legal issues arising from the use of information technology and the internet.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Summarize the cyber forensics tools and techniques to interpret cybercrimes.	L2
CO2	Build good cyber forensic report by utilizing evidence acquisition and data preparation methodologies.	L3
CO3	Inspect the network forensic tools and techniques like Wireshark, Network Miner, Xplico to detect and prevent intrusions.	L4
CO4	Survey the cloud forensic techniques associated with Google Drive, Dropbox and WhatsApp.	L4
CO5	Summarize different hardware specific tools and techniques like Slack Space, RAM Slack, Drive Slack, Swap File to investigate cybercrime.	L2

COURSE CONTENT	
MODULE 1	
8 Hrs	
INTRODUCTION TO CYBER FORENSICS: Introduction, Defining Cyber Forensics, Cyber Forensic Investigation Process, Forensic Protocol for Evidence Acquisition, Digital Forensics Standards and Guidelines, Digital Evidence, What Is a Cybercrime? Types of Cyber Crime, Challenges in Cyber Forensics, Skills Required to Become a Cyber Forensic Expert, Cyber Forensic Tools. (Text Book-3: Chapter 1)	
MODULE 2	
8 Hrs	
CYBER FORENSICS: INVESTIGATIVE SMART PRACTICES: The Forensic Process, Forensic Investigative Smart Practices, The Initial Contact, the Request, Evidence Handling, Acquisition of Evidence, Data Preparation. INVESTIGATION: INCIDENT CLOSURE - Forensic Investigative Smart Practices, Investigation (Continued), Communicate Findings, Characteristics of a Good Cyber Forensic Report, Report Contents, Retention and Curation of Evidence. (Text Book-1: Chapter 10 and Chapter 12).	

MODULE 3	8 Hrs
NETWORK FORENSICS: The OSI Model, Forensic Footprints, Seizure of Networking Devices, Network Forensic Artifacts, ICMP Attacks-Traceroute Attack, Inverse Mapping Attack, ICMP Smurf Attack, Drive-By Downloads, Network Forensic Analysis Tools-Wireshark, Case Study: Wireshark, Network Miner, Case Study: Network Miner, Xplico, Case Study: Xplico. (Text Book:2: Chapter 6)	
MODULE 4	8 Hrs
CLOUD FORENSICS: Cloud Computing Models Defining Cloud Forensics, Server-Side Forensics, Client-Side Forensics, Challenges in Cloud Forensics, Artifacts in Cloud Forensics, Use of Cloud Forensics, Forensics as a Service (FaaS) Case Study: Google Drive Investigation, Case Study: Dropbox Investigation, WhatsApp Forensics, Case Study: WhatsApp Database Extraction. (Text Book:2: Chapter 8)	
MODULE 5	7 Hrs
CYBER FORENSICS AND THE LAW: LEGAL CONSIDERATIONS – Introduction, Objectives, Cyber Forensics, Digital Information, Identification and Analysis, Digital Forensics Complexity Problem, Proliferation of Digital Evidence- Slack Space, RAM Slack, Drive Slack, Swap File. Chain of Custody, Discredit the Witness (aka Refute the Cyber Forensic Expert), Outline of an Investigation, Obtaining Proper Authorization, Who Are You Going to Call? Secure the Scene of the Alleged E-Crime, Seizing Evidence, Chain of Evidence, Chain-of-Evidence Model, seizing a Computer, Pros and Cons of Pulling the Plug. (Text Book-3: Chapter 11)	

TEXT BOOKS:

1. Albert J. Marcella Jr., Frederic Guillosoy, “Cyber Forensics from Data to Digital Evidence” 2012 by John Wiley & Sons.
2. Niranjan Reddy, “Practical Cyber Forensics. An Incident-based Approach to Forensic Investigations”, A press publications.
3. Albert J. Marcella, Jr., Doug Menendez, “Cyber Forensics A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes”, Second Edition, Auerbach Publications.

REFERENCES:

1. R.K. Jain “Zero To Mastery In Information Security And Cyber Laws” , Vayu Education of India, First Edition: 2022.
2. Gerard Johansen “Digital Forensics and Incident Response-An intelligent way to respond to attacks” 7, Packt Publishing, 2017, ISBN 978-1-78728-868-3
3. Albert J. Marcella “Cyber Forensics Examining Emerging and Hybrid Technologies”, CRC Press ,2022.
4. Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions, Thomas J. Mowbray, John Wiley & Sons, 2013.
5. Cyber Security Essentials James Graham, Ryan Olson, Rick Howard, CRC Press,

SEMESTER	VII					
YEAR	IV					
COURSE CODE	20CY4706					
TITLE OF THE COURSE	EMBEDDED SYSTEM SECURITY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	-	-	C Programming for Problem Solving, Embedded Systems and Proactive Security tools.

COURSE OBJECTIVES:

- Understand the technological uplifts with biometrics compared to traditional securing mechanisms and standards applied to security
- To understand the concepts of different types of biometrics and to enable design of biometric system and its privacy risks
- To familiarize with biometric interface and biometric applications

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Summarize the concept of secure embedded (hardware-software integrated device) system design to mitigate side-channel and covert channel attacks in the domain of IoT and cyber-physical systems.	L2
CO2	Determine security, energy efficiency, risk, reliability, availability, and sustainability metrics for a given embedded system.	L5
CO3	Develop secure firmware and trusted embedded devices or electronic gadgets using Raspberry Pi, Python, and Embedded C programming language.	L3
CO4	Design secure IoT applications and deploy the same on various embedded platforms to analyze the attack surface.	L6
CO5	Create vendor-specific secure embedded systems through research-based internships, project-based activities, and life-long learning.	L6

COURSE CONTENT:	
MODULE 1 Introduction to Embedded System Security	10 Hrs
Fundamentals of embedded systems and their security challenges, Overview of different security threats and attack vectors in embedded systems, Side channel and Covert channel Attacks, Security engineering principles and secure development methodologies, Secure coding practices and vulnerability mitigation techniques in embedded systems.	
MODULE 2 Secure Boot and Firmware Integrity	08 Hrs
Importance of secure boot and firmware integrity in embedded systems, Boot loader design and implementation for secure boot process, Trusted Platform Module (TPM), Hardware-based secure boot	

solutions, Secure firmware update mechanisms and over-the-air (OTA) updates.	
MODULE 3 Embedded System Authentication and Authorization	08 Hrs
Authentication and Access control protocols for embedded systems, Public Key infrastructure (PKI) and Digital Certificates in embedded systems, Role-based access control (RBAC) and Privilege Escalation Prevention Techniques (PEPTs), Secure Communication Protocols (SCPs) and Secure Data Transfer (SDT) in embedded systems	
MODULE 4 Embedded System Security Testing and Evaluation	10 Hrs
Security Testing in Embedded Systems, Threat Modeling and Risk Assessment, Vulnerability Assessment and Penetration Testing, Secure Code Review and Static Analysis, Security Evaluation and Compliance, Incident Response and Handling, Security testing using Python with Raspberry Pi and Embedded C Programming.	
MODULE 5 Embedded System Security Case Studies and Emerging Trends	03 Hrs
Embedded System Security Case Studies, Case Studies in Vulnerabilities and Exploits, Case Studies in Secure Design and Implementation, Emerging Trends in Embedded System Security, Future Directions and Industry Perspectives.	

TEXT BOOK:

1. ``Embedded Systems Security: Practical Methods for Safe and Secure Software and Systems Development'' by David Kleidermacher and Mike Kleidermacher, 2012.
2. ``Practical Embedded Security Building Secure Resource-Constrained Systems'' by Timothy Stapko, Elsevier, 2008..

REFERENCES:

1. ``Machine Learning for Embedded System Security-Springer'' by Basel Halak, Springer, 2022.
2. ``Hardware Security: A Hands-on Learning Approach'' by Mark Tehraipoor and Swarup Bhunia, Morgan Kaufmann Publisher, 2019.

SEMESTER	VII					
YEAR	IV					
COURSE CODE	20CY4707					
TITLE OF THE COURSE	BIOMETRIC SECURITY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	38	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	-	-	-

COURSE OBJECTIVES:

1. Understand the technological uplifts with biometrics compared to traditional securing mechanisms and standards applied to security
2. To understand the concepts of different types of biometrics and to enable design of biometric system and its privacy risks
3. To familiarize with biometric interface and biometric applications

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Make use of biometric fundamental and standards to assess privacy risk.	L3
CO2	Examine finger print, palm print, facial, ear, iris, retina, DNA, Hand vascular geometry, ECG for identifying user.	L4
CO3	Utilize behavioral biometric for human gesture identification.	L3
CO4	Inspect hardware and software based biometric scanner.	L4

COURSE CONTENT:	
MODULE 1	08 Hrs
Biometric Fundamentals and Standards: Biometrics versus traditional techniques, Characteristics, Key biometric processes: Verification -Identification -Biometric matching, Performance measures in biometric systems, Assessing the privacy risks of biometrics - Designing privacy sympathetic biometric systems, Different biometric standards, Application properties.	
MODULE 2	08 Hrs
Physiological Biometrics: Facial scan, Ear scan, Retina scan, Iris scan, Finger scan, Automated fingerprint identification system, Palm print, Hand vascular geometry analysis, DNA, Cognitive Biometrics -ECG.	
MODULE 3	08 Hrs
Behavioral Biometrics: Signature scan, Keystroke scan, Voice scan, Gait recognition, Gesture recognition, Video face, Mapping the body technology.	
MODULE 4	07 Hrs
User interfaces: Biometric interfaces: Human machine interface -BHMI structure, Human side interface: Iris image interface -Hand geometry and fingerprint sensor, Machine side interface: Parallel port -Serial port -Network topologies, Case study: Palm Scanner interface.	

MODULE 5	07 Hrs
Biometric applications: Categorizing biometric applications, Application areas: Criminal and citizen identification –Surveillance -PC/network access -E-commerce and retail/ATM, Costs to deploy, Issues in deployment, Biometrics in medicine, cancellable biometrics.	

TEXT BOOK:

1. Anil K Jain, Patrick Flynn and Arun A Ross, Handbook of Biometrics, Springer, US; 2010
2. John R Vacca, Biometric Technologies and Verification Systems, Elsevier, USA; 2009

REFERENCES:

1. Samir Nanavati, Michael Thieme and Raj Nanavati, Biometrics –Identity Verification in a Networked World, John Wiley and Sons; 2003
2. Paul Reid, Biometrics for Network Security, Pearson Education; 2004
3. ReidM. Bolle et al, Guide to Biometrics, Springer, USA; 2004
4. David D Zhang, Automated Biometrics: Technologies and Systems, Kluwer Academic Publishers; 2000.

SEMESTER	VIII					
YEAR	IV					
COURSE CODE	20CY4803					
TITLE OF THE COURSE	IOT AND BIG DATA SECURITY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	39	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	-	-	Cloud Application Development, Python and Computer Networks.

CO No.	Outcomes	Bloom's Taxonomy Level
CO 1	Apply the concept of conventional cryptographic protocols to solve security-related challenges in the domain of Big Data Networks, Wireless Sensor Networks, IoT, and Cyber-Physical Systems (CPSs).	L3
CO 2	Analyze and evaluate security protocols hosted in the IoT and Big Data platforms, and determine latency, energy efficiency, trust, reliability, and availability metrics for the same system.	L4
CO 3	Develop secure Big Data storing and processing platforms using Hadoop and Spark.	L3
CO 4	Design secure IoT applications and deploy the same on Raspberry Pi, Arduino Uno, ESP-32 board.	L6
CO 5	Create vendor-specific secure IoT and Big Data storage systems through research-based internships, project-based activities, and life-long learning.	L6

COURSE CONTENT:	
MODULE 1 Fundamental of IoT and Big Data Security	8 HRS
Internet of Things, Big Data, IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies with Big Data: Development challenges, Security, Privacy, and Trust issues, Internet of Everything in Big Data, Security Requirements in IoT and Big Data Architecture and Applications.	
MODULE 2 Security Architecture of IoT and Big Data	8 HRS
Big Data Architecture, Big Data Eco System, Architecture Reference Model in IoT and Big Data, CISCO IoT Reference Model and architecture, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views of IoT, Security Architecture in the Internet of Things, Security Requirements in IoT, Blockchain.	
MODULE 3 IoT and M2M Security	7 HRS
Introduction, Definition of M2M, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview, Building an architecture, Main design principles and needed capabilities, security and standards considerations in M2M.	

MODULE 4 Privacy, Security, and Trust in WSN and IoT	9 HRS
Security and privacy issues in WSN, Sensor deployment and node discovery, Big Data aggregation and dissemination, CIA: Confidentiality, Integrity, and Availability, Threats and attacks on IoT systems : unauthorized access, side-channel and covert channel attacks, device authentication and access control, accounting and auditing, digital signature algorithm, intrusion detection in IoT aggregation for the IoT in smart cities, Blockchain in IoT, security issues in Cloud assisted IoT, security protocols in IoT.	
MODULE 5 Secure IoT Application Programming	7 HRS
Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart and secure IoT applications design, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Home Management, Real-time monitoring and control of processes - Deploying smart machines, smart sensors, and smart controllers with proprietary communication and Internet technologies.	

TEXT BOOK:

1. “Internet of Things (A Hands-on-Approach)”, Vijay Madisetti and Arshdeep Bahga, 1st Edition, VPT, 2014.
2. “Hadoop Security_ Protecting Your Big Data Platform”, Ben Spivey, Joey Echeverria - O'Reilly Media, 2015,

REFERENCE BOOKS:

1. Handbook of Big Data and IoT Security, Ali Dehghantanha, Kim-Kwang Raymond Choo, Springer International Publishing 2019

SEMESTER	VIII					
YEAR	IV					
COURSE CODE	20CY4804					
TITLE OF THE COURSE	RISK MANAGEMENT					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	39	-	-	-	39	3

COURSE OBJECTIVES:

1. Understand the fundamental concepts and history of information security and its importance in various organizations.
2. Develop the knowledge and skills necessary to perform common system administration tasks and implement hardware and software controls to maintain information security.
3. Identify and characterize assets, analyze threats and vulnerabilities, and implement encryption controls and identity and access management to ensure data protection.
4. Develop the ability to handle and analyze security incidents, conduct risk assessments, and implement risk management frameworks.
5. Understand the importance of policies, standards, and guidelines in information security and develop the ability to write policies that comply with the required guidelines.

COURSE OBJECTIVES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO 1	Identify the importance of information security in the domain of data storage and processing.	L3
CO 2	Apply basic security model for identification and characterization of IT assets.	L3
CO 3	Identify and Analyze threats and vulnerabilities to measure robust encryption controls and identity and access management strategies.	L4
CO 4	Make use of access control, firewalls, and intrusion detection and prevention strategies to inspect security incidents.	L4
CO 5	Interpret risk assessment and management standards, guidelines, policies to develop a new security model.	L6

COURSE CONTENT:	
MODULE 1	8 HRS
Introduction - Overview, professional utility of information security knowledge, History, Definition of Information Security	
System Administration (part 1) - Overview, what is System administration? System administration and information security, Common administration tasks, System administration utilities.	
System Administration (part 2) – Operating system structure, command line interface, files and directories-moving around file system - <i>pwd</i> , <i>cd</i> , file management-viewing of files, searching of files, Access control and user management-Access control lists, File Ownerships-editing files, Account Management.	

MODULE 2	7 HRS
The Basic Information Security Model – Overview, introduction, Components of Basic Information Security Model, Common Vulnerabilities and threats, Case Study- ILOVEYOU Virus. Asset Identification and Characterization – Overview, Asset overview, determining assets that are important to organization, Asset Types, Asset Characterization, IT Asset Lifecycle and asset identification, System profiling, Asset Ownership and operational responsibilities	
MODULE 3	8 HRS
Threats and Vulnerabilities - Overview, Introduction, Threat Models, threat Agents, Threat Actions, Vulnerabilities. Encryption controls – Encryption Basics, Encryption types, Encryption types details, Encryption in use. Identity and Access Management - identity Management, Access management, Authentication, Single-Sign-on, federation.	
MODULE 4	8 HRS
Hardware and Software Controls - Password Management, Access Control, Firewalls, Intrusion detection/Prevention system, patch management for operating system and applications, End-point Protection. Incident Handling and Analysis - Introduction, Incidents overview, Incident handling, The disaster, Log analysis, Event criticality, General log configuration and Maintenance, Live incident responses, Timelines, other forensic topics.	
MODULE 5	8 HRS
IT Risk Analysis and Risk Management - Introduction, Risk Management as a component of organizational management, Risk Management framework, The NIST 800-39 framework, Risk Assessment, Other Risk Management Frameworks, IT general controls for Sarbanes-Oxley Compliance, Compliance VS. Risk Management, Selling Security. Policies, Standards and Guidelines – Guiding Principles, writing a policy, impact assessment and vetting, policy review, compliance, key policy issues.	

TEXT BOOK:

1. Manish Agarwal, Alex Campoe and Eric Pierce – “Information Security and IT Risk Management”, Wiley Publications, ISBN: 978-1-118-80313-4.

REFERENCE BOOKS:

1. D.P. Sharma, E-retailing Principles and Practice, Himalaya Publications.

SEMESTER	VIII					
YEAR	IV					
COURSE CODE	20CY4805					
TITLE OF THE COURSE	MOBILITY SECURITY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	**	***	***

COURSE OBJECTIVE:

- To provide a detailed, in-depth, state-of-the-art description of vehicle connectivity and cybersecurity with respect to developments, technologies, inventions, and services

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Summarize the need of Cyber Security in Automotive industry.	L2
CO2	Categorize security threats for security-critical vehicular applications and In Vehicular Network (IVN).	L4
CO3	Identify the causes of the threats by analyzing threat incentives, attackers, and threat models.	L3
CO4	Evaluate security risk and vulnerabilities in the domain of Vehicular Ad-hoc Network (VANET) and Internet of Vehicle (IoV).	L5

COURSE CONTENT:	
MODULE 1: Introduction to Automotive Cybersecurity	10 Hrs
Overview, Introduction, Security and Its Impact, Cyber Security in Automotive Technology, The Rising Threat, Vehicular Ransomware Attack, Vehicle Ransomware Attack Scheme, Overview, History of Intelligent and Autonomous Vehicle, Classification of Autonomous Vehicle Based on Driving Levels, State of the Art of Intelligent and Autonomous Vehicle, Battle for Adoption, Market Demand of Automotive Cyber Security, Cyber Security in Intelligent and Autonomous Vehicles	
MODULE 2: In-Vehicle Communication and Cyber Security	8 Hrs
Overview, In-Vehicle System, In-Vehicle Communication, In-Vehicle Network Architecture and Topology, Functional Safety and Cyber security, In-Vehicle Cyber security Issues and Challenges, Cyber Security in In-Vehicle Network (IVN)	
MODULE 3: AUTOSAR Embedded Security in Vehicles	7 Hrs
Overview, Introduction, Threat Models for the Automotive Domain, Applying the Adapted Threat Models to the Automotive Domain, Results	

MODULE 4: Inter-Vehicle Communication and Cyber Security	7 Hrs
Overview, Connected Vehicles, State-of-the-Art Technologies in VANET, Role of Edge Computing and SDN in V2X, Connected Vehicle Cyber Security, Trust Management in V2X Communication, Homomorphic Encryption in VANET, Blockchain in V2X Communication, Safety Standards for IAV	
MODULE 5: Internet of Vehicles, Vehicular Social Networks, and Cyber security.	7 Hrs
Overview, Internet of Vehicles, Machine Learning in Vehicular Networks, Vehicular Social Network.	

TEXT BOOK:

1. Shiho Kim, Rakesh Shrestha - Automotive Cyber Security_ Introduction, Challenges, and Standardization-Springer Singapore_Springer (2020)

REFERENCES:

1. Marko Wolf (auth.) - Security Engineering for Vehicular IT Systems_ Improving the Trustworthiness and Dependability of Automotive IT Applications- Vieweg, Teubner Verlag (2009)

DAYANANDA SAGAR UNIVERSITY

SCHOOL OF ENGINEERING



**SCHEME & SYLLABUS
FOR
BACHELOR OF TECHNOLOGY (B.Tech)
COMPUTER SCIENCE & ENGINEERING
(Cyber Security)
(1st to 8th Semester)**

With effect from 2021-22)



**DAYANANDA SAGAR
UNIVERSITY**

DAYANANDA SAGAR UNIVERSITY

(A State Private University under the Karnataka Act No. 20 of 2013)

Approved By UGC & AICTE, New Delhi.

VISION

To be a centre of excellence in education, research & training, innovation & entrepreneurship and to produce citizens with exceptional leadership qualities to serve national and global needs.

MISSION

To achieve our objectives in an environment that enhances creativity, innovation and scholarly pursuits while adhering to our vision.

VALUES

The Pursuit of Excellence

A commitment to strive continuously to improve ourselves and our systems with the aim of becoming the best in our field.

Fairness

A commitment to objectivity and impartiality, to earn the trust and respect of society.

Leadership

A commitment to lead responsively and creatively in educational and research processes.

Integrity and Transparency

A commitment to be ethical, sincere and transparent in all activities and to treat all individuals with dignity and respect.



SCHOOL OF ENGINEERING

SCHOOL OF ENGINEERING

(Hosur Main Road, Kudlu Gate, Bengaluru-560 068)

Approved By UGC & AICTE, New Delhi.

VISION

To transform life through Excellence and Innovation in Engineering Education and Research with an emphasis on Sustainable, Inclusive Technology and Global needs.

MISSION

To Develop School of Engineering at Dayananda Sagar University, as Center of Excellence by imparting Quality Education and Research to generate highly Competent, Skilled and Humane manpower to face emerging Technological, Scientific and Social challenges with Ethics, Integrity, Credibility and Social concern.

LEADERSHIPS

Sl. No	Name	Position
1	Dr. D. Hemachandra Sagar	Chancellor, DSU
2	Dr. D. Premachandra Sagar	Pro Chancellor, DSU
	Mr. Galiswamy	Secretary
3	Dr. K.N.Balasubramanya Murthy	Vice Chancellor, DSU
4	Prof. Janardhan R	Pro Vice Chancellor, DSU
5	Dr. Amith R Bhatt	Pro Vice Chancellor, DSU
6	Dr. Puttamadappa C	Registrar, DSU
7	Dr. Uday Kumar Reddy	Dean, SOE, DSU
8	Dr. Banga M K	Dean - Research, DSU
9	Dr. B V N Ramakumar	Professor and Chairman Department of Aerospace Engineering
10	Dr. Jayavrinda Vrindavanam	Professor and Chairman, Department of CSE (Artificial Intelligence and Machine Learning)
11	Dr. Girisha G S	Professor and Chairman, Department of Computer Science and Engineering
12	Dr. Kiran B. Malagi	Professor and Chairman, Department of CSE (Cyber Security)
13	Dr. Shaila S G	Professor and Chairman, Department of CSE (Data Science)
14	Dr M Shahina Parveen	Professor and Chairperson Department of Computer Science & Technology
15	Dr. Theodore Chandra S	Professor and Chairman, Department of ECE
16	Dr. Vinayak B Hemadri	Professor and Chairman Department of Mechanical Engineering
17	Dr. Vasanthi Kumari P	Chairperson & Professor Department of Computer Applications

GOVERNING REGULATIONS FOR

BACHELOR OF TECHNOLOGY (B. TECH) – 2021

PREAMBLE

The School of Engineering under Dayananda Sagar University (DSU) provides Science & Technology based education leading to the development of high caliber engineers suitable for Industry and Scientific Organization. The curriculum focuses on knowledge-based course work integrated with skill development as a part of training. It equally helps in inculcating the scientific temper for the lifelong processes of learning. At the Under Graduate level, a candidate goes through the foundation courses in Science, Humanities & Engineering. Each department ensures that the courses cover both the core & electives courses, as required. Provision for Institutional elective help the candidates to acquire interdisciplinary knowledge base or specialize significantly in an area outside the parent discipline

DEFINITIONS OF KEY WORDS

- (i) **Academic Year:** Two consecutive odd, even semesters and a summer term for make up if required.
- (ii) **Course:** Usually referred to as a subject, a course may consist of any of Lecture/Tutorials/Practical /Seminar/Mini project/Project work.
- (iii) **Credit:** A unit by which the course work is measured. One credit is equivalent to one hour of lecture or one hour of tutorial or two hours of laboratory/practical/ workshop practice per week.
- (iv) **Credit Point:** It is the product of grade point and number of credits per course.
- (v) **Cumulative Grade Point Average (CGPA):** It is the measure of overall cumulative performance over all semesters. It is expressed upto two decimal places.
- (vi) **First Attempt:** If a candidate has completed all formalities of academic requirement in a term and become eligible to attend the examinations and attend all the end semester examinations, such attempt shall be considered as first attempt.
- (vii) **Grade Point:** It is a numerical weight allotted to each letter grade on a 10-point scale.
- (viii) **Letter Grade:** It is an index of the performance in a said course. Grades are denoted by alphabets.
- (ix) **Programme:** An educational activity leading to award a Degree or Certificate.
- (x) **Semester Grade Point Average:** It is a measure of performance during a semester. It shall be expressed up to two decimal places.
- (xi) **Transcript:** Based on the grades earned, a grade certificate shall be issued after every semester to the candidate registered
- (xii) **Failure:** It is the case of appearing for Semester End Examinations, but fails to obtain minimum passing marks in Semester End Examinations.

- (xiii) **Detain:** It is the case of not satisfying the eligibility criteria w.r.t Attendance /Internal Assessment in each course to appear for Semester End Examination.
- (xiv) **Audit Course:** A course to be taken by the student without benefit of a grade or a credit.
- (xv) **Not Fit For The Program (NFFTP):** It is the failure of satisfying the criteria laid down by regulations to continue the program of study, which leads to the termination from the University

RULES AND REGULATIONS

- UG 1** All B.Tech programmes offered by the University shall be governed by the DSU B.Tech Rules and Regulations – 2021.
- UG 2** The B. Tech. rules and regulations shall be applicable to any new discipline(s) that may be introduced in future.
- UG 3** A candidate shall become eligible for the award of the B.Tech. Degree after fulfilling all the academic requirements as prescribed by the B.Tech. Rules and Regulations of DSU.

UG 4. ELIGIBILITY FOR ADMISSION

- UG 4.1.** Admission to First Year Bachelor of Technology shall be open to candidates who have passed the second year Pre-University or XII standard or equivalent examination recognized by the University.
- UG 4.2.** The candidate shall have studied and passed English as one of the courses and secured not less than forty five percent (45%) marks in aggregate with Physics and Mathematics as compulsory courses, along with any one of the following courses, namely, Chemistry, Bio- Technology, Computer Science, Biology and Electronics. Eligibility shall be 40% in optional courses in case of candidates belonging to SC/ST and OBC candidates from Karnataka.
- UG 4.3.** Admission to II year /III Semester Bachelor of Technology under Lateral entry shall be open to the candidates who have passed diploma or equivalent
- UG 4.4.** Admission to II year /III Semester Bachelor of Technology under Lateral entry shall be open to the candidates who have passed diploma or equivalent
- UG 4.5.** Diploma candidates seeking admission under Lateral entry shall take up bridge courses as prescribed in the Scheme of Teaching.
- UG 4.6.** Admission to II year /III Semester Bachelor of Technology shall be open to candidates who have passed B. Sc. degree from a recognized University or equivalent as recognized by the University and secure not less than 45% marks in aggregate (including all semesters). Eligibility shall be 40% in case of candidates belonging to SC/ST and OBC candidates from Karnataka.
- UG 4.7.** B.Sc. Graduates seeking admission under Lateral entry shall take up bridge Courses as prescribed in the Scheme of Teaching.

UG 5. ACADEMIC SESSION

- UG 5.1.** Each academic session is divided into two semesters of approximately sixteen Weeks duration and a summer term: an odd semester (August -December), an even semester (January - May) and summer term (Make-up term) June-July.
- UG 5.2.** The approved schedule of academic activities for a session, inclusive of dates for registration, mid-semester and end-semester examinations, vacation breaks, shall be laid down in the Academic Calendar for the session.

UG 6. CHANGE OF BRANCH

- UG 6.1.** Normally a candidate admitted to a particular branch of the undergraduate programme will continue studying in that branch till completion.
- UG 6.2.** However, in special cases, the University may permit a candidate to change from one branch of studies to another after the first two semesters. Such changes will be permitted, in accordance with the provisions laid down hereinafter.
- UG 6.3.** Only those candidates will be considered eligible for change of branch after the second semester, who have completed all the credits required in the first two semesters of their studies in their first attempt, without having to pass any course requirement in the summer term examination.
- UG 6.4.** Applications for a change of branch must be made by intending eligible candidates in the prescribed form. The academic section will call for applications at the end of second semester of each academic year and the completed forms must be submitted by the last date specified in the notification.
- UG 6.5.** Candidates may enlist their choices of branch, in order of preference, to which they wish to change over. It will not be permissible to alter the choices after the application has been submitted.
- UG 6.6.** Change of branch shall be made strictly in the order of merit of the applicants. For this purpose, the CGPA obtained at the end of the second semester shall be considered. In case of a tie, SGPA of second semester followed by SGPA of first semester shall decide the tie.
- UG 6.7.** The applicants may be allowed a change in branch, strictly in order of merit, course to the limitation that the strength of a branch should not fall below the existing strength by more than ten percent and should not go above the sanctioned strength by more than ten percent. The minimum class strength of 75% should be maintained, while considering the change of branch.
- UG 6.8.** All changes of branch made in accordance with the above rules shall be effective from the third semester of the applicants concerned. No change of branch shall be permitted after this.

UG 7. COURSE STRUCTURE

- UG 7.1.** Medium of instruction, examination and project reports shall be in English except in case of any language audit courses.
- UG 7.2.** Teaching of the courses shall be reckoned in credits: Credits are assigned to the Courses based on the following general pattern:
- (a) One credit for each lecture period.
 - (b) One credit for each tutorial period.
 - (c) One credit per two hours for each Laboratory or Practical or work shop session.
 - (d) Credits for seminar, mini project, project as indicated in the scheme/curriculum of teaching.
- UG 7.3.** In order to qualify for a B. Tech. degree of the University, a candidate is required to complete the credit requirement as prescribed in the scheme/curriculum for a particular programme.
- UG 7.4.** The program of a study consists of the following components:
- (i) Humanities and Social Sciences including Management courses
 - (ii) Basic Science courses
 - (iii) Engineering Science courses
 - (iv) Professional core courses
 - (v) Open Electives
 - (vi) Project work, seminar and internship
 - (vii) Mandatory/Audit Courses
- UG 7.5.** Every B. Tech. Programme shall have a curriculum and syllabi for the courses approved by the Board of Governors. Board of Studies will discuss and recommend the syllabi of all the under graduate courses offered by the department from time to time before sending the same to the Academic Council. Academic Council will consider the proposals from the Board of Studies and make recommendations to the Board of Management and Board of Governors for consideration and approval. For all approved courses, the copyright shall be with DSU.
- UG 7.6.** Every B. Tech. Programme shall have a curriculum and syllabi for the courses approved by the Board of Governors. Board of Studies will discuss and recommend the syllabi of all the under graduate courses offered by the department from time to time before sending the same to the Academic Council. Academic Council will consider the proposals from the Board of Studies and make recommendations to the Board of Management and Board of Governors for consideration and approval. For all approved courses, the copyright shall be with DSU.

UG 8. REGISTRATION

- UG 8.1.** Every candidate is required to register for approved courses through the assigned Faculty Advisor at the end of previous semester or first week of the current semester, as notified by the Academic Calendar.
- UG 8.2.** The Dean may cancel the registration of one or more courses if they are found to violate some rules or if there are restrictions imposed due to disciplinary reasons.

- UG 8.3.** The student is permitted to drop a course/s from the registered courses, within 4 weeks after the start of the Semester/Year as notified in the academic calendar, with the permission of Faculty Advisor and Chairperson / Dean / Principal of the respective School/College and no mention will be made in the grade card for dropped courses.
- UG 8.4.** The student is permitted to withdraw course/s from the registered courses, within 4 weeks before the start of the Semester/Year End Examinations as notified in the academic calendar, with the permission of Faculty Advisor and Chairperson / Dean / Principal of the respective School / College and Grade “W” will be awarded for course/s that were withdrawn.
- UG 8.5.** For the courses with “W” grade, the students should re-register subsequently when offered, either in MOOCS or in-class or summer term and fulfil the passing criteria to secure a grade in that course for change from “W” grade.
- UG 8.6.** Only those candidates shall be permitted to register who have:
- (a) The academic eligibility to move to higher semesters (UG 9 & UG 11)
 - (b) Cleared all University, Hostel and Library dues and fines (if any) of the previous semesters,
 - (c) Paid all required advance payments of University and Hostel dues for the current semester,
 - (d) Not been debarred from registering on any specific ground.
 - (e) A minimum CGPA of 4 in the previous semesters

UG 9. EXAMINATION: ASSESSMENT CRITERIA & ELIGIBILITY FOR PROGRESSION

Every student shall be assessed for eligibility to higher semester through Continuous Internal Assessment (CIA) and Semester End Examination (SEE) as prescribed.

- UG 9.1.** The Continuous Internal Assessment (CIA), shall normally be conducted by the assessment components spread through the running semester; the components of CIA may be tests, mid-term exam, quiz, term paper, simulation-based problem solving, open-book test, solving open-end problems, mini-projects, seminars, viva-voce, awarding marks for attendance and such activities that enhance original thinking of students. The Course instructor shall announce the detailed methodology for conducting the various components of CIA together specifying component-wise weightages right in the commencement of each semester.
- UG 9.2.** The Semester End Examinations (SEE), shall be conducted at the end of each semester. The SEE components may be a closed or open book examination, project demo, viva-voce, and/or a portfolio presentation.
- UG 9.3.** A and SEE shall respectively have 60:40 percent weightage. The Vice-Chancellor, on the recommendations of the Dean of Faculty and Department Chair, in exceptional cases, may approve the variation in this weightage ratio.

- UG 9.4.** The performance of a student with respect to a course in a semester shall be the combined score of marks/points, he/she secures in CIA and SEE, put together. A minimum of securing 40% marks, combining both the CIA with SEE marks secured with respect to a course, shall entail the student a PASS in the course. The Vice-Chancellor, in such cases where the entire class has fared poorly in the course, upon receiving a representation by the students / department, and based on the recommendations of the committee constituted for the purpose, may review the criterion of 40%.

UG 9.5. ATTENDANCE ELIGIBILITY

- UG 9.5.1.** Candidates are required to attend all the classes (Lectures, Tutorials, Practical, Workshop Practice, etc.) for which they have been registered.
- UG 9.5.2.** The candidate shall not be allowed to appear for the end semester examination if his/her attendance falls below 85% in each course and shall be awarded a “NE” grade in that course.
- UG 9.5.3.** A provision for condonation of 10% of the attendance by the Vice-Chancellor on the specific recommendation of the chairman of the department and Dean, showing reasonable cause such as:
- (a) Any medical emergencies/ illness where the candidate requires rest for the specified number of days certified by a Government Doctor only /any death in the family (near and dear ones).
 - (b) If the student represents the University in Sports/ Cultural Activities/Extra-curricular activities/Co-curricular activities.
 - (c) If a student presents a Paper in National/ International Conferences or attends any recognized Workshops/Seminars.
- UG 9.5.4.** If the period of leave is for a short duration (less than two weeks), prior application for leave shall have to be submitted to the Chairman of the Department concerned stating fully the reasons for the leave requested for along with supporting document(s). Such leave will be granted by the Chairman of the Department. However, the student shall comply with 9.5.2 and 9.5.3. of regulations.
- UG 9.5.5.** If the period of absence is likely to exceed two weeks, a prior application for grant of leave will have to be submitted through the Chairman of the Department to the Dean with supporting documents in each case. The decision to grant leave shall be taken by the Dean on the recommendation of the Chairman of the Department. However, the student shall comply with 9.5.2 and 9.5.3. of regulations.
- UG 9.5.6.** It shall be the responsibility of the candidate to intimate the concerned course instructor(s) regarding his/her absence before availing the leave.

UG 9.6. CONTINUOUS INTERNAL ASSESSMENT

- UG 9.6.1.** Candidate shall participate in all components of Continuous Internal Assessment (CIA) to become eligible to take up the Semester End Examination or else ‘NE’ grade shall be awarded. However, the Vice-Chancellor, under exceptional circumstances on the recommendations of Dean of Faculty and Department Chair, may exempt a student from participation in CIA component/s and permit taking up SEE.

UG 9.6.2. There shall be no marks improvement of Continuous Internal Assessment; however, the withdrawal and re-registering of the course shall be permitted.

UG 9.6.3. Continuous Evaluation consists of:

UG 9.6.3.1. Under normal circumstances for theory courses, total CIA weightage shall be a total of 60%, put together all components with varying weightages; Under exceptional circumstances with the approval of the Vice-Chancellor on the recommendation of Dean of the School, the weightage of CIA may be lower/higher than 60%.
The components of CIA may be tests, mid-term exam, quiz, term paper, simulation-based problem solving, open-book test, solving open-end problems, mini-projects, seminars, viva-voce, awarding marks for attendance and such activities that enhance original thinking of students.

UG 9.6.3.2. Under normal circumstances for the practical courses (laboratory, workshops, and any such hands-on activity), total CIA weightage shall be a total of 60%, put together all components with varying weightages; Under exceptional circumstances with the approval of the Vice-Chancellor on the recommendation of Dean of the School, the weightage of CIA may be lower/higher than 60%.
CIA may have components such as conduction of an experiment, record writing, viva-voce, tests, simulation, mid-term exam, quiz, demo, term paper, mini-projects, seminars, marks for attendance and activities which enhances original thinking of students.

UG 10. GRADING

UG 10.1. There shall be continuous assessment of a candidate's performance throughout the semester and grades shall be awarded by the concerned course instructor and/or the appropriate committee appointed for this purpose on the following basis.

UG 10.2. The grading will normally be based on CIA and SEE.

UG 10.3. Practical Courses/ Work Shop Practice: The evaluation will be based on instructor's continuous internal assessment, a test and end semester examination.

UG 10.4. The weightage assigned to different components of continuous internal assessment will be announced by the concerned instructor(s) in the beginning of the semester

UG 10.5. The results of performance of the candidates in the Continuous Internal assessment Test shall be announced by the instructors.

UG 10.6. In case of seminar, evaluation will be as determined by the grade awarding Committee (as per the Program scheme).

UG 10.7. Mini project /projects will be based on Continuous evaluation by Guide(s) and Semester End Examination (as per the Program scheme)

UG 10.8. The results of performance of the candidates shall be announced by the Controller of Examinations.

UG 10.9. METHOD OF AWARDING LETTER GRADES

UG 10.9.1. Relationships among Grades, Grade points and % of marks are listed in Table1.

UG 10.10. DESCRIPTION OF GRADES

UG 10.10.1. Table 1 shows the relationships among the grades, grade points and percentage of marks.

Table 1: Grade, Points, Grade Description and % of marks

GRADE	GRADE POINTS	DESCRIPTION	% MARKS
O	10	Outstanding	90 to 100
A+	9	Excellent	80 to 89
A	8	Very Good	70 to 79
B+	7	Good	60 to 69
B	6	Above Average	55 to 59
C	5	Average	50 to 54
P	4	Pass	40 to 49
F	0	Fail	< 40
AP	-	Audit Pass	-
AF	-	Audit Fail	-
IC	-	In Complete	-
NE	-	Not Eligible	-
W	-	Withdrawn	-

UG 10.10.2. A student will have to ensure a minimum CGPA of 4, to become eligible for the award of the degree.

UG 10.10.3. A candidate shall have to repeat all courses in which he/she obtains 'F' Grades until a passing grade is obtained.

UG 10.10.4. An IC grade denotes incomplete performance in any Theory and/or Practical Assessment. It may be awarded in case of absence on medical grounds or other special circumstances for SEE. Requests for IC grade should be made at the earliest but not later than the last day of SEE.

UG 10.10.5. The student can appear for the course/s with IC grade, when exams are conducted subsequently by the University for those Courses.

UG10.11. EVALUATION OF PERFORMANCE

UG10.11.1. The performance of a candidate shall be evaluated in terms of the Semester Grade Point Average (SGPA) which is the Grade Point Average for a semester, Cumulative Grade Point Average (CGPA) which is the Grade Point Average for all the completed semesters.

UG 10.11.2. The Earned Credits (EC) are defined as the sum of course credits for courses in which candidates have been awarded grades between O to P. (Table 1)

UG 10.11.3. Points earned in a semester = (Course credits X Grade point) for Grades O - P

- UG 10.11.4.** The SGPA is calculated on the basis of grades obtained in all courses, except audit courses and courses in which F grade or below, registered for in the particular semester.

$$\text{SGPA} = \frac{\text{Points secured in the semester (O – P Grades)}}{\text{Credits registered in the semester, excluding audit}}$$

- UG 10.11.5.** The CGPA is calculated on the basis of all pass grades, except audit courses.

$$\text{CGPA} = \frac{\text{Cumulative points secured in all the passed courses (O – P Grades)}}{\text{Cumulative registered credits, excluding audit}}$$

UG 10.12. WITHHOLDING OF GRADES

- UG 10.12.1.** Grades shall be withheld when the candidate has not paid his/her dues or when there is a disciplinary action pending against him/her

UG 10.13. CONVERSION OF CGPA INTO PERCENTAGE

- UG 10.13.1.** Conversion formula for the conversion of CGPA into percentage is
Percentage of Marks Scored = (CGPA Earned – 0.75) × 10

UG 11. PROMOTION CRITERIA AND ENROLLMENTS TO HIGHER SEMESTERS

- UG 11.1.** During registration to the higher semesters, the following criteria/conditions for promotion, shall be satisfied.
- UG 11.1.1.** A student shall 'Not Eligible' (NE) for writing SEE if he/she does not comply to the minimum prescribed attendance in any course that carry a credit.
Students shall register afresh for such course/s, whenever offered next, to meet the attendance requirements and secure a pass grade, subsequently in that course/s.
- UG 11.1.2.** In a semester (ODD / EVEN), a student is deemed to be Not Eligible (NE) if he/she does not satisfy minimum attendance requirements criteria in a credit course.
If this course happens to be a prerequisite to a connected course in the subsequent semester, then the student shall not be permitted to register for that connected course until he / she secures pass grade in the prerequisite course by complying to the minimum attendance requirement when the prerequisite course is offered next (either during summer term or regular semester).
- UG 11.1.3.** A student shall be permitted to register for FOUR credited courses or to a total of 16 credits whichever is higher along with pending audit courses, if any, during a summer term by paying the prescribed course registration fee per credit notified by the university from time to time.
- UG 11.1.4.** A student shall be permitted to register for FOUR credited courses or to a total of 16 credits whichever is higher along with pending audit courses, if any, during a summer term by paying the prescribed course registration fee per credit notified by the university from time to time.

- UG 11.1.5.** Candidates who secure 'F' grade in any courses in regular semester or summer term shall secure PASS grade in such course/s either in the subsequent summer term examination or shall repeat in the next appropriate semester whenever it is/they are offered, i.e. odd semester courses during odd semesters examinations and even semester courses during even semester examinations, respectively.
- UG 11.2.** In case of failure in Practical/Workshop practice course the candidate in any semester may clear it in the subsequent summer term examination or semester examination.
- UG 11.3.** In case a candidate fails in Practical/ Workshop practice he/she shall register when it is offered next either in the summer term or subsequent semester, as the case may be.
- UG 11.4.** Candidates may add and drop course(s) with the concurrence of the Faculty Advisor, and under intimation to the concerned course instructors and the academic section provided this is done within the date mentioned in the Academic Calendar.

UG 11.5. SUMMER TERM & MAKEUP EXAMINATIONS

- UG 11.5.1.** A summer term program may be offered by a department and with the approval of the Dean.
- UG 11.5.2.** Summer term courses will be announced by the Academic Affairs Office at the end of the even semester and before the commencement of the end semester examination. A candidate will have to register for summer term courses by paying the prescribed fees within the stipulated time in the announcement.
- UG 11.5.3.** The total number of contact hours in any summer term program will be the same as in the regular semester course. The assessment procedure in a summer term course will also be similar to the procedure for a regular semester course.
- UG 11.5.4.** Candidates granted semester drop by the Board of Governors, on medical ground, shall be allowed to clear the concerned courses in summer term course and subject to conditions as stated under clauses 11.5.1, 11.5.2.and 11.5.3.
- UG 11.5.5.** The Candidates with “NE” grade shall register for summer term by paying the prescribed fees.
- UG 11.5.6.** Candidates who are awarded ‘F’ grades in regular semester examinations have the option to register for the concerned courses in summer term examinations to the conditions as stated under clauses 11.5.1, 11.5.2.and 11.5.3above, or they can re-sit for subsequent semester/summer term examination only.
- UG 11.5.7.** Provision for make-up exam shall be available to the students who might have missed to attend the Semester / Annual end examinations of one or more courses for exceptional cases arising out of natural calamities / medical emergencies / death of a member in the family, with the permission of Faculty Advisor and Chairperson / Dean / Principal of the respective School/College. All such cases have to be exclusively to be approved by the Vice-Chancellor and ratified in the Academic Council / BOM / BOG. All such courses approved for makeup examinations are awarded a transitory grade “IC” (incomplete grade)
- UG 11.5.8.** The makeup examinations shall be held as notified in the academic calendar or through an exclusive notification duly approved by the Vice-chancellor.

UG 12. DURATION OF THE PROGRAMME

- UG 12.1.** Normally a candidate should complete all the requirements for under graduate programme in four years. However, academically weaker candidates who do not fulfil some of the requirements in their first attempt and have to repeat them in subsequent semesters may be permitted up to eight consecutive years (from the first year of registration) to complete all the requirements of the degree.
- UG 12.2.** Normally a candidate under lateral entry should complete all the requirements for undergraduate programme in three years. However, academically weaker candidates who do not fulfil some of the requirements in their first attempt and have to repeat them in subsequent semesters may be permitted up to six consecutive years (from the second year registration) to complete all the requirements of the degree.

UG 13. TERMINATION FROM THE PROGRAMME

- UG 13.1.** A candidate may also be compelled to leave the Program in the University on disciplinary grounds.
- UG 13.2.** On having been found to have produced false documents or having made false declaration at the time of seeking admission.
- UG 13.3.** On having been found to be pursuing regular studies and/or correspondence courses (leading to degree or diploma) in any other college, university or an educational institution simultaneously.
- UG 13.4.** On having been found to be concurrently employed and performing duty or carrying out business in contravention to academic schedules of the University and without seeking approval from the University.
- UG 13.5.** If a student fails to earn a pass grade even after 4 attempts such a student is terminated from the university on the grounds of NOT FIT FOR THE PROGRAM (NFFTP).
- UG 13.6.** If a student secures a CGPA less than 4.0, 4 times during entire duration of the program of study, such a student is terminated from the university on the grounds of NOT FIT FOR THE PROGRAM (NFFTP).
- UG 13.7.** However, if the student appeals for reconsideration of termination from the university under NFFTP rule by providing the genuine reasons to the Vice-Chancellor through the Dean of Faculty, then the Vice-Chancellor may consider constituting a committee for the purpose of review and provide 2 additional attempts on the recommendations of the committee.

UG 14. TEMPORARY WITHDRAWAL FROM THE UNIVERSITY

- UG 14.1.1.** He/she applies to the University within at least 6 weeks of the commencement of the semester or from the date he last attended his/her classes whichever is later, stating fully the reasons for such withdrawal together with supporting documents and endorsement of his/her guardian.

- UG 14.1.2.** The University is satisfied that, counting the period of withdrawal, the candidate is likely to complete his/her requirements of the B. Tech. Degree within the time limits specified in Clause 12.1 or 12.2 above.
- UG 14.1.3.** There are no outstanding dues or demands in the University/Hostel/Department/Library.
- UG 14.1.4.** Normally, a candidate will be permitted only one such temporary withdrawal during his/her tenure as a candidate of the undergraduate programme.

UG 15. TRANSFER OF CANDIDATES

- UG 15.1.** Transfer of candidates from higher education institutions outside University shall be considered at the beginning of Third and Fifth Semesters but subject to confirmation of equivalence.
- UG 15.2.** The candidates shall apply for equivalence with the No-objection for admission to DSU from the University where they are perusing their study.
- UG 15.3.** The candidates must have passed in all courses in the earlier semesters prior to transfer.

UG 16. ELIGIBILITY FOR THE AWARD OF B. TECH. DEGREE

A candidate shall be declared to be eligible for the award of B. Tech. degree if he/she has:

- UG 16.1.** Completed all the credit requirements for the degree with a CGPA 4.0 or higher at the end of the programme.
- UG 16.2.** Satisfactorily completed all the mandatory audit courses.
- UG 16.3.** No dues to the University, Department, Hostels.
- UG 16.4.** No disciplinary action pending against him/her.

UG 17. AWARD OF DEGREE

The award of B. Tech. degree must be recommended by the Academic Council and approved by the Board of Management and Board of Governors of the DSU.

UG 18. CONDUCT AND DISCIPLINE

- UG 18.1.** Candidates shall conduct themselves within and outside the precincts of the University in a manner befitting the candidates of an institution of national importance. The University has a separate ordinance Code and Conduct of Candidates which is applicable to all candidates of the University.

UG 19. REPEAL AND SAVINGS

Notwithstanding anything contained in these Regulations, the provisions of any guidelines, orders, rules or regulations in force at the University shall be inapplicable to the extent of their inconsistency with these Regulations. The Academic Council,

Board of Management and Board of Governors of Dayananda Sagar University may revise, amend or change the regulations from time to time.

UG 20. INTERPRETATION

Any questions as to the interpretation of these Regulations shall be decided by the University, whose decision shall be final. The University shall have the powers to issue clarifications to remove any doubt, difficulty or anomaly which may arise during the implementation of the provisions of these regulations

Department of Computer Science and Engineering (Cyber Security)

VISION

Ignite and nurture young learners to provide a sustainable, humane, and research-centric educational platform in the domain of cybersecurity for building a robust, resilient, and attack-free digital universe.

MISSION

1. Provide committed and competent faculty and educational infrastructure to impart the theoretical and practical foundation of cybersecurity in the emanating youth.
2. Establish MoUs and Centre of Excellences (CoEs) with Information Technology Sector to provide industry-ready cybersecurity graduates with research instinct imbibed for the sustainable development of young learners
3. Build collaborative and teamwork-centric project-oriented learning environment, to address global challenges whilst preserving human and ethical values.
4. Encourage young minds to educate society to restore nationwide human safety and security in digital world.

FACULTY LIST

Sl No	Name of the Faculty	Designation
1	Dr. Kiran B. Malagi	Associate Professor and Chairperson CSE (Cyber Security)
2	Dr. Durbadal Chattaraj	Associate Professor
3	Naveen Kulkarni	Assistant Professor
4	Sharanabasappa Tadkal	Assistant Professor
5	Ranjima P	Assistant Professor

PROGRAM OUTCOMES (PO'S):

A graduate of Computer Science and Engineering (Cyber Security) program will demonstrate:

- **PO1. Engineering knowledge:** Apply the information of arithmetic, science, engineering fundamentals, associate degree and an engineering specialization to the answer of advanced engineering issues.
- **PO2. Problem analysis:** Identify, formulate, review analysis literature, and analyse complicated engineering issues reaching corroborated conclusions mistreatment initial principles of arithmetic, natural sciences, and engineering sciences.
- **PO3. Design/development of solutions:** Design solutions for advanced engineering issues and style system elements or processes that meet the required wants with applicable thought for the general public health and safety, and therefore the cultural, societal, and environmental concerns.
- **PO4. Conduct investigations of complex problems:** Use analysis-based information and research ways as well as style of experiments, analysis and interpretation of information, and synthesis of the knowledge to supply valid conclusions.
- **PO5. Modern tool usage:** Create, select, and apply acceptable techniques, resources, associate degree fashionable engineering and IT tools as well as prediction and modelling to advanced engineering activities with an understanding of the restrictions.
- **PO6. The engineer and society:** Apply reasoning familiar by the discourse information to assess social group, health, safety, legal and cultural problems and therefore the resulting responsibilities relevant to the skilled engineering apply.
- **PO7. Environment and sustainability:** Understand the impact of the skilled engineering solutions in social and environmental contexts, and demonstrate the information of, and want for property development.

- **PO8. Ethics:** Apply moral principles and decide to skilled ethics and responsibilities and norms of the engineering follow.
- **PO9. Individual and team work:** Function effectively as a private, and as a member or leader in numerous groups, and in multidisciplinary settings.
- **PO10. Communication:** Communicate effectively on advanced engineering activities with the engineering community and with society at giant, such as, having the ability to grasp and write effective reports and style documentation, build effective shows, and provides and receive clear directions.
- **PO11. Project management and finance:** Demonstrate information and understanding of the engineering and management principles and apply these to one's own work, as a member AND leader in an passing team, to manage comes and in multidisciplinary environments.
- **PO12. Life-long learning:** Recognize the necessity for, and have the preparation and talent to interact in freelance and life-long learning within the broadest context of technological amendment.

PSOs

1. Ability to understand, analyse and develop computer programs in the areas related to networking, cryptography, web development and database management by adhering software development life cycle.
2. Graduate students will be able to develop data, resource, and asset protection strategies for organizations, processes, peoples, and individuals through Cybersecurity-centric skills.

SCHEME - B.TECH — 2021-22 ONWARDS
I SEM - CHEMISTRY CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	101-105 & 121-123	21EN1101	LINEAR ALGEBRA AND CALCULUS	CR	3	1	-	-	4	*	***
2	101-105 & 121-123	21EN1102	ENGINEERING CHEMISTRY	CR	3	-	2	-	4	*	***
3	101-105 & 121-123	21EN1103	BASIC ELECTRICAL ENGINEERING	CR	3	-	-	-	3	*	***
4	101-105 & 121-123	21EN1104	ELEMENTS OF MECHANICAL ENGINEERING	CR	2	-	2	-	3	*	***
5	101-105 & 121-123	21EN1105	FUNDAMENTALS OF PROGRAMMING	CR	3	-	4	-	5	*	***
6	101-105 & 121-123	21EN1106	ENVIRONMENTAL SCIENCES	CR	2	-	-	-	2	*	***
7	101-105 & 121-123	21EN1107	KANNADA KALI/MANASU	CR	1	-	-	-	1	*	***
					17	01	08	--	22		

CR — Credit, AU — Audit, L — Lecture, T — Tutorial, P — Practical, S/P — Seminar/Project, C — No. of Credits

SCHEME - B.TECH — 2021-22 ONWARDS
I SEM - PHYSICS CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	101-105 & 121-123	21EN1101	LINEAR ALGEBRA AND CALCULUS	CR	3	1	–	–	4	*	***
2	101-105 & 121-123	21EN1108	ENGINEERING PHYSICS	CR	3	–	2	–	4	*	***
3	101-105 & 121-123	21EN1109	BASIC ELECTRONICS	CR	3	–	2	–	4	*	***
4	101-105 & 121-123	21EN1110	ENGINEERING GRAPHICS AND DESIGN	CR	1	–	4	–	3	*	***
5	101-105 & 121-123	21EN1111	ENGINEERING MECHANICS	CR	2	–	–	–	2	*	***
6	101-105 & 121-123	21EN1112	BIOLOGICAL SCIENCES	CR	2	–	–	–	2	*	***
7	101-105 & 121-123	21EN1113	TECHNICAL COMMUNICATION	CR	2	–	–	–	2	*	***
8	101-105 & 121-123	21EN1114	DESIGN THINKING	CR	–	–	2	–	1	*	***
					16	01	10	--	22		
9	101-105 & 121-123	21AU0004	CONSTITUTION OF INDIA AND ETHICS	AU	02	--	--	--	--	*	***

CR — Credit, AU — Audit, L — Lecture, T — Tutorial, P — Practical, S/P — Seminar/Project, C — No. of Credits

SCHEME - B.TECH — 2021-22 ONWARDS
II SEM - CHEMISTRY CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	101-105 & 121-123	21EN1201	TRANSFORMS AND DIFFERENTIAL EQUATIONS	CR	3	1	-	-	4	*	***
2	101-105 & 121-123	21EN1102	ENGINEERING CHEMISTRY	CR	3	-	2	-	4	*	***
3	101-105 & 121-123	21EN1103	BASIC ELECTRICAL ENGINEERING	CR	3	-	-	-	3	*	***
4	101-105 & 121-123	21EN1104	ELEMENTS OF MECHANICAL ENGINEERING	CR	2	-	2	-	3	*	***
5	101-105 & 121-123	21EN1105	FUNDAMENTALS OF PROGRAMMING	CR	3	-	4	-	5	*	***
6	101-105 & 121-123	21EN1106	ENVIRONMENTAL SCIENCES	CR	2	-	-	-	2	*	***
7	101-105 & 121-123	21EN1107	KANNADA KALI/MANASU	CR	1	-	-	-	1	*	***
					17	01	08	--	22		

CR — Credit, AU — Audit, L — Lecture, T — Tutorial, P — Practical, S/P — Seminar/Project, C — No. of Credits

SCHEME – B.TECH — 2021-22 ONWARDS

II SEM - PHYSICS CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/ P	C	SEM	COURSE CODE
1	101-105 & 121-123	21EN1201	TRANSFORMS AND DIFFERENTIAL EQUATIONS	CR	3	1	–	–	4	*	***
2	101-105 & 121-123	21EN1108	ENGINEERING PHYSICS	CR	3	–	2	–	4	*	***
3	101-105 & 121-123	21EN1109	BASIC ELECTRONICS	CR	3	–	2	–	4	*	***
4	101-105 & 121-123	21EN1110	ENGINEERING GRAPHICS AND DESIGN	CR	1	–	4	–	3	*	***
5	101-105 & 121-123	21EN1111	ENGINEERING MECHANICS	CR	2	–	–	–	2	*	***
6	101-105 & 121-123	21EN1112	BIOLOGICAL SCIENCES	CR	2	–	–	–	2	*	***
7	101-105 & 121-123	21EN1113	TECHNICAL COMMUNICATION	CR	2	–	–	–	2	*	***
8	101-105 & 121-123	21EN1114	DESIGN THINKING	CR	–	–	2	–	1	*	***
					16	01	10	--	22		
9	101-105 & 121-123	21AU0004	CONSTITUTION OF INDIA AND ETHICS	AU	02	--	--	--	--	*	***

CR - Credit, AU - Audit, L - Lecture, T - Tutorial, P - Practical, S/P - Seminar/Project, C - No. of Credits

SCHEME - B.TECH – 2021-22 ONWARDS
III SEM - COMPUTER SCIENCE & ENGINEERING (CYBER SECURITY)

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SE M	COURSE CODE
1	123	21CS2301	DISCRETE MATHEMATICAL STRUCTURES	CR	3	-	-	-	3	*	***
2	123	21CS2302	DATA STRUCTURES	CR	3	-	-	-	3	*	***
3	123	21CS2303	DIGITAL ELECTRONICS & LOGIC DESIGN	CR	3	-	-	-	3	*	***
4	123	21CS2304	FULL STACK DEVELOPMENT	CR	2	-	2	-	3	*	***
5	123	21CS2305	COMPUTATIONAL THINKING WITH PYTHON	CR	2	-	2	-	3	*	***
6	123	21CY2301	COMPUTER NETWORKS	CR	3	-	-	-	3	*	***
7	123	21CS2307	DATA STRUCTURES LAB	CR	-	-	2	-	1	*	***
8	123	21CS2308	DIGITAL ELECTRONICS & LOGIC DESIGN LAB	CR	-	-	2	-	1	*	***
9	123	21CS2309	MANAGEMENT AND ENTREPRENEURSHIP	CR	2	-	-	-	2	*	***
10	123	21CS2310	LIBERAL STUDIES – I	CR	1	-	-	-	1	*	***
					19	-	08	-	23		

CR – CREDIT, AU – AUDIT, L – LECTURE, T – TUTORIAL, P – PRACTICAL, S/P – SEMINAR/PROJECT, C – NO. OF CREDITS

SCHEME - B.TECH – 2021-22 ONWARDS
IV SEM - COMPUTER SCIENCE & ENGINEERING (CYBER SECURITY)

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	123	21CS2401	PROBABILITY AND STATISTICS	CR	3	-	-	-	3	*	***
2	123	21CS2402	DESIGN AND ANALYSIS OF ALGORITHMS	CR	3	-	-	-	3	*	***
3	123	21CS2403	PRINCIPLES OF MICROPROCESSORS AND COMPUTER ORGANIZATION	CR	4	-	-	-	4	*	***
4	123	21CS2404	FINITE AUTOMATA AND FORMAL LANGUAGES	CR	3	-	2	-	4	*	***
5	123	21CS2405	SOFTWARE ENGINEERING AND PROJECT MANAGEMENT	CR	3	-	-	-	3	*	***
6	123	21CY2401	CRYPTOGRAPHY AND NETWORK SECURITY	CR	3	-	-	-	3	*	***
7	123	21CS2407	DESIGN AND ANALYSIS OF ALGORITHMS LAB	CR	-	-	2	-	1	*	***
8	123	21CY2402	CRYPTOGRAPHY AND NETWORK SECURITY LABORATORY	CR	-	-	2	-	1	*	***
9	123	21CS2409	SPECIAL TOPICS – I	CR	-	-	-	4	2	*	***
10	123	21CS2410	LIBERAL STUDIES – II	CR	1	-	-	-	1	*	***
					20	-	6	4	25		

CR – CREDIT, AU – AUDIT, L – LECTURE, T – TUTORIAL, P – PRACTICAL, S/P – SEMINAR/PROJECT, C – NO. OF CREDITS

SCHEME - B. TECH – 2021-22 ONWARDS
V SEM - COMPUTER SCIENCE & ENGINEERING (CYBER SECURITY)

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	123	21CY3501	DATABASE MANAGEMENT SYSTEM	CR	3	-	-	-	3	*	***
2	123	21CY3502	CYBER FORENSIC AND CYBER LAW	CR	3	-	-	-	3	***	***
3	123	21CY3503	OPERATING SYSTEMS	CR	3	1	-	-	4	*	***
4	123	21CY3504	MACHINE LEARNING FOR CYBER SECURITY	CR	3	-	-	2	4	IV	PROBABILITY AND STATISTICS
5	123	21CY35XX	PROFESSIONAL ELECTIVE-1	CR	3	-	-	-	3	*	AS INDICATED IN ELECTIVE LIST
6	123	21OEXXXX	OPEN ELECTIVE-1 FUNDAMENTAL OF CYBER SECURITY	CR	3	-	-	-	3	*	***
7	123	21CY3505	DATABASE MANAGEMENT SYSTEM LAB	CR	-	-	2	-	1	*	***
8	123	21CY3506	OPERATING SYSTEMS LAB	CR	-	-	2	-	1	*	***
9	123	21CY3507	SPECIAL TOPICS -II	CR	-	-	-	4	2	*	***
					18	1	4	6	24		

V SEM- PROFESSIONAL
ELECTIVE – I

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING				
			L	T	P	S/ P	C
1	21CY3508	OOPS WITH JAVA	3	-	-	-	03
2	21CY3509	DATA WARFARE	3	-	-	-	03
3	21CY3510	INTERNET OF THINGS	3	-	-	-	03
4	21CY3511	MICROCONTROLLERS AND EMBEDDED SYSTEMS	3	-	-	-	03

SCHEME - B.TECH – 2021-22 ONWARDS
VI SEM - COMPUTER SCIENCE & ENGINEERING (CYBER SECURITY)

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	123	21CY3601	ETHICAL HACKING	CR	3	1	-	-	4	*	***
2	123	21CY3602	DIGITAL IMAGE PROCESSING	CR	3	-	-	-	3	*	***
	123	21CY3603	CLOUD APPLICATION DEVELOPMENT	CR	3	-	2	-	4	*	***
4	123	21CY36XX	PROFESSIONAL ELECTIVE-2	CR	3	-	-	-	3	*	AS INDICATED IN ELECTIVE LIST
5	123	21CY36XX	PROFESSIONAL ELECTIVE-3	CR	3	-	-	-	3	*	
6	123	21OEXXX	OPEN ELECTIVE-2 FUNDAMENTAL OF CRYPTOGRAPHY	CR	3	-	-	-	3	*	***
7	123	21CY3604	ETHICAL HACKING LAB	CR	-	-	2	-	1	*	***
8	123	21CY3605	DIGITAL IMAGE PROCESSING LAB	CR	-	-	2	-	1	*	***
					18	1	06	0	22		

CR – CREDIT, AU – AUDIT, L – LECTURE, T – TUTORIAL, P – PRACTICAL, S/P – SEMINAR/PROJECT, C – NO. OF CREDITS

VI SEM-PROFESSIONAL
ELECTIVE – II

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING				
			L	T	P	S/P	C
1	21CY3606	OPERATING SYSTEM SECURITY	3			-	03
2	21CY3607	PROACTIVE SECURITY TOOLS	3			-	03
3	21CY3608	IOT AND BIG DATA SECURITY	3			-	03

VI SEM-PROFESSIONAL
ELECTIVE – III

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING				
			L	T	P	S/P	C
1	21CY3609	DATA MINING AND ANALYSIS	3			-	03
2	21CY3610	CYBER SECURITY PROGRAMS AND POLICIES	3			-	03
3	21CY3611	MOOC COURSE	3			-	03

SCHEME - B.TECH – 2021-22 ONWARDS
VII SEM - COMPUTER SCIENCE & ENGINEERING (CYBER SECURITY)

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	123	21CY47XX	Professional Elective – 4	CR	3	-	-	-	3	*	AS INDICATED IN ELECTIVE LIST
2	123	21CY47XX	Professional Elective – 5	CR	3	-	-	-	3	*	
3	123	21OEXXXX	Open Elective-3 FUNDAMENTAL OF NETWORK SECURITY	CR	3	-	-	-	3	*	***
4	123	21CY4701	Project Phase – I / Internship	CR	-	-	-	6	3	*	***
					09			06	12		

CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits

VII SEM-PROFESSIONAL
ELECTIVE – IV

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING				
			L	T	P	S/P	C
1	21CY4702	VULNERABILITY ANALYSIS AND PENETRATION TESTING	3			-	03
2	21CY4703	QUANTUM CRYPTOGRAPHY AND COMMUNICATION	3			-	03
3	21CY4704	WIRELESS NETWORK SECURITY	3			-	03

VII SEM-PROFESSIONAL
ELECTIVE – V

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING				
			L	T	P	S/P	C
1	21CY4705	DATA PRIVACY	3			-	03
2	21CY4706	EMBEDDED SYSTEM SECURITY	3			-	03
3	21CY4707	PATTERN RECOGNITION	3			-	03

SCHEME - B.TECH – 2021-22 ONWARDS
VIII SEM - COMPUTER SCIENCE & ENGINEERING (CYBER SECURITY)

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	123	21CY4701	Professional Elective – 6	CR	3	-	-	-	3	*	AS INDICATED IN ELECTIVE LIST
2	123	21CY4701	Project Phase – II	CR	-	-	-	12	6	*	***
3	123	21CY4702	Internship	CR	-	-	-	6	3		
					03	-	-	18	12		

CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits

VIII SEM-PROFESSIONAL
ELECTIVE – VI

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING				
			L	T	P	S/P	C
1	21CY4703	RISK MANAGEMENT	3			-	03
2	21CY4704	MOBILITY SECURITY	3			-	03
3	21CY4705	BIOMETRIC SECURITY	3			-	03

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21EN1101	LINEAR ALGEBRA AND CALCULUS	3	1	–	–	4

COURSE LEARNING OBJECTIVES:

1. To understand the basic concepts of linear algebra to illustrate its power and utility through applications to science and Engineering.
2. To study the basic concepts of vector spaces, linear transformations, matrices and inner product spaces in engineering.
3. To discuss the algebraic as well as geometric perspectives pertaining to the course.
4. To learn the basic functions represented in a variety of ways: graphical, numerical, analytical, or verbal.
5. To develop an appreciation of calculus as a coherent body of knowledge and as a human accomplishment.
6. To understand the meaning of the definite integral both as a limit of Riemann sums and as the net accumulation of a rate of change.
7. To understand the relationship between the derivative and the definite integral as expressed in both parts of the Fundamental Theorem of Calculus.

COURSE OUTCOME:

At the end of this course the students are expected to

1. Determine the reasonableness of solutions, including sign, size, relative accuracy, and units of measurement.
2. Apply the abstract concepts of matrices and system of linear equations using decomposition methods
3. Explain the basic notion of vector spaces and subspaces
4. Apply the concept of vector spaces using linear transforms which is used in computer graphics and inner product spaces.
5. Analyze functions using limits, derivatives, and integrals.
6. Recognize the appropriate tools of calculus to solve applied problems.

COURSE CONTENT:

Total: 52 Hours

Module-1

LINEAR EQUATIONS AND VECTOR SPACES

Introduction - Row reduction and echelon forms- Gaussian-Elimination - Solution set of linear equations – LU decomposition - Inverse of a matrix by Gauss Jordan method, Linear spaces – Subspaces - Linear independence – Span - Bases and Dimensions. Self Learning Component: Algebra of Matrices.

Module-2

LINEAR TRANSFORMATIONS AND ORTHOGONALITY

Linear transformations – Basic properties - Invertible linear transformation - Matrices of linear transformations – Vector space of linear transformations— Orthogonal Vectors - Projections onto Lines - Projections and - The Gram- Schmidt Orthogonalization process.

Self Learning Component: Examples of vector spaces and subspaces, Rank of a matrix.

Module-3

EIGEN VALUES AND EIGEN VECTORS

Introduction to Eigen values and Eigen vectors - Characteristic equation -Diagonalization of a Matrix- Diagonalization of symmetric matrices - Quadratic forms

- Singular Value Decomposition - QR factorization.

Self Learning Component: Determinant and Properties of Eigen values and Eigenvectors

Module-4

DIFFERENTIAL CALCULUS

Taylor's Theorem- Taylor's series – Maclaurin Series- Indeterminate forms and L- Hospital's Rule- Partial Differentiation – Total derivative-Chain Rule of Partial Differentiation-Differentiation of Implicit function, Euler's Theorem on homogeneous function- Jacobian- Maxima and Minima of functions of two variables-Taylor's Theorem.

Self Learning Component: Functions and graphs, Limits and Continuity, Differentiation

Module-5

INTEGRAL CALCULUS

Reduction formula-Improper integrals- Beta and Gamma integrals-Double integration-Change of order of integration-triple integration.

TEXT BOOK(S)

1. D C Lay, S R Lay and JJ McDonald, Linear Algebra and its Applications, Pearson India, Fifth edition.
2. Linear Algebra and its Applications by Gilbert Strang, 4 th Edition, Thomson Brooks/Cole, Second Indian Reprint 2007.
3. G.B. Thomas, Maurice T Weir and Joel Hass Thomas's Calculus ,12th Edition, Pearson India.

REFERENCE BOOKS

1. Introduction to Linear Algebra, Gilbert Strang, 5th Edition, Cengage Learning (2015).
2. Higher Engineering Mathematics by B S Grewal, 42 nd Edition, Khanna Publishers.
3. Elementary Linear Algebra, Stephen Andrilli and David Hecker, 5th Edition, Academic Press (2016)
4. Contemporary linear algebra, Howard Anton, Robert C Busby, Wiley 2003
5. B.S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, 2014.
6. Introductory Linear Algebra- An applied first course, Bernard Kolman and David, R.Hill, 9th Edition, Pearson Education, 2011.

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21EN1102	ENGINEERING CHEMISTRY	3	–	2	–	4

COURSE LEARNING OBJECTIVES:

- The Theory Course intends to provide chemical concepts most relevant to engineering students and demonstrate them in an applied context.
- The student is exposed to the principles required to understand important contemporary topics like alternate energy sources, corrosion control, polymer technology, phase equilibria nanomaterials and green chemistry and catalysis.
- The underlying theme is to emphasize on applications of these concepts to realworld problems

COURSE OUTCOME:

- Appreciate the basic principles of electrochemistry, use of different types of electrodes in analysis and evaluate cell potential for different cell reactions.
- Know construction, working and applications of various energy storage devices such as batteries, fuel cells and supercapacitors.
- Understand basic principles of corrosion and apply suitable techniques for corrosion control. Also know the technological importance and processes involved in metal finishing.
- Know the synthesis, structure —property relationship and applications of commercially important polymers and polymer composites. Understand properties and applications of nanomaterials. Also learn the principles of green chemistry for a sustainable and eco-friendly world.

COURSE CONTENT:

Total: 40 Hours

Theory —Syllabus

Module-1

Chemical Energy Source:

Introduction to energy; Fuels – definition, classification, importance of hydrocarbons as fuels; Calorific value-definition, Gross and Net calorific values (SI units). Determination of calorific value of a solid / liquid fuel using Bomb calorimeter. Numerical problems on GCV & NCV. Petroleum cracking-fluidized catalytic cracking.Reformation of petrol. octane number, cetane number, anti-knocking agents, power alcohol, Biodiesel & Biogas.

Solar Energy:

Thermal energy: Photovoltaic cells- Introduction, definition, importance, working of PV cell. Solar grade silicon physical and chemical properties relevant to photo-voltaics, doping of silicon by diffusion technique.

Module-2

Energy Science and Technology

Single electrode potential - Definition, origin, sign conventions. Standard electrode potential- Definition-Nernst equation expression and its Applications. EMF of a cell-

Definition, notation and conventions. Reference electrodes— Calomel electrode, Ag/AgCl electrode. Measurement of standard electrode potential. Numerical problems on EMF. Ion-selective electrode- glass electrode

Battery technology: Basic concepts including characteristics of anode, cathode, electrolyte and separator. Battery characteristics. Classification of batteries—primary, secondary and reserve batteries. State of the art Batteries-Construction working and applications of Zn-air, Lead acid battery, Nickel-Metal hydride and Lithium ion batteries.

Introduction to fuel cells, types of fuel cells. Construction, working and application of Methanol-Oxygen fuel cell.

Module-3 Corrosion

Science:

Definition, Chemical corrosion and Electro-chemical theory of corrosion, Types of corrosion, Differential metal corrosion, Differential aeration corrosion (pitting and water line corrosion), Stress corrosion. Corrosion control, Metal coatings- Galvanization, Tinning and its disadvantages. Cathodic protection of Corrosion: Sacrificial anode method and current impression method. Surface Modification Techniques:

Definition, Technological importance of metal finishing. Significance of polarization, decomposition potential and over-voltage in electroplating processes, Electroless Plating. Distinction between electroplating and Electroless plating, advantages of electroless plating. Electroless plating of copper.

Module-4

High Polymers: Introduction to polymers, Glass transition temperature, structure and property relationship. Synthesis, properties and applications of Teflon. PMMA. Elastomers - Deficiencies of natural rubber and advantages of synthetic rubber. Synthesis and application of silicone rubber, Conducting polymers-Definition, mechanism of conduction in polyacetylene. Structure and applications of conducting Polyaniline.

Nanotechnology: Introduction, properties, synthesis by sol-gel. Fullerenes, Carbon nanotubes, dendrimers and nano-composites

Module-5

Water Technology:

Impurities in water. Hardness of Water: Types of Hardness and determination of total hardness of water by using disodium salt of ethylenediaminetetraacetic acid method, Potable water treatment by Electro dialysis and Reverse Osmosis. Water analysis- Biochemical oxygen demand and Chemical oxygen demand. Determination of COD. Numerical problems on COD. Sewage treatment.

Instrumental Methods of Analysis: Instrumental methods of analysis, Principles of spectroscopy- Beer's Lambert's law, Difference between spectrometer and spectrophotometer, Potentiometry, Conductometry (Strong acid against strong base, weak acid against strong base, mixture of strong acid and a weak acid against strong base).

TEXT BOOK(S)

1. Dr. S. Vairam, Engineering Chemistry, Wiley-India Publishers, 2017,
2. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015

REFERENCE BOOK(S)

1. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
2. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

List of Laboratory/Practical Experiments activities to be conducted:

28 Hrs

Volumetric Analysis and Preparations

1. Evaluation of quality of water in terms of total hardness by Complexometric titration.
2. Determination of Chemical Oxygen Demand (COD) of the given industrial wastewater sample.
3. Determination of Alkalinity of the given water sample
4. Preparation of MgO nanoparticles by solution combustion method (Demonstration experiment) and spectrometric analysis.
5. Electroless plating of copper (Demo experiment)
6. Preparation of Polyaniline (Demo experiment)

Instrumental methods of Analysis

1. Potentiometric titration—Estimation of FAS using standard $K_2Cr_2O_7$ solution.
2. Conductometric estimation of hydrochloric acid using standard sodium hydroxide solution
3. Determination of viscosity coefficient, surface tension, density of a given liquid
4. Colorimetric estimation of copper in a given solution
5. Determination of Pka of given weak acid.
6. Determination of calorific value of coal/oil using Bomb calorimeter (Group

REFERENCE BOOKS:

1. Dayanada Sagar University laboratory manual.
2. J. Bassett, R.C. Denny, G.H. Jeffery, Vogels, Text book of quantitative inorganic analysis, 4th Edition.

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21EN1103	BASIC ELECTRICAL ENGINEERING	3	-	-	-	3

COURSE LEARNING OBJECTIVES:

This course enables students:

- To impart basic knowledge of electrical quantities such as current, voltage, power and energy
- To distinguish between passive and active electrical components
- To explain the general structure of electrical power system
- To define basic laws of electric circuit and to solve related problems
- To understand basics of earthing, protective devices and wiring
- To introduce concepts, analogies and laws of magnetic circuits
- To learn the working principle, construction and characteristics of various DC machines
- To study the construction, principle of operation and types of transformers
- To understand the working principles of measuring equipment.

COURSE OUTCOME:

- Explain the basic knowledge about the Electric and Magnetic circuits.
- Applying basic laws and determine various circuit parameters in AC and DC Circuits.
- Analyze the working of various Electrical Machines.
- Explain the construction, basic principle of operation, applications and determine performance parameters of various measuring instruments
- Outline the knowledge of Green Energy, Electrical Safety Rules & standards COURSE

CONTENT:

Total: 45 Hours

Module -1

ELECTRICAL CIRCUIT CONCEPTS

Voltage and current sources: independent, dependent, ideal and practical; V-I relationships of resistor, ohm's law, inductor, and capacitor; types of electrical circuits, voltage and current divider rule, Kirchhoff's laws, Peak, average and rms values of quantities; apparent, active and reactive powers; phasor analysis, Power factor, impedance and admittance, power and energy in electrical elements, introduction to 3 phase systems

Module -2

MAGNETIC CIRCUIT CONCEPTS

Basics of magnetic circuits, laws of magnetism, magnetic field, magnetic lines of force, permeability, Electromagnetic Fields: Relation between field theory and circuit theory; numerical on capacitance calculations, Biot-Savart's law, Ampere's law, Curl, Faraday's law, Lorentz force, Inductance, Self and Mutual inductance of simple configurations.

Module-3

DC Machines and Transformers

Dc Machines: Basic principles of electromagnetic energy conversion, Construction, operation, characteristics, performance, of dc generators and motors, testing of dc machines, applications, Transformers: Construction, working principle, equivalent circuit, voltage regulation, efficiency, Auto-transformers

Module-4

SI units, systematic and random errors in measurement, expression of uncertainty - accuracy and precision index, propagation of errors. General working principles and construction of indicating instruments. Electro-magnetic Instruments for the measurement of current, voltage, power and energy. Instruments for the measurement of power factor, frequency, Potentiometers. CRO, Calibration of instruments; importance, procedures and standards

Module-5

POWER STATION PRACTICES, ECONOMICS, AND GREEN ENERGY CONCEPTS

Energy generation-Conventional generation of electrical energy using thermal, hydro,nuclear and, non-conventional sources of energy; overview on green energy technology, load forecasting, electricity tariffs, power factor improvement, power plant economics, Overview on electrical safety standards in industries

Text Books

1. D.P.Kothari and I.J. Nagrath, “Basic Electrical Engineering”, 4th Edition, Tata McGrawHill, 2010
2. B.L Thereja and A.K Thereja, “A text book of Electrical Technology (Vol III) (Transmission, distribution, and Utilization)”, 23rd Edition, S Chand and Company.

Reference Books

1. Clayton Paul, Syed A Nasar and Louis Unnewehr, 'Introduction to Electrical Engineering', 2nd Edition, McGraw-Hill, 1992
2. P.S. Dhogal, 'Basic Electrical Engineering – Vol. I& II', 42nd Reprint, McGraw-Hill, 2012.
3. A. K Sawhney, A course in Electrical and Electronic Measurements and Instrumentation Dhanpat Rai & Co. (P) Limited January 2015
4. NPTEL - <https://nptel.ac.in/courses/108/108/108108076/>

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21EN1104	ELEMENTS OF MECHANICAL ENGINEERING	2	-	2	-	3

COURSE LEARNING OBJECTIVES:

The objectives of the Course are to:

- Introduce different ways power generation using renewable and non-renewable energy resources
- Understand thermodynamic cycles for power generation
- Explain materials used for engineering applications
- Learn transmission of power using Gear & Belt Drives
- Understand manufacturing process like metal cutting, welding and Foundry
- Introduce mechatronics, PLC, instrumentation & control systems
- Explain rapid prototyping, 3D printing and electric mobility
- Develop skills to use tools, machines, and measuring instruments

COURSE OUTCOMES:

- Identify various renewable and non-renewable energy resources
- State laws of thermodynamics used for energy conversion
- Compare power transmission using gear and belt drives
- Select different manufacturing methods like metal cutting, joining and foundry
- Construct different types of fitting, welding, sheet metal, turning models
- Demonstrate working of engines, turbines, pumps, 3D printing; wood working, foundry & smithy operations

COURSE CONTENT:

Total: 28 Hours

Module-1

Energy Conversion

Renewable & Nonrenewable energy resources: Introduction to Steam, Hydro & Nuclear power plants, solar, wind and biomass energy based power plants, Effect of power generation on environment

Thermodynamics: First and second laws of thermodynamics, Efficiency, COP, Carnot theorem, Numericals

Module-2

Prime Movers & Pumps

Gas and Vapour cycles: Carnot, Otto, Diesel, Brayton, Rankine & Refrigeration cycles Prime movers: 4 stroke- petrol and Diesel engines, Gas turbines-open and closedCycle, steam turbines-Impulse and reaction, Numericals.

Introduction to pumps: Working of centrifugal and reciprocating

Module-3

Materials & Mechanical Design

Materials: Introduction to ferrous, non-ferrous & composites, Stress-strain diagrams, Mechanical Properties for materials

Mechanical Design: Introduction, Simple Stresses and strains, Elastic constants, Power

Transmission: Gear & Belt Drives, Numerical problems

Module-4

Manufacturing Processes

Metal cutting: Introduction, classification of machine tools, basic operations on lathe, drilling, shaper, milling, grinding, introduction to CNC machining

Joining Processes: Welding- classification, gas, arc, laser & friction welding, brazing and soldering

Foundry: Basic terminology, Types of patterns, sand moulding

Module-5

Advanced Technologies in Mechanical Engineering

Mechatronics: Introduction, Mechatronics, PLC, Instrumentation & control systems Robotics:

Introduction, Robot anatomy, configurations, Sensors, applications

Rapid prototyping & 3D Printing: Introduction & applications, powder-based additive manufacturing processes

Electric Mobility: Introduction, electric, hybrid and autonomous vehicles

List of Laboratory/Practical Experiments activities to be conducted:

28 Hrs

1. Fitting Shop- Simple exercises involving fitting work-Dove tail.
2. Welding Shop- Simple butt and Lap welded joints using arc welding
3. Sheet-metal Shop- Fabrication of tray, Making Funnel complete with soldering
4. Lathe machining on plain and step turning

Demonstration of:

1. Pelton wheel and Francis turbine
2. 4 stroke petrol and diesel engines
3. Lathe, milling, drilling, grinding & CNC milling machines and wood turning lathe
4. Foundry and smithy operations
5. 3D printing parts

Industrial Visit- Report making

Text books:

1. Nag P K (2017). “Basics and applied thermodynamics”, Second edition, Tata McGrawHill, New Delhi.
2. P.N. Rao (2018). “Manufacturing Technology-Foundry, Forming and Welding”, Volume 1, 4th Edition, Tata McGraw Hill Publishing Co Ltd.
3. P.N. Rao (2018). “Manufacturing Technology- Metal Cutting and Machine Tools”, Volume 2, 4th Edition, Tata McGraw Hill Publishing Co Ltd.

REFERENCES:

- 1.El —Wakil M. M (2017). “Power plant technology”, Tata McGraw Hill edition, New Delhi.
2. Larminie J, Lowry J (2017). “Electric vehicle technology explained”, John Wiley and & Sons Ltd. USA.
3. William D. Callister and David G. Rethwisch (2011). “Fundamentals of Materials Science and Engineering: An Integrated Approach”, John Wiley & Sons; 4th Edition.

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21EN1105	FUNDAMENTALS OF PROGRAMMING	3	-	4	-	5

COURSE LEARNING OBJECTIVES:

- To develop student competence in writing clear, correct, and maintainable programs that implement known algorithms.

COURSE OUTCOMES:

- Express algorithms learned implicitly in school explicitly in algorithmic form and calculate the number of basic operations (exact or upper bound).
- Trace the execution of short programs/code fragments involving fundamental programming constructs.
- Write a short program/code fragment for a given task using fundamental programming constructs.
- Debug a short program/code fragment with fundamental programming constructs manually, and debug more complex code using a modern IDE and associated tools.
- Design a large program, conduct a personal code review, and contribute to a small-team code review focused on common coding errors and maintainability using a provided checklist.

COURSE CONTENT:

Total: 56 Hours

Module-1

BASICS AND OVERVIEW OF C

Introduction to Problem Solving using Algorithms and Flowchart: Key features of Algorithms: Sequence, Decision, Repetition with examples. Background, structure of C program, keywords, Identifiers, Data Types, Variables, Constants, Input / Output statements, Operators (Arithmetic, relational, logical, bitwise etc.), Expressions, Precedence and Associativity, Expression Evaluation, Type conversions. Conditional Branching Statements-if and switch statements, iterative statements (loops)-while, for, do-while statements, Loop examples, Nested loops, break, continue, go to statement.

Module-2

ARRAYS AND STRINGS

Arrays: Introduction, declaration & initialization of array, reading and writing array elements, Operations on array: Traversal, searching, sorting. Declaration and Initialization of two-dimensional arrays. Matrix Operations (addition, subtraction, multiplication, transpose) using two-dimensional array.

Strings: Definition, declaration, initialization, and representation. String handling functions and character handling functions.

Module-3

POINTER AND FUNCTIONS

Pointers: Definition and declaration and initialization of pointers. Accessing values using pointers. Accessing array elements using pointers.

Functions: Definition and declaration. Built-in functions and User-defined functions. Categories of functions with example. Pointers as function arguments, array as function argument, Call-by-value and call-by-reference. Recursion.

Module-4

STRUCTURES AND UNIONS

Structures: Purpose and usage of structures. Declaration of structures. Assignment with structures. Structure variables and arrays. Nested structures. Student and employee database implementation using structures.

Unions: Declaration and initialization of a union. Difference between structures and unions. Example programs.

Module-5

DYNAMIC MEMORY ALLOCATION AND FILES

Memory allocation in C programs: Dynamic memory allocation, memory allocation process, allocating a block of memory, releasing the used space, altering the size of allocated memory.

Files: Defining, opening and closing of files. Input and output operations.

List of Laboratory/Practical Experiments activities to be conducted :
1. Design a C program to Swapping of two numbers. (Simple Expressions).
2. Design a C program to Convert Celsius to Fahrenheit.
3. Design a C program to find the simple interest as per the below conditions(Simple expressions, Integer division issues (data loss), Explicit typecasting, when p, t, r are integers and si is float.
4. Design a C program to find the largest of 3 numbers. a) Using if and no else. (Conditionals) b) Using nested if. (conditionals and Boolean expressions) c) Using Ladder if else if d) Using Ternary operator.
5. Design a program that takes three coefficients (a, b, and c) of a Quadratic equation ($ax^2+bx+c=0$) as input and compute all possible roots.
6. Design a C program to read the vehicle type (Use c or C for car, b or B for bus, t or T for Tempo for vehicle type) and Duration of customer vehicle

parked in parking slot. Parking fare is calculated as per the rates given below: print the total parking charges.

Vehicle	First Rate	Second Rate
Car	Rs 20/hr for first 2hr	Rs 30/hr for next
Bus	Rs 40/hr for first 2hr	Rs 50/hr for next
Tempo	Rs 30 /hr for first 2hr	Rs 40/hr for next

7. a Write a program to calculate the factorial of a given number.
b Write a program using four functions to check if the given number is apalindrome.

8. a Sum of natural numbers ($\text{sum}(n) = n + \text{sum}(n-1)$);
b. Write a program to calculate Power of a number ($b^n = b * b^{n-1}$).

9. Write a program to calculate nth fibonacci number given first two numbers in the series.

Inputs	n	Output
0,1	3	2
1,5	4	11
2,4	7	42
8,1	5	19
3,5	6	34

10. a Write a program using four functions to check if the given number is a palindrome.
b. Write a program to calculate GCD of two numbers.

11. Write a program to emulate a calculator with the following operations:Addition, Subtraction, Multiplication, Division – using functions, switch and break.)

12. Write a program using four functions to compute the sine of a value using Taylor's series approximation - pass by value.

13. Write a program to find the sum of n different using four functions and arrays.
Use the following function prototype: void
input(int n, int a[n]);
int add(int n, int a[n]);
void output(int n, int a[n],int sum) and main().

14. Write a program to add two matrices using separate function for input, add matrices, display_matrix and main function.

15. String handling:
a) Write a function to reverse the string in reverse and display it. (Strings))

b) Write a function to concatenate the two strings without using strcat.(Strings) c) Write a function to find the length of the string.
16. Write a program using Bubble sort technique to sort an array of integer elements .(Sorting technique, Const array arguments.)
17. Write a program to search an array of elements of data type requested by the user for a given item using binary search algorithm. (Searching technique, Const array arguments).
18. Write a program with functions to add and multiply two complex numbers. Define a structure Complex to represent a complex number. The main function should call other functions for the purposes of input, computations and display. (Structs as arguments).
19. Write a program to add n fractions using function.
20. Define a structure, student, to store the following data about a student: rollno (integer), name (string) and marks(integer) . Your program must contain the following functions: (Array of Structures). (5 marks) · A function to read the students data. · A function to display records of each student. · A function to sort the records of student RankWise · A function print all students details · A function to search student details by Rollno · A function to print the names of the students having the highest testscore

TEXT BOOKS:

1. Brian W. Kernigham and Dennis M. Ritchie, (2012) “The C Programming Language”, 2nd Edition, PHI.
2. Reema Thareja, "Programming in C". Oxford University Press, Second Edition, 2016

REFERENCES:

1. R. S Bichkar, “Programming with C and Data Structure”, University Press, 2014
2. Behrouz A. Forouzan, Richard F. Gilberg, “Computer Science - A Structured Approach Using C”, Cengage Learning, 2007
3. Brian W. Kernigham and Dennis M. Ritchie, “The C Programming Language”, 2nd Edition, PHI, 2012
4. Vikas Gupta, “Computer Concepts and C Programming”, Dreamtech Press 2013.

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21EN1106	ENVIRONMENTAL SCIENCES	2	-	-	-	2

COURSE LEARNING OBJECTIVES:

- To understand the concepts of ecosystem, energy and non-renewable energy resources
- To learn water quality aspects requirement and water safety plans
- To explain solid waste and sewage management
- To create awareness of noise, air & land pollution and knowledge of the current issues and pollution endangering life on earth
- To learn environmental laws and regulations
- To understand environmental protection protocols and regulations

COURSE OUTCOMES

- Analyse basic concepts that govern environmental quality, atmospheric principles and environmental standards
- Compare different Energy resource and their environmental implications
- Identify different types of pollution, waste streams
- Identify different natural and manmade disasters and prevention
- Apply the process of environmental impact assessment and implications of Indian Environment Laws

COURSE CONTENT:

Total: 28 Hours

Module-1

Basic Concepts of Environment

Scope and importance of environmental studies, Definition of environment- comprehensive understanding of environment, Basic concepts: Xenobiotic, natural & anthropogenic; why are we concerned? Types of xenobiotics: Chemical, Physical, Biological pollutants; Hazard & Risk, Eco-kinetic & Bio-kinetic Properties of a xenobiotic, Dose-Response Relationships-chronic and acute effects, Environmental Standards: AAQS, TLV's, Appraisal, Assessment & Abatement (Recognition, Evaluation & Control) of pollutants- Structure of Atmosphere; Atmospheric inversions, Environmental System.

Air Pollution: Criteria pollutants — Ozone, Particulate Matter, Carbon Monoxide, Nitrogen, Oxides, Sulphur Dioxide, Lead; SMOG & Air-pollution episodes

Aerosols: Primary & Secondary pollutants, Acid Rain Cycle.

Module-2

Water Treatment
Hydrosphere, Lentic and Lotic Water Systems, Fresh Water as a resource; Rain Water Harvesting, Treatment of potable water, Waste water- Characteristics, Municipal Sewage Water and Treatment. Waste Management

Types of Wastes: Municipal Solid Waste, Hazardous Waste, Nuclear Waste, Electronic Waste, Biomedical Waste, Solid Waste Management: Landfills, composting
Water Standards

Module-3

Energy

Types of energy: Conventional sources of energy, fossil fuel, Coal, Nuclear based, Solar, wind, sea-Tidal Wave energy, Geo-Thermal, Non-conventional sources of Energy, Biofuels - biomass, biogas, Natural Gas; Hydrogen as an alternative future source of energy.

Module-4

Disasters & Management

Definition, origin and classification. Natural (Earthquakes, landslides, floods, Cyclones), Man-made disasters (biological, chemical, nuclear, radiological explosions) — definition, causes and management and/or mitigation strategies; Bhopal & Chernobyl Disasters, Environment & Health - Occupational Health Hazards, Occupational Diseases, Epidemics, Pandemics, Endemics (Fluoride, Arsenic)

Principles and Significance of Sanitation

5

Environmental Impact Assessment (EIA) and Indian acts and regulations

Principles of EIA, Indian Acts and Rules, Wildlife (Protection) Act 1972. Water Act — 1974 (Rules 1975), Forest Conservation Act 1980 (Rules 2003), Air Act -1981 (Rules 1982, 1983), Environment Protection Act, 1986

TEXT BOOKS:

1. Benny Joseph (2005). “Environmental Studies”, Tata McGraw — Hill Publishing Company Limited, New Delhi.
2. R.J.Ranjit Daniels and Jagadish Krishnaswamy (2009). “Environmental Studies”. Wiley India Private Ltd., New Delhi.

REFERENCES:

1. P.Aarne Vesilind, Susan M.Morgan, Thomson (2008). “Introduction to Environmental Engineering” (2008), Thomson learning, Second Edition, Boston.
2. R. Rajagopalan (2005). “Environmental Studies — From Crisis to Cure” Oxford University Press, New Delhi.
3. R. J. Ranjit Daniels and Jagadish Krishnaswamy (2014). “Environmental Studies”(2014), Wiley India Pvt Limited, New Delhi.

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21EN1107`	KANNADA KALI	1	-	-	-	1

COURSE OBJECTIVES:

- To introduce Kannada language & culture to Non – Kannada speakers.
- To train them to communicate in colloquial Kannada with connivance

COURSE OUTCOMES:

- The learners can communicate in Kannada & acquaint themselves withKannada culture

COURSE CONTENT

- Introduction to Karnataka & Kannada Culture.
- Evolution of Kannada.
- Introduction to Kannada Alphabets.
- Introduction to Kannada Numbers.
- Kannada words, sentences & phrase making for colloquial communication.

REFERENCE BOOKS:

1. Kannada Kali —Dr. Lingadevaru Halemane
2. Kannada Paatagalu— Editor: Dr. Chandrashekara Kambara.
3. SLN Sharma & K Shankaranarayana “Basic Grammar”, Navakarnataka Publications.
4. Spoken Kannada. Publication: Kannada Sahitya Parishat Bengaluru.

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21EN1201	TRANSFORMS AND DIFFERENTIAL EQUATIONS	3	1	-	-	4

COURSE LEARNING OBJECTIVES:

1. To provide the basic concepts and necessary fundamentals to formulate, solve and analyze engineering problems.
2. To discuss the theoretic as well as geometric perspectives.
3. To understand the Fourier Series and Laplace Transform to solve real world problems.
4. To make strong foundation of the integral transforms and their inverses.
5. To understand the basic concepts of ODE and PDE to illustrate its power and utility through applications to science and Engineering.

COURSE OUTCOME:

At the end of this course the students are expected to

1. Apply Laplace transform and its inverse to solve differential and integral equations.
2. Represent the periodic functions using Fourier series.
3. Use Fourier transforms and its inverse in practical applications of engineering problems.
4. Apply transform techniques to analyze continuous-time and discrete-time
5. Solve engineering problems using the principles of solution of differential equations.
6. Solve ordinary differential equations using Laplace transform.
7. Apply the partial differential equation for solving engineering problems.

COURSE CONTENT:

Total: 52 hours

Module-1

LAPLACE TRANSFORM AND INVERSE LAPLACE TRANSFORM

Basic concepts, Laplace transform of basic functions-Linearity and First shifting theorem, Laplace transforms of derivatives and integrals, Second shifting theorem, Initial and Final value theorems, Some basic transforms, Inverse Laplace transform, Convolution theorem, Applications to differential equations.

Self-Learning Component: Differentiation of functions

Module-2

FOURIER SERIES

Fourier Series, Dirichlet's conditions, Euler's Formulae, Fourier series of discontinuous functions, Even and odd functions, Change of interval, Parseval's theorem, Complex form of Fourier series

Self-Learning Component: Basic definitions of series, examples

Module-3

FOURIER TRANSFORM AND INVERSE FOURIER TRANSFORM

Fourier transform and Fourier's integral theorem, Fourier cosine integral, Fourier sine integral, Basic properties of Fourier transform.

Self-Learning Component: Basic definitions and properties of integration

Module-4

ORDINARY DIFFERENTIAL EQUATION

Basic definitions-First order first degree differential equations-Non homogeneous equations reducible to Homogeneous Form-Exact differential equations-Bernoulli equation-Linear differential equations of second order with variable coefficients- Second order D.E with constant coefficients.

Self-Learning Component: Basic definitions of differential equation and examples

Module-5

PARTIAL DIFFERENTIAL EQUATION

Formation of partial differential equation — Solutions of partial differential equation — Linear equations of the first order- Charpit's Method-Rules for finding the complementary function-Finding the particular integral-Method of separation of variables-Heat equation- Wave equation — Laplace equation

Self-Learning Component: Geometrical interpretation of Partial Differential equation

TEXT BOOKS

1. B.V Ramana, Higher Engineering Mathematics, Mc Graw Hill education India Pvt Ltd, 31st edition
2. B.S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, 2014.
3. G.B. Thomas, Maurice T Weir and Joel Hass Thomas's Calculus, 12th Edition, Pearson India.

REFERENCE BOOKS

1. P. P. G. Dyke, An introduction to Laplace transform and Fourier Series, 4th Edition, Springer (2004).
2. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad S. Chand publication.
3. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley, 10th edition.
4. Stanley J. Farlow, Partial Differential Equations for Scientists and Engineers.

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21EN1108	ENGINEERING PHYSICS	3	–	2	–	4

COURSE LEARNING OBJECTIVES:

- To introduce the basic concepts of Quantum mechanics which are essential in understanding and solving problems in engineering,
- To review different types of Engineering materials —Electronic, electrical, mechanical and Magnetic materials Properties and their applications in Science and Engineering.
- To understand Band structure of solids, Semiconductors and electrical conductivity of SC's, and their applications.
- To explain semiconductor devices like LED, Photodiode and Solar cell and Semiconductor BJT.
- To explain Thin-film Phenomena, Thin-film fabrication Process and their applications in engineering.
- To learn how to fabricate Nano materials by using Top–down and Bottom —up approach & To review Nano science and technology and its practical applications in biology, engineering and medicine.

COURSE OUTCOME:

- Describe the concepts of Quantum mechanics and applications of Schrodinger time independent wave equation in one dimensions.
- Discuss the different engineering materials such as Electronic, electrical and mechanical materials properties and their applications in engineering
- Illustrate Semiconductors , Semiconductor devices like Photo diode, LED, Solar cell and BJT and its applications
- Classify Lattice parameters of different crystalline solids by using X-ray diffraction methods and Summarize theoretical background of laser, construction and working of different types of lasers and its applications in science and engineering
- Interpret Basic concepts of Thin films and Thin film deposition processes and their applications leads to Sensors and engineering devices
- Discuss Nano materials, Properties and fabrication of Nano materials by using Top–down and Bottom —up approach's–Applications for Science and technology

COURSE CONTENT:

Total: 42 Hours

Module-1

Quantum Mechanics: Foundations of quantum theory, Wave function and its

properties, de-Broglie hypothesis, Heisenberg Uncertainty principle. One dimensional time independent Schrodinger wave equation, Eigen values and Eigen functions. Applications: one dimensional motion of an electron in a potential-well.

LASER PHYSICS: Introduction to lasers. Conditions for laser action. Requisites of a Laser system Principle, Construction and working of Nd-YAG and , Semiconductor Laser. Application of Lasers in Defense (Laser range finder), Engineering (Data storage) and Applications of Lasers in medicine

Module-2

Semiconductor Physics: Band structure, Fermi level in intrinsic and extrinsic semiconductors, Density of energy states in conduction and valence bands of a semiconductor (Mention the expression), Expression for concentration of electrons in conduction band (Derivation), Hole concentration in valence band (Mention the expression), Intrinsic carrier concentration Conductivity of semiconductors.

Semiconducting devices for optoelectronics applications: Principle and working of LED, photodiode, Solar cell, BJT and Numericals

Module-3

Introduction to Engineering materials: Classification of Engineering Materials such as Conductors, Semiconductors, Insulators. Electrical conductivity of metals and Semiconductors. Effect of temperature, composition on resistivity of materials.

Dielectrics: Introduction — Dielectric polarization — Dielectric Polarizability, Susceptibility and Dielectric constant-types of polarizations: Electronic and Ionic (Quantitative), Orientation polarizations (qualitative) — Lorentz Internal field — Clausius-Mossotti equation – Applications of Dielectrics. Numericals.

Module-4

Crystallography: Lattice, unit cell, lattice parameters, crystal systems, Bravais lattices, Packing fraction for SCC, BCC and FCC crystal systems. Introduction to Miller Indices. Determination of Crystal structure by Miller Indices. Expression for Inter-planar distance. X-ray diffraction, Bragg's law and Determination of Crystal structure by Powder method. Numericals

Mechanical Engineering Materials — mechanical properties: stress- strain curve for different materials. Introduction to Tensile strength, Compressive strength, Ductility, Toughness, Brittleness, Impact strength, Fatigue, Creep. Testing of engineering materials: Hardness Tests: Brinell and Vickers hardness test- (4 hours)

Module-5

Thin films technology: Introduction to thin-films-Advantages of thin-films over bulk materials. Thin film deposition processes- Physical vapour deposition (Thermal evaporation technique, and sputtering technique) process, Applications of Thin films.

Nano Science & technology: Introduction to Nano materials, Classification of nano materials, Size dependent properties of materials, Top-down and Bottom-up

approach- Ball-milling and Photolithography, Process. Fundamental Principles of Bio-Physics & Applications of Nano technology in Biology and Engineering.

LABORATORY EXPERIMENTS

List of Experiments:

1. I-V characteristics of a Zener Diode
I—V Characteristics of a Zener diode in forward and reverse bias condition (Module 2)
2. Planck's constant
Measurement of Planck's constant using LED (Module 2)
3. Transistor characteristics
Input and output characteristics of a NPN transistor in C-E configuration (Module 2)
4. Dielectric constant
Determination of dielectric constant of a dielectric material (Module 2)
5. Torsional Pendulum
Determination of moment of inertia of a circular disc using torsional pendulum
6. Diffraction grating
Determination of wavelength of a laser light using diffraction grating (Module 4)
7. LCR series and parallel resonance
Study the frequency response of a series and parallel LCR circuit (Module 3)
8. Band gap energy
Determination of energy gap of an intrinsic semiconductor (Module 2)

TEXT BOOKS

1. S. M. Sze, Semiconductor devices, Physics and Technology, Wiley Publishing
2. Engineering Physics (2019), DSU Pearson, New Delhi

REFERENCE BOOKS

1. M. Young (1977), Optics & Lasers An Engineering Physics approach, Springer
2. K.L. Chopra, Thin film Phenomena, McGraw Hill, New York.
3. S. O. Pillai (2018), Solid State Physics, revised edition, New Age International Publishers, New Delhi
4. M N Avadhanulu, P G Kshirsagar, TVS Arun Murthy (2018), A textbook of Engineering Physics, S Chand, New Delhi.

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21EN1109	BASIC ELECTRONICS	3	–	2	–	4

COURSE OBJECTIVES

This course enables students:

- To introduce the concepts of fundamentals of semiconductor devices with the basic knowledge of the flow of current in semiconductor devices such as diodes and transistors
- To Explain the characteristics of various semiconductor devices and the concept of Integrated circuits
- To understand the principles of electronic circuits for operations of energy conversions from AC to DC, noise removal and building the required power supply
- To understand how a particular electronic device can increase the power of a signal and also to be acquainted with gain calculations
- To implement the Boolean functions and to realize basic logic gate operations and logic functions
- To understand the basics of communication system, to modify the characteristics of carrier signals according to the information signals
- To study the fundamentals of electromagnetic waves
- To identify and understand the different blocks present in transmitter and receiver.
- To describe various parameters of Op-Amp, its characteristics and specifications.
- To understand the various applications of Op-Amp.

COURSE OUTCOMES

- Explain the fundamentals of semiconductor devices, analog and digital circuits
- Design and analyze the behavior of analog and digital circuits.
- Outline the overview of communication systems and oscillators.
- Solve various kinds of numerical problems
- Develop the analog and digital circuits using simulation tool COURSE

CONTENT:

Total: 45 Hours

Module-1

Semiconductor Diodes Semiconductor materials- intrinsic and extrinsic types, Ideal Diode. Terminal characteristics of diodes: p-n junction under open circuit condition, p-n junction under forward bias and reverse bias conditions, p-n junction in breakdown region, Zener diode, Series voltage regulator, Rectifier Circuits: Half wave and full wave, Reservoir and smoothing circuits.

Module-2

Transistors - Introduction, Transistor construction, operation and characteristics; Configuration types: Common base and common emitter configuration, Active region operation of transistor, Transistor amplifying action, Biasing the BJT: fixed bias, emitter feedback bias, collector feedback bias and voltage divider bias, Transistor as a

switch: cut-off and saturation modes. Field Effect Transistors: Construction and characteristics of n-channel JFET, Types of power amplifiers: Class A operation, ClassB operation, Class AB operation.

Module-3 Operation Amplifier

Ideal Op-amp, Differential amplifier: differential and common mode operation common mode rejection ratio (CMRR), Practical op-amp circuits: inverting amplifier, non-inverting amplifier, comparator, summing amplifier, integrator, differentiator. The concept of positive feedback, Oscillator circuits using op amps: RC phase shift oscillator, wein bridge oscillator.

Module-4

Communication system - The radio frequency spectrum, electromagnetic waves, A simple CW transmitter and receiver, modulation, demodulation, AM transmitter, FM transmitter, Tuned radio frequency receiver, Superhetrodyne receiver. RF amplifiers, AM demodulators.

Module-5

Digital circuits - Logic functions, Switch and lamp logic, logic gates, combinational logic, bistables/flipflops, application of Flipflops, Integrated circuit logic devices: introduction to Microprocessor and microcontrollers (Architecture), Related Problems.

TEXT BOOKS

1. Electronic Devices and Circuit Theory: Robert L Boylestad and Louis Nashelsky, Pearson Education, Eleventh Edition, 2013.
2. Electronic Circuits: Fundamentals and applications, Michael Tooley, Elsevier, Third edition, 2006

REFERENCE BOOKS

1. David A Bell, Electronic Devices and Circuits, PHI, 5th edition, 2007.
2. Millman & Halkias, Electronics Devices and Circuits, McGraw Hill, second edition, 2010
3. Modern Digital and Analog Communication Systems by B.P.Lathi. Oxford University Press, Fourth edition, 2010
4. NPTEL- <https://nptel.ac.in/courses/122/106/122106025/>
5. Virtual Labs- <http://vlabs.iitkgp.ac.in/be/>

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21EN1110	ENGINEERING GRAPHICS & DESIGN	1	–	4	–	3

COURSE OBJECTIVES:

- To create awareness and emphasize the need for Engineering Graphics
- To understand the principles of geometrical curves and construct manually
- To learn using professional CAD software for construction of geometry
- To construct orthographic projection of points, lines, planes and solids
- To develop the lateral surfaces of solids
- To construct isometric projections of planes and solids
- To create simple engineering 3D components and assembly

COURSE OUTCOMES

- Identify usage of instruments, dimensioning & tolerances, conventions and standards related to working drawings
- Construct points, lines, planes and solids using orthographic projections principles
- Construct geometries of planes and solids using isometric projection principles
- Develop section of solids for different planes of inclination
- Construct lateral surfaces of solids using geometry development principles
- Create associative models at the component and assembly levels for product design

COURSE CONTENT:

Total 70 hours

Module-1

Introduction: Fundamentals, Drawing standard - BIS, dimensioning, Lines, lettering, scaling of figures, symbols and drawing instruments, Introduction to orthographic & perspective projection. Types of projections, Principles of Orthographic projection Plain & Miscellaneous Curves: Construction of ellipse, parabola, hyperbola, Construction of Tangent and Normal at any point on these curves. Construction of Cycloid, Epicycloid and Hypocycloid, Involute of a circle. Construction of Tangent and Normal at any point on these curves.

Module-2

Projection of Points and Lines: Projections of points located in same quadrant and different quadrants. Projection of straight lines inclined to both the principal planes – Determination of true lengths and true inclinations by rotating line method. Projection of planes: Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by change of position method.

Module-3

Projection of Solids: Projection of solids such as prisms, pyramids, cone, cylinder, tetrahedron, Projections of solids with axis perpendicular and parallel to HP and VP,

solids with axis inclined to one or both the planes, suspension of solids.

Module-4

Sections of Solids: Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other, obtaining true shape of section.

Development of Surfaces: Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

Module-5

Isometric Projection: Principles of isometric projection, isometric scale, Isometric projections of simple solids and truncated solids – Prisms, pyramids, cylinders, cones, combination of two solid objects in simple vertical positions, Conversion of orthographic views into isometric projection and vice versa

Module-6

Computer Aided Design: Introduction to computer aided drafting and tools to make drawings. Layout of the software, standard tool bar/menus and description, drawing area, dialog boxes and windows, Shortcut menus, setting up and use of Layers, layers to create drawings, customized layers, create, zoom, edit, erase and use changing line lengths through modifying existing lines (extend/lengthen) and other commands. Demonstration of a simple team design project: Product Design- Introduction, stages, Design Geometry and topology of engineered components creation of engineering models and their presentation in standard 3D view. Use of solid-modeling software for creating associative models at the component and assembly levels; include: simple mechanical components-bolts, nuts, couplings; simple civil fixtures -windows, doors, bath, sink, shower, etc. Applying colour coding to the components.

TEXT BOOKS:

1. Gopalakrishna, K. R. and Sudheer Gopala Krishna (2015). “Computer Aided Engineering Drawing”, Subash Publishers, Bangalore, India.
2. Bhatt N.D. (2019). “Engineering Drawing”, 53rd Edition, Charotar Publishing House, Gujarat, India.

REFERENCES:

1. Dhananjay .A .J, (2018). “Engineering Drawing with Introduction to AutoCAD”, Tata McGraw-Hill Publishing Company Ltd.

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21EN1111	ENGINEERING MECHANICS	2	–	2	–	3

COURSE OBJECTIVES:

- Explain different types of forces and couples, resolution of forces and couples, equilibrium conditions and related theorems
- Explain concepts of friction and their relevance in Engineering problems
- Describe centroid, center of gravity and differences between them, area moment of inertia, examples of planar objects and computations for them
- Describe Trusses and its classification, assumptions in analysis of trusses, forces in members in a truss
- Calculate various dynamic quantities of translational motion and projectile motion
- Explain principles of dynamics in plane motion analysis

Course Outcomes

- Analyze structure using free body diagrams and principle of statics
- Analyze structures using concept of equilibrium conditions considering effect of frictional forces
- Calculate the centroid and moment of inertia of composite geometrical sections
- Compute axial forces in members of determinate truss
- Analyze plane kinematics and kinetics of particles/rigid bodies COURSE

CONTENT:

Total 28 hours

Module-1

Introduction to Engineering Mechanics

Introduction to Engineering Mechanics, Force Systems Basic concepts, Particle Equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Resultant- Moment of Forces and its Application; Couples and Resultant of force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium.

Module-2

Friction

Introduction, Types of friction, Limiting friction, Cone of Friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, Ladder friction, related problems.

Module-3

Centroid, Centre and gravity and Moment of inertia

Introduction, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia Definition,

Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone.

Module-4

Analysis of Trusses

Introduction, Classification of trusses, Equilibrium in two and three dimension; Method of Sections; Method of Joints; To determine if a member is in tension or compression; Simple Trusses; Zero force members.

Module-5

Dynamics

Introduction, Rectilinear motion; Plane curvilinear motion (rectangular path, and polar coordinates); Projectile motion, Relative and constrained motion; Basic terms, general principles in dynamics; Types of motion, Instantaneous Centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies.

TEXT BOOKS:

1. Irving H. Shames (2006), "Engineering Mechanics", 4th Edition, Prentice Hall publications.
2. A. Nelson (2009), "Engineering Mechanics: Statics and dynamics", Tata McGraw Hill publications.

REFERENCES:

1. R.C. Hibbler (2006), "Engineering Mechanics: Principles of Statics and Dynamics", Pearson Press.
2. Bansal R.K (2010), "A Text Book of Engineering Mechanics", Laxmi Publications.
3. H.J. Sawant, S.P Nitsure (2018), "Elements of Civil Engineering and Engineering Mechanics", Technical Publications.

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21EN1112	BIOLOGICAL SCIENCES	2	-	-	-	2

COURSE OBJECTIVES

1. To familiarize the student with the structure and function of important components of biological systems and cellular processes.
2. Biological systems and processes will be analyzed from an engineering perspective, with an emphasis on how these can be re-designed for industrial processes and commercial products.

COURSE OUTCOMES

1. Student understands biological systems
2. Student gets the engineering aspects from biological systems

COURSE CONTENT:

Total 28 hours

Biology in the 21st Century: The new world in the post genome era. Past, present and future of our society, industry and life style: impact of discoveries and technological innovations in biology. Challenges and excitement of research in biology and bioengineering. Bioengineering as an emerging science at the intersection of biology, engineering, physics and chemistry.

Career opportunities in biotechnology, biomedical engineering, pharmaceutical industry, agro-biotechnology and in the diverse areas of basic science and medical research. Emerging trends of collaboration between industry and academia for development of entrepreneurship in biotechnology.

Quantitative views of modern biology. Importance of illustrations and building quantitative/qualitative models. Role of estimates. Cell size and shape. Temporal scales. Relative time in Biology. Key model systems - a glimpse.

Management and transformation of energy in cells. Mathematical view - binding, gene expression and osmotic pressure as examples. Metabolism. Cell communication. Genetics. Eukaryotic genomes. Genetic basis of development. Evolution and diversity. Systems biology and illustrative examples of applications of Engineering in Biology.

TEXT BOOKS:

1. R. Phillips, J. Kondev and J. Theriot, Physical Biology of the Cell, Garland Science Publishers. 2008. 1st edition.
2. J. B. Reece, L. A. Urry, M. L. Cain, S. A. Wasserman, P.V. Minorsky, and R.B. Jackson. Campbell Biology, Benjamin Cummings publishers. 2010. 9th edition.

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21EN1113	TECHNICAL COMMUNICATION	2	-	-	-	2

COURSE LEARNING OBJECTIVES:

The objectives of the Course are:

- To improve students lexical, grammatical competence
- To enhance their communicative skills
- To equip students with oral and appropriate written communicationskills
- To inculcate students with employability and job search skills
- To achieve proficiency in English
- To develop professional communication skills
- To create interest among the students about a topic by exploring thoughts and ideas
- To enable students with good use of tenses
- To learn the use of body language and improve verbal message
- To equip with Types of Teams and Leadership styles to developmanaging skills in corporate world.
- To acquire skills for placement

COURSE OUTCOMES

- Explain communication and types of Communication: Managerial, Corporate, Technical & Organizational Communication.
- Distinguish Listening and hearing. Demonstrate various aspects of speaking.Discuss Word formation and types.
- Write a report, essay. Minutes of Meeting. Evaluate current issues and debate
- Use Leadership skills and Team building. Solve Tense exercise.
- Write a job application and CV.
- Discuss topic and speak on the spot. Interpret data

COURSE CONTENT:

Module-1

Language Skills & Communication and Types of Communication.

Definitions. Communication process diagram. Types of Communication: Managerial,Corporate, Technical & Organizational Communication.

Barriers to effective Communication.

Listening: Types & its Importance. Difference between hearing & listening.Speaking: Different aspects of Effective Speaking.

Reading: Extensive and intensive.

Word Formation and Types of Word Formation.Word Family.

Module-2

Group Discussion and Writing Skills

Report Writing: Importance. Steps for Report Writing.

Group Discussion: Definition, How GD helps in Student Life & Corporate Life. Minutes of Meeting: Importance; Steps for writing MOM in Organizations.

Module-3

Team & Team Building; Leadership Styles & Tenses. Teams:

Definition, Importance, Types of Team; TEAM BUILDING:

Approaches to team building, Characteristics of Effective Teams,

Creating Effective Teams Key Team Roles, Team Processes, Interpersonal Processes in Teams, Task and maintenance leadership, Team Dynamics, Team cohesiveness, Decision Making in Teams,

Diversity, Characteristics of “High Performance Teams,” Principles of Effective Teamwork, Turning Individuals into Team Players, Teams and Quality Management, Relationship between team working and innovation in organization.

Leadership: Styles of Leadership; Characteristics of a good leader, Influence of different forces on leadership

LAB BASED: Tenses: Types of tenses, structure & usage. (Exercises based on tenses)

Module-4

JOB APPLICATION, RESUME, COVER LETTER & Data Interpretation. JOB

Application, Covering Letter; Resume/CV Writing; Difference between Job Application & Resume.

Writing Covering letter and Resume.

Module-5

DATA Interpretation-Tables, Bar-graph, Pie chart & Flowchart.

(Theoretical as well as Numerical).

Activities:

1. Activities on Fundamentals of Inter-personal Communication and Building Vocabulary —Starting a conversation — responding appropriately and relevantly – using the right body language – Role Play in different situations and Discourse Skills- using visuals – Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations and usage of vocabulary.
2. Activities on Group Discussion, Interview Skills and Debate— Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference and video-conference and Mock Interviews- Critical thinking skills in debate,

analytical research , organize thoughts, note-taking skills, effective speech composition and delivery and team work

REFERENCE BOOKS

1. Chauhan, Gajendra S., L. Thimmesha and Smita, Kashiramka (2019). Technical Communication, Cengage Learning, New Delhi.
2. Bailey, Stephen. Academic Writing: A Handbook for International Students. Routledge, 5th Edition.
3. Kumar, Shiv K., Nagarajan, Hemalatha. (2007). Learn Correct English – A Book of Grammar, Usage and Composition.
4. Raman, Meenakshi, Sharma, Sangeeta. (2009). Technical Communication. Oxford University Press.
5. English Vocabulary in Use. (2008) Cambridge University Press.

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21EN1114	DESIGN THINKING	-	-	2	-	1

COURSE OBJECTIVES:

- Introduce students to a discipline of design thinking that enhances innovation activities in terms of value creation, speed, and sustainability
- Learn application of design methods and tools on real world problem
- To impart knowledge and skills to use various workbenches in Autodesk Fusion360.
- To provide hands-on training in virtual modeling and table-top modeling.
- Application of design thinking, design methods and tools on real world problem.

Course Outcomes

- Apply the design thinking principles and recognize the significance of innovation
- Develop creative ideas through design criteria & brainstorming sessions
- Sketch various part models related to engineering field using Autodesk Fusion360
- Evaluate project on ideation & generate solution
- Construct table top models using card board and clay

COURSE CONTENT:

Total 28 hours

Module-1 Design

Thinking

Introduction, Phases of design thinking, Design thinking: an iterative and non-linear process.

Module-2

Scope and Morphology of Design Process

Creativity and Idea Generation, Concept Development, Testing and Prototyping, Brainstorming & decision making.

Module-3

Design Communication and Presentation

Types of design communications, Barriers and Difficulties in Communication

Module-4

Project on Ideation

Generation of Solution from Students for Problem Brief Generated. Brainstorming session with students on example problem.

Module-5

Project on Creativity

Table-top modelling: Using paper and cardboard based modelling, clay modelling.

TEXT BOOKS:

1. C. L. Dym and Patrick Little (2015). “Engineering Design- A Project Based Introduction”, John Wiley.
2. N. Cross (2021). “Engineering Design Methods: Strategies for Product Design”, John Wiley.

REFERENCES:

1. Tim Brown (2019). “Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation”, Harper Business.
2. Bruce Hannington and Bella Martin (2015). “Universal Methods of Design: 100 Ways to Research Complex Problems, Develop Innovative Ideas, and Design Effective Solutions”, Rockport Publishers.

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21AU0004	CONSTITUTION OF INDIA & ETHICS	2	-	-	-	-

Course objectives

1. To provide basic information about Indian constitution.
2. To identify individual role and ethical responsibility towards society.

Course outcomes

At the end of the course student will be able

- Understand state and central policies, fundamental duties
- Understand Electoral Process, special provisions
- Understand powers and functions of Municipalities, Panchayats and Cooperative Societies,
- Understand Engineering ethics and responsibilities of Engineers

Introduction to the Constitution of India, The Making of the Constitution and Salient features of the Constitution. Preamble to the Indian Constitution Fundamental Rights & its limitations.

Directive Principles of State Policy & Relevance of Directive Principles State Policy fundamental Duties.

Union Executives – President, Prime Minister Parliament Supreme Court of India. State Executives – Governor Chief Minister, State Legislature High Court of State.

Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th & 91st Amendments.

Special Provision for SC & ST Special Provision for Women, Children & Backward Classes Emergency Provisions.

Powers and functions of Municipalities, Panchyats and Co – Operative Societies.

Text Books:

1. Brij Kishore Sharma, "Introduction to the Constitution of India", PHI Learning Pvt. Ltd., New Delhi, 2011.
2. Durga Das Basu: "Introduction to the Constitution on India", (Students Edn.) Prentice Hall, 19th / 20th Edn., 2001

Reference Books:

1. M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.

SEMESTER	III					
YEAR	II					
COURSE CODE	21CS2301					
TITLE OF THE COURSE	DISCRETE MATHEMATICAL STRUCTURES					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- Solve problems using relations and generating functions.
- Understand and Construct mathematical arguments.
- Use propositional and predicate logic in knowledge representation and program verification.
- Develop recursive algorithms based on mathematical induction.
- Know essential concepts in graph theory and related algorithms.
- Apply knowledge of discrete mathematics in Elementary Number Theory and problem solving.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Classify functions, basic set theory relations.	L4
CO2	Demonstrate the correctness of an argument using propositional and predicate logic, laws and truth tables.	L2
CO3	Compare and differentiate graphs in different geometries related to edges.	L4
CO4	Apply mathematical induction, counting principles, recursion, elementary number theory.	L3
CO5	Apply and solve Euclidean Division Algorithm and Chinese Remainder Theorem.	L3

COURSE CONTENT:	
MODULE 1	8Hrs
RELATIONS AND FUNCTIONS: Relation and Types of relations, Closure Properties, Equivalence Relations, Partial Ordering Relations, n-ary relations, Functions: one-to-one, onto and invertible functions, sequences, indexed classes of sets, recursively defined functions, cardinality Counting Principles: Permutation, combination, the pigeon hole principle, inclusion-exclusion principle Self – Learning Component: Set theory definition and Properties	
MODULE 2	8Hrs
LOGIC: Propositions and truth tables, tautologies and contradictions, logical equivalence, algebra of propositions, logical implications, predicate logic, theory of inference for propositional logic and predicate logic. Introduction to Predicate Calculus.	
MODULE 3	8Hrs

NUMBER THEORY: Properties of Integers: Introduction, order and inequalities, absolute value, mathematical induction, division algorithm, divisibility, primes, greatest common divisor, Euclidean algorithm, fundamental theorem of arithmetic, congruence relation, congruence equations and Chinese Remainder Theorem (CRT).	
MODULE 4	7Hrs
GRAPH THEORY: Graphs and multi-graphs, sub-graphs, isomorphic and homomorphic graphs, paths, connectivity, Euler and Hamilton paths, labelled and weighted graphs, complete, regular and bipartite graphs, planar graphs.	
MODULE 5	8Hrs
TREES AND GRAPH COLORING: Trees: Definitions-properties - fundamental theorems of trees-rooted trees-binary trees-spanningtrees. Coloring of planar graphs, Chromatic Number- Chromatic partitioning- The four Color Problem-Five-color.	

TEXT BOOKS:

1. K. H. Rosen, Discrete Mathematics & its Applications, 7th Ed., Tata McGraw-Hill, 2007.
2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall India (PHI).

REFERENCES:

1. M.Huth and M. Ryan, Logic in Computer Science, Cambridge University N.Press, 2004.

SEMESTER	III					
YEAR	II					
COURSE CODE	21CS2302					
TITLE OF THE COURSE	DATA STRUCTURES					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)

#	Sem/Year	Course Code	Title of the Course
*	**	***	***

COURSE OBJECTIVES:

- To introduce the concept of data structure and its applications
- To introduce C language concepts required for data structures
- To design data structure operations to solve problems
- To introduce applications of data structures
- To introduce non-primitive data structures
- To analyse the complexity of a data structure
- To introduce static and dynamic memory allocation using C language
- To explain linear data structures – stack, queue, linked list
- To explain non-linear data structures – trees and graphs

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Outline basic C program design for data structures	L2
CO2	Implement stack & queue data structure and their applications	L3
CO3	Apply concepts of dynamic memory allocation to real-time Problems	L3
CO4	Implement tree data structure and its applications	L3
CO5	Implement graph data structure and its applications	L3
CO6	Outline the concepts of file structures	L2

COURSE CONTENT:

MODULE 1		7Hrs
INTRODUCTION TO DATA STRUCTURES: Definition, Types, C Pointers, C Structure, Arrays, Representation of Linear Array in Memory, Array Operations (Insertion, Deletion, Search and Traversal), Single Dimensional Arrays, Two Dimensional Arrays, Function Associated with Arrays, Arrays as Parameters, Recursive Functions.		
MODULE 2		9Hrs
INTRODUCTION TO STACK AND QUEUE: Stack: Definition, Array Representation of Stack, Operations Associated with Stacks- Push & Pop, Applications of Stack: Recursion, Polish expressions, Conversion of Infix to Postfix, Infix to Prefix, Postfix Expression Evaluation, Tower of Hanoi. Queue: Definition, Representation of Queues, Operations of Queues, Priority Queues, Circular Queue.		

MODULE 3	9Hrs
DYNAMIC DATA STRUCTURE: Linked List: Types, Introduction to Singly Linked lists: Representation of Linked Lists in Memory, Traversing, Searching, Insertion & Deletion from Linked List. Doubly Linked List, Operations on Doubly Linked List (Insertion, Deletion, Traversal). Applications: Polynomial Representation & Basic Operations, Stack & Queue Implementation using Linked Lists.	
MODULE 4	8 Hrs
TREES & GRAPHS: Trees: Basic Terminology, Binary Trees and their Representation, Complete Binary Trees, Binary Search Trees, Operations on Binary Trees (Insertion, Deletion, Search & Traversal), Application: Expression Evaluation. Graphs: Terminology and Representations, Graphs & Multigraphs, Directed Graphs, Sequential Representation of Graphs, Adjacency Matrices, Graph Traversal	
MODULE 5	6 Hrs
FILE STRUCTURES: Physical storage media, File Organization, Linked Organization of File, Inverted File, Organization Records into Blocks, Sequential Blocks, Indexing & Hashing	

TEXT BOOKS:

1. A M Tannenbaum, Y Langsam, M J Augentien “Data Structures using C”, Pearson, 2013
2. R.L. Kruse, B.P. Leary, C.L. Tondo, “Data Structure and Program Design in C” PHI

REFERENCES:

1. Horowitz Anderson-Freed, and Sahni, “Fundamentals of Data structures in C”, 2nd Edition, Orient Longman, 2008
2. Data Structures and Algorithm analysis in C by Mark Allen Weiss, Published by Addison Wesley (3rd Indian Reprint 2000).
3. D E Knuth, The Art of Computer Programming, Volume 1, Addison-Wesley Publishing, 2013

SEMESTER	III					
YEAR	II					
COURSE CODE	21CS2303					
TITLE OF THE COURSE	DIGITAL ELECTRONICS & LOGIC DESIGN					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To understand various number systems and conversion from one to other number systems
- To introduce basic postulates of Boolean algebra
- To manipulate expressions into POS or SOP form.
- To introduce the methods for simplifying Boolean expressions like K-Map and Quine Mclusky
- To understand the concept of don't care conditions and how they can be used to further optimize the logical functions
- To design simple combinational circuits such as multiplexers, decoders, encoders
- To understand the differences between combinational and sequential Logic circuits
- To familiar with basic sequential logic component-SR Latch
- To understand the basics of various types of memories.
- To present the working of various Flip- Flops (T flip-flop, D flip-flop, R-S flip-flop, JK flip-flop)
- To get familiarized with State Diagram, State Table, State Assignment
- To design combinational circuits using programmable logic devices.
- To design sequential circuits such as different types of Counters, Shift Registers

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Demonstrate the knowledge of binary number systems, Logic families, Boolean algebra and logic gates	L2
CO2	Analyze different methods used for simplification of Boolean expressions	L4
CO3	Design combinational logic circuits using combinational logic elements	L3
CO4	Design combinational circuits using Programmable Logic Devices	L3
CO5	Analyze sequential logic elements in the design of synchronous and asynchronous systems	L4
CO6	Design sequential systems composed of standard sequential modules, such as counters and registers	L3

COURSE CONTENT:	
MODULE 1	9Hrs
NUMBER SYSTEMS: BCD number representation, Unsigned and signed number representation, Binary arithmetic. BOOLEAN ALGEBRA AND SIMPLIFICATION: Laws of Boolean algebra, Theorems of Boolean algebra, Boolean/Switching functions and their implementation. SIMPLIFICATION OF BOOLEAN EXPRESSIONS AND FUNCTIONS: Canonical forms, Sum-of-Products Method, Truth Table to Karnaugh Map, Karnaugh Simplifications, Don't-care Conditions. Product-of-sums Method, Product-of-sums simplifications, Simplification by Quine-McClusky Method.	
MODULE 2	8Hrs
DESIGN OF COMBINATIONAL LOGIC CIRCUITS: Modular combinational logic elements- Multiplexers and Demultiplexers, Decoders, Magnitude comparator, BCD converter, Encoders, Priority encoders.	
MODULE3	9Hrs
INTRODUCTION TO SEQUENTIAL CIRCUITS: Introduction to Sequential Circuits. Combinational Vs sequential circuits, Clock, Clock Triggering, Memory elements and their excitation functions – Latches, T flip-flop, D flip-flop, R-S flip-flop. JK flip-flop and their excitation requirements, State diagram, state table and state equation	
MODULE 4	6 Hrs
REGISTERS Registers-Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In –Parallel Out, Universal Shift Register. Applications of Shift Registers	
MODULE 5	7 Hrs
COUNTERS, PROGRAMMABLE LOGIC: Ring, Johnson counters, Design of synchronous and asynchronous Counters Programmable Logic Arrays, Design of Combinational Circuits using Programmable Logic Devices (PLDs):	

TEXT BOOKS :

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", 6th Edition, N. Pearson Education, 2018
2. Donald P. Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015

REFERENCES:

1. D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2010.
2. Charles H. Roth: Fundamentals of Logic Design, Jr., 7th Edition, Cengage Learning, 2014
3. John M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.

SEMESTER	III					
YEAR	II					
COURSE CODE	21CS2304					
TITLE OF THE COURSE	FULL STACK DEVELOPMENT					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	-	2	-	26+26	3

Prerequisite Courses			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

1. Understand the major areas of web programming
2. To gain the skill into web applications and development.
3. To create website using HTML5, CSS3, JavaScript.
4. Server-Side Scripting using Node.JS, Express JS and Mongo dB

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Know the fundamentals of front end web technologies using HTML 5 and CSS3	L1
CO2	Apply Cascading Style Sheets and XHTML to the idea of a web application.	L3
CO3	Comprehend the principles of client-side programming and understand how to use JavaScript to implement them in order to create dynamic web sites.	L3
CO4	Implementing the principles of server side programming using Node.js, Mongo dB	L3
CO5	Applying the Node.js framework -Express.JS to create web applications faster and smarter	L3

COURSE CONTENT:	
MODULE 1: Markup Language (HTML5)	4 Hrs
Introduction to HTML and HTML5 - Formatting and Fonts -Commenting Code – Anchors – Backgrounds – Images – Hyperlinks – Lists – Tables – HTML Forms, Audio ,Video Tag.	
MODULE 2: CSS3	4 Hrs
CSS3: Levels of style sheets; Style specification formats; Selector forms; Property value forms; Font properties; List properties; Color; Alignment of text; Background images, Conflict Resolution, CSS Box Model .CSS3 features: Box Shadow, Opacity, Rounded corners, Attribute selector.	

MODULE 3 : JavaScript	6 Hrs
Overview of JavaScript; Object orientation and JavaScript; General syntactic, characteristics; Primitives, operations, and expressions; Screen output and keyboard input. Control statements; Arrays; Functions, Constructors; A brief introduction on pattern matching using regular expressions, DOM Events	
MODULE 4: Node JS	6 Hrs
Introduction to NodeJS, Set up Dev Environment, Node JS Modules, Node Package Manager, File System, Events, Database connectivity using Mongo DB.	
MODULE 5: Express.JS	6 Hrs
Introducing Express: Basics of Express, Express JS Middleware: Serving Static Pages ,Listing Directory Contents, Accepting JSON Requests and HTML Form Inputs, Handling Cookies.	

List of Laboratory/Practical Experiments activities to be conducted:

HTML5

- Design a web page depicting: -
 - How markup works, including the working of various basic HTML elements and attributes..
 - The basic structure of an HTML document.
 - The usage of table tag to format a web page
 - Use and <div> tags to provide a layout to the page instead of a table Layout.
 - The usage of lists to bring order to web pages
 - The usage of other various HTML tags like Image, anchor, links etc.
- Design a web page and embed various multimedia features in the page.
- Building of HTML Forms

CSS3:

- Change the Look of a web page with a Style Sheet

JAVASCRIPT

- Design of dynamic and Interactive web pages using Java script
 - Depicting the usage of declaring variables, running loops, if/then statements, and writing functions/Constructors using JavaScript
 - Depicting Event handling using Java script.
 - Depicting the Pattern matching using regular expressions.

NODE.JS

- Demonstrate how to use Node.js http module to create a web server.
- Create a Node.js file that depicts the usage of various File System Modules

EXPRESS.JS

- Create an app that starts a server using Express.js.
- Demonstrate the usage of various Express JS Middleware.

TEXT BOOKS:

- Robert W. Sebesta , "Programming the World Wide Web", 7th Edition, Pearson Education, 2008.
- Basarat Ali Syed," Beginning Node.js ",Apress ,2014

SEMESTER	III					
YEAR	II					
COURSE CODE	21CS2305					
TITLE OF THE COURSE	COMPUTATIONAL THINKING WITH PYTHON					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	-	2	-	26+26	3

Perquisite Courses (if any)

#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To understand basic concepts of computational thinking.
- To introduce python programming for problem solving.
- To introduce different debugging and unit testing tools.
- To solve real world problems using python data structures.
- Learn to handle files and exception handling in python.
- To explore Python's object-oriented features.
- To build Web services and Networked programs in python.
- To train students to design an application as part of the course mini- project using computational thinking with python.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand basic concepts of computational thinking.	L2
CO2	Outline basic python programming for problem solving.	L2
CO3	Apply computational thinking to solve real world programs using Python	L3
CO4	Build python programs using core data structures like list, dictionaries and tuples	L3
CO5	Implement object oriented concepts using python	L3
CO6	Design applications related to web services and network Programming.	L3

COURSE CONTENT:

MODULE 1		13	5Hrs
INTRODUCTION TO COMPUTATIONAL THINKING AND PYTHON: Introduction to computational thinking: Stages of Computational thinking, Basics: Values, expressions and statements, Conditional execution, Functions, Iterations			
MODULE 2			6Hrs
PYTHON DATA STRUCTURES: Python Data Structures: Strings, Arrays, Lists, Tuples, Sets and Dictionaries			

MODULE 3	5Hrs
PYTHON OBJECTS: Classes and Objects: Creating classes, Using Objects, Accessing attributes, Classes as Types, Introduction to Multiple Instances, Inheritance.	
MODULE 4	5Hrs
EXCEPTION HANDLING: Try-Except, Exception syntax, examples, Types of exception with except, multiple exceptions with except, Try-Finally, Raise exceptions with arguments, Python built-in exceptions, User-defined exceptions, Assertions	
MODULE 5	5Hrs
PYTHON FILES & LIBRARIES Files: File types, modes, File functions, File attributes, File positions, Looping over file. Basics of NumPy and Pandas	

List of Laboratory/Practical Experiments activities to be conduct
- Python program to evaluate Values, expressions, and statements, Conditional execution, and Functions Iterations - prompt the user to enter an integer and reverse it. And print the sum of the reversed integer. - Write a python program to find whether a number (num1) is a factor of 255. - Write a python program to find whether a number (num1) is a factor of 255. - Write a program to find the sum of the following series: $1 + 1/3 + 1/5 + 1/7 + \dots$ up to 'N' terms. $1 + x/1! + x^3/2! + x^5/3! + x^7/4! + \dots + x^{2n-1}/n!$ - Python program to evaluate Python Collections - Write a Python Program to demonstrate the inbuilt functions of Strings, List, and sets. - Write a Python program for counting a specific letter 'o' in a given string; the number of times vowel 'o' appears. - Write a Python Program to find the frequency of each word in given strings/strings - Store the following for 'n' countries, using a dictionary: - Name of a country, country's capital, per capita income of the country. - Write a program to display details of the country with the highest and second lowest per capita income. - Write a python program to create two classes "Python" and "Java" having data members "Version" and "name" and a member function "display()". With the help of the object, print the appropriate messages. - Create a class "Employee" with <u>init</u> method to initialize data members: Name, Designation, Ph. No., and a member function display(). Create an instance for the class and display the details of the employee - Write an interactive calculator! User input is assumed to be a formula that consist of a number, an operator (at least + and -), and another number, separated by white space (e.g. 1 + 1). Split user input using str.split(), and check whether the resulting list is valid: - If the input does not consist of 3 elements, raise a FormulaError, which is a custom Exception.

- b. Try to convert the first and third input to a float (like so: `float_value = float(str_value)`). Catch any `ValueError` that occurs, and instead raise a `FormulaError`
 - c. If the second input is not '+' or '-', again raise a `FormulaError`
 - d. If the input is valid, perform the calculation and print out the result. The user is then prompted to provide new input, and so on, until the user enters quit.
- 6. Write a Python program to count the number of lines in a text file and read the file line by line and store it into a list as well as find the longest word in the file.
 - 7. Write a Python program to create a list of student details: usn, name dob and email {using dictionary} and write a list to a file.
 - 8. Generate one-hot encodings for an array in numpy.
 - 9. Write a Pandas program to import excel data into a Pandas dataframe and find a list of employees where hire_date is between two specific month and year.

TEXT BOOKS:

- 1. “Python for Everybody-Exploring Data Using Python 3”, Dr. Charles R. Severance,
- 2. “Introduction to Computing & Problem Solving with Python”, Jeeva Jose, P. Sojan Lal, Khanna Book Publishing; First edition (2019).

REFERENCES:

- 1. “Computer Science Using Python: A Computational Problem- Solving Focus”, Charles Dierbach, Introduction John Wiley, 2012.
- 2. “Introduction to Computation and Programming Using Python”, John V Guttag, Prentice Hall of India, 2015.
- 3. "How to think like a Computer Scientist, Learning with Python", Allen Downey, Jeffrey Elkner and Chris Meyers, Green Tea Press, 2014.
- 4. “Learning to Program with Python”, Richard L. Halterman, 2011.

SEMESTER	III					
YEAR	III					
COURSE CODE	21CY2301					
TITLE OF THE COURSE	COMPUTER NETWORKS					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem /Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To introduce the fundamental aspects of various types of computer networks.
- To demonstrate the TCP/IP and OSI models with merits and demerits.
- To Understand the working principle of layering structure and basic network components
- To explore the features of each layer by various approach and methods

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand and explore the basics of Computer Networks and physical layer	L2
CO2	Understand about data link layer and its protocols	L2
CO3	Understand about routing mechanisms and different routing protocols	L2
CO4	Identify the issues of Transport layer to analyse the congestion control mechanism	L2
CO5	Explain principles of application layer protocols	L2

COURSE CONTENT	
MODULE 1: Overview of Networks	9 Hrs
Network Components- Network Physical Structure, Classification of networks (LAN-MAN- WAN), Protocols and Standards, Data representation and data flow, Layered Architecture – Comparison of the OSI and TCP/IP reference model. Physical Layer: Introduction to wired and wireless transmission media. Transmission mode (Serial/Parallel signals, Analog/Digital Signals and Periodic/Aperiodic Signals), Line coding Schemes.	
MODULE 2: Data Link Layer	9 Hrs
Data Link Layer – MAC (Media Access Control) and LLC (Logical Link Control) sublayer Functionalities– Design Issues: Framing – Flow control (Simplest protocol, Stop and wait, sliding window) – Error control (CRC, Hamming code) — Ethernet Basics-Multi Access Protocols: ALOHA, CSMA/CD, Connecting Devices: Hubs, Bridges, Switches, Routers, and Gateways	

MODULE 3: Network Layer	8 Hrs
Network Layer Design issues, Routing Protocol Basics, Routing Algorithm (Distance Vector Routing, Link State Routing and Hierarchical Routing). IP addressing, IP Packet format IPV4,IPV6 and IP Tunneling. Congestion control algorithms, QoS (Traffic Shaping, Packet Scheduling).	
MODULE 4: Transport Layer	7 Hrs
Transport Layer functions- Multiplexing and Demultiplexing. Introduction to TCP and UDP, The TCP Service Model, The TCP Segment Header, The TCP Connection Management, TCP Flow Control- Sliding Window, TCP Congestion Control, User Datagram Protocol	
MODULE 5: Application Layer	6 Hrs
Principles of Network Applications, WEB and HTTP, FTP, E-MAIL(SMTP, POP3), TELNET,DNS, SNMP	

TEXT BOOKS:

1. Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013.
2. Computer Networks - Andrew S Tanenbaum, 5th Edition, Pearson Education.

REFERENCES:

1. James F. Kurose, Keith W. Ross, “Computer Networking: A Top-Down Approach”, Seventh Edition, Pearson Education, 2017.
2. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers Inc., 2011.
3. William Stallings, “Data and Computer Communications”, Tenth Edition, Pearson Education, 2014.

SEMESTER	III					
YEAR	II					
COURSE CODE	21CS2307					
TITLE OF THE COURSE	DATA STRUCTURES LAB					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	26	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	**	**	***

COURSE OBJECTIVES:

- To introduce C language concepts required for data structures
- To design data structure operations to solve problems
- To introduce applications of data structures
- To implement linear data structures – stack, queue, linked list
- To implement non-linear data structures – trees and graphs

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Design and develop the programs in C to understand the different concepts of data structures.	L3
CO2	Implement stack & queue data structure and their applications, Analyse the output based on the given input data.	L3
CO3	Implement Conversions of Polish and reverse polish expressions and Record Experimental process and results	L4
CO4	Apply and implement concepts of dynamic memory allocation	L3
CO5	Use the concepts of file structures and communicate results effectively	L3

Sl. No.	List of Laboratory/Practical Experiments activities to be conduct
1.	Write a program to add, subtract, multiply and divide two integers using user defined function with return type.
2.	Write a program to find the sum of digits of the number and print the reverse of that number using Recursive Function.
3.	Write a program to add and multiply two matrices using pointers
4.	Design, Develop and Implement a menu driven Program in C for the Searching Techniques on arrays i.e, 1. Linear search 2. Binary search. If unsorted array is given as input, your program must perform sorting (bubble sort) to use it as input for binary search algorithm.
5.	Write a C program to convert infix expression to prefix expression.

6.	Write a C program to convert infix expression to postfix expression.
7.	Write a C program to implement stack, queue and their variations using arrays.
8.	Write a C program to evaluate postfix expressions
9.	Write a C program to solve tower of hanoi using recursion
10.	Write a C program to implement stack, queue and their variations using linked <u>lists</u> .
11.	Write a C program to implement Binary search tree insertion, deletion and <u>traversal</u> .
12.	Write a C program to implement Graph insertion, and traversal.
13.	Write a C program to implement File operations a. Open a file b. Write c. Read d. close d. close

Open-Ended Experiments

1. A man in an automobile search for another man who is located at some point of a certain road. He starts at a given point and knows in advance the probability that the second man is at any given point of the road. Since the man being sought might be in either direction from the starting point, the searcher will, in general, must turnaround many times before finding his target. How does he search to minimize the expected distance travelled? When can this minimum expectation be achieved?
2. The computing resources of a cloud are pooled and allocated according to customer demand. This has led to increased use of energy on the part of the service providers due to the need to maintain the computing infrastructure. What data structure will you use for allocating resources which addresses the issue of energy saving? Why? Design the solution.
3. Mini-Project on applying suitable data structure to a given real-world problem

TEXTBOOKS:

1. A M Tannenbaum, Y Langsam, M J Augentien “Data Structures using C”, Pearson, 2013
2. R.L. Kruse, B.P. Leary, C.L. Tondo, “Data Structure and Program Design in C” PHI

REFERENCE BOOKS

1. Horowitz Anderson-Freed, and Sahni, “Fundamentals of Data structures in C”, 2nd Edition, Orient Longman, 2008
2. Data Structures and Algorithm analysis in C by Mark Allen Weiss, Published by Addison Wesley (3rd Indian Reprint 2000).
3. D E Knuth, The Art of Computer Programming, Volume 1, Addison-Wesley Publishing, 2013

SEMESTER	III					
YEAR	II					
COURSE CODE	21CS2308					
TITLE OF THE COURSE	DIGITAL ELECTRONICS & LOGIC DESIGN LAB					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	26	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	**	**	***

COURSE OBJECTIVES:

- To design digital circuit for given Boolean expressions using logic gates.
- To verify the design of arithmetic circuits using logic gates and ICs.
- To test different code-conversion circuits.
- Applications of Multiplexer and De-multiplexers for implementation of different logic circuits.
- To test comparator circuits.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Build a logic circuit using basic gates after simplifying the given Boolean expression using Karnaugh map method	L3
CO2	Design and implementation of comparators	L3
CO3	Build logic circuits and realize the given Boolean expression using Multiplexers.	L3
CO4	Design of Combinational circuits like Encoder and Decoder using basic gates	L3
CO5	Design of Synchronous and Asynchronous Sequential circuits like registers and counters.	L3

List of Laboratory/Practical Experiments activities to be conducted
1. Study and verification of Basic gates with Truth Tables 2. Simplification of expressions using Karnaugh Maps and realizing circuits using Basic Gates 3. Realize binary to gray code converter and vice versa 4. Simplify the given expression using tabular method and to realize circuits using Multiplexers. 5. Design and implementation parallel adder and subtractor 6. Design and implementation of comparators 7. Design various combinational logic circuits like encoders, decoders 8. Design and implementation of shift register 9. Design and implementation synchronous counters 10. Design and implementation ring counter and Johnson counter 11. Study of 7490 BCD counter 12. Design and implementation of asynchronous counters

TEXT BOOKS:

1. M. Morris Mano and Michael D. Ciletti, “Digital Design”, 6th Edition, Pearson Education, 2018
2. Donald.P. Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015

SEMESTER	III					
YEAR	II					
COURSE CODE	21CS2309					
TITLE OF THE COURSE	MANAGEMENT & ENTREPRENEURSHIP					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2		-	-	26	2

Perquisite Courses (if any)

#	Sem/Year	Course Code	Title of the Course
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COURSE OBJECTIVES:

- Identify and analyze the factors that contribute to the process of successfully launching an entrepreneurial venture and managing a new business.
- Learn the entrepreneurial process from idea generation to implementation.
- Acquaint with special problems of starting new ventures, finding products and services, which can support new enterprises, and raising capital.
- Discuss how to start own business and also to work in or with small business or are involved with entrepreneurship.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Demonstrate knowledge of the key elements of the entrepreneurial Process	L2
CO2	Employ strategies to generate new ideas for startups	L2
CO3	Outline how to protect IP legally	L2
CO4	Examine different ways of generating funding	L2
CO5	Explain organizing managing people, finance and customers	L2

COURSE CONTENT:

MODULE 1		5Hrs
OVERVIEW OF ENTREPRENEURSHIP: THE ENTREPRENEURIAL PERSPECTIVE: Nature and Development of Entrepreneurship. Defining Manager, Entrepreneur, Entrepreneurship and Entrepreneurship. Key Elements of Entrepreneurship. Personality Characteristics of Successful Entrepreneurs. Common Myths about Entrepreneurs. Ethics and Social Responsibility of Entrepreneurs. Types of Start-Up Firms. Process of New Venture Creation. Role of Entrepreneurship in Economic Development. Emerging Trends and Issues in entrepreneurship.		
Case Study: Successful Entrepreneurs Narayana Murthy Infosys		
MODULE 2		6Hrs
THE ENTREPRENEURIAL AND ENTREPRENEURIAL MIND: The Entrepreneurial Process: Identify and Evaluate the Opportunity, Develop a Business Plan, Determine the Resources Required, Manage the Enterprise. Managerial Versus Entrepreneurial Decision Making: Strategic Orientation, Commitment to Opportunity, Commitment of Resources, Control of Resources, Management Structure, Entrepreneurial Venturing inside a Corporation, Causes for Interest in		

Entrepreneurship, Climate for Entrepreneurship, Entrepreneurial Leadership Characteristics. Case study: How to develop effective Business Plan	
MODULE 3	5Hrs
CREATIVITY AND BUSINESS IDEA: Identify and Recognizing Opportunities: Observing Trends and Solving Problems. Creativity: Concept, Components and Types of Creativity, Stages of Creative Process. Sources of New Venture Ideas. Techniques for Generating Ideas. Stages of Analyzing and Selecting the Best Ideas. Protecting the Idea: Intellectual Property Rights and its Components. Linking Creativity, Innovation and Entrepreneurship. Case study: Application of Design Thinking in New business ideas generation in particular sector (Health care, Water Saving, Energy saving)	
MODULE 4	5Hrs
PREPARING THE PROPER ETHICAL AND LEGAL FOUNDATION: Initial Ethical and Legal Issues Facing a New Firm, Establishing a Strong Ethical Culture, Choosing an attorney (Lawyer), Drafting a founder's agreement, Avoiding legal disputes, Choosing a form of business organization, Obtaining business licenses and permits, Choosing a Form of Business Ownership (Sole, Proprietorship, Partnership, Corporation & Limited Liability Company) Case study: Startup Law A to Z IP https://techcrunch.com/2019/02/25/startup-law-a-to-z-intellectual-property/	
MODULE 5	5Hrs
MANAGING EARLY GROWTH AND CHALLENGES Recruiting and Selecting Key Employees. Lenders and Investors. Funding Requirements: Sources of Personal Financing. Venture Capital. Commercial Banks. Sources of Debt Financing. Key Marketing Issues for New Ventures. Why marketing is critical for Entrepreneurs. Entrepreneurs face unique Marketing Challenges. Guerrilla Marketing. Business Growth: Nature of Business Growth, Planning for Growth, Reasons for Growth. Managing Growth: Knowing and Managing the Stages of Growth, Challenges of Growing a Firm. Strategies for Firms Growth: Internal and External Growth Strategies. Implications of Growth for the Firm and Entrepreneur. Entrepreneurial Skills and Strategies to Overcome Pressures On: Financial Resources (Financial Control, Managing Inventory and Maintaining Good Records). Human Resources, Management of Employees, Time Management. Case study: 9 ways to get startups funded https://www.quicksprout.com/how-to-get-your-startup-funded/	

TEXT BOOKS:

1. Barringer, Ireland, "Entrepreneurship: Successfully Learning New Ventures", Pearson, Latest Edition.
2. Hisrich, Peters, Shepherd, "Entrepreneurship", Mc Graw Hill, Sixth Edition.

SEMESTER	IV					
YEAR	II					
COURSE CODE	21CS2401					
TITLE OF THE COURSE	PROBABILITY AND STATISTICS					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- Understand probability, random variable and random process concepts and their importance in Computer Engineering course.
- Calculate statistics related to Random variables and process such as mean, variance, etc.
- Evaluate standard distribution functions such as Poisson's, Normal distributions
- Apply functions of random variables such as characteristic function, moment generating function to calculate statistics.
- Understand probability, random variable and random process concepts and their importance in Computer Engineering course.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Compute and interpret descriptive statistics using numerical and graphical techniques.	L4
CO2	Understand the basic concepts of random variables and find an appropriate distribution for analyzing data specific to an experiment.	L2
CO3	Extend the concepts to multiple random variables and apply them to analyze practical problems.	L2
CO4	Make appropriate decisions using statistical inference that is the central to experimental research.	L4

COURSE CONTENT:	
MODULE 1: INTRODUCTION TO PROBABILITY THEORY:	6 Hrs
Basic Notions of Probability, Axiomatic definition, properties, Conditional Probability and Independence – Baye's Theorem.	
MODULE 2: DISCRETE PROBABILITY DISTRIBUTIONS:	7 Hrs
Discrete random variables and its properties - Bernoulli trials – Binomial Distribution and its properties – Poisson Distribution and its properties.	
MODULE 3	8 Hrs
CONTINUOUS PROBABILITY DISTRIBUTIONS Continuous random variables and its properties – Exponential Distribution and its properties - Normal Distribution and its properties. BIVARIATE DISTRIBUTIONS: Bivariate random variables – Joint – Marginal - Conditional distribution.	

MODULE 4: RANDOM PROCESS AND QUEUING THEORY	9 Hrs
Classification – Stationary process – Markov process – Markov chain – Poisson process Auto correlation functions – Cross correlation functions – Properties – Power spectral density Queuing Models, Methods for generating random variables and Validation of random numbers	
MODULE 5: TESTING OF HYPOTHESIS	9 Hrs
Testing of hypothesis – Introduction-Types of errors, critical region, procedure of testing hypothesis- Large sample tests- Z test for Single Proportion - Difference of Proportion, mean and difference of mean - Small sample tests- Student's t-test.	

TEXT BOOKS:

1. A First Course in Probability, S. Ross, Pearson International Edition, 9th Edition.
2. Fundamentals of Mathematical Statistics, S. C. Gupta and V. K. Kapoor, Sultan Chand & Sons, 11th Edition.

REFERENCES:

1. K. S. Trivedi, Probability and Statistics with Reliability, Queuing, and L.Computer Science Applications, 2nd Ed., Wiley, 2001.
2. Robert V. Hogg, J.W. McKean, and Allen T. Craig: Introduction to Mathematical Statistics, Seventh Edition, Pearson Education, Asia.
3. Rohatgi, V K. and Saleh , A. K. Md. Ehsanes, "An Introduction to Probability and Statistics", (John Wiley and Sons) , (2nd edition) (2000)
4. Higher Engineering Mathematics by B S Grewal, 42 nd Edition, Khanna Publishers.
5. Probability and Statistics for engineers and scientists, R.,E.Walpole, R.H.Myers, S.L.Mayers and K.Ye, 9th Edition, Pearson Education (2012).
6. An Introduction to Probability Theory and its Applications, W. Feller , Vol. 1, 3rd Ed., Wiley, 1968

SEMESTER	IV					
YEAR	II					
COURSE CODE	21CS2402					
TITLE OF THE COURSE	DESIGN AND ANALYSIS OF ALGORITHMS					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	**	**	***

COURSE OBJECTIVES:

- To introduce and implement various techniques for designing algorithms and advanced data structures
- To learn space and time complexity analysis of algorithms.
- To understand the Divide and conquer design strategy and the Greedy Technique
- To understand the concepts of Dynamic Programming Applications
- Synthesize efficient algorithms in common engineering design situations

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Outline the overview of Data structures and Algorithms	L1
CO2	Understand the different Algorithmic Design strategies	L2
CO3	Apply the Design principles and concepts to Algorithmic design	L3
CO4	Describe the DAA paradigms and when an Algorithmic Design situation calls for it.	L6
CO5	Analyse the efficiency of Algorithms using Time and Space complexity theory	L4
CO6	Implement an existing algorithm to improve the run time efficiency	L3

COURSE CONTENT:	
MODULE 1: INTRODUCTION	6 Hrs
The role of Algorithms in Computing, Running time analysis -- recall of asymptotic notation, big-oh, theta, big-omega, and introduce little-oh and little-omega. Worst case and average case complexity	
MODULE 2: DIVIDE AND CONQUER	9 Hrs
Recursive algorithms, Divide-and-Conquer recurrences, Methods for solving recurrences: substitution method, recursion tree method and the Master method. Examples-Binary search, Quick sort, Merge sort, Strassen's Matrix Multiplication. GREEDY METHOD Optimal substructure property- Minimum cost spanning tree, Knapsack problem, Single Source Shortest Path Algorithm. Fractional knapsack	
MODULE 3 : DYNAMIC PROGRAMMING	9 Hrs
Integral knapsack (contrasted with the fractional variant: 0/1 knapsack), longest increasing subsequence, All pair shortest path in graph, Matrix chain multiplication, Travelling salesman Problem	

MODULE 4: APPLICATION OF GRAPH TRAVERSAL TECHNIQUES	9 Hrs
Recall representation of graphs, BFS, DFS, connected components, Strongly-connected components of DAGs, Kosaraju's algorithm 1 and 2, Applications. Graph matching, String Matching; Boyer Moore algorithm.	
MODULE 5: REASONING ABOUT ALGORITHMS	6 Hrs
Complexity Analysis (Polynomial vs Non-Polynomial time complexity), P, NP-hard and NP-Completeness, Reductions.	

TEXT BOOK:

1. T. H. Cormen, Leiserson, Rivest and Stein, "Introduction of Computer algorithm," , 3rd Edition, The MIT Press, 2015

REFERENCES:

1. E. Horowitz, S. Sahni, and S. Rajsekaran, " Fundamentals of Computer Algorithms," Galgotia Publication, 2015.
2. Anany Levitin, —Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012
3. Sara Basse, A. V. Gelder, "Computer Algorithms : Introduction Design & Analysis", 3rd Edition, Addison Wesley.
4. J.E Hopcroft, J.D Ullman, "Design and analysis of Computer algorithms", PearsonEducation, 2009.
5. Steven S. Skiena, "The Algorithm Design Manual", Second Edition, Springer, 2008

SEMESTER	IV					
YEAR	II					
COURSE CODE	21CS2403					
TITLE OF THE COURSE	PRINCIPLES OF MICROPROCESSORS & COMPUTER ORGANIZATION					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	4	-	-	-	52	4

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	*	**	***

COURSE OBJECTIVES:

- To introduce the architecture of 8086
- To understand the importance and function of each pin of 8086 Microprocessor
- To familiarize with the architecture of 8086 microprocessor and its operation
- To understand the various addressing modes required for assembly language
- Programming and to calculate the physical address.
- To learn the 8086 instruction set and write 8086 Assembly level programs
- To understand the importance of different peripheral devices and their interfacing to 8086
- Understand the concepts of Hardwired control and micro programmed control.
- To explain the current state of art in memory system design
- Discuss the concept of memory organization.
- Summarize the types of memory.
- Learn about various I/O devices and the I/O interface.
- Learn the different types of serial communication techniques.
- To understand DMA technique
- To provide the knowledge on Instruction Level Parallelism
- To understand the concepts of pipelining techniques.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Identify the basic building blocks of 8086 microprocessor and use the addressing modes for executing programs efficiently	L2
CO2	Develop 8086 assembly language programs using modern assembler tools	L3
CO3	Discuss the computer arithmetic and design algorithms for various Arithmetic operations.	L2
CO4	Design data part and control part of a processor	L3
CO5	Analyze the performance of various ² / ₈ classes of Memories	L4
CO6	Understand pipeline & parallel processing	L2

COURSE CONTENT:	
MODULE 1: Introduction to Microprocessor & its Architecture:	8 Hrs
Introduction-Evolution of Microprocessor, The Microprocessor-Based Personal Computer Systems, Internal Microprocessor Architecture, Real mode memory addressing, 8086 pin diagram, Internal Architecture of 8086, Registers, Addressing Modes-Immediate addressing, Register addressing, direct addressing, indirect addressing, relative addressing, Instruction formats	
MODULE 2: Programming 8086	12 Hrs
Assembler directives, Data Movement Instructions, String Data Transfers, Miscellaneous Data Transfer Instructions, Arithmetic and Logic Instructions, BCD and ASCII Arithmetic, Basic Logic Instructions, Shift and Rotate, String Comparisons. Program Control Instructions: The Jump Group, Assembly language programming with 8086, macros, procedures	
MODULE 3: Processor Organization:	10 Hrs
Basic organization of computers, Block level description of the functional units as related to the execution of a program; Fetch, decode and execute cycle. Execution cycle in terms machine instructions. Information representation, Floating point representation (IEEE754), computer arithmetic and their implementation; Data Part Design: Fixed-Point Arithmetic-Addition, Subtraction, Multiplication and Division, Arithmetic Logic Units control and data path, data path components, design of ALU and data-path, Control Part Design: Control unit design; Hardwired and Micro programmed Control unit. Discussions about RISC versus CISC architectures.	
MODULE 4: Memory Technology, Input/Output Organization:	12 Hrs
Memory hierarchy, static and dynamic memory, RAM and ROM chips, Memory address map, Auxiliary Memory, Associative Memory, Cache Memory and organization. Peripheral devices, Input-Output Interface; I/O Bus and Interface Modules, Isolated versus Memory-Mapped I/O, Modes of Transfer; Programmed I/O, Interrupt-initiated I/O, Direct memory access (DMA)	
MODULE 5: Pipelining	10 Hrs
Basic Concepts, Arithmetic Pipeline, Instruction Pipeline; Four-Segment Instruction Pipeline, Pipeline hazards and their resolution, Parallel Processing; Flynn's classification, Multicore architectures, Introduction to Graphics Processing Units, Example: NVIDIA GPU Architecture	

TEXT BOOK:

1. Barry B Brey: The Intel Microprocessors, 8th Edition, Pearson Education, 2009
2. Mano, Morris M. Computer system architecture. Dorling Kindsley Pearson, 2005.

REFERENCES:

1. Douglas V Hall, “MICROPROCESSORS AND INTERFACING, PROGRAMMING ANDHARDWARE” TMH, 2006.
2. Kenneth J. Ayala, “The 8086 Microprocessor: Programming & Interfacing The PC”,Delmar Publishers, 2007
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Danny Causey, The x86 PC Assembly LanguageDesign and Interfacing, 5th Edition, Pearson, 2013.
4. V. Carl Hamacher, Safwat G. Zaky and Zvonko G. Vranesic , Computer Organization ,McGraw-Hillseries 2002
5. Hayes, J.P , Computer Architecture and Organization, McGraw-Hill, 1998
6. David Patterson and John Hennessey, Computer Organization and Design, Elsevier. 2008
7. Comer, Douglas. Essentials of computer architecture. Chapman and Hall/CRC, 2017.
8. Hord, R. Michael. Parallel supercomputing in MIMD architectures. CRC press, 2018.
9. Tanenbaum, Andrew S. Structured computer organization. Pearson Education India, 2016.
10. William Stallings-Computer Organization and Architecture, Seventh Edition, Pearson Education

SEMESTER	IV					
YEAR	II					
COURSE CODE	21CS2404					
TITLE OF THE COURSE	FINITE AUTOMATA AND FORMAL LANGUAGES					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	2	-	39+26	4

Perquisite Courses (if any)

#	Sem/Year	Course Code	Title of the Course
*	*	**	***

COURSE OBJECTIVES:

- To learn general theory of automata, properties of regular sets and regular expressions.
- To understand basics of formal languages.
- To know push-down automata, context- free languages, Turing machines.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand the basic concepts of formal languages of finite automata techniques such as DFA, NFA and E-NFA	L2
CO2	Design Finite Automata for different Regular Expressions and Languages Demonstrate the properties of regular grammar, regular language, regular expression & their relationship with finite automata	L3
CO3	Construct context free grammar for various languages. Interpret and design different PDA for a given language	L3
CO4	Construct context free, regular, Chomsky normal form grammars to design computer languages	L3
CO5	Design Turing machine to solve problems	L3

COURSE CONTENT:

MODULE 1		8Hrs
Introduction to Finite Automata: Study and Central concepts of automata theory, An informal picture of finite automata, deterministic and non-deterministic finite automata, applications of finite automata, finite automata with epsilon – transitions.		
MODULE 2		8Hrs
Regular expression and languages: Regular expressions, finite automata and regular expressions, algebraic laws of regular expressions. Properties of Regular Languages: closure properties of regular languages, Pumping Lemma, equivalence and minimization of automata.		

MODULE 3	9Hrs
Context – free Grammars and Languages: Context free grammars, Context-free languages, Parse trees, Ambiguity in grammars and languages, Pushdown Automata: Pushdown automation (PDA), the language of PDA, equivalence of PDA's and CFG's, Deterministic Pushdown Automata	
MODULE 4	8Hrs
Properties of Context – Free Languages: Normal forms of context free grammars, pumping lemma for context free languages, closure properties of context free languages. Applications of CFG - such as spec of programming languages, parsing techniques, and Yacc	
MODULE 5	6Hrs
Introduction to Turing Machine- The Turing machine, programming techniques for Turing machine, extensions to the basic Turing machine, Chomsky hierarchy	

List of Laboratory/Practical Experiments activities to be conducted

1. Design a Program for creating machine that accepts three consecutive one.
2. Design a Program for creating machine that accepts the string always ending with 101.
3. Design a Program for Mode 3 Machine
4. Design a program for accepting decimal number divisible by 2.
5. Design a program for creating a machine which accepts string having equal no. of 1's and 0's.
6. Design a program for creating a machine which count number of 1's and 0's in a given string.
7. Design a Program to find 2's complement of a given binary number.
8. Design a Program which will increment the given binary number by 1.
9. Design a Program to convert NDFA to DFA.
10. Design a Program to create PDA machine that accept the well-formed parenthesis.
11. Design a PDA to accept WCWR where w is any string and WR is reverse of that string and C is a Special symbol.
12. Design a Turing machine that's accepts the following language $a^n b^n c^n$ where $n > 0$.

TEXT BOOKS:

1. Daniel I. A. Cohen, Introduction to Computer Theory, 2nd Edition, Wiley India Student Edition, 2008.
2. J.E. Hopcroft, R. Motwani, and J. D. Ullman, Introduction to Automata Theory, Languages and Computation, 3rd Edn. Pearson Education, New Delhi 2008

REFERENCES:

1. K.L.P. Misra and N. Chandrashekar. Theory of Computer Science- Automata, Languages and Computation, 3rd Edn. PHI, New Delhi, 2007
2. C. Martin - Introduction to Languages and the Theory of Computation 2nd Edn, TMH, New Delhi, 2000.

SEMESTER	IV					
YEAR	II					
COURSE CODE	21CS2405					
TITLE OF THE COURSE	SOFTWARE ENGINEERING AND PROJECT MANAGEMENT					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- This course is introduced to give the students necessary knowledge.
- Understanding and Design aspects in Software Engineering
- To understand the Software Project Planning and Evaluation techniques

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand software development life cycle models, process models, and various design engineering techniques	L2
CO2	Apply new software models, techniques and technologies to bring out innovative and novelistic solutions for the growth of the society in all aspects and evolving into their continuous professional development	L3
CO3	Analyze a problem, and identify and define the computing requirements appropriate to its solution	L4
CO4	Apply a wide variety of testing techniques in an effective and efficient manner.	L3
CO5	Understand Project Management principles while developing software.	L2

COURSE CONTENT:	
MODULE 1	8Hrs
Introduction to Software Engineering: FAQs about software engineering, Professional and ethical responsibility. Socio-Technical systems: Emergent system properties, Organizations, people and computer systems; Legacy systems, the evolving role of software, Changing Nature of Software, Software myths. A Generic view of process: Software engineering- A layered technology, a process framework, The Capability Maturity Model Integration (CMMI), Process patterns, process assessment, personal and team process models. Software Cost Estimation: Productivity; Estimation techniques	

MODULE 2	8Hrs
Process models: A simple safety- critical system; System dependability; Availability and reliability, the waterfall model, Incremental process models, Evolutionary process models, The Unified process. Agile Development: Agile Tech, Extreme Programming, and other Agile Process Models: Scrum Methodology	
MODULE 3	8Hrs
Software Requirements: Functional and non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document. Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management.	
MODULE 4	8Hrs
Testing Strategies: Verification and Validation: Planning; Software inspections; Automated static analysis; Verification and formal methods. A strategic approach to software testing, System testing, the art of Debugging; Component testing; Test case design; Test automation - Selenium, Test strategies for conventional software: Black-Box and White-Box testing, Validation tests, System testing.	
MODULE 5	7Hrs
Software Project Management Introduction to Software Project Management – all life cycle activities – Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.	

TEXT BOOKS:

1. Software Engineering, by Ian Sommerville Eighth edition, International Computer Science Series.
2. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition. McGraw Hill International Edition.

REFERENCES:

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.
2. Software Engineering-K.K.Agarwal&Yogesh Singh, New Age International Publishers
3. Software Engineering, an Engineering approach-James F. Peters, Witold Percy, John Wiley.
4. Systems Analysis and Design –Shelly Cashman Rosenblatt, Thomson Publications.
5. Software Engineering principles and practice-Waman Jawadekar, The McGraw-Hill Companies

SEMESTER	IV					
YEAR	II					
COURSE CODE	21CY2401					
TITLE OF THE COURSE	CRYPTOGRAPHY AND NETWORK SECURITY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
**	***	**	***
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COURSE OBJECTIVES:

- Understand the need for, and the concepts of various cryptographic algorithms.
- Illustrate key management issues in security and their solutions.
- Familiarize with standard security Protocols.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Discuss cryptography and its need for various applications.	L2
CO2	Illustrate novel security solutions for various cyber security issues.	L2
CO3	Identify right protocols at different layers of security	L3
CO4	Utilize the technologies available for Web Services, WS- Security, SAML, Other Standards.	L3

COURSE CONTENT:	
MODULE 1	08 Hrs
INTRODUCTION- Cyber Attacks, Defense Strategies, and Techniques, Guiding Principles, Mathematical Background for Cryptography – Modulo Arithmetic's, The GCD, Useful Algebraic Structures, Basics of Cryptography – Preliminaries, Elementary Substitution Ciphers, Elementary Transport Ciphers, Other Cipher Properties, Secret key Cryptography – Product Ciphers, DES Construction	
MODULE 2	08 Hrs
RSA Operations, Performance, Applications, Practical Issues, Public Key Cryptography Standard (PKCS), Cryptographic Hash - Introduction, Properties, Construction, Applications and Performance, The Birthday Attack, Discrete Logarithm and its Applications - Introduction, Diffie-Hellman Key Exchange, Other Applications.	

MODULE 3	08 Hrs
Introduction, Digital Certificates, Public Key Infrastructure, Identity-based Encryption, Authentication-I - One way Authentication, Mutual Authentication, Dictionary Attacks, Authentication – II – Centralized Authentication, The Needham-Schroeder Protocol, Kerberos, Biometrics	
MODULE 4	09 Hrs
IPSec- Security at the Network Layer – Security at Different layers: Pros and Cons, IPSec in Action, Internet Key Exchange (IKE) Protocol, Security Policy and IPSEC, Virtual Private Networks, Security at the Transport Layer - Introduction, SSL Handshake Protocol, SSL Record Layer Protocol, OpenSSL.	
MODULE 5	09 Hrs
IEEE 802.11 Wireless LAN Security - Background, Authentication, Confidentiality and Integrity, Viruses, Worms, and Other Malware, Firewalls – Basics, Practical Issues, Intrusion Prevention and Detection - Introduction, Prevention Versus Detection, Types of Intrusion Detection Systems, DDoS Attacks Prevention/Detection, Web Service Security – Motivation, Technologies for Web Services, WS- Security, SAML, Other Standards.	

TEXT BOOK:

1. Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition

REFERENCES:

1. William Stallings - Cryptography and Network Security 5th edition
2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill Edition

SEMESTER	IV					
YEAR	II					
COURSE CODE	21CS2407					
TITLE OF THE COURSE	DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	26	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	****	****	****

COURSE OBJECTIVES:

- To learn mathematical background for analysis of algorithm
- To understand the concept of designing an algorithm.
- To analyze the algorithms using space and time complexity.
- To learn dynamic programming and greedy method.
- To acquire knowledge of various applied algorithms.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Design and develop the Algorithms to understand the different concepts.	L3
CO2	Apply the Design principles and concepts to Algorithmic design	L3
CO3	Describe the DAA paradigms and when an Algorithmic Design situation calls for it.	L6
CO4	Analyse worst-case and best – case running times of algorithms using asymptotic analysis.	L4
CO5	Implement an existing algorithm to improve the run time efficiency	L3

List of Laboratory/Practical Experiments activities to be conducted:

1. Design a C program to solve the Tower of Hanoi. Compute the time complexity.
2. Apply divide and conquer method and Design a C program to search an element in a given array and Compute the time complexity. Binary search - recursive method
3. Apply Divide and Conquer method Design a C program to sort an array using Merge sort algorithm and compute its time complexity
4. Apply Divide and Conquer method Design a C program to sort an array using Quick sort algorithm and compute its time complexity.
5. Apply Greedy method and Design a C program to find the minimum cost spanning tree using Prim's and Kruskal's Algorithm and compute its complexity
6. Apply Dynamic Programming Technique and Design a C program to find the all pair shortest path using Dijkstra's Algorithm and compute its complexity
7. Design a C program to find the optimal solution of 0-1 knapsack problem using dynamic programming and Compute the time complexity
8. Design a C program to solve the Travelling Salesman Problem using dynamic programming and compute

its time complexity.

9. Design a C program to find the longest common subsequence using dynamic programming and compute its time complexity.
10. Mini project proposal should be submitted and Implementation should be done based on the problem stated in the proposal

TEXT BOOK:

1. Levitin A, “Introduction to the Design And Analysis of Algorithms”, Pearson Education, 2008.
2. T. H. Cormen, Leiserson, Rivest and Stein, “Introduction of Computer algorithm,” , 3rd Edition, The MIT Press, 2015

REFERENCES:

1. E. Horowitz, S. Sahni, and S. Rajsekaran, “Fundamentals of Computer Algorithms,” Galgotia Publication, 2015.
2. Goodrich M.T., R Tomassia, “Algorithm Design foundations Analysis and Internet Examples”, John Wiley and Sons, 2006.
3. Sara Basse, A. V. Gelder, “Computer Algorithms : Introduction Design & Analysis”, 3rd Edition, Addison Wesley.

SEMESTER	IV					
YEAR	II					
COURSE CODE	21CY2402					
TITLE OF THE COURSE	CRYPTOGRAPHY AND NETWORK SECURITY LAB					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	26	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

Course objectives: This course will enable students to

1. Exemplify Encryption and Decryption algorithm.
2. Illustrate security software's and Tools.
3. Demonstrate Virtual box, Root kits.

Course Outcomes:

1. Install necessary software and setup the environment to work with cryptography and network security.
2. Implement various Encryption and Decryption algorithm
3. Demonstrate the working of security tools and perform audits.

Lab Experiments:
PART A 1. Implement the encryption and decryption of 8-bit data using 'Simplified DES Algorithm' 2. Configure a mail agent to support Digital Certificates, send a mail and verify the correctness of this system using the configured parameters. 3. Implement the Euclid Algorithm to generate the GCD 4. Using Java Cryptography, encrypt the text "Hello world" using BlowFish. Create your own key using Java key tool 5. Implementation of Advanced Encryption Standard (AES)
PART B 1. Learn to install Wine/Virtual Box/ or any other equivalent s/w on the host OS 2. Perform an experiment to grab a banner with telnet and perform the task using Netcat 3. Perform an experiment how to use DumpSec. 4. Perform a wireless audit of an access point / router and decrypt WEP and WPA (software's netstumbler or aircrack-ng). 5. Install IPCop on a Linux system and learn all the function available on the software. Install Rootkits and study variety of opt.

REFERENCES:

1. Build Your Own Security Lab: A field guide for network Testing, Michael Gregg, Wiley India edition, ISBN: 9788126516919.

SEMESTER	V					
YEAR	III					
COURSE CODE	21CY3501					
TITLE OF THE COURSE	DATABASE MANAGEMENT SYSTEM					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	0	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

This course will enable students to:

- To learn data models, conceptualize and depict a database system using ER diagram.
- To understand the internal storage structures in a physical DB design.
- To know the fundamental concepts of transaction processing techniques.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Summarize basic concepts of database management system design and build database blueprint using E-R model.	L2
CO2	Apply SQL queries for building structured databases.	L3
CO3	Make use of normalization techniques to design relational database management system.	L3
CO4	Examine transaction management, concurrency control and error recovery techniques in database management systems.	L4
CO5	Examine PLSQL and NoSQL queries for building structured and unstructured databases.	L4

COURSE CONTENT:	
MODULE 1	8 Hrs
Introduction: Purpose of Database System—Views of data—data models, database management system, three-schema architecture of DBMS, components of DBMS. E/R Model - Conceptual data modeling - motivation, entities, entity types, attributes relationships, relationship types, E/R diagram notation, examples.	
MODULE 2	8 Hrs
Relational Model: Relational Data Model - Concept of relations, schema-instance distinction, keys, referential integrity and foreign keys, relational algebra operators, SQL -Introduction, data definition in SQL, table, key and foreign key definitions, update behaviors. Querying in SQL, notion of aggregation, aggregation functions group by and having clauses.	
MODULE 3	8 Hrs
Database Design: Dependencies and Normal forms, dependency theory– functional dependencies, Armstrong's axioms for FD's, closure of a set of FD's, minimal covers, definitions of 1NF, 2NF, 3NF and BCNF, decompositions and desirable properties of them, algorithms for 3NF and BCNF normalization, 4NF,	

and 5NF	
MODULE 4	8 Hrs
Transactions: Transaction processing and Error recovery - concepts of transaction processing, ACID properties, concurrency control, locking based protocols for CC, error recovery and logging, undo, redo, undo-redo logging and recovery methods.	
MODULE 5	7 Hrs
Embedded SQL: triggers, procedures and database connectivity. Introduction to NoSQL	

TEXT BOOKS:

1. Silberschatz, Henry F. Korth, and S. Sudharshan, “Database System Concepts”, 5th Ed, Tata McGraw Hill, 2006.
2. J. Date, A. Kannan and S. Swamynathan, “An Introduction to Database Systems”, 8th ed, Pearson Education, 2006.

REFERENCES:

1. Ramez Elmasri and Shamkant B. Navathe, “Fundamentals of Database Systems”, Fourth Edition, Pearson/Addison Wesley, 2007
2. Raghu Ramakrishnan, “Database Management Systems”, Third Edition, McGraw Hill, 2003
3. S. K. Singh, “Database Systems Concepts, Design and Applications”, First Edition, Pearson Education, 2006

SEMESTER	III					
YEAR	V					
COURSE CODE	21CY3502					
TITLE OF THE COURSE	CYBER FORENSIC AND CYBER LAW					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To introduce the fundamentals cyber forensics.
- To Learn forensic tools and techniques used for Forensic Investigations
- To Provide an overview of the legal issues arising from the use of information technology and the internet.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Summarize the cyber forensics tools and techniques to interpret cybercrimes.	L2
CO2	Build good cyber forensic report by utilizing evidence acquisition and data preparation methodologies.	L3
CO3	Inspect the network forensic tools and techniques like Wireshark, Network Miner, Xplico to detect and prevent intrusions.	L4
CO4	Survey the cloud forensic techniques associated with Google Drive, Dropbox and WhatsApp.	L4
CO5	Summarize different hardware specific tools and techniques like Slack Space, RAM Slack, Drive Slack, Swap File to investigate cybercrime.	L2

COURSE CONTENT	
MODULE 1	8 Hrs
INTRODUCTION TO CYBER FORENSICS: Introduction, Defining Cyber Forensics, Cyber Forensic Investigation Process, Forensic Protocol for Evidence Acquisition, Digital Forensics Standards and Guidelines, Digital Evidence, What Is a Cybercrime? Types of Cyber Crime, Challenges in Cyber Forensics, Skills Required to Become a Cyber Forensic Expert, Cyber Forensic Tools. (Text Book-3: Chapter 1)	
MODULE 2	8 Hrs
CYBER FORENSICS: INVESTIGATIVE SMART PRACTICES: The Forensic Process, Forensic Investigative Smart Practices, The Initial Contact, the Request, Evidence Handling, Acquisition of Evidence, Data Preparation. INVESTIGATION: INCIDENT CLOSURE - Forensic Investigative Smart Practices, Investigation (Continued), Communicate Findings, Characteristics of a Good Cyber Forensic Report, Report Contents, Retention and Curation of Evidence. (Text Book-1: Chapter 10 and Chapter 12).	

MODULE 3	8 Hrs
NETWORK FORENSICS: The OSI Model, Forensic Footprints, Seizure of Networking Devices, Network Forensic Artifacts, ICMP Attacks-Traceroute Attack, Inverse Mapping Attack, ICMP Smurf Attack, Drive-By Downloads, Network Forensic Analysis Tools-Wireshark, Case Study: Wireshark, Network Miner, Case Study: Network Miner, Xplico, Case Study: Xplico. (Text Book:2: Chapter 6)	
MODULE 4	8 Hrs
CLOUD FORENSICS: Cloud Computing Models Defining Cloud Forensics, Server-Side Forensics, Client-Side Forensics, Challenges in Cloud Forensics, Artifacts in Cloud Forensics, Use of Cloud Forensics, Forensics as a Service (FaaS) Case Study: Google Drive Investigation, Case Study: Dropbox Investigation, WhatsApp Forensics, Case Study: WhatsApp Database Extraction. (Text Book:2: Chapter 8)	
MODULE 5	7 Hrs
CYBER FORENSICS AND THE LAW: LEGAL CONSIDERATIONS – Introduction, Objectives, Cyber Forensics, Digital Information, Identification and Analysis, Digital Forensics Complexity Problem, Proliferation of Digital Evidence- Slack Space, RAM Slack, Drive Slack, Swap File. Chain of Custody, Discredit the Witness (aka Refute the Cyber Forensic Expert), Outline of an Investigation, Obtaining Proper Authorization, Who Are You Going to Call? Secure the Scene of the Alleged E-Crime, Seizing Evidence, Chain of Evidence, Chain-of-Evidence Model, seizing a Computer, Pros and Cons of Pulling the Plug. (Text Book-3: Chapter 11)	

TEXT BOOKS:

1. Albert J. Marcella Jr., Frederic Guillosoy, “Cyber Forensics from Data to Digital Evidence” 2012 by John Wiley & Sons.
2. Niranjana Reddy, “Practical Cyber Forensics. An Incident-based Approach to Forensic Investigations”, A press publications.
3. Albert J. Marcella, Jr., Doug Menendez, “Cyber Forensics A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes”, Second Edition, Auerbach Publications.

REFERENCES:

1. R.K. Jain “Zero To Mastery In Information Security And Cyber Laws” , Vayu Education of India, First Edition: 2022.
2. Gerard Johansen “Digital Forensics and Incident Response-An intelligent way to respond to attacks” 7, Packt Publishing, 2017, ISBN 978-1-78728-868-3
3. Albert J. Marcella “Cyber Forensics Examining Emerging and Hybrid Technologies”, CRC Press ,2022.
4. Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions, Thomas J. Mowbray, John Wiley & Sons, 2013.
5. Cyber Security Essentials James Graham, Ryan Olson, Rick Howard, CRC Press,

SEMESTER	V					
YEAR	III					
COURSE CODE	21CY3503					
TITLE OF THE COURSE	OPERATING SYSTEMS					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	1	-	-	52	4

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To understand the basic concepts and functions of operating systems.
- To understand Processes and Threads
- To analyze Scheduling algorithms.
- To understand the concept of Deadlocks.
- To analyze various Memory and Virtual memory management, File system and storage techniques.
- To discuss the goals and principles of protection in a modern computer system.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Summarize basic concepts of operating systems and identify its variants.	L2
CO2	Apply FIFO, SJF, SRT, Priority, Round Robin algorithms to solve process scheduling.	L3
CO3	Summarize process coordination and apply Banker's algorithm to prevent inter-process deadlock.	L2
CO4	Distinguish contiguous and virtual memory management.	L4
CO5	Apply the page replacement algorithms to detect page fault appear in virtual memory.	L3
CO6	Apply FCFS, SSTF, SCAN, C-SCAN, Look and C-Look algorithms to solve I/O scheduling.	L3

COURSE CONTENT:	
MODULE 1: OS Overview and System Structure	10Hrs
Introduction to operating systems, System structures: What operating systems do?; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Computing environments. Operating System Services: User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines;	
MODULE 2: Process Management	12Hrs
Process Management: Process concept; Process scheduling; Operations on processes. Multi-threaded Programming: Overview; Multithreading models; Threading issues. Process Scheduling: Basic concepts;	

Scheduling Criteria; Scheduling Algorithms.	
MODULE 3: Process Coordination	10Hrs
Process Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors. Deadlocks: Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.	
MODULE 4: Memory Management	10Hrs
Memory Management Strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation. Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.	
MODULE 5: File System and Secondary Storage Structure	10Hrs
File System, Implementation of File System: File system: File concept; Access methods; Directory structure; File system mounting; File sharing. Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management. Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection and Security: Protection: Goals of protection, Principles of protection, System Security: The Security Problem, Program Threats, System and Network Threats.	

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 8th edition, Wiley-India, 2010.

REFERENCES:

1. Operating Systems-Internals and Design Principles, William Stallings, 6th Edition, Pearson Education, 2009.
2. Operating Systems: A Modern Perspective, Gary J. Nutt, Addison-Wesley, 1997

SEMESTER	V					
YEAR	III					
COURSE CODE	21CY3504					
TITLE OF THE COURSE	MACHINE LEARNING FOR CYBER SECURITY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	3	-	2	-	52	4

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	IV	21CS2401	PROBABILITY AND STATISTICS

COURSE OBJECTIVES:

- Understand the basic concepts of machine learning and artificial intelligence.
- Implementation of machine learning algorithms in cyber security applications.
- Enable students to understand the need for AI in cyber security.
- To solve real world problems regarding anomaly detection techniques.

COURSE OUTCOMES:

CO No.	Outcomes	Blooms Taxonomy Level
CO1	Summarize the classical and statistical learning concepts to identify features for a given dataset.	L2
CO2	Make use of statistical and probability distributions functions to analyse comparing learning algorithms	L4
CO3	Experiment with supervised learning mechanisms for spam filtering and anomaly detection by considering email and log file datasets.	L3
CO4	Utilize unsupervised machine learning algorithms for network traffic analysis, intrusion detection and prevention by considering malware datasets.	L3
CO5	Measure different performance matrix like Confusion Matrix, Accuracy, Precision, F score, Cost function to analyse effectiveness of learning algorithms.	L5

COURSE CONTENT:	
MODULE 1: Introduction to Machine Learning	8Hrs
Overview of learning problems, Designing a Learning system. Types of learning: supervised, unsupervised and reinforcement learning. Perspective and Issues in Machine Learning. Settings of the learning problem: Classical paradigm of solving learning problems, The learning problems--classes and types of learning, fundamental of statistical learning and its framework. Introduction to feature representation and extraction. <i>(Textbook 1: Chapter 1,13 and Textbook 2: Chapter 5 and Textbook 3: Chapter 1)</i>	
MODULE 2: Mathematics for Machine Learning	4Hrs
Introduction to Probability: joint probability, conditional probability, Bayes theorem, different distributions, univariate and multivariate Gaussian distribution, PDF, MLE, Motivation, estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms.	

(Textbook 1: Chapter 5, Textbook 2: Chapter 2,3,4 and Textbook 3: Chapter 3)	
MODULE 3: Supervised Learning	14Hrs
Introduction to Supervised Learning, Introduction to Perceptron model and its adaptive learning algorithms, Introduction to classification, Naive Bayes, regression, classification Binary and multi class Classification, Regression (methods of function estimation) --Linear regression and Non-linear regression, logistic regression Regularization, Introduction To Kernel Based Methods of machine learning: Nearest neighbourhood , kernel functions, maximal margin classifier and SVM Introduction to ensemble based learning methods-decision trees and random forest, introduction to ensemble machine learning algorithms, bagging and boosting. [Algorithms have to be explained with Cyber Security Case studies] (Textbook 1: Chapter 3, Textbook 3: Chapter 2,5)	
MODULE 4: Unsupervised Learning	9Hrs
Introduction to Unsupervised Learning, Clustering (hard and soft clustering) Hierarchical clustering: K-means, Fuzzy C-Means (FCM) algorithm, Gaussian mixture models (GMM), Expectation Maximization algorithm, feature Engineering in Machine Learning, Dimensionality reduction, Linear Discriminant Analysis and Principal Component Analysis. (Textbook 3: Chapter 3,5)	
MODULE 5: Model Selection	8Hrs
Machine Learning model validation - Confusion Matrix, Accuracy, Precision, F score, Cost function, Machine Learning Optimization algorithms: Gradient descent, stochastic GD. Regularization: Normalization and Standardization overfitting, underfitting, optimal fit, bias, variance, cross-validation. (Textbook 3: Chapter 7)	

List of Laboratory/Practical Experiments activities to be conducted

1. Design and develop payment fraud detection model using logistic regression.
2. Develop a program for spam E-mail detection using Naïve Bayes algorithm.
3. Write a program for spam E-mail detection using Blacklist. Consider the required dataset.
4. Perform Anomaly detection using Elliptic Envelope Fitting for simple normally distributed datasets.
5. Know the difference between Compiled Execution and Interpreted Execution with Malware Analysis

TEXT BOOKS;

1. Thomas M. Mitchell, Machine Learning, McGraw- Hill, Inc. New York.
2. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press book in preparation. (2015).
3. Chio, Clarence_Freeman, David - Machine learning and security_ protecting systems with data and algorithms - O'Reilly Media (2018)

REFERENCE BOOKS:

1. Ethem Alpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning series), The MIT Press; second edition, 2009.

SEMESTER	V					
YEAR	III					
COURSE CODE	21CY3508					
TITLE OF THE COURSE	OOPS WITH JAVA					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- This subject will help to improve the analytical skills of object-oriented Programming
- Overall development of problem solving and critical analysis
- Formal introduction to Java programming language

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Experiment with the execution of short programs/code fragments involving object-oriented programming.	L3
CO2	Make use of Inheritance, Polymorphism and Packages to construct modular, scalable and reusable object-oriented codes.	L3
CO3	Utilize try-catch, throw, throws, finally keywords to handle compile time and run time exceptions.	L3
CO4	Make use of Abstract Window Toolkit (AWT), Swing and Applet to develop Stand-alone and Web based Graphical User Interface.	L3, L6
CO5	Evaluate object-oriented program/code fragments using a modern IDE and associated tools.	L5
CO6	Summarize File and Multi-Threading concepts in OOPS.	L2

COURSE CONTENT:	
MODULE 1	13Hrs
Introduction to Java: Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java. Objects and Classes: Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, StringBuffer, File, this reference.	
MODULE 2	6Hrs
Inheritance and Polymorphism: Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic	

programming, Casting objects, Instance of operator, Abstract class, Interface.	
MODULE 3	4Hrs
Packages and Exception Handling: Package in java, Exception handling with try-catch-finally block, throw and throws.	
MODULE 4	9Hrs
Event and GUI programming: Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Introduction to swing.	
MODULE 5	7Hrs
I/O programming: Text and Binary I/O, Binary I/O classes, Object I/O, Random Access Files. Multithreading in java: Thread life cycle and methods, Runnable interface, Thread synchronization, Collections in java, Introduction to JavaBeans and Network Programming.	

TEXT BOOKS:

1. The Complete Reference, Java 2 (Fourth Edition), Herbert Schild, TMH.

REFERENCES:

1. Murach's Beginning Java 2, Doug Lowe, Joel Murach and Andrea Steelman, SPD.
2. Core Java Volume-I Fundamentals, Eight Edition, Horstmann & Cornell, Pearson Education.
3. Java Programming, D. S. Malik, Cengage Learning.
4. Introduction to Java Programming (Comprehensive Version), Daniel Liang, Seventh Edition, Pearson.
5. Programming in Java, Sachin Malhotra & Saurabh Chaudhary, Oxford University Press.
6. Head First Java A Brain-Friendly Guide, Kathy Sierra, 3rd Edition,.

SEMESTER	V					
YEAR	III					
COURSE CODE	21CY3509					
TITLE OF THE COURSE	DATA WARFARE					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- Introduce to the Unique and emerging policies, doctrine, strategy, and operational requirements of conducting cyber warfare at the nation-state level.
- Enable learners to appreciate unified battle-space perspective and enhances their ability to manage and develop operational systems and concepts in a manner that results in the integrated, controlled, and effective use of cyber assets in warfare.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Summarize the theory of data, information and knowledge as they pertain to information warfare.	L2
CO2	Identify the social, legal and ethical implications of information warfare.	L3
CO3	Inspect contemporary information warfare and Trusted recovery models.	L4
CO4	Experiment with Computer Break-Ins and Hacking-Accounts.	L3

COURSE CONTENT:	
MODULE 1	9Hrs
Concepts and Theories: Doctrines, Information warfare: definitions, models (The information environment, Definitions and models for information warfare), Information warfare or data warfare? (Defining data, Some theories about data, Visualization, Data warfare?)	
MODULE 2	7Hrs
Defensive Information Warfare: Introduction, Background and traditional system recovery, Trusted recovery models (Modelling Databases, Modelling IW Attack and Defense, Database Trusted Recovery Models)	
MODULE 3	7Hrs
Trusted Recovery by Syntactic approaches: The Repair Model, On-the-Fly Repair Based on In-Log Read Information, Extracting Read Information from Transaction Profiles, Trusted Recovery System Development.	
MODULE 4	8Hrs
Trusted Recovery by Rewriting Histories: The Model, Basic Algorithm to Rewrite a History, Saving Additional	

Good Transactions, Pruning Rewritten Histories, Relationships between Rewriting Algorithms, Implementing the Repair Model on Top of Sagas	
MODULE 5	8Hrs
Trusted Recovery in distributed systems: Introduction, The Damage Assessment and Repair Algorithm, Performance Issues, Discussion, Future Research.	

TEXT BOOKS:

1. Daniel Ventre, Information Warfare, Wiley - ISTE (2009) (ISBN 9781848210943).
2. Peng Liu, Sushil Jajodia, Trusted Recovery and Defensive Information Warfare, Springer Science + Business Media, LLC (ISBN 978-1-4419-4926-4 ISBN 978-1-4757-6880-0 (eBook)).

REFERENCES:

1. Information Warfare and Security, Dorothy E. Denning, Denning Edition 1, 1998 Addison Wesley.
2. Cyberwar and Information Warfare, edited by Daniel Ventre, Wiley – ISTE, 2011

SEMESTER	III					
YEAR	V					
COURSE CODE	21CY3510					
TITLE OF THE COURSE	INTERNET OF THINGS					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To learn the building blocks of the Internet of Things (IoT) and their characteristics.
- To introduce the students to the programming aspects of the Internet of Things with a view toward rapid prototyping of IoT applications.
- To learn communication protocol for IoT.
- To learn Reference architectures for different levels of IoT applications.
- To learn IoT data analytics and Tools for IoT.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Summarize the evolution of IoT and identify the difference with M2M technologies.	L3
CO2	Make use of the basic building blocks of IoT to design robust IoT-centric security and privacy preserving protocols.	L3
CO3	Apply communication technologies like Zigbee, 6LoWPAN, SOAP, REST to analyze data access methodologies in IoT.	L3
CO4	Design secure IoT applications and deploy the same on Raspberry Pi, Arduino Uno, ESP-32 board.	L6
CO5	Examine Cloud Computing infrastructure with IoT devices to access Big-Data Analytics.	L4

COURSE CONTENT:	
MODULE 1: INTRODUCTION TO IOT	
8Hrs	
Introduction: Concepts behind the Internet of Things, Definition, Characteristics of IoT, IoT Conceptual framework, Physical design of IoT, Logical design of IoT, Application of IoT, IoT and M2M, IoT System Management with NETCONF-YANG.	
MODULE 2: IOT ARCHITECTURE AND SECURITY	
8Hrs	
M2M high-level ETSI architecture, IETF architecture for IoT, IoT reference model, IoT 3 Tier, and 5 tier architecture	
IoT Security: IoT and cyber-physical systems, IoT security (vulnerabilities, attacks, and countermeasures), Security engineering for IoT development, IoT security lifecycle	

MODULE 3: IOT PROTOCOLS	7Hrs
IoT Access Technologies: Physical and MAC layers, Web Communication Protocols for connected devices, SOAP, REST, HTTP Restful, and Web Sockets. Internet Connectivity Principles: Internet Connectivity, Internet-based communication, Network Layer: IP versions, IP addressing in IoT, Zigbee, 6LoWPAN, Routing over Low Power and Lossy Networks.	
MODULE 4: HARDWARE AND DEVELOPMENT TOOLS FOR IOT	8Hrs
Sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, and participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IoT supported Hardware platforms such as Arduino, Raspberry Pi, NodeMCU, Programming with Arduino IDE.	
MODULE 5: CASE STUDY AND REAL-WORLD APPLICATION	8Hrs
Case Studies: Smart Agriculture, IoMT, Smart Cities (Smart Parking, Smart Lighting, Smart Road, Health and Lifestyle), Data Analytics for IoT, Cloud Storage Models & Communication APIs, Cloud for IoT, Amazon Web Services for IoT.	

TEXT BOOKS:

1. Arshdeep Bahga and Vijay Madisetti, “Internet of Things - A Hands-On Approach”.
2. Rajkamal,” Internet of Things”, Tata McGraw Hill publication

REFERENCES:

1. Hakima Chaouchi “The Internet of Things: Connecting Objects”, Wiley publication.
2. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, by David Hanes, Gonzalo Salgueiro , Patrick Grossetete , Robert Barton, Jerome Henry by CISCO
3. Donald Norris “The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and Beagle Bone Black”, McGraw Hill publication

SEMESTER	V					
YEAR	III					
COURSE CODE	21CY3511					
TITLE OF THE COURSE	MICROCONTROLLERS AND EMBEDDED SYSTEMS					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- Explain the architectural features and instructions of 32 bit microcontroller -ARM Cortex M3.
- Develop Programs using the various instructions of ARM Cortex M3 and C language for different applications.
- Identify and understand the unique characteristics and components of embedded systems
- Understand how can we interfacing different input and output devices/components to cortex M3 microcontroller
- Understanding of how Arduino Uno & Raspberry Pi work

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Summarize the architectural features and instructions of 32-bit ARM Cortex M3.	L2
CO2	Apply the knowledge of ARM Cortex M3 instruction sets and programming to design Microcontroller-based applications.	L3
CO3	Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.	L2
CO4	Develop an embedded application with Cortex M3 architecture	L3
CO5	Design embedded systems using Arduino board and RaspberryPi	L3

COURSE CONTENT:	
MODULE 1 MODULE 1: ARM-32 bit Microcontroller	8Hrs
Microprocessors versus Microcontrollers, Different Microcontroller Architectures (CISC, RISC, ARISC), Microcontroller Types: PIC, AVR, ARM, Background of ARM and ARM Architecture: A Brief History, Architecture Versions, The Thumb-2 Technology and Instruction Set Architecture, Cortex-M3 Processor Applications, Overview of the Cortex- M3: What Is the ARM Cortex-M3 Processor, Architecture of ARM Cortex M3, Various Units in the architecture, General Purpose Registers, Special Registers, Exceptions and Interrupts	
MODULE 2: ARM Cortex M3 Instruction Sets and Programming:	8Hrs
Assembly basics, Instruction List, Instruction Descriptions: Moving Data, LDR and ADR Pseudo-Instructions, Processing Data, Call and Unconditional Branch, Decisions and Conditional Branches, Combined Compare	

and Conditional Branch, Conditional Execution Using IT Instructions, Instruction Barrier and Memory Barrier Instructions, MSR and MRS, More on the IF-THEN Instruction Block, SDIV and UDIV, REV, REVH, and REVSH, Reverse Bit, SXTB, SXTH, UXTB, and UXTH.	
MODULE 3: Cortex-M3 Programming	8Hrs
A Typical Development Flow, Using C, CMSIS: Background of CMSIS, Organization of CMSIS, Using CMSIS, Using Assembly: The Interface between Assembly and C, The First Step in Assembly Programming, Producing Outputs, The “Hello World” Example, Using Data Memory, Simple programming exercises	
MODULE 4: Embedded System Design Concepts	8Hrs
Introduction: Definition of Embedded System, Embedded Systems Vs General Computing Systems, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems, Core of the Embedded System: General Purpose and Domain Specific Processors, Embedded system architecture.	
MODULE 5: Embedded System Design using Raspberry Pi	7Hrs
Introduction to RaspberryPi, About the Raspberry Pi board and programming (on Linux) Hardware Layout, Operating systems on RaspberryPi, Configuring raspberry Pi, Programming raspberry Pi with Python libraries.	

TEXT BOOKS:

1. Joseph Yiu, “The Definitive Guide to the ARM Cortex-M3”, 2nd Edition, Newnes, (Elsevier), 2010.
2. Shibu K V, “Introduction to Embedded Systems”, Tata McGraw Hill Education Private Limited, 2nd Edition.

REFERENCES:

1. Muhammad Tahir, Kashif Javed, ARM Microprocessor Systems: Cortex-M Architecture, CRC Press 2017
2. Richard Blum, “Arduino Programming in 24 Hours”, Sams Teach Yourself, Pearson Education, 2017.
3. Vijay Madiseti and Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2016
4. Srinivasa K G, Internet of Things, CENGAGE Learning India, 2017

SEMESTER	V					
YEAR	III					
COURSE CODE	21CY3505					
TITLE OF THE COURSE	DATABASE MANAGEMENT SYSTEMS LAB					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	30	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- Understand the fundamental concepts of database management. These concepts include aspects of database design, database languages, and database-system implementation.
- To provide a strong formal foundation in database concepts, recent technologies and best industry practices.
- To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
- To learn the SQL and NoSQL database system.
- To learn and understand various Database Architectures and its use for application development.
- To programme PL/SQL including stored procedures, stored functions, cursors and packages

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Make use of Oracle version 11i software to install and configure a relational database system in Windows OS.	L3
CO2	Design database-centric schema, entity, relation, and entity-relationship abstractions for a given problem-domain utilizing Oracle version 11i.	L5
CO3	Experiment with different varieties of Structure Query Languages (SQL) like Data Description Language (DDL), Data Manipulation Language (DML), Data Control Language (DCL), and Transaction Control Language (TCL) in Oracle version 11i.	L3
CO4	Examine SQL, Nested SQL, and sub-SQL queries to observe the behavior of the aggregate and built-in functions in DBMS.	L3
CO5	Make use of PL/SQL queries to design triggers, procedures, function and database cursor.	L3

List of Laboratory/Practical Experiments activities to be conducted
1. Design any database with at least 3 entities and relationships between them. Apply DCL and DDL commands. Draw suitable ER/EER diagram for the system.
2. Design and implement a database and apply at least 10 different DML queries for the following task. For a given input string display only those records which match the given pattern or a phrase in the search string. Make use of wild characters and LIKE operator for the same. Make use of Boolean and arithmetic operators wherever necessary.

3. Execute the aggregate functions like count, sum, avg etc. on the suitable database. Make use of built in functions according to the need of the database chosen. Retrieve the data from the database based on time and date functions like now (), date (), day (), time () etc. Use group by and having clauses.
4. Implement nested sub queries. Perform a test for set membership (in, not in), set comparison (<some, >=some, <all etc.) and set cardinality (unique, not unique).Retrieve the data from the database based on time and date functions like now (), date (), day (), time () etc., Use of group by and having clauses.
5. Write and execute suitable database triggers. Consider row level and statement level triggers.
6. Write and execute PL/SQL stored procedure and function to perform a suitable task on the database. Demonstrate its use.
7. Write a PL/SQL block to implement all types of cursor.
8. Execute DDL statements which demonstrate the use of views. Try to update the base table using its corresponding view. Also consider restrictions on updatable views and perform view creation from multiple tables.
9. Mini project.

TEXT BOOKS:

1. Ramon A. Mata-Toledo, Pauline Cushman, Database management systems, TMGH, ISBN: IS978-0-07-063456-5, 5th Edition.

REFERENCES:

1. Dr. P. S. Deshpande, SQL and PL/SQL for Oracle 10g Black Book, DreamTech.
2. Ivan Bayross, SQL, PL/SQL: The Programming Language of Oracle, BPB Publication.
3. Dalton Patrik, SQL Server – Black Book, DreamTech Press.

SEMESTER	V					
YEAR	III					
COURSE CODE	21CY3506					
TITLE OF THE COURSE	OPERATING SYSTEMS LAB					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	26	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To learn creating process and Threads
- To implement various CPU Scheduling Algorithms
- To implement Process Creation and Inter Process Communication.
- To implement Deadlock Avoidance and Deadlock Detection Algorithms
- To implement Page Replacement Algorithms
- To implement File Organization and File Allocation Strategies

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Make use of system calls to create a new process, display PID, PPID and I/O operations on files.	L3
CO2	Develop C programs to implement FIFO, SJF, Priority, Round Robin algorithms to solve process scheduling.	L3
CO3	Construct C programs for process synchronization using semaphores and deadlock detection and avoidance algorithm using Banker's algorithm.	L3
CO4	Make use of FIFO, LRU and LFU techniques to simulate page replacement strategies.	L3
CO5	Develop C program to implement Single level directory and Two-level directory file organization strategies and Sequential and Indexing file allocation strategies.	L3

List of Laboratory/Practical Experiments activities to be conducted		
Exp. No	Division of Experiments	List of Experiments
1	System Calls	Write a C program to create a new process that exec a new program using system calls fork(), execlp() & wait()
2		Write a C program to display PID and PPID using system calls getpid () & getppid ()
3		Write a C program using I/O system calls open(), read() & write() to copy contents of one file to another file
4	Process Management	Write a C program to implement multithreaded program using pthreads
5		Write C program to simulate the following CPU scheduling algorithms a) FCFS b) SJF c) Priority d) Round Robin

6	Process synchronization	Write a C program to simulate producer-consumer problem using semaphores
7	Deadlock	Write a C program to simulate Banker's algorithm for the purpose of deadlock avoidance.
8		Write a C program to simulate deadlock detection.
9	Memory Management	Write a C program to simulate paging technique of memory management
10		Write a C program to simulate page replacement algorithms a) FIFO b) LRU c) LFU
11	I/O System	Write a C program to simulate the following file organization techniques a) Single level directory b) Two level directory
12		Write a C program to simulate the following file allocation strategies. a) Sequential b) Indexed

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 8th edition, Wiley-India, 2010

REFERENCES:

1. Operating Systems-Internals and Design Principles, William Stallings, 6th Edition, Pearson Education, 2009.
2. Operating Systems: A Modern Perspective, Gary J. Nutt, Addison-Wesley, 1997

SEMESTER	VI					
YEAR	III					
COURSE CODE	21CY3601					
TITLE OF THE COURSE	ETHICAL HACKING					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	1	-	-	52	4

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To understand and analyze Information security threats & countermeasures
- To perform security auditing & testing
- To understand issues relating to ethical hacking
- To study & employ network defense measures
- To understand penetration and security testing issues

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Outline the influence of security, penetration testing and vulnerability assessment on ethical hacking.	L2
CO2	Make use of port scanning tools like Nmap, OpenVAS and Nessus and ping sweeps such as Hping and Fping to identify open ports and ip addresses of an active host.	L3
CO3	Utilize brute force, key logger, sniffing and spoofing techniques to assess the computational security of a system.	L5
CO4	Summarize sql injection, cross-site scripting and session hijacking techniques to secure e-commerce-based web services.	L2
CO5	Perceive network packets of WLAN using modern tools like WLAN Scanners and WLAN Sniffers.	L5

COURSE CONTENT:	
MODULE 1- ETHICAL HACKING OVERVIEW & PENETRATION TESTING	10Hrs
Understanding the importance of security, Concept of ethical hacking and essential Terminologies Threat, Attack, Vulnerabilities, Target of Evaluation, Exploit. Phases involved in hacking. Penetration Test – Vulnerability Assessments versus Penetration Test – Pre-Engagement – Rules of Engagement - Penetration Testing Methodologies – OSSTMM – NIST – OWASP – Categories of Penetration Test – Types of Penetration Tests – Vulnerability Assessment Summary -Reports.	
MODULE 2- FOOTPRINTING & PORT SCANNING	9Hrs
Foot printing - Introduction to foot printing, Understanding the information gathering methodology of the hackers, Tools used for the reconnaissance phase. Port Scanning - Introduction, using port scanning tools, ping sweeps, Scripting Enumeration-Introduction, Enumerating windows OS & Linux OS.	

MODULE 3- SYSTEM HACKING	10Hrs
Aspect of remote password guessing, Role of eavesdropping, Various methods of password cracking, Keystroke Loggers, Understanding Sniffers, Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing.	
MODULE 4- HACKING WEB SERVICES & SESSION HIJACKING	12Hrs
Web application vulnerabilities, application coding errors, SQL injection into Back-end Databases, cross-site scripting, cross-site request forging, authentication bypass, web services and related flaws, protective http headers Understanding Session Hijacking, Phases involved in Session Hijacking, Types of Session Hijacking, Session Hijacking Tools.	
MODULE 5- HACKING WIRELESS NETWORKS	8Hrs
Introduction to 802.11, Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless DOS attacks, WLAN Scanners, WLAN Sniffers, Hacking Tools, Securing Wireless Networks.	

TEXT BOOKS:

1. Kimberly Graves, "Certified Ethical Hacker", Wiley India Pvt Ltd, 2010
2. Michael T. Simpson, "Hands-on Ethical Hacking & Network Defense", Course Technology, 2010

REFERENCES:

1. Rajat Khare, "Network Security and Ethical Hacking", Luniver Press, 2006
2. Ramachandran V, BackTrack 5 Wireless Penetration Testing Beginner's Guide (3rd ed.). Packt Publishing, 2011
3. Thomas Mathew, "Ethical Hacking", OSB publishers, 2003

SEMESTER	VI					
YEAR	III					
COURSE CODE	21CY3602					
TITLE OF THE COURSE	DIGITAL IMAGE PROCESSING					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	-	-	-

COURSE OBJECTIVES:

- To become familiar with digital image fundamentals.
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Make use of the fundamentals of digital image processing to interpret the basic characteristics of two-dimensional images.	L3
CO2	Utilize digital signal processing techniques like transformation, restoration and enhancement to improvise the quality of an image.	L3
CO3	Make use of digital signal processing tools like conventional filters to construct fine-grained images.	L2
CO4	Examine segmentation algorithms to compute the edges and region of interest of a given images.	L3

COURSE CONTENT:	
MODULE 1	08 Hrs
Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.	
MODULE 2	10 Hrs
Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.	
MODULE 3	08 Hrs
Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering.	
MODULE 4	07 Hrs
Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region	

growing – Region splitting and merging.	
MODULE 5	06 Hrs
Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.	

TEXT BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, 'Digital Image Processing', Pearson, Third Edition, 2010.
2. Anil K. Jain, 'Fundamentals of Digital Image Processing', Pearson, 2002.

REFERENCES

1. Kenneth R. Castleman, 'Digital Image Processing', Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, 'Digital Image Processing using MATLAB', Pearson Education, Inc., 2011.

SEMESTER	VI					
YEAR	III					
COURSE CODE	21CY3603					
TITLE OF THE COURSE	CLOUD APPLICATION DEVELOPMENT					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	2	-	52	4

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To give insights into the Cloud computing Technology, Service Oriented Architecture (SOA) and Virtualization.
- To recognize the basic programming for building the Cloud Application and to be familiar with version control tool.
- To understand the design and development framework for Cloud Applications.
- To deploy the cloud infrastructure using different methods from the scratch.
- To apply and map theoretical knowledge to practical through case studies and tutorials.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Summarize the cloud architecture, cloud delivery and cloud deployment models including Virtualization Technology	L2
CO2	Design a cloud application and work with the version control tools.	L5
CO3	Select an appropriate cloud-oriented framework for the development of a specific cloud application.	L5
CO4	Implement cloud-based application by exploring modern tools like Microsoft Azure, Google Cloud Platform, and Amazon AWS.	L6
CO5	Examine cloud security risks in Amazon AWS cloud infrastructure.	L3

COURSE CONTENT:	
MODULE 1: Introduction	8Hrs
Introduction- Cloud Computing Architecture – The Cloud Reference Model – Cloud Characteristics –Cloud Deployment Models: Public, Private, Community, Hybrid Clouds- Cloud Delivery Models: IaaS, PaaS, SaaS Virtualization: Introduction, Characteristics of Virtualized Environments, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Paravirtualization, Full Virtualization	
MODULE 2: Understanding Cloud Programming	8Hrs
Introduction to Cloud development using HTML5-Tag and Structural elements, Input elements and Data Attributes, Management and support and scripting. CSS3-Styling HTML, JavaScript- Variables and control statement, functions and API's Client side Javascript	

MODULE 3: Design and Developing cloud Application	9Hrs
Building Native Cloud Application: REST APIs and JSON - Using RESTAPI's with WatsonAI Services. JSON Data types-Arrays, objects, Parse, Server and HTML Developing Cloud Applications with Node.js and React: Create server-side applications using Node.js and develop the front-end using React.	
MODULE 4: Deploying Cloud Applications and services	7Hrs
Cloud Application deployment models: Amazon Web Services- Compute Services, Storage Services, Communication Services, Google AppEngine- Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations. Microsoft Azure- Azure Core Concepts	
MODULE 5: Cloud Security	7Hrs
Introduction to Cloud Security: Security: The top concern for cloud users, Cloud security risks, Security as a service (SecaaS), Privacy and privacy impact assessment, Operating system security, Virtual machine security, Security of virtualization, Security risks posed by a management OS, Xoar: Breaking the monolithic design of the TCB, A trusted virtual machine monitor, Mobile devices and cloud security, AWS security	

List of Laboratory/Practical Experiments activities to be conducted
1. Install Oracle Virtual box and create two VMs on your laptop/Desktop. 2. Test ping command to test the communication between the guest OS and Host OS 3. Use gcc to compile c-programs. Split the programs to different modules and create an application using make command 4. Find a procedure to transfer the files from one virtual machine to another virtual machine. 5. Establish an AWS account. Use the AWS Management Console to launch an EC2 instance and connect to it. 6. Develop a Hello World application using Google App Engine in Eclipse. 7. Use version control systems command to clone, commit, push, fetch, pull, checkout, reset, and delete repositories 8. Develop a Windows Azure Hello World application. 9. Install Google App Engine. Create a hello world app and other simple web applications using python/java. Use GAE launcher to launch the web applications 10. Launch GUI applications inside Docker Container & access them from the Docker Host system.

TEXT BOOKS:

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud Computing McGraw Hill Education
2. Deitel, Deitel and Neito, "Internet and World Wide Web – How to program", Pearson Education Asia, 5th Edition, 2011.
3. Dan C. Marinescu - Cloud Computing_ Theory and Practice-Morgan Kaufmann (2022)

REFERENCES:

1. Tom Marrs, "JSON at Work - Practical Data Integration for the Web", O'REILLY, First edition, 2017
2. Guo Ning Liu, Qiang Guo Tong, Harm Sluiman, Alex Amies, "Developing and Hosting Applications on the Cloud", IBM Press (2012)
3. Dan Marinescu, "Cloud Computing: Theory and Practice", M K Publishers, 1st Edition, 2013
4. A.Srinivasan, J.Suresh, "Cloud Computing, A practical approach for learning and implementation", Pearson, 2014

SEMESTER	VI					
YEAR	III					
COURSE CODE	21CY3606					
TITLE OF THE COURSE	OPERATING SYSTEM SECURITY					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

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

- Outline the models of protection and techniques to enforce security in operating systems.
- Describe the impact of security features and access control mechanisms used in secure operating systems.
- Summarizes a variety of ways that commercial operating systems have been extended with security features by using case studies.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Identify and explain operating system security preliminaries.	L3
CO2	Survey the major and distinct approaches to build secure operating systems.	L4
CO3	Examine secure capability systems and virtual machine systems.	L4
CO4	Compare and contrast Separation and VAX VMM Security Kernel.	L2

COURSE CONTENT:	
MODULE 1	9Hrs
Operating System Resource Security and Protection: Access and Flow Control – Introduction, Preliminaries, The access Matrix Model, Implementation of Access Matrix, Safety in the Access Matrix Model, Advanced Models of Protection, Case Studies: The UNIX operating System, The Hydra Kernel, Amoeba, Andrew. Text Book 1: Ch.14.1 to Ch.14.7	
MODULE 2	7Hrs
Access Control Fundamentals: Secure Operating Systems, Security Goals, Trust Model, Threat Model, Protection System, Lampson's Access Matrix, Mandatory Protection Systems, Reference Monitor, Secure Operating System Definition, Assessment Criteria, Multics History, The Multics System, Multics Security, Multics Vulnerability Analysis. Text Book 2: Ch. 1.1 Ch 1.4, Ch. 2.1 to 2.4 and Ch.3.1 to 3.4	
MODULE 3	7Hrs
Security in Ordinary Operating Systems, Verifiable Security Goals, Security Kernels: System Histories, UNIX Security, Windows Security, Information Flow, Information Flow Secrecy Models, Information Flow Integrity Models, The Security Kernel, Secure communications processor, Gemini Secure operating system. Text Book 2: Ch. 4.1 to Ch. 4.3, Ch 5.1 to Ch 5.4 and Ch. 6.1 to Ch. 6.3	

MODULE 4	9Hrs
Securing Commercial Operating Systems, Case Studies: Retrofitting Security into a Commercial OS, History of Retrofitting Commercial OS's, Commercial Era, Microkernel Era, UNIX Era, Case Study1: Solaris Trusted Extensions, Case Study2: Building a Secure Operating System for Linux. Text Book 2: Ch. 7.1 to 7.5, Ch. 8.1 to 8.8 and Ch.9.1 to Ch. 9.3	
MODULE 5	8Hrs
Secure Capability & Virtual Machine Systems: Capability System Fundamentals, Capability Security, Challenges in Secure Capability Systems, Building Secure Capability Systems, Separation Kernels, VAX VMM Security Kernel, Security in Other Virtual Machine Systems. Text Book 2: Ch. 10.1 to Ch. 10.4 and Ch. 11.1 to 11.3	

TEXT BOOKS:

1. Mukesh Singhal and Niranjana Shivaratri, Advanced Concepts in Operating Systems, McGraw-Hill, 2011.
2. Trent Jaeger, Operating System Security, Morgan & Claypool Publishers, 2008.

REFERENCES:

1. Michael J. Palmer, "Guide To Operating Systems Security", 1st Edition, Cengage Learning, 2004.
2. Gerard Blokdyk, "Security-focused operating system: Master the Art of Design Patterns", CreateSpace Independent Publishing Platform, 2017.

SEMESTER	VI					
YEAR	III					
COURSE CODE	21CY3607					
TITLE OF THE COURSE	PROACTIVE SECURITY TOOLS					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

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

- To understand the fundamentals of risk management
- To identify the threat assessment process and its input to risk assessment
- To learn the different vulnerability issues and its assessment for hazards, disaster, threats
- To understand various tools, types of risk assessment and processes of risk management

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Summarize the significance of risk, security and vulnerability assessment.	L2
CO2	Make use of threat assessment features to generate risk assessment parameters.	L3
CO3	Utilize COTS-based software to assess vulnerability issues like disasters, hazards and threats.	L3
CO4	Build policies using qualitative and quantitative risk assessment tools and techniques.	L3

COURSE CONTENT:	
MODULE 1	7Hrs
An Introduction to Risk Management: Introduction to the Theories of Risk Management; The Changing Environment; The Art of Managing Risks.	
MODULE 2	7Hrs
The Threat Assessment Process: Threat Assessment and its Input to Risk Assessment, Threat Assessment Method, Example Threat Assessment.	
MODULE 3	9Hrs
Vulnerability Issues: Operating System Vulnerabilities; Application Vulnerabilities; Public Domain or Commercial Off-the-Shelf Software; Connectivity and Dependence; Vulnerability assessment for natural disaster, technological hazards, and terrorist threats; implications for emergency response, vulnerability of critical infrastructures.	
MODULE 4	8Hrs
The Risk Process: What is Risk Assessment? Risk Analysis; Who is Responsible?	

MODULE 5	8Hrs
Tools and Types of Risk Assessment: Qualitative and Quantitative risk Assessment; Policies, Procedures, Plans, and Processes of Risk Management; Tools and Techniques; Integrated Risk Management; Future Directions: The Future of the Risk Management.	

TEXT BOOKS:

1. Malcolm Harkins, Managing Risk and Information Security, Apress, 2012.
2. Daniel Minoli, Information Technology Risk Management in Enterprise Environments, Wiley, 2009.

REFERENCES:

1. Andy Jones, Debi Ashenden ,Risk Management for Computer Security: Protecting Your Network & Information Assets, , 1st Edition, Butterworth-Heinemann, Elsevier, 2005.
2. Andreas Von Grebmer, Information and IT Risk Management in a Nutshell: A pragmatic approach to Information Security, 2008, Books On Demand Gmbh.

SEMESTER	VI					
YEAR	III					
COURSE CODE	21CY3608					
TITLE OF THE COURSE	IOT AND BIG DATA SECURITY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	39	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	-	-	Cloud Application Development, Python and Computer Networks.

CO No.	Outcomes	Bloom's Taxonomy Level
CO 1	Apply the concept of conventional cryptographic protocols to solve security-related challenges in the domain of Big Data Networks, Wireless Sensor Networks, IoT, and Cyber-Physical Systems (CPSs).	L3
CO 2	Analyze and evaluate security protocols hosted in the IoT and Big Data platforms, and determine latency, energy efficiency, trust, reliability, and availability metrics for the same system.	L4
CO 3	Develop secure Big Data storing and processing platforms using Hadoop and Spark.	L3
CO 4	Design secure IoT applications and deploy the same on Raspberry Pi, Arduino Uno, ESP-32 board.	L6
CO 5	Create vendor-specific secure IoT and Big Data storage systems through research-based internships, project-based activities, and life-long learning.	L6

COURSE CONTENT:	
MODULE 1 Fundamental of IoT and Big Data Security	9 HRS
Internet of Things, Big Data, IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies with Big Data: Development challenges, Security, Privacy, and Trust issues, Internet of Everything in Big Data, Security Requirements in IoT and Big Data Architecture and Applications.	
MODULE 2 Security Architecture of IoT and Big Data	9 HRS
Big Data Architecture, Big Data Eco System, Architecture Reference Model in IoT and Big Data, CISCO IoT Reference Model and architecture, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views of IoT, Security Architecture in the Internet of Things, Security Requirements in IoT, Blockchain.	
MODULE 3 IoT and M2M Security	7 HRS
Introduction, Definition of M2M, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An	

Architectural Overview, Building an architecture, Main design principles and needed capabilities, security and standards considerations in M2M.	
MODULE 4 Privacy, Security, and Trust in WSN and IoT	10 HRS
Security and privacy issues in WSN, Sensor deployment and node discovery, Big Data aggregation and dissemination, CIA: Confidentiality, Integrity, and Availability, Threats and attacks on IoT systems : unauthorized access, side-channel and covert channel attacks, device authentication and access control, accounting and auditing, digital signature algorithm, intrusion detection in IoT aggregation for the IoT in smart cities, Blockchain in IoT, security issues in Cloud assisted IoT, security protocols in IoT.	
MODULE 5 Secure IoT Application Programming	8 HRS
Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart and secure IoT applications design, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Home Management, Real-time monitoring and control of processes - Deploying smart machines, smart sensors, and smart controllers with proprietary communication and Internet technologies.	

TEXT BOOK:

1. “Internet of Things (A Hands-on-Approach)”, Vijay Madisetti and Arshdeep Bahga, 1st Edition, VPT, 2014.
2. “Hadoop Security_ Protecting Your Big Data Platform”, Ben Spivey, Joey Echeverria - O'Reilly Media, 2015,

REFERENCE BOOKS:

1. Handbook of Big Data and IoT Security, Ali Dehghantanha, Kim-Kwang Raymond Choo, Springer International Publishing 2019

SEMESTER	VI					
YEAR	III					
COURSE CODE	21CY3609					
TITLE OF THE COURSE	DATA MINING AND ANALYSIS					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	39	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	-	-	***

COURSE OBJECTIVES:

- To understand the basic concepts of Data Mining and Data-ware Housing
- To identify different Classification, clustering and association algorithms
- To learn the challenges and tasks of data mining process
- To understand various methods and techniques for implementing Data Ware-house

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO 1	Summarize data warehousing architectures and models like stars, snowflakes and fact constellations to measure data abstraction, complexity and computation.	L2
CO 2	Examine basic, intermediate and advanced data cube computation techniques to analysis the storage complexity.	L2
CO 3	Make use of FPGrowth algorithm to determine frequent item set.	L3
CO 4	Construct and examine classification and clustering strategies like Decision Tree, KNN, Rule based, Bayesian Classifiers, k- Means, DBSCAN, Density- Based, Graph-Based Clustering to detect hidden pattern inside datasets.	L4

COURSE CONTENT:	
MODULE 1	9 HRS
Data Warehousing & modelling: Basic Concepts, A multitier Architecture, Data warehouse models, Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading, Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations.	
MODULE 2	8 HRS
Data warehouse implementation& Data mining Efficient Data Cube computation: An overview, Indexing OLAP Data: Bitmap index and join index, Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP.	

Introduction: What is data mining, Challenges, Data Mining Tasks, Data: Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity.	
MODULE 3	8 HRS
Association Analysis Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FPGrowth Algorithm, Evaluation of Association Patterns.	
MODULE 4	7 HRS
Classification Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers.	
MODULE 5	7 HRS
Clustering Analysis Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density- Based Clustering, Graph-Based Clustering, Scalable Clustering Algorithms.	

TEXT BOOK:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson, First impression, 2014.
2. Jiawei Han, Micheline Kamber, Jian Pei: Data Mining -Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publisher, 2012.

REFERENCE BOOKS:

1. Sam Anahory, Dennis Murray: Data Warehousing in the Real World, Pearson, Tenth Impression, 2012.
2. Michael.J.Berry, Gordon.S.Linoff: Mastering Data Mining , Wiley Edition, second edition, 2012.

SEMESTER	VI					
YEAR	III					
COURSE CODE	21CY3610					
TITLE OF THE COURSE	CYBER SECURITY PROGRAMS AND POLICIES					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	39	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	-	-	***

COURSE OBJECTIVES:

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

- Know the importance of policies and governance in information security and cybersecurity.
- Maintaining confidentiality and integrity of information.
- Understand Asset Management and Data Loss Prevention and access controls
- Summarize Cybersecurity Framework Reference Tool.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO 1	Summarize cybersecurity policies, standards, hierarchy and format to protect IT assets.	L2
CO 2	Examine NIST's Cybersecurity Framework, risk assessment strategies to protect data privacy from both active and passive adversaries.	L3
CO 3	Choose robust employee learning, defense, access control models to assist asset management and loss prevention.	L3
CO 4	Make use of PCI-DSS HIPAA and GDPR standards to protect data breaches.	L3

COURSE CONTENT:	
MODULE 1	8 HRS
Cybersecurity Policy and Governance: Information Security vs. Cybersecurity Policies, Looking at Policy Through the Ages, Cybersecurity Policy, Assets, Cybersecurity Policy Life Cycle. Policy Organization, Format, and Styles: Policy Hierarchy, Writing Style and Technique, Policy Format.	
MODULE 2	6 HRS
Confidentiality, Integrity, and Availability, NIST's Cybersecurity Framework, Understanding Cybersecurity Policies, Cybersecurity Risk.	
MODULE 3	10 HRS
Asset Management and Data Loss Prevention: Information Assets and Systems, Information Classification, Labeling and Handling Standards, Information Systems Inventory, Understanding Data Loss Prevention	

Technologies, Employee life cycle, Employee learning during orientation, The Importance of Employee Agreements, The Importance of Security Education and Training, Understanding the secure Facility layered Defense Model, Protecting Equipment, Access Control Fundamentals, Infrastructure Access Controls, User Access Controls.	
MODULE 4	7 HRS
Incident Response, Investigation and Evidence Handling, Data Breach Notification Requirements.	
MODULE 5	8 HRS
Protecting Cardholder Data, PCI Compliance, Introduction to NIST Cybersecurity Framework Components, Framework Implementation Tiers, Improvement of Cybersecurity Program, NIST Cybersecurity Framework Reference Tool.	

TEXT BOOK:

1. Developing Cybersecurity Programs & Policies, OMAR SANTOS, Pearson Education.

REFERENCE BOOKS:

1. Cyber Law: The law of the Internet”, Jonathan Rosenoer, Springer-Verlag, 1997.

SEMESTER	VI					
YEAR	III					
COURSE CODE	21CY3604					
TITLE OF THE COURSE	ETHICAL HACKING LAB					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	26	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To cover the fundamentals and mathematical models in digital image and video processing
- To develop time and frequency domain techniques for image enhancement
- To expose the students to current technologies and issues in image and video processing.
- To develop image and video processing applications in practice.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Make use of reconnaissance tools like WHOIS, dig, nslookup, traceroute, ping, ifconfig, netstat to analyze computer network.	L3
CO2	Apply nmap to perform port scanning and visualize the OS fingerprinting.	L3
CO3	Utilize ARPWATCH tool to detect ARP spoofing and to perform ARP poisoning and make use of WireShark tool to analyze network packets.	L3
CO4	Inspect Cain and Abel tools for determine the Windows account and wireless network passwords using Dictionary attack.	L4
CO5	Experiment with DVWA, Tamper Data, Metasploit, Xampp applications to stimulate Cross Site Scripting attack, Session impersonation, exploiting, sql injection attack.	L3

List of Experiments:

1. Study the use of network reconnaissance tools like WHOIS, dig, nslookup, traceroute, ping, ifconfig, netstat to gather information about networks and domain registrars.
2. Download and install nmap. Use it with different options to scan open ports, perform OS fingerprinting, do a ping scan, tcp port scan and udp port scan.
3. Using Nmap scanner to perform port scanning of various forms like ACK, SYN, FIN, NULL, XMAS.
4. Detect ARP spoofing using open-source tool ARPWATCH.
5. Perform ARP Poisoning in Windows.
6. Use Cain and Abel for cracking Windows account password using Dictionary attack and to decode wireless network passwords.
7. Use WireShark sniffer to capture network traffic and analyze.
8. Simulate persistent Cross Site Scripting attack.
9. Session impersonation using Firefox and tamper data add-on.

- | |
|---|
| <ol style="list-style-type: none">10. Perform SQL injection attack.11. Create a simple keylogger using python.12. Using Metasploit to exploit to create exploit and add the exploit to the victim's PC. |
|---|

REFERENCES:

1. Patrick Engebretson, The Basics of hacking and penetration testing, 8th edition, Wiley-India, 2010
2. Michael Gregg, Build Your Own Security Lab: A Field Guide for Network Testing, Wiley Publishing, Inc, 2008.

SEMESTER	VI					
YEAR	III					
COURSE CODE	21CY3605					
TITLE OF THE COURSE	DIGITAL IMAGE PROCESSING LAB					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	26	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To understand image acquisition and storage using a open source software – SCILAB
- To study and analyze different image transforms on images
- To study, analyze and apply different techniques and algorithms for image enhancement
- To study, analyze and apply different techniques and algorithms for image restoration
- To study, analyze and apply different techniques and algorithms for image compression

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Construct program to read binary, gray scale, multi-spectral two-dimensional images and perform DFT, IDFT, DCT, IDCT, DWT and IDWT.	L3
CO2	Examine rotation, transformation, dimensionality reduction of a given gray-scale image	L4
CO3	Inspect image enhancement, smoothing, sharpening and noise reduction in spatial and frequency domain utilizing filters.	L4
CO4	Make use of Discrete Wavelet Transform to perform compress and decompress of a given gray-scale images.	L3

List of Experiments

The following programs can be developed in C or Java or Python programming languages or MATLAB tool: 1. Representation of a binary, gray scale, color and multi-spectral two-dimensional images. 2. Apply the Discrete Fourier Transform to a given gray scale image and perform inverse DFT. 3. Analyze the rotation, transformation, dimensionality reduction of a given gray scale image. 4. Find the Discrete Cosine Transforms of a given image. Compare Discrete Fourier Transform and Discrete Cosine Transforms. 5. Apply histogram equalization for enhancing the given images. 6. Perform image enhancement, smoothing and sharpening, in spatial domain using different spatial filters. 7. Perform image enhancement, smoothing and sharpening, in frequency domain using different filters. 8. Perform noise removal using different spatial filters and compare their performances. 9. For the given image perform edge detection using different operators and compare the results. 10. For a given gray-scale image, compress and decompress using wavelets.
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REFERENCES:

1. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, 'Digital Image Processing using MATLAB', Pearson Education, Inc., 2011.

SEMESTER	VII					
YEAR	IV					
COURSE CODE	21CY4702					
TITLE OF THE COURSE	VULNERABILITY ANALYSIS AND PENETRATION TESTING					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- Understand the evolving tools, tactics and procedures used by cybercriminals to breach networks.
- Discuss implications of common vulnerabilities and recommend ways to rectify or mitigate.
- More complex vulnerabilities are sought which cannot be found by automated scanners and the effectiveness of the security measures taken at the technical, organizational and personnel level is checked.
- Understand the legal aspects, industry ethics and the approaches and methodologies used when performing a penetration test.
- Be able to use the appropriate penetration testing tools for a given scenario and understand their output.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Summarize the significance of risk, security and vulnerability assessment.	L2
CO2	Analyze penetration testing strategies for diagnosing security of web application using OWASP standards.	L4
CO3	Identify the types of vulnerability assessment policies to evaluate system security.	L5
CO4	Apply modern tools and techniques like Metasploit, RouterSploit, Backdoor, remote access to gather active and passive information of a system.	L3
CO5	Apply web application security concepts to design application portfolio for reducing risk and vulnerabilities.	L3

COURSE CONTENT:	
MODULE 1	
8Hrs	
Vulnerability Management Governance: Security basics, Identification, Authentication, Authorization, Auditing, Accounting, Non-repudiation, Vulnerability, Threats, Exposure, Risk, Safeguards, Attack vectors. Understanding the need for security assessments: Types of security tests: Security testing, Vulnerability assessment versus penetration testing, Security assessment, Security audit.	
MODULE 2	
7Hrs	
Penetration testing standards, Penetration testing lifecycle, industry standard, Open Web Application Security Project (OWASP) testing guide. Security Assessment Prerequisites: Target scoping and planning, Gathering requirements: checklist of test requirements, time frame and testing hours, Identifying stakeholders.	

MODULE 3	8Hrs
Types of vulnerability assessment: based on location, based on knowledge about environment/ infrastructure, Announced and Unannounced Automated Testing, Manual Testing Estimating the resources and deliverables, Preparing a test plan, Getting approval and signing NDAs, Confidentiality and Nondisclosure Agreements.	
MODULE 4	9Hrs
Information Gathering: Passive information gathering, Active information gathering. Enumeration: Enumeration Services. Gaining Network Access: Gaining remote access, Cracking passwords, Creating backdoors using Backdoor Factory, Exploiting remote services using Metasploit, Hacking embedded devices using RouterSploit, Social engineering using SET.	
MODULE 5	7Hrs
Assessing Web Application Security: Importance of web application security testing, Application profiling, Common web application security testing tools, Authentication, Authorization, Session management, Input validation, Security misconfiguration.	

TEXT BOOKS:

1. Sagar Rahalkar, Network Vulnerability Assessment, Packt Publishing Inc, 2018.

REFERENCES:

1. Abhishek Singh, Baibhav Singh and Hirosh Joseph, Vulnerability Analysis and Defense for the Internet, Springer Publishing Inc, 2008.
2. Wil Allsopp, Unauthorized Access: Physical Penetration Testing For IT Security, Wiley Publishing Inc, 2009.
3. Kimberly Graves, Vulnerability Analysis and Defense for the Internet, Wiley Publishing Inc.; 2007.
4. Shakeel Ali and Tedi Heriyanto, Backtrack -4: Assuring security by penetration testing”, PACKT Publishing; 2011

SEMESTER	VII					
YEAR	IV					
COURSE CODE	21CY4703					
TITLE OF THE COURSE	QUANTUM CRYPTOGRAPHY AND COMMUNICATION					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	42	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To apply techniques of linear algebra to quantum mechanics
- To analyze basic quantum circuits
- To explore the techniques of quantum communication
- To study the protocols of quantum cryptograph

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Examine the tools and techniques of linear algebra to the quantum mechanics problems	L4
CO2	Design and analyze basic quantum circuits and quantum computing algorithms	L5
CO3	Develop the quantum communication tools using quantum gates	L6
CO4	Design quantum cryptography protocol using quantum mechanics	L6

COURSE CONTENT:	
MODULE 1: LINEAR ALGEBRA REVIEW	9 Hrs
Bases and Linear Independence, Linear Operators and Matrices, Inner Products Eigen Vectors and Eigen Values, Adjoints and Hermitian Operators, Tensor Products, Operator Functions, Commutator and Anti-Commutator	
MODULE 2: QUANTUM MECHANICS	8 Hrs
State Space, Evolution, Measurement, Distinguishing Quantum States, Projective Measurements and POVMs	
MODULE 3: QUANTUM GATES AND ALGORITHMS	7 Hrs
Universal set of gates, quantum circuits, Solovay-Kitaev theorem, Deutsch-Jozsa algorithm, Shor's factoring, Grover Algorithm and HHL Algorithm	
MODULE 4: QUANTUM COMMUNICATION	9 Hrs
Overview of Quantum Operations, Quantum Noise, Distance Between Quantum States, Accessible Information, Data Compression, Classical Information Over Quantum Channels, Quantum Information Over Quantum Channels, Entanglement as a Physical Resource	

MODULE 5 : QUANTUM CRYPTOGRAPHY	9 Hrs
Private Key Cryptography, Privacy Amplification, Quantum Key Distribution, Privacy and Coherent Information, Security of Quantum Key Distribution	

TEXT BOOKS:

1. Nielsen, M. A., & Chuang, I. (2002). Quantum computation and quantum information.

REFERENCE BOOKS:

1. Phillip Kaye, Raymond Laflamme et. al., An introduction to Quantum Computing, Oxford University press, 2007.
2. Chris Bernhardt, Quantum Computing for Everyone, The MIT Press, Cambridge, 2020

SEMESTER	VII					
YEAR	IV					
COURSE CODE	21CY4704					
TITLE OF THE COURSE	WIRELESS NETWORK SECURITY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

COURSE OBJECTIVES:

1. Understanding the fundamentals and architecture of wireless sensor networks, enabling students to evaluate and comprehend their structure and components.
2. Explore different security architectures and protocols used in wireless networks.
3. Students will be able analyze the OSI model, evaluate wireless LAN security protocols, apply cryptographic techniques, and assess security considerations in wireless networks.
4. Gaining knowledge of identity-based cryptography and countermeasures against attacks, identifying and mitigating wireless threats,
5. Studying hacking techniques, familiarizing with wireless security tools, and developing skills in creating effective wireless security policies.

CO No.	Outcomes	Bloom's Taxonomy Level
CO 1	Summarize the WSN applications, history, architecture, routing challenges, and security countermeasures.	L2
CO 2	Compare different wireless security architectures and assess their strengths and weaknesses.	L2
CO 3	Interpret the OSI model, wireless LAN security protocols, cryptography, and security considerations.	L2
CO 4	Analyze symmetric, asymmetric key systems, PKI, and identity-based cryptography.	L3
CO 5	Utilize scanning, sniffing, denial-of-service, and access point attacking tools to identify wireless threats, employ hacking techniques, and develop a comprehensive wireless security policy.	L3

COURSE CONTENT:	
MODULE 1	8 HRS
Introduction To Wireless Sensor Networks: Introduction-WSN Applications, History of WSN, WSN Architecture, Architecture of Sensor Nodes, The Protocol Stack in WSN; MANET Versus WSN, Challenges in WSN, The Routing Problem in WSN, Broadcasting and Multicasting. Security in Wireless Sensor Networks: Introduction, Attacks on WSN, Countermeasures to Attacks in WSN.	
MODULE 2	8 HRS

Wireless Security Architectures: Static WEP Wireless Architecture, VPN, Wireless VPN Architecture Overview, Wireless VPN Architecture Overview, VPN Policy Aspect, Wireless Gateway Systems ,802.1x, Comparing Wireless Security Architectures. Introduction to Wireless Security Protocols and Cryptography: Removing the FUD, OSI Model, Wireless Local Area Network (LAN) Security Protocols, Cryptography, Secure Sockets Layer/Transport Layer Security (SSL/TLS), Man-in-the-Middle (MITM) of SSL/TLS and SSH, Security Considerations for Wireless Security-wireless device security issues.	
MODULE 3	8 HRS
Identity-Based Cryptography: Introduction-Symmetric Key Cryptographic Systems, Asymmetric Key Cryptographic Systems, Public Key Infrastructure- Single-Certificate Authority Model, A Hierarchy of Certificate Authorities, Pros and Cons of PKI, Identity-Based Cryptography-Computational Problems, Identity-Based Encryption Schemes, Hierarchical Identity-Based Encryption Scheme , Identity-Based Authentication Schemes , Key Distribution in IBC, Key Escrow Problem, Threshold Signature Scheme	
MODULE 4	8 HRS
Wireless Threats: The Uncontrolled Terrain, Eavesdropping, Communications Jamming, Injection and Modification of Data, Rogue Client, Attacker Equipment, Covert Wireless Channels, Roaming Issues, Cryptographic Threats. Breaking Wireless Security: The Hacking Process, Wireless Network Compromising Technique, Access Point Compromising Techniques	
MODULE 5	7 HRS
Wireless Tools: Scanning Tools., Sniffing Tools, Hybrid Tools, Denial-of-Service Tools, Denial-of-Service Tools, Access Point Attacking Tools, Other Wireless Security Tools. Wireless Security Policy: Policy Overview, The Policy-Writing Process, Risk Assessment, Impact Analysis, Wireless Security Policy Areas.	

TEXT BOOK:

1. Harsh Kupwade Patil Stephen A. Szygenda, “Security for Wireless Sensor Networks using Identity-Based Cryptography”, CRC Press, Taylor & Francis Group-2013
2. Merritt Maxim and David Pollino, “Wireless Security”, McGraw-Hill publication,2002
3. Aaron E. Earle, “Wireless Security Handbook”, Published in 2006 by Auerbach Publications Taylor & Francis Group

REFERENCE BOOKS:

1. “MOBILE AND WIRELESS NETWORKS SECURITY”, Maryline Laurent-Maknavicius, Hakima Chaouchi, France Proceedings of the MWNS 2008 Workshop Singapore 9 April 2008.
2. “Wireless Network Security”, by YANG XIAO, XUEMIN SHEN, and DING-ZHU DU, Springer Series, 2007, ISBN-10 0-387-28040-5.

SEMESTER	VII					
YEAR	IV					
COURSE CODE	21CY4705					
TITLE OF THE COURSE	DATA PRIVACY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	38	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	-	-	-

COURSE OBJECTIVES:

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

- Learn about keeping data private with classical cryptography, modern cryptography, Steganography.
- Understand different types of Ciphers.
- Use various algorithms of public key cryptography.
- Identify the methods for data hiding in different types of images and videos.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Examine Monoalphabetic and Polyalphabetic Substitution Ciphers to discover plaintext.	L4
CO2	Make use of public cryptography to hide data in text, image, audio and video signal.	L2
CO3	Summarize LSB Encoded, BPCS, Spread Spectrum Steganography to hide private data inside text, image, audio and video signal.	L2
CO4	Apply digital signal processing tools and techniques to construct digital watermark.	L3

COURSE CONTENT:	
MODULE 1	08 Hrs
Monoalphabetic Substitution Ciphers: Letter Distributions, Breaking a Monoalphabetic Cipher, The Pigpen Cipher, Polybius's Monoalphabetic Cipher, Extended Monoalphabetic Ciphers, The Playfair Cipher, Homophonic Substitution Ciphers. Polyalphabetic Substitution Ciphers: Self-Reciprocal Ciphers, The Porta Polyalphabetic Cipher, The Beaufort Cipher, The Trithemius Cipher, The Vigenere Cipher, Breaking the Vigenere Cipher, Long Keys, A Variation on Vigenere, The Gronsfeld Cipher, Generating Permutations, The Etyraud Cipher, The Hill Cipher, The Jefferson Multiplex Cipher, Strip Ciphers, Polyphonic Ciphers and Ambiguity, Polybius's Polyalphabetic Cipher.	
MODULE 2	08 Hrs
Public-Key Cryptography: - Diffie-Hellman-Merkle Keys, Public-Key Cryptography, Rabin Public-Key Method, El Gamal Public-Key Method, Pretty Good Privacy, Sharing Secrets: Threshold Schemes, The Four	

Components, Authentication, Elliptic Curve Cryptography. Data Hiding in Text: Basic Features, Applications of Data Hiding, Watermarking, Intuitive Methods, Simple Digital Methods, Data Hiding in Text, Innocuous Text, Mimic Functions	
MODULE 3	08 Hrs
Data Hiding in Images: LSB Encoding, BPCS Steganography, Lossless Data Hiding, Spread Spectrum	
MODULE 4	09 Hrs
Data Hiding in Images with Watermarking: Watermarking, Detecting Malicious Tampering Wavelet Methods, Kundur-Hatzinakos Watermarking: Kundur-Hatzinakos Watermarking: II Data Hiding in Binary Images, The Zhao-Koch Method, The Wu-Lee Method, The CPT Method, The TP Method, Data Hiding in Fax Images	
MODULE 5	09 Hrs
Data Hiding: [Other Methods] Protecting Music Scores, Data Hiding in MPEG-2 Video, Digital Audio, The Human Auditory System, Audio Watermarking in the Time Domain, Echo Hiding, The Steganographic File System, Ultimate Steganography, Public-Key Steganography, Current Software	

TEXT BOOK:

1. Data Privacy and Security, David Salomon, 2003 Springer-Verlag New York, Inc.

REFERENCES:

1. William Stallings - Cryptography and Network Security 5th edition
2. Cryptography and Network Security : Atul Kahate, Mc Graw Hill Edition

SEMESTER	VII					
YEAR	IV					
COURSE CODE	21CY4706					
TITLE OF THE COURSE	EMBEDDED SYSTEM SECURITY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	38	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	-	-	C Programming for Problem Solving, Embedded Systems and Proactive Security tools.

COURSE OBJECTIVES:

- Understand the technological uplifts with biometrics compared to traditional securing mechanisms and standards applied to security
- To understand the concepts of different types of biometrics and to enable design of biometric system and its privacy risks
- To familiarize with biometric interface and biometric applications

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand the concept of secure embedded (hardware-software integrated device) system design to mitigate side-channel and covert channel attacks in the domain of IoT and cyber-physical systems.	L2
CO2	Determine security, energy efficiency, risk, reliability, availability, and sustainability metrics for a given embedded system.	L5
CO3	Develop secure firmware and trusted embedded devices or electronic gadgets using Raspberry Pi, Python, and Embedded C programming language.	L3
CO4	Design secure IoT applications and deploy the same on various embedded platforms to analyze the attack surface.	L6
CO5	Create vendor-specific secure embedded systems through research-based internships, project-based activities, and life-long learning.	L6

COURSE CONTENT:	
MODULE 1 Introduction to Embedded System Security	10 Hrs
Fundamentals of embedded systems and their security challenges, Overview of different security threats and attack vectors in embedded systems, Side channel and Covert channel Attacks, Security engineering principles and secure development methodologies, Secure coding practices and vulnerability mitigation techniques in embedded systems.	
MODULE 2 Secure Boot and Firmware Integrity	08 Hrs
Importance of secure boot and firmware integrity in embedded systems, Boot loader design and implementation for secure boot process, Trusted Platform Module (TPM), Hardware-based secure boot solutions, Secure	

firmware update mechanisms and over-the-air (OTA) updates.	
MODULE 3 Embedded System Authentication and Authorization	08 Hrs
Authentication and Access control protocols for embedded systems, Public Key infrastructure (PKI) and Digital Certificates in embedded systems, Role-based access control (RBAC) and Privilege Escalation Prevention Techniques (PEPTs), Secure Communication Protocols (SCPs) and Secure Data Transfer (SDT) in embedded systems	
MODULE 4 Embedded System Security Testing and Evaluation	10 Hrs
Security Testing in Embedded Systems, Threat Modeling and Risk Assessment, Vulnerability Assessment and Penetration Testing, Secure Code Review and Static Analysis, Security Evaluation and Compliance, Incident Response and Handling, Security testing using Python with Raspberry Pi and Embedded C Programming.	
MODULE 5 Embedded System Security Case Studies and Emerging Trends	03 Hrs
Embedded System Security Case Studies, Case Studies in Vulnerabilities and Exploits, Case Studies in Secure Design and Implementation, Emerging Trends in Embedded System Security, Future Directions and Industry Perspectives.	

TEXT BOOK:

1. “Embedded Systems Security: Practical Methods for Safe and Secure Software and Systems Development” by David Kleidermacher and Mike Kleidermacher, 2012.
2. “Practical Embedded Security Building Secure Resource-Constrained Systems” by Timothy Stapko, Elsevier, 2008..

REFERENCES:

1. “Machine Learning for Embedded System Security-Springer” by Basel Halak, Springer, 2022.
2. “Hardware Security: A Hands-on Learning Approach” by Mark Tehraipoor and Swarup Bhunia, Morgan Kaufmann Publisher, 2019.

SEMESTER	VII					
YEAR	IV					
COURSE CODE	21CY4707					
TITLE OF THE COURSE	PATTERN RECOGNITION					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	38	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	-	-	Digital Image Processing

COURSE OBJECTIVES:

- To understand the fundamentals of parameter estimation techniques
- To learn the basics of classification and clustering methods
- To understand various learning algorithms and risk minimization factors.
- To identify the different kernel methods useful in classification

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Interpret parameter estimation strategies like MLE, MAP, MMIE to analyze the basic characteristics of data.	L2
CO2	Summarize classification methodologies like PDM, Regression, Least squares, Discriminant analysis method to categorize hidden data pattern.	L2
CO3	Make use of unsupervised learning algorithms to identify the incomplete data present in the pattern.	L3
CO4	Construct and formulate kernel methods like SVM and clustering strategies like Rough k- Means, Fuzzy k-Means, k-Harmonic Means algorithms for pattern classification.	L3

COURSE CONTENT:	
MODULE 1	8 Hrs
Parameter Estimation Maximum Likelihood Estimation, Maximum A-Posteriori (MAP) Estimation, Maximum Entropy Estimation, Minimum Relative Entropy Estimation, Maximum Mutual Information Estimation (MMIE); Model Selection, Akaike Information Criterion (AIC) Bayesian Information Criterion (BIC)	
MODULE 2	09 Hrs
Classification Linear Models for Classification, Discriminant Functions, Two classes, Multiple classes, Least squares for classification, Fisher's linear discriminant, Relation to least squares, Fisher's discriminant for multiple classes, The perceptron algorithm; Probabilistic Generative Models, Continuous inputs, Maximum likelihood solution, Discrete features, Exponential family; Probabilistic Discriminative Models, Fixed basis functions, Logistic regression, Iterative reweighted least squares, Multiclass logistic regression, Probit regression, Canonical link functions.	

MODULE 3	07 Hrs
Learning Learning Algorithms, Risk Minimization, Empirical Risk Minimization, Capacity and Bounds on Risk, Structural Risk Minimization; Decision and Regression Trees, Vector Quantization (VQ)	
MODULE 4	07 Hrs
Clustering Basic Clustering Techniques, Standard k-Means (Lloyd) Algorithm, Generalized Clustering, Over-partitioning, Merging, Modifications to the k-Means Algorithm, k-Means Wrappers, Rough k- Means, Fuzzy k-Means, k-Harmonic Means Algorithm, Hybrid Clustering Algorithms; Estimation using Incomplete Data, Expectation Maximization (EM); Semi-Supervised Learning.	
MODULE 5	08 Hrs
Kernel Methods and Support Vector Machines The Two-Class Problem, Dual Representation, Soft Margin Classification; Origins of Kernel methods, Kernel Mapping, The Kernel Trick; Constructing Kernels Formulation and Computation; Radial Basis Function Networks; Positive Semi-Definite Kernels, Linear Kernel, Polynomial Kernel, Gaussian Radial Basis Function (GRBF) Kernel, Cosine Kernel, Fisher Kernel, GLDS Kernel, GMM-UBM Mean Interval (GUMI) Kernel.	

TEXT BOOK:

1. HomayoonBeigi, Fundamentals of Speaker Recognition, Springer,2011
2. K.P. Soman, R.Loganathan, V.Ajay, Machine Learning with SVM and other Kernel methods, PHI Learning Private Limited,2009

REFERENCES:

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer,2006
2. Tom Mitchell,Machine Learning, McGraw Hill, 1997.
3. Petra Perner. Machine Learning and Data Mining in Pattern Recognition, Springer Science & Business Media, 2009.

SEMESTER	VIII					
YEAR	IV					
COURSE CODE	21CY4803					
TITLE OF THE COURSE	RISK MANAGEMENT					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	39	-	-	-	39	3

COURSE OBJECTIVES:

1. Understand the fundamental concepts and history of information security and its importance in various organizations.
2. Develop the knowledge and skills necessary to perform common system administration tasks and implement hardware and software controls to maintain information security.
3. Identify and characterize assets, analyze threats and vulnerabilities, and implement encryption controls and identity and access management to ensure data protection.
4. Develop the ability to handle and analyze security incidents, conduct risk assessments, and implement risk management frameworks.
5. Understand the importance of policies, standards, and guidelines in information security and develop the ability to write policies that comply with the required guidelines.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO 1	Identify the importance of information security in the domain of data storage and processing.	L3
CO 2	Apply basic security model for identification and characterization of IT assets.	L3
CO 3	Identify and Analyze threats and vulnerabilities to measure robust encryption controls and identity and access management strategies.	L4
CO 4	Make use of access control, firewalls, and intrusion detection and prevention strategies to inspect security incidents.	L4
CO 5	Interpret risk assessment and management standards, guidelines, policies to develop a new security model.	L6

COURSE CONTENT:	
MODULE 1	8 HRS
Introduction - Overview, professional utility of information security knowledge, History, Definition of Information Security System Administration (part 1) - Overview, what is System administration? System administration and information security, Common administration tasks, System administration utilities. System Administration (part 2) – Operating system structure, command line interface, files and directories-moving around file system - <i>pwd</i> , <i>cd</i> , file management-viewing of files, searching of files, Access control and user management-Access control lists, File Ownerships-editing files, Account Management.	
MODULE 2	7 HRS

The Basic Information Security Model – Overview, introduction, Components of Basic Information Security Model, Common Vulnerabilities and threats, Case Study- ILOVEYOU Virus. Asset Identification and Characterization – Overview, Asset overview, determining assets that are important to organization, Asset Types, Asset Characterization, IT Asset Lifecycle and asset identification, System profiling, Asset Ownership and operational responsibilities	
MODULE 3	8 HRS
Threats and Vulnerabilities - Overview, Introduction, Threat Models, threat Agents, Threat Actions, Vulnerabilities. Encryption controls – Encryption Basics, Encryption types, Encryption types details, Encryption in use. Identity and Access Management - identity Management, Access management, Authentication, Single-Sign-on, federation.	
MODULE 4	9 HRS
Hardware and Software Controls - Password Management, Access Control, Firewalls, Intrusion detection/Prevention system, patch management for operating system and applications, End-point Protection. Incident Handling and Analysis - Introduction, Incidents overview, Incident handling, The disaster, Log analysis, Event criticality, General log configuration and Maintenance, Live incident responses, Timelines, other forensic topics.	
MODULE 5	9 HRS
IT Risk Analysis and Risk Management - Introduction, Risk Management as a component of organizational management, Risk Management framework, The NIST 800-39 framework, Risk Assessment, Other Risk Management Frameworks, IT general controls for Sarbanes-Oxley Compliance, Compliance VS. Risk Management, Selling Security. Policies, Standards and Guidelines – Guiding Principles, writing a policy, impact assessment and vetting, policy review, compliance, key policy issues.	

TEXT BOOK:

1. Manish Agarwal, Alex Campoe and Eric Pierce – “Information Security and IT Risk Management”, Wiley Publications, ISBN: 978-1-118-80313-4.

REFERENCE BOOKS:

1. D.P. Sharma, E-retailing Principles and Practice, Himalaya Publications.

SEMESTER	VIII					
YEAR	IV					
COURSE CODE	21CY4804					
TITLE OF THE COURSE	MOBILITY SECURITY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)

#	Sem/Year	Course Code	Title of the Course
*	**	***	***

COURSE OBJECTIVE:

- To provide a detailed, in-depth, state-of-the-art description of vehicle connectivity and cybersecurity with respect to developments, technologies, inventions, and services

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Summarize the need of Cyber Security in Automotive industry.	L2
CO2	Categorize security threats for security-critical vehicular applications and In Vehicular Network (IVN).	L4
CO3	Identify the causes of the threats by analyzing threat incentives, attackers, and threat models.	L3
CO4	Evaluate security risk and vulnerabilities in the domain of Vehicular Ad-hoc Network (VANET) and Internet of Vehicle (IoV).	L5

COURSE CONTENT:

MODULE 1: Introduction to Automotive Cybersecurity	10 Hrs
Overview, Introduction, Security and Its Impact, Cyber Security in Automotive Technology, The Rising Threat, Vehicular Ransomware Attack, Vehicle Ransomware Attack Scheme, Overview, History of Intelligent and Autonomous Vehicle, Classification of Autonomous Vehicle Based on Driving Levels, State of the Art of Intelligent and Autonomous Vehicle, Battle for Adoption, Market Demand of Automotive Cyber Security, Cyber Security in Intelligent and Autonomous Vehicles	
MODULE 2: In-Vehicle Communication and Cyber Security	8 Hrs
Overview, In-Vehicle System, In-Vehicle Communication, In-Vehicle Network Architecture and Topology, Functional Safety and Cyber security, In-Vehicle Cyber security Issues and Challenges, Cyber Security in In-Vehicle Network (IVN)	
MODULE 3: AUTOSAR Embedded Security in Vehicles	7 Hrs
Overview, Introduction, Threat Models for the Automotive Domain, Applying the Adapted Threat Models to the Automotive Domain, Results	
MODULE 4: Inter-Vehicle Communication and Cyber Security	7 Hrs
Overview, Connected Vehicles, State-of-the-Art Technologies in VANET, Role of Edge Computing and SDN in V2X, Connected Vehicle Cyber Security, Trust Management in V2X Communication, Homomorphic	

Encryption in VANET, Blockchain in V2X Communication, Safety Standards for IAV	
MODULE 5: Internet of Vehicles, Vehicular Social Networks, and Cyber security.	7 Hrs
Overview, Internet of Vehicles, Machine Learning in Vehicular Networks, Vehicular Social Network.	

TEXT BOOK:

1. Shiho Kim, Rakesh Shrestha - Automotive Cyber Security_ Introduction, Challenges, and Standardization-Springer Singapore_Springer (2020)

REFERENCES:

1. Marko Wolf (auth.) - Security Engineering for Vehicular IT Systems_ Improving the Trustworthiness and Dependability of Automotive IT Applications- Vieweg, Teubner Verlag (2009)

SEMESTER	VIII					
YEAR	IV					
COURSE CODE	21CY4805					
TITLE OF THE COURSE	BIOMETRIC SECURITY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	38	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	-	-	-

COURSE OBJECTIVES:

- Understand the technological uplifts with biometrics compared to traditional securing mechanisms and standards applied to security
- To understand the concepts of different types of biometrics and to enable design of biometric system and its privacy risks
- To familiarize with biometric interface and biometric applications

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Make use of biometric fundamental and standards to assess privacy risk.	L3
CO2	Examine finger print, palm print, facial, ear, iris, retina, DNA, Hand vascular geometry, ECG for identifying user.	L4
CO3	Utilize behavioral biometric for human gesture identification.	L3
CO4	Inspect hardware and software based biometric scanner.	L4

COURSE CONTENT:	
MODULE 1	08 Hrs
Biometric Fundamentals and Standards: Biometrics versus traditional techniques, Characteristics, Key biometric processes: Verification -Identification -Biometric matching, Performance measures in biometric systems, Assessing the privacy risks of biometrics - Designing privacy sympathetic biometric systems, Different biometric standards, Application properties.	
MODULE 2	08 Hrs
Physiological Biometrics: Facial scan, Ear scan, Retina scan, Iris scan, Finger scan, Automated fingerprint identification system, Palm print, Hand vascular geometry analysis, DNA, Cognitive Biometrics -ECG.	
MODULE 3	08 Hrs
Behavioral Biometrics: Signature scan, Keystroke scan, Voice scan, Gait recognition, Gesture recognition, Video face, Mapping the body technology.	
MODULE 4	07 Hrs
User interfaces: Biometric interfaces: Human machine interface -BHMI structure, Human side interface: Iris image interface -Hand geometry and fingerprint sensor, Machine side interface: Parallel port -Serial port - Network topologies, Case study: Palm Scanner interface.	

MODULE 5	07 Hrs
Biometric applications: Categorizing biometric applications, Application areas: Criminal and citizen identification –Surveillance -PC/network access -E-commerce and retail/ATM, Costs to deploy, Issues in deployment, Biometrics in medicine, cancellable biometrics.	

TEXT BOOK:

1. Anil K Jain, Patrick Flynn and Arun A Ross, Handbook of Biometrics, Springer, US; 2010
2. John R Vacca, Biometric Technologies and Verification Systems, Elsevier, USA; 2009

REFERENCES:

1. Samir Nanavati, Michael Thieme and Raj Nanavati, Biometrics –Identity Verification in a Networked World, John Wiley and Sons; 2003
2. Paul Reid, Biometrics for Network Security, Pearson Education; 2004
3. ReidM. Bolle et al, Guide to Biometrics, Springer, USA; 2004
4. David D Zhang, Automated Biometrics: Technologies and Systems, Kluwer Academic Publishers; 2000.



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**Department of
Computer Science and Engineering
(Cyber Security)**

SCHEME AND SYLLABUS

B.Tech. PROGRAMME– 2022 BATCH

(With effective from - 2022-23)



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Definitions / Descriptions

Definition of Credit:

1 Hour Lecture (L) Per Week	01 Credit
1 Hour Tutorial (T) Per Week	01 Credit
1 Hour Practical (P) Per Week	0.5 Credit
1 Hour Project (J) Per Week	0.5 Credit

Course code and Definition:

BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management Courses
IPCC	Integrated Professional Core Course
PCC	Professional Core Courses
PEC	Professional Elective Courses
OEC	Open Elective Courses
SEC	Skill Enhancement Courses
UHV	Universal Human Value Course
PROJ	Project Work
INT	Internship



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Implementation of National Education Policy (NEP) 2020 for the B.Tech students of Batch 2022-2026

The implementation of Curriculum follows NEP 2020 and addresses the following features and categories of courses:

1. Student Centric flexible curriculum.
2. Inter-disciplinary Courses,
3. Multi-disciplinary Courses,
4. Ability Enhancement Courses,
5. Skill Enhancement Courses,
6. Value Added Courses,
7. Product Design and Development,
8. Internship (Rural Internship, Industry Internship, Research/Development Internship), and
9. Multiple Exit and Multiple Entry
 - Certificate in Engineering after completion of first year.
 - Diploma in Engineering after completion of second year.
 - Advanced Diploma in Engineering after completion of third year.
 - Degree in Engineering after completion of fourth year.



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SCHEME - B. TECH - 2022-23 ONWARDS - I SEM - CHEMISTRY CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	101-105 & 121-123	22EN1101	LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS	CR	3	-	-	-	3	*	***
2	101-105 & 121-123	22EN1102	C PROGRAMMING FOR PROBLEM SOLVING	CR	2	-	2	-	3	*	***
3	101-105 & 121-123	22EN1103	ENGINEERING CHEMISTRY	CR	3	-	2	-	4	*	***
4	101-105 & 121-123	22EN1104	ELEMENTS OF MECHANICAL ENGINEERING	CR	2	-	2	-	3	*	***
5	101-105 & 121-123	22EN1105	INTRODUCTION TO ELECTRICAL ENGINEERING	CR	3	-	-	-	3	*	***
6	101-105 & 121-123	22EN1106	BIOLOGY FOR ENGINEERS	CR	3	-	-	-	3	*	***
7	101-105 & 121-123	22EN1107	CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS	CR	1	-	-	-	1	*	***
8	101-105 & 121-123	22EN1108	KANNADA KALI / MANASU	CR	1	-	-	-	1	*	***
					18	-	06	-	21		

CR - Credit, AU - Audit, L - Lecture, T - Tutorial, P - Practical, S/P - Seminar/Project, C - No. of Credits



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SCHEME - B.TECH - 2022-23 ONWARDS - I SEM - PHYSICS CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	101-105 & 121-123	22EN1101	LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS	CR	3	-	-	-	3	*	***
2	101-105 & 121-123	22EN1102	C PROGRAMMING FOR PROBLEM SOLVING	CR	2	-	2	-	3	*	***
3	101-105 & 121-123	22EN1109	ENGINEERING PHYSICS	CR	3	-	2	-	4	*	***
4	101-105 & 121-123	22EN1110	ENGINEERING MECHANICS	CR	3	-	-	-	3	*	***
5	101-105 & 121-123	22EN1111	INTRODUCTION TO ELECTRONICS	CR	3	-	-	-	3	*	***
6	101-105 & 121-123	22EN1112	ENGINEERING GRAPHICS AND DESIGN THINKING	CR	2	-	2	-	3	*	***
7	101-105 & 121-123	22EN1113	ENVIRONMENTAL SCIENCE	CR	1	-	-	-	1	*	***
8	101-105 & 121-123	22EN1114	TECHNICAL ENGLISH	CR	1	-	-	-	1	*	***
					18	-	06	-	21		

CR - Credit, AU - Audit, L - Lecture, T - Tutorial, P - Practical, S/P - Seminar/Project, C - No. of Credits



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SCHEME - B.TECH - 2022-23 ONWARDS - II SEM - CHEMISTRY CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	101-105 & 121-123	22EN1201	SINGLE AND MULTIVARIATE CALCULUS	CR	3	-	-	-	3	*	***
2	101-105 & 121-123	22EN1202	PYTHON PROGRAMMING FOR PROBLEM SOLVING	CR	2	-	2	-	3	*	***
3	101-105 & 121-123	22EN1103	ENGINEERING CHEMISTRY	CR	3	-	2	-	4	*	***
4	101-105 & 121-123	22EN1104	ELEMENTS OF MECHANICAL ENGINEERING	CR	2	-	2	-	3	*	***
5	101-105 & 121-123	22EN1105	INTRODUCTION TO ELECTRICAL ENGINEERING	CR	3	-	-	-	3	*	***
6	101-105 & 121-123	22EN1106	BIOLOGY FOR ENGINEERS	CR	3	-	-	-	3	*	***
7	101-105 & 121-123	22EN1107	CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS	CR	1	-	-	-	1	*	***
8	101-105 & 121-123	22EN1108	KANNADA KALI / MANASU	CR	1	-	-	-	1	*	***
					18	-	06	-	21		

CR - Credit, AU - Audit, L - Lecture, T - Tutorial, P - Practical, S/P - Seminar/Project, C - No. of Credits



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SCHEME - B.TECH - 2022-23 ONWARDS - II SEM - PHYSICS CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	101-105 & 121-123	22EN1201	SINGLE AND MULTIVARIATE CALCULUS	CR	3	-	-	-	3	*	***
2	101-105 & 121-123	22EN1202	PYTHON PROGRAMMING FOR PROBLEM SOLVING	CR	2	-	2	-	3	*	***
3	101-105 & 121-123	22EN1109	ENGINEERING PHYSICS	CR	3	-	2	-	4	*	***
4	101-105 & 121-123	22EN1110	ENGINEERING MECHANICS	CR	3	-	-	-	3	*	***
5	101-105 & 121-123	22EN1111	INTRODUCTION TO ELECTRONICS	CR	3	-	-	-	3	*	***
6	101-105 & 121-123	22EN1112	ENGINEERING GRAPHICS AND DESIGN THINKING	CR	2	-	2	-	3	*	***
7	101-105 & 121-123	22EN1113	ENVIRONMENTAL SCIENCE	CR	1	-	-	-	1	*	***
8	101-105 & 121-123	22EN1114	TECHNICAL ENGLISH	CR	1	-	-	-	1	*	***
					18	-	06	-	21		

CR - Credit, AU - Audit, L - Lecture, T - Tutorial, P - Practical, S/P - Seminar/Project, C - No. of Credits



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III SEMESTER

III SEMESTER													
S.N	Course Type	Course Code	Course Name	Teaching Department	Teaching Hours / Week				Examination				Credits
					Lecture	Tutorial	Practical	Project	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	J					
1	BSC	22CY2301	Transforms and Numerical Techniques	MAT	3	0	0	0	03	60	40	100	3
2	IPCC	22CY2302	Data Structures	CSE(CY)	3	0	2	0	03	60	40	100	4
3	IPCC	22CY2303	Digital Logic Design	ECE	3	0	2	0	03	60	40	100	4
4	PCC	22CY2304	Discrete Mathematics and Graph Theory	CSE(CY)	3	0	0	0	03	60	40	100	3
5	PCC	22CY2305	Introduction to Computer Networks	CSE(CY)	3	0	2	0	03	60	40	100	4
6	AEC	22LSXXXX	Liberal Studies	Any Dept.	1	0	0	0	01	50	--	50	1
7	SEC	22CY23XX	Skill Enhancement Course – I	CSE(CY)	1	0	2	0	01	100	--	100	2
			Total		17	0	08	0		450	200	650	21



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Liberal Studies	
Course Code	Course Name
22LS0001	Drama
22LS0002	Dance
22LS0003	Music
22LS0004	Photography
22LS0005	Introduction to Japanese language
22LS0006	Law for Engineers
22LS0007	Canvas Painting
22LS0008	Communication in Sanskrit
22LS0009	Vedic Mathematics
22LS0010	Critical Thinking
22LS0011	Introduction to Film Studies
22LS0012	Yoga & Meditation
22LS0013	Cyber Crimes, Policies & Laws
22LS0014	Holistic Medicine
22LS0015	3 D Modelling using Tinkercad



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Skill Enhancement Course – I	
Course Code	Course Name
22CY2306	Linux Programming
22CY2307	Web Technologies



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IV SEMESTER													
S.N	Course Type	Course Code	Course Name	Teaching Department	Teaching Hours / Week			Examination					Credits
					Lecture	Tutorial	Practical	Project	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	J					
1	BSC	22CY2401	Probability & Statistics	MAT	3	0	0	0	03	60	40	100	3
2	IPCC	22CY2402	Design and Analysis of Algorithms	CSE(CY)	3	0	2	0	03	60	40	100	4
3	IPCC	22CY2403	Database Management System	CSE(CY)	3	0	2	0	03	60	40	100	4
4	IPCC	22CY2404	Introduction to Cyber Security	CSE(CY)	3	0	0	0	03	60	40	100	3
5	PCC	22CY2405	Embedded System Design	ECE	3	0	2	0	03	60	40	100	4
6	PCC	22CY2406	Computer Organization and Architecture	CSE(CY)	3	0	0	0	03	60	40	100	3
			Total		18	0	06	0		360	240	600	21



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SEMESTER	I					
YEAR	I					
COURSE CODE	22EN1101					
TITLE OF THE COURSE	LINEAR ALGEBRA & DIFFERENTIAL EQUATIONS					
SCHEME OF INSTRUCTION	Lecture Hours (L)	Tutorial Hours (T)	Practical Hours (P)	Project Hours (J)	Total Hours	Credits
	3	-	-	-	39	3

COURSE OBJECTIVES:

- Understanding basic concepts of linear algebra to illustrate its power and utility through applications to science and Engineering.
- Apply the concepts of vector spaces, linear transformations, matrices and inner product spaces in engineering.
- The course is discussed with algebraic as well as geometric perspectives.
- Solve problems in cryptography, computer graphics and wavelet transforms.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Apply the abstract concepts of matrices and system of linear equations using decomposition methods	L3
CO2	Implement the basic notion of vector spaces and subspaces	L3
CO3	Apply the concept of vector spaces using linear transforms which is used in computer graphics and inner product spaces	L3
CO4	Applications of linear transforms in computer graphics and imaging	L3
CO5	Applications of orthogonality in various domains	L3

COURSE CONTENT:

MODULE 1		8Hrs
Linear algebra: Introduction - The Geometry of Linear Equations - Row reduction and echelon forms- Rank of a matrix - Gaussian Elimination - Solution sets of linear equations – LU decomposition - Inverse of a matrix by Gauss-Jordan method.		
MODULE 2		8Hrs
Vector spaces and subspaces: Linear spaces – Subspaces - Linear independence – Span - Bases and Dimensions -Finite dimensional vector spaces, Fundamental subspaces associated with a matrix.		
MODULE 3		9Hrs



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Linear transformations and orthogonality: Linear transformations – Basic properties - Invertible linear transformation - Matrices of linear transformations - Vector space of linear transformations – Inner Product, Orthogonal Vectors - Projections onto Lines - Projections and Least Squares - The Gram-Schmidt Orthogonalization process, QR Factorization.

MODULE 4

7Hrs

Eigenvalues and eigenvectors: Introduction to Eigenvalues and Eigenvectors - Diagonalization of a Matrix- Diagonalization of symmetric matrices - Quadratic forms.

MODULE 5

7Hrs

Differential equations: Linear second order ordinary differential equation with constant coefficients – Solutions of homogenous and non-homogenous equations - Method of undetermined coefficients – method of variation of parameters – Solutions of Cauchy-Euler and Cauchy-Legendre differential equations.

TEXT BOOKS:

1. D C Lay, S R Lay and JJ McDonald, Linear Algebra and its Applications, Pearson India, Fifth edition.
2. Linear Algebra and its Applications by Gilbert Strang, 4 th Edition, Thomson Brooks/Cole, Second Indian Reprint 2007.
3. Introductory Linear Algebra- An applied first course, Bernard Kolman and David, R. Hill, 9th Edition, Pearson Education, 2011.
4. Thomas' Calculus, George B.Thomas, D.Weir and J. Hass, 2014, 13th edition, Pearson.

REFERENCES:

1. Introduction to Linear Algebra, Gilbert Strang, 5th Edition, Cengage Learning (2015).
2. Higher Engineering Mathematics by B S Grewal, 42 nd Edition, Khanna Publishers.
3. Elementary Linear Algebra, Stephen Andrilli and David Hecker, 5th Edition, Academic Press (2016).
4. Contemporary linear algebra, Howard Anton, Robert C Busby, Wiley 2003.
5. Practical Linear Algebra, Farin and Hansford, CRC Press (2013).



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SEMESTER	I/II					
YEAR	I					
COURSE CODE	22EN1103					
TITLE OF THE COURSE	ENGINEERING CHEMISTRY					
SCHEME OF INSTRUCTION	L	T	P	J	Total Hours	Credits
	3	-	2	-	39(L)+26(P) = 65	4

COURSE OBJECTIVES:

- To provide chemical concepts most relevant to engineering students and demonstrate them in an applied context.
- To expose to the principles required to understand important contemporary topics like alternate energy sources, corrosion control, polymer technology, phase equilibria nanomaterials and green chemistry and catalysis.
- To emphasize on applications of these concepts to real world problems

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Appreciate the basic principles of electrochemistry, use of different types of electrodes in analysis and evaluate cell potential for different cell reactions.	L2
CO2	Know construction, working and applications of various energy storage devices such as batteries, fuel cells and supercapacitors.	L2
CO3	Understand basic principles of corrosion and apply suitable techniques for corrosion control. Also know the technological importance and processes involved in metal finishing.	L3
CO4	Know the synthesis, structure –property relationship and applications of commercially important polymers and polymer composites. Understand properties and applications of nanomaterials. Also learn the principles of green chemistry for a sustainable and eco-friendly world	L3
CO5	Differentiate various instrumental techniques involved in determining chemical reactions	L3

COURSE CONTENT:

MODULE 1	8Hrs
Chemical energy source: Introduction to energy; Fuels - definition, classification, importance of hydrocarbons as fuels; Calorific value-definition, Gross and Net calorific values (SI units). Determination of calorific value of a solid / liquid fuel using Bomb calorimeter. Numerical problems on GCV&NCV. Petroleum cracking-fluidized catalytic cracking. Reformation of petrol. octane number, cetane number, anti-knocking agents, power alcohol, Biodiesel & Biogas. Solar energy: Thermal energy: Photovoltaic cells- Introduction, definition, importance, working of PV cell. Solar grade silicon physical and chemical properties relevant to photo-voltaics, doping of silicon by diffusion technique.	



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MODULE 2	8Hrs
Energy science and technology: Single electrode potential - Definition, origin, sign conventions. Standard electrode potential- Definition-Nernst equation expression and its Applications. EMF of a cell- Definition, notation and conventions. Reference electrodes- Calomel electrode, Ag/AgCl electrode. Measurement of standard electrode potential. Numerical problems on EMF. Ion-selective electrode- glass electrode Battery technology: Basic concepts including characteristics of anode, cathode, electrolyte and separator. Battery characteristics. Classification of batteries- primary, secondary and reserve batteries. State of the art Batteries-Construction working and applications of Zn-air, Lead acid battery, Nickel-Metal hydride and Lithium ion batteries. Introduction to fuel cells, types of fuel cells. Construction, working and application of Methanol-Oxygen fuel cell.	
MODULE 3	8Hrs
Corrosion science: Definition, Chemical corrosion and Electro-chemical theory of corrosion, Types of corrosion, Differential metal corrosion, Differential aeration corrosion (pitting and water line corrosion), Stress corrosion. Corrosion control, Metal coatings-Galvanization, Tinning and its disadvantages. Cathodic protection of Corrosion: Sacrificial anode method and current impression method. Surface Modification Techniques: Definition, Technological importance of metal finishing. Significance of polarization, decomposition potential and over-voltage in electroplating processes, Electroless Plating. Distinction between electroplating and Electroless plating, advantages of electroless plating. Electroless plating of copper.	
MODULE 4	8Hrs
High Polymers: Introduction to polymers, Glass transition temperature, structure and property relationship. Synthesis, properties and applications of Teflon. PMMA. Elastomers - Deficiencies of natural rubber and advantages of synthetic rubber. Synthesis and application of silicone rubber, Conducting polymers-Definition, mechanism of conduction in polyacetylene. Structure and applications of conducting polyaniline. Nanotechnology: Introduction, properties, synthesis by sol-gel. Fullerenes, Carbon nanotubes, dendrimers and nano-composites.	
MODULE 5	7Hrs
Water Technology: Impurities in water. Hardness of Water: Types of Hardness and determination of total hardness of water by using disodium salt of ethylenediaminetetraacetic acid method, Potable water treatment by Electro dialysis and Reverse Osmosis. Water analysis- Biochemical oxygen demand and Chemical oxygen demand. Determination of COD. Numerical problems on COD. Sewage treatment. Instrumental Methods of Analysis: Instrumental methods of analysis, Principles of spectroscopy- Beer's Lambert's law, Difference between spectrometer and spectrophotometer, Potentiometry, Conductometry (Strong acid against strong base, weak acid against strong base, mixture of strong acid and a weak acid against strong base).	



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List of Laboratory/Practical Experiments activities to be conduct	26Hrs
Volumetric Analysis and Preparations	
1. Evaluation of quality of water in terms of total hardness by Complexometric titration. 2. Determination of Chemical Oxygen Demand (COD) of the given industrial waste water sample. 3. Determination of Alkalinity of the given water sample 4. Preparation of MgO nanoparticles by solution combustion method (Demonstration experiment) and spectrometric analysis. 5. Electroless plating of copper (Demo experiment) 6. Preparation of Polyaniline (Demo experiment)	

Instrumental methods of Analysis	
1. Potentiometric titration–Estimation of FAS using standard $K_2Cr_2O_7$ solution. 2. Conductometric estimation of hydrochloric acid using standard sodium hydroxide solution 3. Determination of viscosity coefficient, surface tension, density of a given liquid 4. Colorimetric estimation of copper in a given solution 5. Determination of Pka of given weak acid. 6. Determination of calorific value of coal/oil using Bomb calorimeter (Group experiment)	

TEXT BOOKS:

1. Dr. S. Vairam, Engineering Chemistry, Wiley-India Publishers, 2017
2. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015

REFERENCES:

1. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015
2. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015
3. Dayanada Sagar University laboratory manual
4. J. Bassett, R.C. Denny, G.H. Jeffery, Vogel's, Text book of quantitative inorganic analysis, 4th edition



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SEMESTER	I/II					
YEAR	I					
COURSE CODE	22EN1104					
TITLE OF THE COURSE	ELEMENTS OF MECHANICAL ENGINEERING					
SCHEME OF INSTRUCTION	L	T	P	J	TotalHours	Credits
	2	-	2	-	26(L)+26(P) = 52	3

COURSE OBJECTIVES:

The course will enable the students to

- Acquire a basic understanding of renewable energy resources and basic concepts of hydraulic turbines.
- Acquire knowledge of various engineering materials and metal joining techniques.
- Acquire essential knowledge of modern manufacturing tools and techniques.
- Acquire knowledge on basics of refrigeration and air-conditioning.
- Explain about the cooling of electronic devices.
- Acquire knowledge of basic concepts of mechatronics and robotics.
- Explain about the electric and hybrid vehicles.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's TaxonomyLevel
CO1	Describe basic concepts of renewable energy resources and power generation	L2
CO2	Distinguish various engineering materials and metal joining techniques	L2
CO3	Demonstrate different modern manufacturing tools and techniques	L3
CO4	Make use of basic concepts of refrigeration and air-conditioning concepts	L3
CO5	Illustrate essential knowledge of basic concepts of mechatronics and robotics	L2
CO 6	Comprehend the important concepts of electric and hybrid vehicles	L2

COURSE CONTENT:

MODULE 1 Energy Sources and Power Generation

10 Hrs



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Review of energy sources: Construction and working of Hydel power plant, Thermal power plant, Nuclear power plant, Solar power plant, Tidal power plant, Wind power plant. Principle and Operation of Hydraulic turbines, Pelton Wheel, Francis Turbine and Kaplan Turbine. Working of Centrifugal Pump & reciprocating pump.

Thermodynamics: System, boundary, surroundings, types of systems, Zeroth law, First and second laws of thermodynamics, Efficiency, COP, Carnot theorem

MODULE 2 Engineering Materials and Metal Joining Processes	10 Hrs
Metals-Ferrous: Tool steels and stainless steels. Non-ferrous /metals: aluminum alloys. Ceramics- Glass, optical fiber glass, cermets. Composites- Fiber reinforced composites, Metal matrix Composites. Smart materials- Piezoelectric materials, shape memory alloys, semiconductors, and super-insulators. Metal Joining Processes: Fitting, Sheet metal, Soldering, brazing and Welding: Definitions. Classification and methods of soldering, brazing, and welding. Brief description of arc welding, Oxy-acetylene welding, Introduction to TIG welding and MIG welding.	
MODULE 3 Modern Manufacturing Tools and Techniques	12 Hrs
CNC: Introduction, components of CNC, advantages and applications of CNC, CNC Machining centres and Turning Centers Concepts of Smart Manufacturing and Industrial IoT. Additive Manufacturing: Introduction to reverse Engineering, Traditional manufacturing vs Additive Manufacturing, Computer aided design (CAD) and Computer aided manufacturing (CAM) and Additive Manufacturing (AM), Different AM processes, Rapid Prototyping, Rapid Tooling, 3D printing: Introduction, Classification of 3D printing process, Applications to various fields.	
MODULE 4 Thermal Systems and Management	10 Hrs
Heat in Electronic Devices: Modes of Heat Transfer, heat generation in electronics, temperature measurement, heat sink, Cooling of electronic devices: Active, Passive, and Hybrid Cooling. Refrigeration: Principle of refrigeration, Refrigeration effect, Ton of Refrigeration, COP, Refrigerants and their desirable properties. Principles and Operation of Vapor Compression and Vapor absorption refrigeration. Applications of Refrigerator. Air-Conditioning: Classification and Applications of Air Conditioners. Concept and operation of Centralized air conditioning system.	
MODULE 5 Advanced Technologies	10 Hrs
Mechatronics: Introduction, Concept of open-loop and closed-loop systems, Examples of Mechatronic systems and their working principle. Robotics: Introduction, Robot anatomy, Joints & links, common Robot configurations. Applications of Robotics in Material Handling, Processing, Assembly, and Inspection. Electric and Hybrid Vehicles: Introduction, Components of Electric and Hybrid Vehicles, Drives and Transmission. Advantages and disadvantages of EVs and Hybrid vehicles.	



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List of Laboratory/Practical Experiments activities to be conduct

Demonstration on Principle and Operation of any one Turbo-machine
Demonstration on pumps
Visit any one Conventional or Renewable Energy Power Plant and prepare a comprehensive report.
One exercises each involving Fitting and Sheet metal.
One exercises each involving welding and Soldering.
Study oxy-acetylene gas flame structure and its application to gas welding
Demonstration on Principle and Operation of CNC machine.
Demonstration on Principle and Operation of 3D printing process.
Demonstration of anyone Heat transfer application device and prepare a comprehensive report.
Demonstration of anyone air conditioning system.
Demonstration of the machine consists of Gear Trains.
Demonstration of various elements of mechatronic system.
Demonstration of any one model of Robot

TEXT BOOKS:

1. Basic and Applied Thermodynamics, P.K.Nag, Tata McGraw Hill 2nd Ed., 2002
2. Non-Conventional Energy Sources, G.D Rai, Khanna Publishers, 2003
3. Elements of Workshop Technology (Vol. 1 and 2), Hazra Choudhry and Nirzar Roy, Media Promoters and Publishers Pvt. Ltd., 2010



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4. Thermal Management in Electronic Equipment, HCL Technologies, 2010
5. Robotics, Appu Kuttan KK K. International Pvt Ltd, volume 1

REFERENCES:

1. An Introduction to Mechanical Engineering, Jonathan Wickert and Kemper Lewis, Third Edition, 2012
2. Turbo Machines, M. S. Govindgowda and A. M. Nagaraj, M. M. Publications 7Th Ed, 2012
3. Manufacturing Technology- Foundry, Forming and Welding, P.N.Rao Tata McGraw Hill 3rd Ed., 2003.
4. Thermal Management of Microelectronic Equipment, L. T. Yeh and R. C. Chu, ASME Press, New York, 2002
5. Fundamentals of Robotics: Analysis and Control, Robert J. Schilling, Pearson Education (US).



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SEMESTER	I/II					
YEAR	I					
COURSE CODE	22EN1105					
TITLE OF THE COURSE	INTRODUCTION TO ELECTRICAL ENGINEERING					
SCHEME OF INSTRUCTION	L	T	P	J	Total Hours	Credits
	3	-	-	-	39	3

COURSE OBJECTIVES:

This course enables students:

- To impart basic knowledge of electrical quantities such as current, voltage, power and energy
- To distinguish between passive and active electrical components
- To explain the general structure of electrical power system
- To define basic laws of electric circuit and to solve related problems
- To understand basics of earthing, protective devices and wiring
- To introduce concepts, analogies and laws of magnetic circuits
- To learn the working principle, construction and characteristics of various DC machines
- To study the construction, principle of operation and types of transformers
- To understand the working principles of measuring equipment.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Explain the basic knowledge about the Electric and Magnetic circuits.	L2
CO2	Analyze the working of various Electrical Machines.	L3
CO3	Applying basic laws and determine various circuit parameters in AC and DC Circuits.	L3
CO4	Explain the construction, basic principle of operation, applications and determine performance parameters of various measuring instruments.	L2
CO5	Outline the knowledge of Green Energy, Electrical Safety Rules & standards course.	L3

COURSE CONTENT:

MODULE 1

8Hrs

ELECTRICAL CIRCUIT CONCEPTS: Voltage and current sources: independent, dependent, ideal and practical; V-I relationships of resistor, ohm's law, inductor, and capacitor; types of electrical circuits, voltage and current divider rule, Kirchhoff's laws, Peak, average and rms values of ac quantities; apparent, active and reactive powers; phasor analysis, Power factor, impedance and admittance, power and energy in electrical elements, introduction to 3 phase systems.



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MODULE 2	8Hrs
MAGNETIC CIRCUIT CONCEPTS: Basics of magnetic circuits, laws of magnetism, magnetic field, magnetic lines of force, permeability, Electromagnetic Fields: Relation between field theory and circuit theory; numerical on capacitance calculations, Biot-Savart's law, Ampere's law, Curl, Faraday's law, Lorentz force, Inductance, Self and Mutual inductance of simple configurations.	
MODULE 3	8Hrs
DC MACHINES AND TRANSFORMERS: DC Machines: Basic principles of electromagnetic energy conversion, Construction, operation, characteristics, performance, of dc generators and motors, testing of dc machines, applications, Transformers: Construction, working principle, equivalent circuit, voltage regulation, efficiency, Auto-transformers.	
MODULE 4	8Hrs
SI units, systematic and random errors in measurement, expression of uncertainty - accuracy and precision index, propagation of errors. General working principles and construction of indicating instruments. Electro-magnetic Instruments for the measurement of current, voltage, power and energy. Instruments for the measurement of power factor, frequency, Potentiometers. CRO, Calibration of instruments; importance, procedures and standards.	
MODULE 5	7Hrs
POWER STATION PRACTICES, ECONOMICS, AND GREEN ENERGY CONCEPTS: Energy generation-Conventional generation of electrical energy using thermal, hydro, nuclear and, non-conventional sources of energy; overview on green energy technology, load forecasting, electricity tariffs, power factor improvement, power plant economics, Overview on electrical safety standards in industries	

TEXT BOOKS:

1. D.P.Kothari and I.J. Nagrath, "Basic Electrical Engineering", 4th Edition, Tata McGrawHill, 2010
2. B.L Thereja and A.K Thereja, "A text book of Electrical Technology (Vol III)(Transmission, distribution, and Utilization)", 23rd Edition, S Chand and Company

REFERENCES:

1. Clayton Paul, Syed A Nasar and Louis Unnewehr, 'Introduction to Electrical Engineering', 2nd Edition, McGraw-Hill, 1992
2. P.S. Dhogal, 'Basic Electrical Engineering - Vol. I & II', 42nd Reprint, McGraw-Hill, 2012.
3. K Sawhney, A course in Electrical and Electronic Measurements and Instrumentation Dhanpat Rai & Co. (P) Limited January 2015
4. NPTEL - <https://nptel.ac.in/courses/108/108/108108076/>



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SEMESTER	I					
YEAR	I					
COURSE CODE	22EN1102					
TITLE OF THE COURSE	C PROGRAMMING FOR PROBLEM SOLVING					
SCHEME OF INSTRUCTION	L	T	P	J	Total Hours	Credits
	2	-	2	-	26(L)+26(P) = 52	3

COURSE OBJECTIVES :

- To develop student competence in writing clear, correct, and maintainable programs that implement known algorithms.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Express algorithms learned implicitly in school explicitly in algorithmic form and calculate the number of basic operations (exact or upper bound).	L3
CO2	Trace the execution of short programs/code fragments involving fundamental programming constructs.	L4
CO3	Write a short program/code fragment for a given task using fundamental programming constructs.	L3
CO4	Debug a short program/code fragment with fundamental programming constructs manually, and debug more complex code using a modern IDE and associated tools.	L4
CO5	Design a large program, conduct a personal code review, and contribute to a small-team code review focused on common coding errors and maintainability using a provided checklist.	L3

COURSE CONTENT:

MODULE 1

7 Hrs

Basics and overview of C: Introduction to Problem Solving using Algorithms and Flowchart: Key features of Algorithms: Sequence, Decision, Repetition with examples. Background, structure of C program, keywords, Identifiers, Data Types, Variables, Constants, Input / Output statements, Operators (Arithmetic, relational, logical, bitwise etc.), Expressions, Precedence and Associativity, Expression Evaluation, Type conversions. Conditional Branching Statements-if and switch statements, iterative statements (loops)-while, for, do-while statements, Loop examples, Nested loops, break, continue, go to statement.



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MODULE 2	5 Hrs
Arrays: Introduction, declaration & initialization of array, reading and writing array elements, Operations on array: Traversal, searching, sorting. Declaration and Initialization of two-dimensional arrays. Matrix Operations (addition, subtraction, multiplication, transpose) using two-dimensional array.	
Strings: definition, declaration, initialization, and representation. String handling functions and character handling functions.	
MODULE 3	6 Hrs
Pointers: Definition and declaration and initialization of pointers. Accessing values using pointers. Accessing array elements using pointers.	
Functions: Definition and declaration. Built-in functions and User-defined functions. Categories of functions with example. Pointers as function arguments, array as function argument, Call-by-value and call-by-reference. Recursion.	
MODULE 4	4 Hrs
Structures: Purpose and usage of structures. Declaration of structures. Assignment with structures. Structure variables and arrays. Nested structures. Student and employee database implementation using structures.	
Unions: Declaration and initialization of a union. Difference between structures and unions. Example programs.	
MODULE 5	4 Hrs
Memory allocation in C programs: Dynamic memory allocation, memory allocation process, allocating a block of memory, releasing the used space, altering the size of allocated memory.	
Files: Defining, opening and closing of files. Input and output operations.	

List of Laboratory/Practical Experiments activities to be conducted		
1. Design a C program to Swapping of two numbers. (Simple Expressions).		
2. Design a C program to find the simple interest as per the below conditions (Simple expressions, Integer division issues (data loss), Explicit typecasting, when p, t, r are integers and si is float.		
3. Design a C program to find the largest of 3 numbers.		
a) Using if and no else. (Conditionals)		
b) Using nested if. (conditionals and Boolean expressions)		
c) Using Ladder if else if		
d) Using Ternary operator.		
4. Design a program that takes three coefficients (a, b, and c) of a Quadratic equation ($ax^2+bx+c=0$) as input and compute all possible roots.		
5. Design a C program to read the vehicle type (Use c or C for car, b or B for bus, t or T for Tempo for vehicle type) and Duration of customer vehicle parked in parking slot. Parking fare is calculated as per the rates given below: print the total parking charges.		
Vehicle	First Rate	Second Rate



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Car	Rs 20/hr for first 2hr	Rs 30/hr for next
Bus	Rs 40/hr for first 2hr	Rs 50/hr for next
Tempo	Rs 30 /hr for first 2hr	Rs 40/hr for next

6. a Write a program to calculate the factorial of a given number.
 b Write a program using four functions to check if the given number is a palindrome.

- 7.a Sum of natural numbers ($\text{sum}(n) = n + \text{sum}(n-1);$).
 b. Write a program to calculate Power of a number ($b^n = b * b^{n-1}$).

8. a. Write a program to calculate nth fibonacci number given first two numbers in the series.

Inputs	N	Output
0,1	3	2
1,5	4	11
2,4	7	42
8,1	5	19
3,5	6	34

- b. Write a program to calculate GCD of two numbers.

9. Write a program to emulate a calculator with the following operations: Addition, Subtraction, Multiplication, Division – using functions, switch and break.)

10. Write a program using four functions to compute the sine of a value using Taylor's series approximation - pass by value.

11. Write a program to find the sum of n different using four functions and arrays.

Use the following function prototype:

void input(int n, int a[n]);

int add(int n, int a[n]);

void output(int n, int a[n],int sum) and main().

12. Write a program to add two matrices using separate function for input, add matrices, display matrix and main function.

13. String handling:

- Write a function to reverse the string in reverse and display it. (Strings))
- Write a function to concatenate the two strings without using strcat.(Strings)
- Write a function to find the length of the string.

14. Write a program using Bubble sort technique to sort an array of integer elements (Sorting technique, Const array arguments.)



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15. Write a program to search an array of elements of data type requested by the user for a given item using binary search algorithm. (Searching technique, Const array arguments).

16. Write a program with functions to add and multiply two complex numbers. Define a structure Complex to represent a complex number. The main function should call other functions for the purposes of input, computations and display. (Structs as arguments).

17. Define a structure, student, to store the following data about a student: rollno (integer), name (string) and marks(integer) . Your program must contain the following functions: (Array of Structures).

- A function to read the students data.
- A function to display records of each student.
- A function to sort the records of student Rank Wise
- A function print all students details
- A function to search student details by Rollno
- A function to print the names of the students having the highest test score

EXT BOOKS:

1. Brian W. Kernigham and Dennis M. Ritchie, (2012) "The C Programming Language", 2nd Edition, PHI.
2. ReemaThareja, "Programming in C". Oxford University Press, Second Edition, 2016

REFERENCES :

1. R. S Bichkar, "Programming with C and Data Structure", University Press, 2014
2. Behrouz A. Forouzan, Richard F. Gilberg, "Computer Science - A Structured Approach Using C", Cengage Learning, 2007
3. Brian W. Kernigham and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, PHI, 2012
4. Vikas Gupta, "Computer Concepts and C Programming", Dreamtech Press 2013.



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SEMESTER	I/II					
YEAR	I					
COURSE CODE	22EN1106					
TITLE OF THE COURSE	BIOLOGY FOR ENGINEERS					
SCHEME OF INSTRUCTION	L	T	P	J	Total Hours	Credits
	3	-	-	-	39	3

COURSE OBJECTIVES:

- To introduce students to basics modern biological concepts with an emphasis on how bio-processes are analogous to engineering field, as a multidisciplinary field.
- To make students understand basic engineering principles imminently run physiological processes particularly about engineering designs and solutions are arrived citing body functional examples.
- To motivate students of engineering that many bio-solutions could be foundational to design, develop better processes, products and useful to achieve quality of life.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's TaxonomyLevel
CO1	Student appreciates and explains the biological mechanisms of living organisms from the perspective of engineers and find solutions to solve bio-engineering problems with appropriate tools.	L2
CO2	Explain optimal designs in engineering that are bio-mechanical in nature and build and use by observing and understanding bio-physiological processes involved in sensing, locomotion, and knowledge application of range of bio-chemicals.	L3
CO3	Demonstrate that bio-chemical, bio-sensory, bio-processes could be path-finders to optimise similarities for functional aspects of electronic, computer, mechanical, electrical machines	L3

COURSE CONTENT:

MODULE 1		8 Hrs
Biomimetics: Biology for Engineers, Body Fluid: Blood- Mechanics of heart, Blood pressure, Life molecules: Water, Carbohydrates, Proteins, Lipids and Nucleic acids, Biomimetics: Bio-processes - engineering analogies		
MODULE 2		8 Hrs
Bioenergy: Unit of life: Human and Plant cell, Metabolism: Enzymes as Bio-catalysts and physiological entities, Development- Bioenergy from Sun-Photosynthesis		
MODULE 3		8 Hrs



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Biomechanics (Human Body Movement Mechanics): Normal Human Movement: Force-Vector of Body; Movement Angles; Muscle contraction -Relaxation; Posture – Static & Dynamic; Ideal and abnormal posture, Practical: Stepping-Lifting-Sit-Stand.

MODULE 4	8 Hrs
Bioelectronics: Brain & Computer: Senso-neural networks, IoT as applied to biology, Bionic Eye: Mechanism of Vision, Electronic Nose: Bio-olfactory mechanisms (Science of smell), Impulses: Cardiac and Nerve, Biological Clock, Circadian rhythm	
MODULE 5	7 Hrs
Biopharma: Metabolic syndromes, Cancer and its diagnostics, Lab on a chip, Bio-Sensors, Drug Discovery	

REFERENCES:

- Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M,L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson. "Biology: A global approach", , Global Edition, 10/E, 2014
- David Nelson, Michael Cox. "Lehninger Principles of Biochemistry". W H Freeman & Company, Seventh Edition, 2017.
- Janine M Benvus. "Biomimicry: Innovation inspired by Nature". William Morrow Paperbacks, 2002.
- Lecture Notes, PPT slides by course instructor.



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SEMESTER	I/II					
YEAR	I					
COURSE CODE	22EN1107					
TITLE OF THE COURSE	CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS					
SCHEME OF INSTRUCTION	L	T	P	J	Total Hours	Credits
	1	-	-	-	13	1

COURSE OBJECTIVES:

This course enables students:

- To provide basic information about Indian constitution.
- To identify individual role and ethical responsibility towards society.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand state and central policies, fundamental duties.	L2
CO2	Understand Electoral Process, special provisions.	L2
CO3	Understand powers and functions of Municipalities, Panchayats and Cooperative Societies.	L2
CO4	Understand Engineering ethics and responsibilities of Engineers	L2

COURSE CONTENT:

MODULE 1:	7Hrs
Introduction to the Constitution of India, the making of the constitution and salient features of the constitution. Preamble to the Indian constitution fundamental rights & its limitations. Directive principles of state policy & relevance of directive principles state. Policy fundamental Duties.	
MODULE 2	6Hrs
Union Executives – President, Prime Minister, Parliament, Supreme Court of India. State Executives – Governor Chief Minister, State Legislature High Court of State. Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86 th & 91st amendments. Special provision for SC & ST, special provision for Women, children & backward classes, Emergency provisions. Powers and functions of municipalities, panchyats and co – operative Societies.	

TEXT BOOKS:

1. Brij Kishore Sharma, "Introduction to the Constitution of India", PHI Learning Pvt. Ltd., New Delhi, 2011.
2. Durga Das Basu: "Introduction to the Constitution on India", (Students Edn.) PrenticeHall, 19th / 20th Edn., 2001.

REFERENCES:

1. M.V. Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.



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SEMESTER	I/II					
YEAR	I					
COURSE CODE	22EN1109					
TITLE OF THE COURSE	KANNADA KALI					
SCHEME OF INSTRUCTION	L	T	P	J	Total Hours	Credits
	1	-	-	-	13	1

COURSE OBJECTIVES:

This course enables students:

- To introduce Kannada language & culture to Non – Kannada speakers.
- To train them to communicate in colloquial Kannada with connivance.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	The learners can communicate in Kannada & acquaint themselves with Kannada culture.	L2

COURSE CONTENT:

MODULE 1:	7Hrs
Introduction to Karnataka & Kannada Culture, Evolution of Kannada. Introduction to Kannada Alphabets. Introduction to Kannada Numbers.	
MODULE 2	6Hrs
Kannada words, sentences & phrase making for colloquial communication.	

REFERENCES:

1. Kannada Kali –Dr. Lingadevaru Halemane
2. Kannada Paatagalu– Editor: Dr. Chandrashekara Kambara.
3. SLN Sharma & K Shankaranarayana “Basic Grammar”, Navakarnataka Publications.
4. Spoken Kannada. Publication: Kannada Sahitya Parishat Bengaluru.



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SEMESTER	II					
YEAR	I					
COURSE CODE	22EN1201					
TITLE OF THE COURSE	SINGLE AND MULTI VARIABLE CALCULUS					
SCHEME OF INSTRUCTION	L	T	P	J	Total Hours	Credits
	3	-	-	-	39	3

COURSE OBJECTIVES:

- To analyze and solve constrained and unconstrained optimization problems.
- To understand the meaning of the definite integral both as a limit of Riemann sums and as the net accumulation of a rate of change.
- To find volumes of solids by calculating appropriate double integrals in rectangular and polar coordinates.
- To relate rectangular coordinates in 3-space to spherical and cylindrical coordinates.
- To evaluate triple integrals and use them to find volumes in rectangular, cylindrical and spherical coordinates.
- To evaluate line integrals of curves and vector fields and interpret such quantities as work done by a force.
- To use Green's theorem to evaluate line integrals along simple closed contours on the plane.
- To apply Stoke's theorem to compute line integrals along the boundary of a surface.
- To apply Divergence theorem to evaluate surface integral.
- To have a good foundation of Sequences of Bounded, Monotonic and Convergence.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's TaxonomyLevel
CO1	Understand basic calculus concept such as limit, continuity and derivatives	L2
CO2	Compute partial derivatives and use it to give polynomial approximation of functions in several variables	L3
CO3	Apply calculus concepts to solve real-world problems such as optimization and related rates problems	L3
CO4	Evaluate integrals of functions or vector-related quantities over curves, surfaces, and domains in two- and three-dimensional space	L5
CO5	Apply Fundamental Theorem of Line Integrals, Green's Theorem, Stokes' Theorem, or Divergence Theorem to evaluate integrals	L3
CO6	Distinguish between the concepts of sequence and series, and determine limits of sequences and convergence and approximate sums of series	L3



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COURSE CONTENT:

MODULE 1	9Hrs
Differential Calculus: Functions of two or more variables: Definition, Region in a plane, Level curves, Level surfaces, Limits, Continuity, Partial derivatives, Differentiability, Gradients, Directional derivatives, Normals to level curves and tangents, Extreme values and saddle points, Lagrange multipliers. Self-Learning Component : Single variable calculus	
MODULE 2	9Hrs
Integral calculus: Double integral and iterated integrals - Cartesian and polar coordinates, Volume of solids of revolution, Triple integral, Change of variables, Multiple integrals in cylindrical and spherical coordinates.	
MODULE 3	9Hrs
Vector Calculus: Line Integrals, Vector Fields, Work, Circulation and flux, Path independence, Potential functions, and Conservative fields, Green's theorem in the plane, Surface area and surface integrals, Surface area of solid of revolution, Parametrized surfaces, Stokes' theorem, The Divergence theorem.	
MODULE 4	6Hrs
Sequence and Series I: Sequences of real numbers and their convergence criteria, Infinite series, Sequence of partial sums, Tests for convergence/divergence - n^{th} term test, Boundedness and monotonicity, Integral, Condensation, Comparison, Ratio and root tests	
MODULE 5	6Hrs
Sequence And Series II: Alternating series, Absolute and conditional convergence, Rearrangement theorem, Power series, Taylor and Maclaurin series (one and two variables)	

TEXT BOOKS:

1. Thomas' Calculus, George B. Thomas, D. Weir and J. Hass, 2014, 13th edition, Pearson.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 2015, 10th Edition, Wiley India.

REFERENCES:

1. Higher Engineering Mathematics, B.S. Grewal, 2015, 43rd Edition, Khanna Publishers.
2. Higher Engineering Mathematics, John Bird, 2017, 6 th Edition, Elsevier Limited.
3. Calculus: Early Transcendentals, James Stewart, 2017, 8 th edition, Cengage Learning.
4. Engineering Mathematics, K.A. Stroud and Dexter J. Booth, 2013, 7 th Edition, Palgrave Macmillan.
5. Basic Multi Variable Calculus, Marsden, Tromba and Weinstein, W.H. Freeman, Third Edition



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SEMESTER	I/II					
YEAR	I					
COURSE CODE	22EN1109					
TITLE OF THE COURSE	ENGINEERING PHYSICS					
SCHEME OF Instruction	L	T	P	J	Total Hours	Credits
	3	-	2	-	39(L)+26(P)=65	4

COURSE OBJECTIVES:

- To introduce the basic concepts of Quantum mechanics which are essential in understanding and solving problems in engineering,
- To understand Band structure of solids, Semiconductors and electrical conductivity of SC's, and their applications.
- To explain semiconductor devices like LED, Photodiode and Solar cell and Semiconductor BJT.
- To review different types of Engineering materials –Electronic, electrical, mechanical and Magnetic materials and Dielectric material Properties and their applications in Science and Engineering.
- Classify the magnetic materials based on susceptibility and their temperature dependence
- To understand different crystal systems and determine structure by miller-indices
- To explain Thin-film Phenomena, Thin-film fabrication Process and their applications in engineering.
- To learn how to fabricate Nano materials by using Top-down and Bottom-up approach & To review Nano science and technology and its practical applications in biology, engineering and medicine.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Describe the concepts of Quantum mechanics and applications of Schrodinger time independent wave equation in one dimension	L1
CO2	Illustrate Semiconductors, Semiconductor devices like Photo diode, LED, Solar cell and BJT and its applications	L3
CO3	Distinguish the different engineering materials such as Electronic, electrical and mechanical materials properties and their applications in engineering	L2
CO4	Apply the concept of magnetism to magnetic data storage devices.	L3



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C05	Classify Lattice parameters of different crystalline solids by using X-ray diffraction methods and its applications in science and engineering.	L2
O6	Interpret Basic concepts of thin films and thin film deposition processes and their applications leads to Sensors and engineering devices	L3
C07	Categorize Nano materials, Properties, and fabrication of Nano materials by using Top-down and Bottom -up approach's - Applications for Science and technology	L2

COURSE CONTENT:

MODULE 1

8Hrs

Quantum Mechanics: Foundations of quantum theory, wave function and its properties, de-Broglie hypothesis, Heisenberg uncertainty principle, one dimensional time independent Schrodinger wave equation, eigen values and eigen functions, applications: one dimensional motion of an electron in a potential-well.

LASER PHYSICS: Introduction to lasers, conditions for laser action, requisite of a laser system principle, construction and working of Nd-YAG and semiconductor laser, application of lasers in defense (LASER range finder), engineering (data storage) and applications of LASERS in medicine.

MODULE 2

8Hrs

Semiconductor Physics: Band structure, Fermi level in intrinsic and extrinsic semiconductors, Density of energy states in conduction and valence bands of a semiconductor (Mention the expression), Expression for concentration of electrons in conduction band (Derivation), Hole concentration in valance band (Mention the expression), Intrinsic carrier concentration, Conductivity of semiconductors, Hall effect, Numericals.

Semiconducting devices for optoelectronics applications: - Principle and working of LED, photodiode, Solar cell, BJT.

MODULE 3

8Hrs

Dielectrics: Introduction - Dielectric polarization - Dielectric Polarizability, Susceptibility and Dielectric constant - Types of polarizations: Electronic, Ionic and Orientation polarizations (qualitative) - Lorentz Internal field (Expression only) - Claussius - Mossoti equation (derivation) - Applications of Dielectrics - Numericals.

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability - Classification of magnetic materials: Dia, para, Ferro, antiferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials - Engineering applications.

MODULE 4

8Hrs



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Crystallography: Lattice, unit cell, lattice parameters, crystal systems, Bravais lattices, Packing fraction for SCC, BCC and FCC crystal systems. Introduction to Miller Indices. Determination of Crystal structure by Miller Indices. Expression for Inter-planar distance. X-ray diffraction, Bragg's law and Determination of Crystal structure by Powder method. Numericals.

Mechanical Engineering Materials – mechanical properties: stress- strain curve for different materials. Introduction to Tensile strength, Compressive strength, Ductility, Toughness, Brittleness, Impact strength, Fatigue, Creep. Testing of engineering materials: Hardness Tests: Brinell and Vickers hardness test.

MODULE 5

7Hrs

Thin films technology: Introduction to thin-films-Advantages of thin-films over bulk materials. Thin film deposition processes- Physical vapour deposition (Thermal evaporation technique, and sputtering technique) process, Applications of Thin films.

Nano Science & technology: Introduction to Nano materials, Classification of nano materials, Size dependent properties of materials, Top-down and Bottom-up approach- Ball-milling and Photolithography, Process. Fundamental Principles of Biophysics & Applications of Nano technology in Biology and Engineering.

List of Laboratory/Practical Experiments activities to be conduct

1. I-V characteristics of a Zener Diode

I-V Characteristics of a Zener diode in forward and reverse bias condition (Module 2)

2. Planck's constant

Measurement of Planck's constant using LED (Module 2)

3. Transistor characteristics

Input and output characteristics of a NPN transistor in C-E configuration (Module 2)

4. Dielectric constant

Determination of dielectric constant of a dielectric material (Module 2)

5. Torsional Pendulum

Determination of moment of inertia of a circular disc using torsional pendulum

6. Diffraction grating

Determination of wavelength of a laser light using diffraction grating (Module 4)

7. LCR series and parallel resonance

Study the frequency response of a series and parallel LCR circuit (Module 3)

8. Band gap energy

Determination of energy gap of an intrinsic semiconductor (Module 2)

TEXT BOOKS:

1. S. M. Sze, Semiconductor devices, Physics and Technology, Wiley. Publishing
2. Engineering Physics (2019), DSU Pearson, New Delhi.

REFERENCES:

1. M. Young (1977), Optics & Lasers An Engineering Physics approach, Springer
2. K.L. Chopra, Thin film Phenomena, McGraw Hill, New York.
3. S. O. Pillai (2018), Solid State Physics, revised edition, New Age International Publishers, New Delhi
4. M N Avadhanulu, P G Kshirsagar, TVS Arun Murthy (2018), A textbook of Engineering Physics, S Chand, New Delhi.



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SEMESTER	I/II					
YEAR	I					
COURSE CODE	222EN1110					
TITLE OF THE COURSE	ENGINEERING MECHANICS					
SCHEME OF Instruction	L	T	P	J	TotalHours	Credits
	3	-	-	-	39	3

COURSE OBJECTIVES:

The course will enable the students to

- Explain different types of forces, equilibrium conditions and related theorems
- Illustrate Couples and equivalent force couple system and related problems
- Explain concepts of friction and their relevance in Engineering problems
- Describe centroid, center of gravity, moment of inertia and mass moment of inertia and their relevance in Engineering problems
- Describe Trusses and its classification
- Determine axial forces in members of Planar determinate Truss
- Illustrate various concepts in dynamics and related problems

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's TaxonomyLevel
CO1	Understand free body diagrams and principle of statics	L2
CO2	Analyze structures using concept of equilibrium conditions considering effect of frictional forces	L4
CO3	Describe the centroid and moment of inertia of composite geometrical sections	L2
CO4	Calculate axial forces in members of determinate truss	L3
CO5	Demonstrate plane kinematics and kinetics of particles/rigid bodies	L3

COURSE CONTENT:

MODULE 1

9 Hrs

Introduction to Engineering Mechanics: Introduction to Engineering Mechanics, Force Systems Basic concepts, Particle Equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Resultant- Moment of Forces and its Application; Couples and Resultant of force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium.

MODULE 2

7 Hrs

Friction : Introduction, Types of friction, Limiting friction, Cone of Friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, Ladder friction, related problems.

MODULE 3

8 Hrs

Centroid, Centre and gravity and Moment of inertia: Introduction, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia Definition, Moment of inertia of plane sections from first principles, Theorems of moment of



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inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder and Prism.

MODULE 4

7 Hrs

Analysis of Truss: Introduction, Classification of trusses, Equilibrium in two and three dimension; Method of Sections; Method of Joints; To determine if a member is in tension or compression; Simple Trusses; Zero force members.

MODULE 5

8 Hrs

Dynamics: Introduction, Rectilinear motion; Plane curvilinear motion (rectangular path, and polar coordinates); Projectile motion, Basic terms, general principles in dynamics; Types of motion, motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies.

TEXT BOOKS:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall publications.
2. A Nelson (2009), Engineering Mechanics: Statics and dynamics, Tata McGraw Hill publications.

REFERENCES:

1. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, - Dynamics, 9th Ed, Tata McGraw Hill publications.
3. R.C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications.
5. H.J. Sawant, S.P Nitsure(2018), Elements of Civil Engineering and Engineering Mechanics, Technical Publications.



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SEMESTER	I/II					
YEAR	I					
COURSE CODE	22EN1111					
TITLE OF THE COURSE	INTRODUCTION TO ELECTRONICS					
SCHEME OF INSTRUCTION	L	T	P	J	Total Hours	Credits
	3	-	-	-	39	3

COURSE OBJECTIVES:

This course enables students:

- To introduce the concepts of fundamentals of semiconductor devices with the basic knowledge of the flow of current in semiconductor devices such as diodes and transistors
- To Explain the characteristics of various semiconductor devices and the concept of Integrated circuits
- To understand the principles of electronic circuits for operations of energy conversions from AC to DC, noise removal and building the required power supply
- To understand how a particular electronic device can increase the power of a signal and also to be acquainted with gain calculations
- To implement the Boolean functions and to realize basic logic gate operations and logic functions
- To understand the basics of communication system, to modify the characteristics of carrier signals according to the information signals
- To study the fundamentals of electromagnetic waves
- To identify and understand the different blocks present in transmitter and receiver.
- To describe various parameters of Op-Amp, its characteristics and specifications.
- To understand the various applications of Op-Amp.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Explain the fundamentals of semiconductor devices, analog and digital circuits	L2
CO2	Design and analyze the behavior of analog and digital circuits.	L3
CO3	Outline the overview of communication systems and oscillators. Solve various kinds of numerical problems.	L3
CO4	Develop the analog and digital circuits using simulation tool	L3

COURSE CONTENT:

MODULE 1	8Hrs
Semiconductor Diodes: Semiconductor materials- intrinsic and extrinsic types, Ideal Diode. Terminal characteristics of diodes: p-n junction under open circuit condition, p-n junction under forward bias and reverse bias conditions, p-n junction in breakdown region, Zener diode, Series voltage regulator, Rectifier Circuits: Half wave and full wave, Reservoir and smoothing circuits.	



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MODULE 2	8Hrs
Transistors: Introduction, Transistor construction, operation and characteristics; Configuration types: Common base and common emitter configuration, Active region operation of transistor, Transistor amplifying action, Biasing the BJT: fixed bias, emitter feedback bias, collector feedback bias and voltage divider bias, Transistor as a switch: cut-off and saturation modes. Field Effect Transistors: Construction and characteristics of n-channel JFET, Types of power amplifiers: Class A operation, Class B operation, Class AB operation.	
MODULE 3	8Hrs
Operation Amplifier: Ideal Op-amp, Differential amplifier: differential and common mode operation common mode rejection ratio (CMRR), Practical op-amp circuits: inverting amplifier, non-inverting amplifier, comparator, summing amplifier, integrator, differentiator. The concept of positive feedback, Oscillator circuits using op amps: RC phase shift oscillator, wein bridge oscillator.	
MODULE 4	8Hrs
Communication system: The radio frequency spectrum, electromagnetic waves, A simple CW transmitter and receiver, modulation, demodulation, AM transmitter, FM transmitter, Tuned radio frequency receiver, Superheterodyne receiver. RF amplifiers, AM demodulators.	
MODULE 5	7Hrs
Digital circuits: Logic functions, Switch and lamp logic, logic gates, combinational, Logic, bistables/flipflops, application of Flip flops, Integrated circuit logic devices:introduction to Microprocessor and microcontrollers (Architecture), Related Problems.	

TEXT BOOKS:

1. Electronic Devices and Circuit Theory: Robert L Boylestad and Louis Nashelsky, Pearson Education, Eleventh Edition, 2013.
2. Electronic Circuits: Fundamentals and applications, Michael Tooley, Elsevier, Third edition, 2006.

REFERENCES:

1. David A Bell, Electronic Devices and Circuits, PHI, 5th edition, 2007.
2. Millman & Halkias, Electronics Devices and Circuits, McGraw Hill, second edition, 2010
3. Modern Digital and Analog Communication Systems by B.P.Lathi. Oxford University Press, Fourth edition, 2010
4. NPTEL- <https://nptel.ac.in/courses/122/106/122106025/>
Virtual Labs- <http://vlabs.iitkgp.ac.in/be/>



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SEMESTER	I/II					
YEAR	I					
COURSE CODE	22EN1112					
TITLE OF THE COURSE	ENGINEERING GRAPHICS & DESIGN THINKING					
SCHEME OF Instruction	L	T	P	J	Total Hours	Credits
	2	-	2	-	26(L)+26(L)	3

COURSE OBJECTIVES:

- To create awareness and emphasize the need for Engineering Graphics & design thinking
- To learn using professional CAD software for construction of geometry
- To understand the concepts of orthographic and isometric projections
- To construct orthographic projection of points, lines, planes and solids
- To construct development of surfaces of solids
- To construct isometric projections of planes and solids
- To create simple engineering 3D components
- To work in a team for creating conceptual design of products
- To learn application of design methods and tools on real world problem

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's TaxonomyLevel
CO1	Explain usage of instruments, dimensioning & tolerances, conventions and standards related to working drawings	L1
CO2	Construct points, lines, planes and solids using orthographic projections principles	L3
CO3	Construct & understand development of lateral surfaces of solids	L3
CO4	Construct geometries of planes and solids using isometric projection principles	L3
CO5	Apply the design thinking principles and recognize the significance of innovation	L3
CO6	Design various part models related to engineering field using AutoCAD modelling software	L3

COURSE CONTENT:

MODULE 1	
	4 Hrs
Introduction to engineering graphics: Fundamentals, Drawing standard - BIS, dimensioning, Lines, lettering, scaling, symbols, dimensioning & tolerances, conventions, Introduction to orthographic projection. Types of projections & their principles - (For CIA only) Introduction to computer aided drafting software- Co-ordinate system and reference planes HP, VP, RPP & LPP of 2D/3D. Selection of drawing sheet size and scale. Commands and creation of Lines, coordinate points, axes, polylines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, coloring, mirror, rotate, trim, extend, break, chamfer, fillet and curves - (For CIA only)	



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MODULE 2	12 Hrs
Projection of points and lines- Orthographic projections of points in all the quadrants, Orthographic projections of lines- inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method. Orthographic projections of planes viz triangle, square, rectangle, pentagon, hexagon and circular laminae.	
MODULE 3	16 Hrs
Projection of solids & development of surfaces: Projection of simple solids like prisms, pyramids, cylinder & cone when the axis is inclined to one or both of the principal planes by change of position method, Development of lateral surfaces of simple solids – Prisms, pyramids cylinders and cones.	
MODULE 4	12 Hrs
Isometric projections: Isometric scale, Isometric projection of hexahedron (cube), regular prisms, pyramids, cylinders, cones and spheres, Isometric projection of combination of two solids Conversion of Isometric Views to Orthographic Views & Conversion of orthographic views to isometric projections.	
MODULE 5	8 Hrs
Introduction to design thinking for innovations: A brief history of Design, Engineering Design process, Product development cycle, creation of models and their presentation in standard 3D view. Theory, Practice & Examples in Design thinking, Storytelling, Creativity and Idea Generation, Concept Development, Testing and Prototyping. (For CIA only)	

List of Laboratory activities to be conducted

- Manual & Computer Sketching problems for all the modules in sketch book and also take print out of the problems.
- Problems to be solved in first quadrant system.
- Minor Project for Design thinking in a group of students with VIVA- (Examples on Solid Modeling - Using 3D Modelling Software & Physical Model Prototype).
Module1 & 5 – Only For CIA

TEXT BOOKS:

1. “A Textbook of Computer Aided Engineering Drawing”, Gopalakrishna, K. R. and Sudheer Gopala Krishna (2017), Subash Publishers, Bangalore, India.
2. “Engineering Design- A Project Based Introduction”, C. L. Dym and Patrick Little, John Wiley & Sons (2022)

REFERENCES:

1. “Engineering Drawing”, Bhatt N.D., 3rd Edition, Charotar Publishing House, Gujarat, India,(2019)
2. “Engineering Drawing with Introduction to AutoCAD” Dhananjay .A .J, Tata McGraw-Hill Publishing Company Ltd, (2018)
3. “Engineering Design Methods: Strategies for Product Design”, N. Cross, John Wiley, 2021.



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SEMESTER	I/II					
YEAR	I					
COURSE CODE	22ENN1114					
TITLE OF THE COURSE	ENVIRONMENTAL SCIENCE					
SCHEME OF Instruction	L	T	P	J	Total Hours	Credits
	1	-	-	-	13	1

COURSE OBJECTIVES:

- To understand the concepts of environment, pollution, energy resources
- To learn water as a resource, rain water harvesting as a method of conservation of water
- To explain solid waste and its management
- To learn environmental Protection Act laws, environmental Impact Analysis and air monitoring

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's TaxonomyLevel
CO1	Critically elucidate the basic concepts that govern environmental quality, ambient air quality standards	L2
CO2	Compare different Energy resource and their environmental implications	L2
CO3	Identify different types of pollution, waste stream	L2
CO4	Identify different natural and manmade disasters and prevention	L2
CO5	Apply the process of environmental impact assessment and implications of Indian Environment Laws	L2

COURSE CONTENT:

MODULE 1	3 Hrs
Definition of environment; Scope and importance of environmental studies; Basic concepts: Xenobiotic, natural & anthropogenic; why are we concerned? Eco-kinetic & Bio-kinetic Properties of a xenobiotic, Dose-Response Relationships; 3 T's, Chronic and acute effects.	
MODULE 2	4 Hrs
Pollution: Criteria Air pollutants – Ozone, Particulate Matter, Carbon Monoxide, Nitrogen, Oxides, Sulphur Dioxide, Lead; Acid Rain Cycle. Water as a resource; Lentic and Lotic Water Systems; Rain Water Harvesting; Water Pollution; Noise pollution-sources and effects of noise; Municipal Solid Waste: Hazardous Waste: Electronic Waste: Biomedical Waste; Solid Waste Management: Landfills, composting Process.	
MODULE 3	2 Hrs
Energy Types of energy: Conventional sources of energy, fossil fuel, Coal, Solar, wind; Non-conventional Sources of Energy, Biofuels - biomass, biogas.	



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MODULE 4	2 Hrs
Disasters & Management; Definition, Natural (Earthquakes, landslides, floods), Man-made disasters (biological, chemical, nuclear, radiological explosions) – definition, causes and management and/or mitigation strategies; Bhopal & Chernobyl Disasters.	
MODULE 5	2 Hrs
Environmental Impact Assessment (EIA); Air pollution monitoring and Ambient Air Quality Standards (AAQS); Environment Protection Act, 1986.	

TEXT BOOKS:

1. Benny Joseph (2005). "Environmental Studies", Tata McGraw – Hill Publishing Company Limited, New Delhi.
2. R. J. Ranjit Daniels and Jagadish Krishnaswamy (2014). "Environmental Studies" (2014), Wiley India Pvt Limited, New Delhi.

REFERENCE BOOKS:

1. P. Aarne Vesilind, Susan M. Morgan, Thomson (2008). "Introduction to Environmental Engineering" (2008), Thomson learning, Second Edition, Boston.
2. R. Rajagopalan (2005). "Environmental Studies – From Crisis to Cure" Oxford University Press, New Delhi.



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SEMESTER	I/II					
YEAR	I					
COURSE CODE	22EN1114					
TITLE OF THE COURSE	TECHNICAL ENGLISH					
SCHEME OF Instruction	L	T	P	J	Total Hours	Credits
		-	2	-	26	1

COURSE OBJECTIVES:

- To enhance their communicative skills
- To equip students with oral and appropriate written communication skills
- To inculcate students with employability and job search skills
- To achieve proficiency in English
- To create interest among the students about any topic
- To learn the use of body language and improve verbal message
- To acquire skills for placement
- To help them frame their ideas and thoughts in a proper manner.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's TaxonomyLevel
CO1	Make a complete Group Project: Poster Making, Power Point Presentation, Abstract Writing, Project Paper, Facing Viva	L2
CO2	Skit Performance on any social awareness theme in group.	L2
CO3	Learning how to create a Cover Letter, Job Application and Resume.	L3

COURSE CONTENT:

MODULE 1	4 Hrs
Group Project: How to create a Poster & do Power Point Presentation. Learn to write an Abstract & Project Paper. Applying the basic etiquettes while facing Viva.	
MODULE 2	12 Hrs
Skit Performance: How to write a script. Use of powerful vocabulary, focus on pronunciation and maintaining the body language.	
MODULE 3	16 Hrs
Cover Letter, Job Application and Resume: Learn to create a resume. How to fill a Job Application form & create a proper Cover letter.	

REFERENCES:

- Chauhan, Gajendra S., L. Thimmesha and Smita, Kashiramka (2019) Technical Communication, Cengage Learning, New Delhi.
- Other Resources: Language Lab



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SEMESTER	II					
YEAR	I					
COURSE CODE	22EN1202					
TITLE OF THE COURSE	PYTHON PROGRAMMING FOR PROBLEM SOLVING					
SCHEME OF INSTRUCTION	L	T	P	J	Total Hours	Credits
	2	-	2	-	26(L)+26(P)	3

COURSE OBJECTIVES:

- To understand basic concepts of computational thinking.
- To introduce python programming for problem solving.
- To introduce different debugging and unit testing tools.
- To solve real world problems using python data structures.
- Learn to handle files and exception handling in python.
- To explore Python's object-oriented features.
- To build Web services and Networked programs in python.
- To train students to design an application as part of the course mini- project using computational thinking with python.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand basic concepts of computational thinking.	L2
CO2	Outline basic python programming for problem solving.	L2
CO3	Apply computational thinking to solve real world programs using Python	L3
CO4	Build python programs using core data structures like list, dictionaries and tuples	L3
CO5	Implement object oriented concepts using python	L3
CO6	Design applications related to web services and network Programming.	L3

COURSE CONTENT:

MODULE 1	5Hrs
INTRODUCTION: Values, expressions and statements, Conditional execution, Functions, Iterations	
MODULE 2	6Hrs
PYTHON DATA STRUCTURES: Python Data Structures: Strings, Arrays, Lists, Tuples, Sets and Dictionaries	
MODULE 3	5Hrs
PYTHON OBJECTS: Classes and Objects: Creating classes, Using Objects, Accessing attributes, Classes as Types, Introduction to Multiple Instances, Inheritance.	



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MODULE 4	5Hrs
EXCEPTION HANDLING: Try-Except, Exception syntax, examples, Types of exception with except, multiple exceptions with except, Try-Finally, Raise exceptions with arguments, Python built-in exceptions, User-defined exceptions, Assertions	
MODULE 5	5Hrs
PYTHON FILES & LIBRARIES: Files: File types, modes, File functions, File attributes, File positions, Looping over file. Basics of NumPy and Pandas	

List of Laboratory/Practical Experiments activities to be conduct

- Python program to evaluate Values, expressions, and statements, Conditional execution, and Functions Iterations
 - prompt the user to enter an integer and reverse it. And print the sum of the reversed integer.
 - Write a python program to find whether a number (num1) is a factor of 255.
 - Write a python program to find whether a number (num1) is a factor of 255.
 - Write a program to find the sum of the following series:
 - $1 + 1/3 + 1/5 + 1/7 + \text{up to 'N' terms.}$
 - $1 + x/1! + x^2/2! + x^3/3! + x^4/4! + \dots + x^{2n-1}/n!$
- Python program to evaluate Python Collections
 - Write a Python Program to demonstrate the inbuilt functions of Strings, List, and sets.
 - Write a Python program for counting a specific letter 'o' in a given string; the number of times vowel 'o' appears.
 - Write a Python Program to find the frequency of each word in given strings/strings
 - Store the following for 'n' countries, using a dictionary:
 - Name of a country, country's capital, per capita income of the country.
 - Write a program to display details of the country with the highest and second lowest per capita income.
- Write a python program to create two classes "Python" and "Java" having data members "Version" and "name" and a member function "display()". With the help of the object, print the appropriate messages.
- Create a class "Employee" with __init__ method to initialize data members: Name, Designation, Ph. No., and a member function display (). Create an instance for the class and display the details of the employee
- Write an interactive calculator! User input is assumed to be a formula that consist of a number, an operator (at least + and -), and another number, separated by white space (e.g. 1 + 1). Split user input using str.split(), and check whether the resulting list is valid:
 - If the input does not consist of 3 elements, raise a FormulaError, which is a custom Exception.
 - Try to convert the first and third input to a float (like so: float_value = float (str_value)). Catch any Value Error that occurs, and instead raise a Formula Error
 - If the second input is not '+' or '-', again raise a Formula Error
 - If the input is valid, perform the calculation and print out the result. The user is then prompted to provide new input, and so on, until the user enters quit.



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6. Write a Python program to count the number of lines in a text file and read the file line by line and store it into a list as well as find the longest word in the file.
7. Write a Python program to create a list of student details: usn, name dob and email {using dictionary} and write a list to a file.
8. Generate one-hot encodings for an array in numpy.
9. Write a Pandas program to import excel data into a Pandas dataframe and find a list of employees where hire_date is between two specific month and year.

TEXT BOOKS:

1. "Python for Everybody-Exploring Data Using Python 3", Dr. Charles R. Severance,

REFERENCES:

1. "Computer Science Using Python: A Computational Problem- Solving Focus", Charles Dierbach, Introduction John Wiley, 2012.
 2. "Introduction to Computation and Programming Using Python", John V Guttag, Prentice Hall of India, 2015.
 3. "How to think like a Computer Scientist, Learning with Python", Allen Downey, Jeffrey Elkner and Chris Meyers, Green Tea Press, 2014.
 4. "Learning to Program with Python", Richard L. Halterman, 2011.
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TRANSFORMS AND NUMERIAL TECHNIQUES

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

Course Code	: 22CY2301	Credits	: 03
Hours / Week	: 03 Hours	Total Hours	: 39 Hours
L-T-P-J	: 3-0-0-0		

Course Learning Objectives:

This Course will enable students to:

1. **Apply** their knowledge of Laplace transforms and inverse Laplace transforms to proficiently solve linear ordinary differential equations with constant coefficients, facilitating the analysis and modelling of complex systems.
2. **Analyze** periodic functions using Fourier series, assessing the convergence properties and precision of the series expansion, thereby enhancing their ability to understand and manipulate periodic phenomena.
3. **Utilize** complex exponential form, Fourier transforms of basic functions, and Fourier sine and cosine transforms to solve problems involving Fourier integrals, developing proficiency in applying these techniques to various mathematical scenarios.
4. **Employ** numerical methods, including Euler's Method, Runge-Kutta 4th order, Adams-Bashforth, and Adams-Moulton Methods, to solve differential equations and effectively analyze dynamic systems, enabling them to model real-world phenomena and make accurate predictions.
5. **Apply** finite difference methods, including the Crank-Nicolson method and appropriate techniques for hyperbolic PDEs, to effectively solve different types of partial differential equations (PDEs) such as elliptic, parabolic, and hyperbolic equations, enhancing their problem-solving skills in the context of differential equations and their applications.



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Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. **Lecture method** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
2. **Interactive Teaching: Adopt the Active learning** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show **Video/animation** films to explain functioning of various concepts.
4. Encourage **Collaborative** (Group Learning) Learning in the class.
5. To make **Critical thinking**, ask at least three Higher order Thinking questions in the class.
6. Adopt **Problem Based Learning**, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the **different ways to solve** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every **concept can be applied to the real world** - and when that's possible, it helps improve the students' understanding.

UNIT - I: Laplace Transform and Inverse Laplace Transform

09 Hours

Laplace Transforms of Elementary functions (without proof),

(Text Book-1: Chapter 6: 203 to 207).

Laplace Transforms of $e^{at}f(t)$, $t^n f(t)$ and $\frac{f(t)}{t}$, Periodic functions, Unit step function and impulse functions

(Text Book-1: Chapter 6:208-230).

Inverse Laplace Transforms- By the method of Partial Fractions, Logarithmic and Trigonometric functions, Convolution Theorem, Inverse Laplace transform using Convolution Theorem (Text Book-1: Chapter 6: 238).

Solution to Differential Equations by Laplace Transform.

(Text Book-1: Chapter 238-242).

UNIT - II: Fourier Series

09 Hours

Periodic Functions, Trigonometric Series

(Text Book-1: Chapter 11: 495).



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Fourier series Standard function, Functions of any Period $2L$, Even and Odd functions, Half-range Expansions.

(Text Book-1: Chapter 11: 483-492)

Practical Harmonic analysis (calculate average power and RMS values of periodic waveforms)

UNIT – III: Fourier Transform

06 Hours

Calculation of Fourier integrals using complex exponential form

(Text Book-1: Chapter 11: 510).

Fourier transform of basic functions (Text Book-1: Chapter 11: 510-516).

Fourier sine and cosine transforms. (Text Book-1: Chapter 11: 518-522).

UNIT – IV: Numerical Methods for Solving Ordinary Differential Equations

07 Hours

Euler's Method-Basic principles of Euler's method for solving first-order ODEs (Text Book-1: Chapter 1:10-12).

Runge-Kutta 4th order (Text Book-1: Chapter 21:904).

Multistep Methods-Explanation of multistep methods (Adams-Bashforth, Adams-Moulton Methods) (Text Book-1: Chapter 21:911-913).

Second-Order ODE. Mass-Spring System (Euler Method, Runge-Kutta Methods) (Text Book-1: Chapter 21:916-918).

UNIT – V: Numerical Methods for Partial Differential Equations

08 Hours

Classification of PDEs (elliptic, parabolic, hyperbolic), (Text Book-1: Chapter 21:922-923).

Finite Difference Methods (Laplace and Poisson Equations), Derivation of finite difference approximations (Text Book-1: Chapter 21:923-927).

Crank-Nicolson Method (Text Book-1: Chapter 21:938-941).

Method for Hyperbolic PDEs (Text Book-1: Chapter 21:943-945).



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Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Apply Laplace transforms and inverse Laplace transforms to solve linear ordinary differential equations with constant coefficients, demonstrating proficiency in system analysis and modelling.	L3
2	Analyze periodic functions using Fourier series and evaluate the convergence properties and precision of the series expansion.	L2 & L3
3	Solve problems involving Fourier integrals by applying complex exponential form, Fourier transforms of basic functions, and Fourier sine and cosine transforms.	L3
4	Utilize numerical methods such as Euler's Method, Runge-Kutta 4th order, Adams-Bashforth, and Adams-Moulton Methods to solve differential equations and analyze dynamic systems	L2 & L3
5	Apply finite difference methods, including the Crank-Nicolson method and appropriate techniques for hyperbolic PDEs, to solve various types of partial differential equations (PDEs) such as elliptic, parabolic, and hyperbolic equations.	L3

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
C01	3	2	2	1					1					
C02	3	2	2						1					
C03	3	2	2	1					1					
C04	3	2	2	1					1					
C05	3	2	2	1					1					

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)



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TEXT BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 2015, 10th Edition, Wiley India.

REFERENCE BOOKS:

1. Higher Engineering Mathematics, B.S. Grewal, 2015, 43rd Edition, Khanna Publishers.
2. Higher Engineering Mathematics, John Bird, 2017, 6 th Edition, Elsevier Limited.

E-Resources:

1. <https://nptel.ac.in/courses/111106139>
2. <https://nptel.ac.in/courses/111101164>
3. <https://nptel.ac.in/courses/111105038>



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DATA STRUCTURES

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

Course Code	: 22CY2302	Credits	: 04
Hours / Week	: 03 Hours	Total Hours	: 39(Th)+26(P) Hours
L-T-P-J	: 3-0-2-0		

Prerequisites:

Proficiency in a C programming language.

Course Learning Objectives:

This Course will enable students to:

1. **Understand** the basic approaches for analysing and designing data structures.
2. **Introduce** dynamic memory allocation and C language concepts required for building data structures
3. **Develop** essential skills to construct data structures to store and retrieve data quickly and **efficiently**.
4. **Utilize** different data structures that support different sets of operations which are suitable for various applications.
5. **Explore & Implement** how to insert, delete, search and modify data in any data structure- Stack, Queues, Lists, Trees.
6. **Develop** applications using the available data structure as part of the course for mini-project.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teachers can use to accelerate the attainment of the various course outcomes.

1. **Lecture method** means it includes not only traditional lecture methods, but different *types of teaching methods* may be adopted to develop the course outcomes.
2. **Interactive Teaching: Adopt the Active learning** that includes brainstorming, discussing, group work, focused listening, formulating questions, note taking, annotating, and roleplaying.



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3. Show **Video/Animation** films to explain functioning of various concepts.
4. Encourage **Collaborative** (Group Learning) Learning in the class.
5. To make **Critical thinking**, ask at least three Higher order Thinking questions in the class.
6. Adopt **Problem Based Learning**, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the **different ways to solve** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every **concept can be applied to the real world** - and when that's possible, it helps improve the students' understanding.

UNIT - I

08 Hours

INTRODUCTION:

Introduction to Data Structure, Classification, C Structure and Union, Array Definition, Representation, Operations (Insertion, Deletion, Search and Traversal), Two/Multidimensional Arrays, sparse matrix, C Pointers

TB1: 1.1, 1.2, 1.3.1-1.3.4; TB2: 2.5; RB1: 5.1 – 5.12, 6.4

UNIT - II

09 Hours

INTRODUCTION TO ADT:

Stack: Definition, Array Representation of Stack, Operations on Stacks.

Applications of Stack: Expression evaluation, Conversion of Infix to Postfix, Infix to Prefix Recursion, Tower of Hanoi

Queue: Definition, Representation of Queues, Operations of Queues, Circular Queue.

Applications of Queue: Job Scheduling, A Maze Problem

TB1: 2.1, 2.2, 2.3, 3.2, 3.3; TB2: 3.3, 3.4, 3.5

UNIT - III

09 Hours

DYNAMIC DATA STRUCTURES:

Linked List: Types, Representation of Linked Lists in Memory. Traversing, Searching, Insertion & Deletion from Linked List. Circular List, Doubly Linked List, Operations on Doubly Linked List (Insertion, Deletion, Traversal).

Applications: Stack & Queue Implementation using Linked Lists.

Case Study: Josephus problem.

TB1: 4.2, 4.3, 4.5



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UNIT – IV		08 Hours
TREES: Basic Terminology, Binary Trees and their representation, Complete Binary Trees, Binary Search Trees, Threaded Binary Trees, Operations on Binary Trees (Insertion, Deletion, Search & Traversal). Applications: Expression Evaluation Case Study: Game Tree TB1: 5.5.3,5.5.4,5.6; TB2: 5.1,5.2,5.3,5.5,5.7		
UNIT – V		05 Hours
Efficient Binary Search Trees: Optimal Binary Search Trees, AVL Trees, Red Black Trees, Splay Trees. Case Study: B Trees TB2: 10.1,10.2,10.3,10.4, 11.2		

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Demonstrate the key C programming concepts such as pointers, structures, unions and arrays data structures to perform operations such as insertion, deletion, searching, sorting, and traversing.	L3
2	Utilize the fundamental concepts of stacks and queues to solve the standard applications like tower of Hanoi, conversion and evaluation of expressions, job scheduling and maze.	L3
3	Implement Singly Linked List, Doubly Linked List, Circular Linked Lists, stacks and queues using linked list.	L3



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4	Develop critical thinking and problem-solving skills by designing and implementing efficient algorithms for Non-linear tree data structure and perform insertion, deletion, search and traversal operations on it.	L3
5	Apply advanced techniques, such as balancing algorithms for AVL trees, Splay trees and Red-Black trees to maintain the balance and efficiency of binary trees.	L3

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3												2	
CO2	3		3									2	2	
CO3	3		3									2	2	
CO4	3	2	3									2	2	
CO5	3	2	3									2	2	

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)

TEXT BOOKS(TB):

1. A.M. Tannenbaum, Y Langsam, M J Augentien "Data Structures using C", 1st Edition, Pearson, 2019.
2. Ellis Horowitz, Susan Anderson-Freed, and Sartaj Sahni, "Fundamentals of Data structures in C", 2nd Edition, Orient Longman, 2008.



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REFERENCE BOOKS:

1. Brian. W. Kernighan, Dennis. M. Ritchie, "The C Programming Language", 2nd Edition, Prentice-Hall, 1988.
2. Gilbert & Forouzan, "Data Structures: A Pseudo-code approach with C", 2nd Edition, Cengage Learning, 2014.
3. Jean-Paul Tremblay & Paul G. Sorenson, "An Introduction to Data Structures with Applications", 2nd Edition, McGraw Hill, 2013.
4. R.L. Kruse, B.P. Learly, C.L. Tondo, "Data Structure and Program design in C", 5th Edition, PHI, 2009.

E-Resources:

1. <https://nptel.ac.in/courses/106102064>
2. <https://www.coursera.org/learn/data-structures?specialization=data-structures-algorithms>
3. <https://www.udemy.com/topic/data-structures/free/>
4. <https://www.mygreatlearning.com/academy/learn-for-free/courses/data-structures>
5. <https://cse01-iiith.vlabs.ac.in/>
6. <https://kremlin.cc/k&r.pdf>

Activity Based Learning (Suggested Activities in Class)

1. Real world problem solving using group discussion.
2. Role play E.g., Stack, Queue, etc.,
3. Demonstration of solution to a problem through programming.
4. Flip class activity E.g., arrays, pointers, dynamic memory allocation, etc.,



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LABORATORY EXPERIMENTS

Total Contact Hours: 26

Following are experiments to be carried out using either C programming language

1. To Implement C programs with concepts of pointers, structures.
2. To implement multidimensional array Matrix Multiplication.
3. To search elements in data structure with different search methods.
4. To implement stack, queue and their variations using arrays.
5. To implement stack, queue and their variations using singly linked lists
6. To implement conversion & evaluation of expression using stacks.
7. To Implement doubly circular Linked Lists and variations and use them to store data and perform operations on it.
8. To Implement Addition/multiplication of 2 polynomial using linked lists
9. To implement binary tree traversal techniques.

OPEN-ENDED EXPERIMENTS

1. A man in an automobile search for another man who is located at some point of a certain road. He starts at a given point and knows in advance the probability that the second man is at any given point of the road. Since the man being sought might be in either direction from the starting point, the searcher will, in general, must turn around many times before finding his target. How does he search to minimize the expected distance travelled? When can this minimum expectation be achieved?
2. The computing resources of a cloud are pooled and allocated according to customer demand. This has led to increased use of energy on the part of the service providers due to the need to maintain the computing infrastructure. What data structure will you use for allocating resources which addresses the issue of energy saving? Why? Design the solution.
3. Mini-Project on applying suitable data structure to a given real-world problem.



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DIGITAL LOGIC DESIGN

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

Course Code	: 22CY2303	Credits	: 04
Hours / Week	: 03 Hours	Total Hours	: 39(Th) + 26(P) Hours
L-T-P-J	: 3-0-2-0		

Course Learning Objectives:

This Course will enable students to:

1. **Translate** the elements of digital logic functions to digital system abstractions using Verilog.
2. **Illustrate** simplification of Boolean expressions using Karnaugh
3. **Model** combinational logic circuits for arithmetic operations and logical operations
4. **Analyse** and model sequential elements flip-flops, counter, shift registers.
5. **Outline** the concept of Mealy Model, Moore Model and apply FSM to solve a given design problem.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. **Lecture method** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
2. **Interactive Teaching:** Adopt the **Active learning** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show **Video/animation** films to explain functioning of various concepts.
4. Encourage **Collaborative** (Group Learning) Learning in the class.
5. To make **Critical thinking**, ask at least three Higher order Thinking questions in the class.
6. Adopt **Problem Based Learning**, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the **different ways to solve** the same problem and encourage the students to come up with their own creative ways to solve them.



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8. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the students' understanding.

UNIT - I

08 Hours

INTRODUCTION:

Number System- Binary, Hexa, Decimal, Octal and its conversion. Canonical Notation - SOP & POS forms, Minimization of SOP and POS forms.

(Text Book-1: Chapter 1: 1.2 to 1.4, Chapter 2: 2.6)

ARITHMETIC CIRCUITS AND VERILOG MODELLING

Adders: Half adder, full adder, Ripple carry adder, parallel adder /subtractor, fast adders-CLA, comparator- 2 bit. Simplification using K-Maps

(Text Book-2: Chapter 5: 5.2, 5.3.3, 5.4,5.5.2, 5.5.3)

Introduction to Verilog, Syntax of Verilog coding, Modelling styles in Verilog, Verilog Operators, Test bench for simulation

(Text Book-3: Chapter 1: 1.1, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 1.4.2, 1.5.1.2, 1.5.2.2, 1.5.3.2, 1.5.4.2, 1.6.2)

UNIT - II

07 Hours

Combinational Circuit Building Multiplexers 4:1, 8:1, decoders 3:8, 2:4, demultiplexers 1:4, encoders 8:3, 4:2, code converters- B to G and G to B- Simplification using K-Maps

Verilog for combinational circuits, if else, case-caseX, caseZ, for loop, generate.

(Text Book-2: Chapter 6: 6.1, 6.2, 6.3, 6.4, 6.6)

UNIT - III

08 Hours

Sequential Circuits-1

Basic Latch, Gated latches, Flip Flops SR, D, JK, T, master-slave flip-flops JK, Characteristic equations, 0's and 1's Catching Problem, Race round condition, Switch debounce, shift registers- SISO, SIPO, PISO, PIPO, Setup time, Hold time, Propagation Delay

(Text Book-2: Chapter 7: 7.1, 7.2,7.3, 7.4,7.5,7.6, 7.8)



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UNIT – IV	08 Hours
Sequential Circuits-2 Binary counters – asynchronous and synchronous, mod-n counter, ripple counter- 4 bit. Verilog blocking and non-blocking, Mealy Model, Moore Model, State machine notation, Construction of Finite State Machine. <i>(Text Book-2: Chapter 7: 7.9, 7.11, 7.12.3, 7.12.4, 8.1, 8.2, 8.3, 8.4)</i>	
UNIT – V	08 Hours
Introduction to Electronic Design Automation: FPGA Design Flow, ASIC Design flow, architectural design, logic design, simulation, verification and testing, 3000 Series FPGA architecture. Applications: Design 4 Bit ALU, 7 Segment display, Vending Machine, 3 Pipeline. <i>(Text Book-4: Chapter 1)</i>	
Laboratory Experiments	
Experiments are conducted using Verilog tool /Kits	
1.	Introduction to Xilinx tool, FPGA flow
2.	Adder – HA, FA using data flow and behaviour modelling styles
3.	Adder – HA, FA using structural modelling style
4.	Combinational designs – I (blocking and non-blocking/looping examples) a. Multiplexer: 4:1, 8:1 MUX. b. De Multiplexer: 1:4, 1:8 DEMUX.
5.	Combinational designs – II (different types of case statements) c. Encoder with and without Priority: 8:3 and 4:2. d. Decoder: 3:8 and 2:4.
6.	Design of 4-bit ALU
7.	Flip Flop: D FF, T FF, JK FF
8.	Design of Mod – n Up/Down Counter with Synchronous reset
9.	Design of Mod – n Up/Down Counter with Asynchronous reset.
10.	Design of Universal shift Register using FSM



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Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Interpret Boolean Expressions of digital design in simplified form	L2
2	Build the various elements of digital logic system with Verilog	L3
3	Construct Combinational and Sequential logic circuits	L3
4	Analyse the hardware model of a digital system at different levels of abstraction in Verilog	L4
5	Evaluate the functionality of digital design by implementing on FPGA kits	L5
6	Design digital systems using FSM	L3

Table: Mapping Levels of COs to POs / PSOs															
Cos	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	1	-	-	-	-	-	-	-	1	-	1	-	-
CO2	3	2	1	2	3	-	-	-	1	-	1	1	2	1	-
CO3	3	2	3	1	2	-	-	1	1	-	1	1	2	1	-
CO4	3	3	2	3	3	1	-	1	-	1	2	1	2	2	1
CO5	3	3	2	3	3	1	-	-	-	1	-	-	2	2	1
CO6	3	3	3	3	3	2	-	1	2	2	2	2	2	1	2

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)



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TEXT BOOKS:

1. M. Morris Mano Michael D. Ciletti , “Digital Design with an Introduction to the Verilog HDL”, 6th Edition, Pearson Education, 2014.
2. Stephen Brown, Zvonko Vranesic, “Fundamentals of Digital Logic with Verilog design”, McGraw Hill, 2014.
3. Nazein M. Botros, “HDL programming (VHDL and Verilog)”, Dreamtech Press, 2006.
4. Douglas J Smith, “HDL Chip Design”, Doone publications 1996.

REFERENCE BOOKS:

1. John M Yarbrough, “Digital Logic Applications and Design”, Thomson Learning, 2014.
2. Donald D. Givone, “Digital Principles and Design”, McGraw Hill, 2015.
3. Samir Palnitkar, “Verilog HDL: A Guide to Digital Design and Synthesis”, Pearson Education, 2016.

E-Resources:

1. <https://archive.nptel.ac.in/courses/106/105/106105165/>
2. <https://nptel.ac.in/courses/117105080>

Activity Based Learning (Suggested Activities in Class)

1. Design problem solving and Programming using group discussion. E.g., Traffic light controller, Digital Clock, Elevator.
2. Demonstration of solution to a problem through simulation.



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DISCRETE MATHEMATICS AND GRAPH THEORY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER - III

Course Code	: 22CY2304	Credits	: 03
Hours / Week	: 03 Hours	Total Hours	: 39 Hours
L-T-P-J	: 3-0-0-0		

Course Learning Objectives:

This Course will enable students to:

1. **Learn** the set theoretic concept and its application in theory of computation.
2. **Determine** the concepts of mathematical induction, recursive relations and their application.
3. **Illustrate** the association of functions, relations, partial ordered set and lattices with problems related to theoretical computer science and network models.
4. **Discuss** the basics of graph theory and its application in computer networks. Learn the concepts of counting techniques and its application.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. **Lecture method** means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes.
2. **Interactive Teaching:** Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show **Video/animation** films to explain functioning of various concepts.
4. Encourage **Collaborative** (Group Learning) Learning in the class.
5. To make **Critical thinking**, ask at least three Higher order Thinking questions in the class.
6. Adopt **Problem Based Learning**, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the **different ways to solve** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every **concept can be applied to the real world** - and when that possible, it helps improve the students' understanding.



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UNIT - I	08 Hours
SET THEORY: Sets and subsets, Operations on Sets: Basic set operations, algebraic properties of sets, The Addition Principle RELATIONS AND ITS PROPERTIES: Relations and their properties, N-Ary Relations and their applications, Representing relations. <i>Textbook - 2: 1.1, 1.2 ; Textbook - 1: 7.1., 7.2, 7.3</i>	
UNIT - II	06 Hours
RELATIONS AND ORDER RELATIONS: Closure of relations, Equivalence Relations, Partial Orderings, Functions, The Growth of Functions. Self-Study: Transitive Closure and Warshall's Algorithm. <i>Textbook - 1: 7.4., 7.5, 7.6, 3.2</i>	
UNIT - III	08 Hours
MATHEMATICAL INDUCTION AND RECURSION: Mathematical Induction, Recurrence Relations: Rabbits and the Fibonacci Numbers, The Tower of Hanoi, Code word Enumeration, Solving Linear Recurrence Relations Self-Study: Basic Connectives and Truth Tables <i>Textbook-1: 4.1;6.1, 6.2;1.1</i>	
UNIT - IV	09 Hours
GRAPH THEORY: Graphs and Graph Models. Graph Terminology and Special Types of Graphs: Basic Terminology, Some Special Simple Graphs, Bipartite Graphs, Complete Bipartite Graphs. Representing Graphs and graph isomorphism: Adjacency lists, Adjacency Matrices, Incidence Matrices, Connectivity: Paths, Connectedness in Undirected and Directed Graphs, Vertex and Edge connectivity and their applications. <i>Textbook-1: 8.1, 8.2, 8.3, 8.4</i>	
UNIT - V	08 Hours
GRAPHS AND ITS APPLICATIONS: Euler and Hamilton Paths and their applications, Planar Graphs and their Applications, Graph Coloring and its applications. <i>Textbook-1: 8.5, 8.7, 8.8</i>	



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Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Identify the membership of the Set and Relations and perform basic Algebraic operations.	L3
2	Illustrate the concept of Mathematical Induction and create linear recurrence relations for the given problem.	L4
3	Construct different types of graphs based on the properties and the real time applications of graph theoretical concepts.	L3
4	Analyze the methods for optimizing the solution for graph coloring problem, Eulerian and Hamiltonian circuits/planes.	L4

Table: Mapping Levels of COs to POs / PSOs														
COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	2					1	1	1		2	2	1
CO2	3	3	2					1	1	1		2	2	1
CO3	3	3	3					1	1	1		1	2	1
CO4	3	3	3					1	1	1		2	2	1
AVG	3	2.5	2.5					1	1	1		1.75	2	1

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)



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TEXT BOOKS:

1. Kenneth H. Rosen, "Discrete Mathematics and its applications", Tata McGraw Hill, 2003.
2. Bernard Kolman, Robert C. Busby, Sharon Ross, "Discrete Mathematical Structures", 3rd Edition, PHI 2001.

REFERENCE BOOKS:

1. Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics", IV Edition, Pearson Education, Asia, 2002.
2. J. P. Tremblay, R. Manohar, "Discrete Mathematical Structures with applications to computer Science", Tata McGraw Hill, 1987.
3. J K Sharma, "Discrete Mathematics", 3rd edition, 2013, Macmillan India Ltd.

E-Resources:

1. Discrete Mathematics with Algorithms by M. O. Albertson, J. P. Hutchinson - J. 1988, Wiley.
2. Discrete Mathematics for Computer Science, Gary Haggard, John Schlipf, Sue Whitesides, Thomson Brooks/Cole, 2006.
3. <http://ocw.mit.edu/courses/mathematics/>
4. <http://www.nptelvideos.in/2012/11/discrete-mathematical-structures.html>
5. <http://cglab.ca/~discmath/notes.html>
6. https://www.cs.odu.edu/~toida/nerzic/content/web_course.html

Activity Based Learning (Suggested Activities in Class)

1. Real world problem solving and puzzles using group discussion.
2. Demonstration of solution to a problem using graph theory.



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INTRODUCTION TO COMPUTER NETWORKS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

Course Code	: 22CY2305	Credits	: 04
Hours / Week	: 03 Hours	Total Hours	: 39(Th) + 26(P) Hours
L-T-P-J	: 3-0-2-0		

Course Learning Objectives:

This Course will enable students to:

1. **Outline** the basic principles of computer networking and how computer network hardware and software operate.
2. **Evaluate** the operation and performance of practical data link protocols using the principles of framing, error detection and correction.
3. **Apply** the principles of network layer design to the analysis and evaluation of routing algorithms, congestion control techniques, internetworking and addressing.
4. **Investigate** the basic transport layer facilities and essentials of transport. protocol
5. **Illustrate** the working of various application layer protocols.

Teaching-Learning Process (General Instructions)

1. These are sample new pedagogical methods, where teachers can use to accelerate the attainment of the various course outcomes.
2. **Lecture method** means it includes not only traditional lecture methods, but different *types of teaching methods* may be adopted to develop the course outcomes.
3. **Interactive Teaching:** Adopt the **Active learning** that includes brainstorming, discussing, group work, focused listening, formulating questions, note taking, annotating, and roleplaying.
4. Show **Video/Animation** films to explain functioning of various concepts.
5. Encourage **Collaborative** (Group Learning) Learning in the class.



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6. To make **Critical thinking**, ask at least three Higher order Thinking questions in the class.
7. Adopt **Problem Based Learning**, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
8. Show the **different ways to solve** the same problem and encourage the students to come up with their own creative ways to solve them.
9. Discuss how every **concept can be applied to the real world** - and when that's possible, it helps improve the students' understanding.

UNIT - I

08 Hours

INTRODUCTION:

Networks, network types, internet history, standards and administration (TB1-Ch1);
 Network models: Protocol layering, TCP/IP protocol suite, the OSI model (TB1-Ch2);
 Transmission media: Introduction, guided media, unguided media (TB1-Ch7);
 Switching: Introduction, circuit-switched networks, packet switching (TB1-Ch8).

UNIT - II

08 Hours

Link layer addressing; (TB1-Ch10)
 Error detection and correction: Cyclic codes, checksum, forward error correction; (TB1-Ch10)
 Data link control: DLC services, data link layer protocols; (TB1-Ch11 & TB2-Ch3)
 Media access control: Random access, virtual LAN. (TB1-Ch12, Ch15)

UNIT - III

08 Hours

Network layer design issues; (TB2-Ch5)
 Routing algorithms; (TB2-Ch5)
 Congestion control algorithms; (TB2-Ch5)
 Quality of service, and internetworking; (TB2-Ch5)
 The network layer in the internet: IPv4 addresses, IPv6; (TB2-Ch5, TB1-Ch19)
 Internet control protocols, OSPF (Open Shortest Path First), IP (Internet Protocol); (TB2-Ch5)

UNIT - IV

08 Hours

The transport service, elements of transport protocols; (TB2-Ch6)
 Congestion control; (TB2-Ch6)



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The internet transport protocols: UDP (User Datagram Protocol), TCP (Transport Control Protocol); (TB2-Ch6)

Performance problems in computer networks, and network performance measurement. (TB2-Ch6)

UNIT - V

07 Hours

Introduction, client server programming, WWW (World Wide Web) and HTTP (Hyper Text Transfer Protocol); (TB1-Ch27)

FTP (File Transfer Protocol); (TB1-Ch26)

E-mail, telnet, (TB1-Ch26 & TB2-Ch7)

DNS (Domain Naming System); (TB2-Ch7)

SNMP (Simple Network Management Protocol) (TB1-Ch28)

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course, the student will be able to:		
1	Elaborate the basic concepts of data communications including the key aspects of networking and their interrelationship, packet switching, circuit switching and cell switching as internal and external operations, physical structures, types, models, and internetworking.	L6
2	Apply the concept of Hamming distance, the significance of the minimum Hamming distance and its relationship to errors as well as the detection and correction of errors in block codes.	L3
3	Estimate the mechanics associated with IP addressing, device interface, the association between physical and logical addressing, and how the Internet protocols IPv4, and IPv6 operate.	L6



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4	Evaluate the concept of reliable and unreliable transfer protocol of data and how TCP and UDP implement these concepts.	L5
5	Infer the significance, and purpose of protocols (FTP, SMTP), standards, and use in data communications and networking and analyze the most common DNS resource records that occur in a zone file.	L4

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3		-	-	-	-	-	-	-	-	2	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	2	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-	1	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	1	-

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)

TEXT BOOKS:

1. Behrouz A. Forouzan,—Data Communications and Networking||, TataMcGraw-Hill,5thEdition, 2012.
2. Andrew S. Tanenbaum, David.J.Wetherall, —Computer Networks||, Prentice-Hall, 5th Edition, 2010.



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REFERENCE BOOKS:

1. Chwan-Hwa Wu, Irwin, —Introduction to Computer Networks and Cyber Security||, CRC publications, 2014.
2. Douglas E. Comer, —Internetworking with TCP/IP —, Prentice-Hall, 5thEdition,2011.
3. Peterson, Davie, Elsevier, —ComputerNetworks,5thEdition,2011
4. Comer, —Computer Networks and Internets with Internet Applications,4thEdition,2004.

E-Resources:

1. <http://computer.howstuffworks.com/computer-networking-channel.htm>
2. <https://www.geeksforgeeks.org/layers-osi-model/>
3. https://www.wikilectures.eu/w/Computer_Network
4. <https://technet.microsoft.com/en-us/network/default.aspx>

Activity Based Learning (Suggested Activities in Class)

5. Real world problem solving using group discussion.
6. Flip class activity

LABORATORY EXPERIMENTS

1. Analyse the various line coding techniques used for data transmission of a digital signal over a transmission line
2. Design a program for error-detecting code using CRC-CCITT (16- bits).
3. Design a program to find the shortest path between vertices using Belman- ford algorithm
4. Given a graph derive the routing table using distance vector routing and link state routing algorithm
5. Try out some simple subnetting problems.



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6. Using TCP/IP sockets, write a client–server program to make the client send the file name and to make the server send back the contents of the requested file if present. Implement the above program using message queues or FIFOs as IPC channels
7. Implement a webserver program to fetch a URL request and display the home page of the same in the browser
8. Implement a simple DNS server to resolve the IP address for the given domain name



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PROBABILITY AND STATISTICS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER - IV

Course Code	: 22CY2401	Credits	: 03
Hours / Week	: 03 Hours	Total Hours	: 39 Hours
L-T-P-J	: 3-0-0-0		

Course Learning Objectives:

This Course will enable students to:

1. **Apply** statistical principles and probability concepts to solve complex problems in real-world scenarios involving uncertainty and randomness.
2. **Evaluate** and select appropriate probability distributions and statistical techniques to analyze and interpret data accurately in various applications.
3. **Justify** the use of estimation methods and hypothesis testing techniques for drawing meaningful inferences about population parameters.
4. **Analyze** and interpret sample test results for different statistical relationships, such as means, variances, correlation coefficients, regression coefficients, goodness of fit, and independence, to make informed decisions.
5. **Identify** sample tests using appropriate statistical procedures to investigate the significance of observed data and communicate findings effectively.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. **Lecture method** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
2. **Interactive Teaching: Adopt the Active learning** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show **Video/animation** films to explain functioning of various concepts.
4. Encourage **Collaborative** (Group Learning) Learning in the class.
5. To make **Critical thinking**, ask at least three Higher order Thinking questions in the class.



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6. Adopt **Problem Based Learning**, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the **different ways to solve** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every **concept can be applied to the real world** - and when that's possible, it helps improve the students' understanding.

UNIT – I : Probability

09 Hours

Definitions of Probability, Addition Theorem, Conditional Probability, Multiplication Theorem, Bayes' Theorem of Probability

UNIT – II: Random Variables and their Properties and Probability Distributions

09 Hours

Discrete Random Variable, Continuous Random Variable, Joint Probability Distributions Their Properties, Probability Distributions: Discrete Distributions: Binomial, Poisson Distributions and their Properties; Continuous Distributions: Exponential, Normal, Distributions and their Properties.

UNIT – III: Estimation and testing of hypothesis

06 Hours

Sample, Populations, Statistic, Parameter, Sampling Distribution, Standard Error, Un-Biasedness, Efficiency, Maximum Likelihood Estimator, Notion & Interval Estimation.

UNIT – IV: Sample Tests-1

07 Hours

Large Sample Tests Based on Normal Distribution, Small Sample Tests: Testing Equality of Means, Testing Equality of Variances, Test of Correlation Coefficient

UNIT – V: Sample Tests-2

08 Hours

Test for Regression Coefficient; Coefficient of Association, 2 – Test for Goodness of Fit, Test for Independence.



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Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Apply the principles of probability to solve complex problems in various real-world scenarios.	L2 & L3
2	Solve and compare different probability distributions, including discrete and continuous random variables, in order to make informed decisions and predictions.	L2 & L3
3	Apply statistical estimation techniques, such as maximum likelihood estimation and interval estimation, to draw meaningful inferences about population parameters from sample data.	L3
4	Examine hypothesis testing methods, including large and small sample tests, to assess the significance of observed data and draw valid conclusions.	L4
5	Analyze statistical relationships and perform sample tests to assess the Equality of means in different populations, Correlation coefficients between variables to determine the strength and direction of the relationship. Independence of variables using appropriate statistical tests to assess the absence of any relationship.	L4

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2		2				1					
CO2	3	2	2		2				1					
CO3	3	2	2						1					
CO4	3	2	2		2				1					
CO5	3	2	2		2				1					

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)



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TEXT BOOKS:

1. Probability & Statistics for Engineers and Scientists, Walpole, Myers, Myers, Ye. Pearson Education.

REFERENCE BOOKS:

1. Probability, Statistics and Random Processes T. Veerarajan Tata McGraw – Hill
2. Probability & Statistics with Reliability, Queuing and Computer Applications, Kishor S. Trivedi, Prentice Hall of India ,1999

E-Resources:

1. <https://nptel.ac.in/courses/106104233>
2. <https://nptel.ac.in/courses/117103067>
3. <https://nptel.ac.in/courses/103106120>
4. <https://www.coursera.org/learn/probability-intro#syllabus>
5. <https://nptel.ac.in/courses/111104073>

Activity Based Learning (Suggested Activities in Class)

1. Tools like Python programming, R programming can be used which helps student to develop a skill to analyze the problem and providing solution.
2. Regular Chapter wise assignments/ Activity/Case studies can help students to have critical thinking, developing an expert mind set, problem-solving and teamwork.

Following are Assignments/ Activities Can be carried out using either R programming language or Python Programming or excel solver.

1. There are n people gathered in a room. What is the probability that at least 2 of them will have the same birthday? (Use excel solver, R Programming, Python Programming)
 - a. Use simulation to estimate this for various n , and Produce Simulation Graph.
 - b. Find the smallest value of n for which the probability of a match is greater than 0.5.
 - c. Explore how the number of trials in the simulation affects the variability of our estimates.
2. **Case Study 1: Customer Arrivals at a Coffee Shop**



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- A coffee shop wants to analyze the number of customer arrivals during its morning rush hour (7:00 AM to 9:00 AM). The shop has been recording the number of customer arrivals every 15 minutes for the past month.
- Data: The data consists of the number of customer arrivals recorded at the coffee shop during each 15-minute interval for the past month.
- Here is a sample of the data:

Time Interval	Customer Arrivals
00 AM - 7:15 AM	6
15 AM - 7:30 AM	4
30 AM - 7:45 AM	9
45 AM - 8:00 AM	7
00 AM - 8:15 AM	5
15 AM - 8:30 AM	8
30 AM - 8:45 AM	10
45 AM - 9:00 AM	6

analyze the customer arrivals and determine the probability distribution that best fits the data. Specifically, explore both discrete and continuous probability distributions, including the binomial, Poisson, exponential, and normal distributions.

3. Case Study 2: Comparing the Performance of Two Groups

- Suppose you are a data analyst working for a company that manufactures a new energy drink. The marketing team conducted a promotional campaign in two different cities (City A and City B) to determine the effectiveness of the campaign in increasing sales. The sales data for a random sample of customers in each city was collected over a week. Your task is to compare the average sales between the two cities and test whether there is a significant difference in the variance of sales.
- Data:** Let's assume the following sample data for the number of energy drinks sold in each city:

City A: [30, 28, 32, 29, 31, 33, 34, 28, 30, 32]

City B: [25, 24, 26, 23, 22, 27, 29, 30, 26, 24]

perform a two-sample t-test to test the equality of means and a test for equality of variances using Python's SciPy library.

- case study 3:** testing independence between two categorical variables.



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- a. Data: Sample of 100 employees, and each employee is classified as either Male or Female. They were asked to rate their job satisfaction on a scale of 1 to 5, where 1 represents low satisfaction and 5 represents high satisfaction. The data is as follows:

Employee	Gender	Job Satisfaction
1	Male	4
2	Female	3
3	Male	2
4	Female	5
...	...	...
100	Female	4

- b. Test for independence between gender and job satisfaction, use the chi-squared test in R.



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DESIGN AND ANALYSIS OF ALGORITHMS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER - IV

Course Code	: 22CY2402	Credits	: 03
Hours / Week	: 03 Hours	Total Hours	: 39(Th)+26(P) Hours
L-T-P-J	: 3-0-2-0		

Course Learning Objectives:

This Course will enable students to:

1. **Analyze** the non-recursive and recursive algorithms and to represent efficiency of these algorithms in terms of the standard Asymptotic notations.
2. **Acquire** the knowledge of Brute Force and Divide and Conquer techniques to design the algorithms and apply these methods in designing algorithms to solve a given problem.
3. **Master** the Decrease and Conquer, Transform and Conquer algorithm design techniques, and Time versus Space Trade-offs.
4. **Learn** Greedy method and dynamic programming methods and apply these methods in designing algorithms to solve a given problem.
5. **Understand** the importance of Backtracking and Branch and Bound algorithm design techniques to solve a given problem.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. **Lecture method** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
2. **Interactive Teaching: Adopt the Active learning** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show **Video/animation** films to explain functioning of various concepts.



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4. Encourage **Collaborative** (Group Learning) Learning in the class.
5. To make **Critical thinking**, ask at least three Higher order Thinking questions in the class.
6. Adopt **Problem Based Learning**, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the **different ways to solve** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every **concept can be applied to the real world** - and when that's possible, it helps improve the students' understanding.

UNIT - I

08 Hours

INTRODUCTION:

What is an Algorithm? Fundamentals of Algorithmic Problem Solving.

(Text Book-1: Chapter 1: 1.1 to 1.2)

FUNDAMENTALS OF THE ALGORITHMS EFFICIENCY:

Analysis Framework, Asymptotic Notations and Standard notations and common functions **(Text Book-2: Chapter 3: 3.1, 3.2),**

Mathematical Analysis of Non-recursive and Recursive Algorithms,
(Text Book-1: Chapter 2: 2.1, 2.3, 2.4,)

UNIT - II

08 Hours

BRUTE FORCE:

Background, Selection Sort, Brute-Force String Matching. TSP

(Text Book-1: Chapter 3: 3.1, 3.2)

DIVIDE AND CONQUER:

General method, Recurrences: The substitution method, The recursion-tree method, The master method.

(Text Book-2: Chapter 4: 4.4, 4.5),

Merge sort, Quick sort, Binary Search, Multiplication of large integers,

Case study: Strassen's Matrix Multiplication.

(Text Book-1: Chapter 4: 4.1 to 4.3, 4.5)



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UNIT – III	06 Hours
DECREASE & CONQUER: General method, Insertion Sort, Graph algorithms: Depth First Search, Breadth First Search, Topological Sorting TRANSFORM AND CONQUER: Case study: Heaps and Heap sort. TIME AND SPACE TRADEOFFS: Input Enhancement in String Matching: Horspool's algorithm, Hashing: Open and Closed hashing. <i>(Text Book-1: Chapter 5: 5.1 to 5.3, Chapter 6: 6.3 to 6.4, Chapter 7: 7.2 to 7.3)</i>	
UNIT – IV	9 Hours
GREEDY TECHNIQUE: General method of Greedy technique, Single-Source Shortest Paths: General method, The Bellman-Ford algorithm, Single-Source Shortest Paths in DAGs, Dijkstra's Algorithm <i>(Text Book-2: Chapter 24: 24.1 to 24.3).</i> Minimum Spanning Trees: Prim's Algorithm, Optimal Tree problem: Huffman Trees; Case study: Kruskal's Algorithm. Fractional Problem <i>(Text Book-1: Chapter 9: 9.1, 9.2, 9.4).</i> DYNAMIC PROGRAMMING: General method, The Floyd-Warshall Algorithm, Johnson's algorithm for sparse graphs <i>(Text Book-2: Chapter 25: 25.1 to 25.3),</i> The Knapsack problem <i>(Text Book-1: Chapter 8: 8.4).</i>	
UNIT – V	08 Hours
LIMITATIONS OF ALGORITHMIC POWER P, NP and NP-complete problems <i>(Text Book-1: Chapter 11: 11.3)</i> BACKTRACKING: General method, N-Queens problem, Subset-sum problem. <i>(Text Book-1: Chapter 12: 12.1)</i> BRANCH AND BOUND: General method, Travelling Salesman problem, Approximation algorithms for TSP. Case study: Knapsack Problem. <i>(Text Book-1: Chapter 12: 12.2, 12.3)</i>	



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Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Exemplify the algorithm design techniques and standard Asymptotic notations. Analyze non-recursive and recursive algorithms to obtain worst-case running times of algorithms using asymptotic analysis	L3
2	Interpret the brute-force, divide-and-conquer paradigms and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize divide-and-conquer algorithms. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.	L3
3	Demonstrate the Decrease and Conquer, Transform and Conquer algorithm design techniques and analyze the performance of these algorithms.	L3
4	Identify and interpret the greedy technique, dynamic-programming paradigm as to when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize dynamic-programming algorithms and analyze them	L3
5	Illustrate the Backtracking, Branch and Bound algorithm design paradigms and explain when an algorithmic design situation calls for it. Recite algorithms that employ these paradigms. Summarize the limitations of algorithmic power.	L3



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Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3										2		3
CO2	3	3	2									2		3
CO3	3	3										1		3
CO4	3	3	2									2		3
CO5	3	3										1		3

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)

TEXT BOOKS:

1. Anany Levitin, "Introduction to the Design & Analysis of Algorithms", 2nd Edition, Pearson Education, 2011.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, PHI, 2014.

REFERENCE BOOKS:

1. Horowitz E., Sahni S., Rajasekaran S, "Computer Algorithms", Galgotia Publications, 2001.
2. R.C.T. Lee, S.S. Tseng, R.C. Chang & Y.T. Tsai, "Introduction to the Design and Analysis of Algorithms A Strategic Approach", Tata McGraw Hill, 2005.

E-Resources:

1. <https://nptel.ac.in/courses/106/101/106101060/>
2. <http://cse01-iiith.vlabs.ac.in/>
3. <http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms>
4. <https://www.coursera.org/specializations/algorithms>

Activity Based Learning (Suggested Activities in Class)

1. Real world problem solving and puzzles using group discussion. E.g., Fake coin identification, Cabbage puzzle, Königsberg bridge puzzle etc.,
2. Demonstration of solution to a problem through programming.



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LABORATORY EXPERIMENTS

Total Contact Hours: 26

Following are experiments to be carried out using either C programming language or Object-oriented programming language:

1. Apply divide and conquer method and Design a C program to implementation of Binary Search algorithm.
2. Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Demonstrate this algorithm using Divide-and-Conquer method.
3. Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Demonstrate this algorithm using Divide-and-Conquer method.
4. Incorporate the array data structure and demonstrate whether a given unweighted graph is connected or not using DFS method.
5. Implement the graph traversal technique using BFS method to print all the nodes reachable from a given starting node in an unweighted graph.
6. Compute the Transitive Closure for a given directed graph using Warshall's algorithm.
7. For a given weighted graph, construct an All-Pairs Shortest Paths problem using Floyd's algorithm and implement this algorithm to find the shortest distance and their shortest paths for every pair of vertices.
8. Implement 0/1 Knapsack problem using Dynamic Programming Memory Functions technique
9. Find Minimum Cost Spanning Tree for a given weighted graph using Prim's and Kruskal's algorithm.
10. From a given vertex in a weighted connected graph, determine the Single Source Shortest Paths using Dijkstra's algorithm.
11. Mini project proposal should be submitted and Implementation should be done based on the problem stated in the proposal

Open ended experiments

1. Implement Fractional Knapsack problem using Greedy Method.
2. Implement N-Queens problem using Backtracking technique.
3. implementation of Travelling Sales man problem using Dynamic programming



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DATABASE MANAGEMENT SYSTEM

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER - IV

Course Code	: 22CY2403	Credits	: 04
Hours / Week	: 03 Hours	Total Hours	: 39(Th)+26(P) Hours
L-T-P-J	: 3-0-2-0		

Course Learning Objectives:

This course will enable students to:

1. **Acquire** the concept of databases, Entity-Relationship Model and relational model for creating and designing databases for the real-world scenario.
2. **Develop** queries to extract data from the databases using a structured query language.
3. **Differentiate** SQL and NoSQL.
4. **Demonstrate** the operations on MongoDB, Database connectivity with front end and **Optimize** the Database design using Normalization Concepts.
5. **Understand** the importance of Transaction Management, Concurrency control mechanism and recovery techniques.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods that teachers can use to accelerate the attainment of the various course outcomes.

1. **Lecture method** means it includes not only the traditional lecture method but a different *type of teaching method* that may be adopted to develop the course outcomes.
2. **Interactive Teaching: Adopt Active learning** that includes brainstorming, discussing, group work, focused listening, formulating questions, note-taking, annotating, and roleplaying.
3. Show **Video/animation** films to explain the functioning of various concepts.
4. Encourage **Collaborative** (Group Learning) Learning in the class.
5. To make **Critical thinking**, ask at least three Higher-order Thinking questions in the class.



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6. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the student's understanding.

UNIT – I

10 Hours

INTRODUCTION TO DATABASE SYSTEMS :

Introduction, Characteristics of the Database Approach, Advantages of using DBMS Approach, Data Models, Schemas, Instances and Data Independence, Three Schema Architecture, various components of a DBMS.

(Text Book-1: Chapter 1: 1.1 to 1.4, 1.6, Chapter 2: 2.1,2.2, 2.4)

ENTITY-RELATIONSHIP MODEL:

Entity Types , Entity Sets , Attributes and Keys, Relationship types, Relationship Sets , Roles and Structural Constraints; Weak Entity Types; ER Diagrams

(Text Book-1: Chapter 7: 7.3, 7.4, 7.5, 7.7).

UNIT – II

07 Hours

RELATIONAL MODEL:

Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update operations and Dealing with Constraint Violations.

(Text Book-1: Chapter 3: 3.1 to 3.3).

SQL –THE RELATIONAL DATABASE STANDARD:

SQL Data Definition and Data types, Specifying constraints in SQL, Basic Queries in SQL-Data Definition Language in SQL, Data Manipulation Language in SQL;

(Text Book-1: Chapter 4: 4.1 to 4.4).

UNIT – III

08 Hours

SQL –THE RELATIONAL DATABASE STANDARD:

Additional Features of SQL; Views (Virtual Tables) in SQL; Database Programming Issues and Techniques ;

(Text Book-1: Chapter 4: 4.5; Chapter 5: 5.1 to 5.4).

SQL AND NOSQL DATA MANAGEMENT:

Triggers, Database connectivity using Python, SQL vs NoSQL, Introduction to MongoDB,

(Text Book-1: Chapter 5: 5.2,5.3)(Text Book-2 Chapter 1: 1.1 to 1.5)

UNIT – IV

07 Hours



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NOSQL DATA MANAGEMENT:

Data Types, Data Modelling, CRUD Operations.

(Text Book-2 Chapter 1: 1.1 to 1.5)

DATABASE DESIGN:

Design Guidelines, Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form;

(Text Book-1: Chapter 14: 14.1 to 14.5)

UNIT – V

07 Hours

TRANSACTION MANAGEMENT

The ACID Properties; Transactions and Schedules; Concurrent Execution of Transactions; Concurrency Control Mechanisms; Error recovery methods.

(Text Book-1: Chapter 20: 20.1 to 20.5, Chapter 21: 21.1 to 21.3, Chapter 22: 22.1 to 22.4)

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Use the basic concepts of database management system in the design and creating database blueprint using E-R model and relational model.	L3
2	Formulate SQL and NoSQL queries for building structure and unstructured databases	L3
3	Demonstrate database connectivity using vendor specific drivers	L3
4	Apply normalization techniques to design relational database management system	L3
5	Adapt Transaction Management, concurrency control and recovery management techniques in database management system.	L3



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Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
C01	3	3	2	-	-	-	-	-	2	2	-	2	3	-
C02	3	2	1	-	3	-	-	-	2	2	-	2	3	-
C03	2	2	2	-	3	-	-	-	2	2	-	2	3	-
C04	3	1	2	-	1	-	-	-	2	2	-	2	3	-
C05	2	1	-	-	-	-	-	-	2	2	-	2	3	-

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)

TEXT BOOKS:

1. Elmasri and Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2021, 2015.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", First Edition, Pearson Education, Inc. 2012.

REFERENCE BOOKS:

1. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", Third Edition, McGraw-Hill, 2003.
2. Silberschatz, Korth and Sudharshan: "Database System Concepts", Seventh Edition, McGrawHill, 2019.
3. C.J. Date, A. Kannan, S. Swamynatham: "An Introduction to Database Systems", Eight Edition, Pearson Education, 2012.

E-Resources:

1. <http://nptel.ac.in/courses/106106093/>
2. <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-830-database-systems-fall-2010/lecture-notes/>
3. <http://agce.sets.edu.in/cse/ebook/DBMS%20BY%20RAGHU%20RAMAKRISHNAN.pdf>
4. <http://iips.icci.edu.iq/images/exam/databases-ramaz.pdf>
5. <https://db-class.org/>
6. <https://www.w3schools.com/mongodb/>



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Activity Based Learning (Suggested Activities in Class)

1. Database designing and data extraction using group discussion.
2. Collaborative Activity is minor project development with a team of 4 students.

LABORATORY EXPERIMENTS

Total Contact Hours: 26

Following are experiments to be carried out using either oracle or mysql, Mongo Db .

1. Design any database with at least 3 entities and establish proper relationships between them. Draw suitable ER/EER diagrams for the system. Apply DCL and DDL commands.
2. Design and implement a database and apply at least 10 Different DML Queries for the following task.
 - a. For a given input string display only those records which match the given pattern or a phrase in the search string. Make use of wild characters and like operators for the same. Make use of Boolean and arithmetic operators wherever necessary
3. Write SQL statements to join table and retrieve the combined information from tables.
4. Execute the Aggregate functions count, sum, avg, min, max on a suitable database. Make use of built in functions according to the need of the database chosen .
5. Retrieve the data from the database based on time and date functions like now(), date(), day(), time() etc., Use of group by and having clauses.
6. Write and execute database trigger. Consider row level and statement level triggers.
7. Write and execute program to perform operations on MongoDB Database.
8. Write and execute program to perform CRUD operations.

Open Ended Experiments

1. Consider the Table “employees”, write a SQL query to remove all the duplicate emails of employees keeping the unique email with the lowest employee id, return employee id and unique emails .

table: employees

employee_id	employee_name	email_id	
-----	-----	-----	
101	Liam Alton	li.al@abc.com	
102	Josh Day	jo.da@abc.com	
103	Sean Mann	se.ma@abc.com	
104	Evan Blake	ev.bl@abc.com	
105	Toby Scott	jo.da@abc.com	



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2. A salesperson is a person whose job is to sell products or services. Consider the table "Sales" [given below]. Write a SQL query to find the top 10 salesperson that have made highest sale. Return their names and total sale amount.

Table: sales

TRANSACTION_ID	SALESMAN_ID	SALE_AMOUNT
501	18	5200.00
502	50	5566.00
503	38	8400.00
599	24	16745.00
600	12	14900.00

Table: salesman

SALESMAN_ID	SALESMAN_NAME
11	Jonathan Goodwin
12	Adam Hughes
13	Mark Davenport
59	Cleveland Hart
60	Marion Gregory



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INTRODUCTION TO CYBER SECURITY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV

Course Code : 22CY2404

Credits : 03

Hours / Week : 03 Hours

Total Hours : 39 Hours

L-T-P-J : 3-0-0-0

Course Learning Objectives:

This Course will enable students to:

1. **Give** insights into the Cyber-incident, Cyber-crime, Cyber-Physical systems and Cybersecurity.
2. **Recognize** the basic programming to detect and protect the systems from cyber threats.
3. **Understand** the design and development framework for IDS and IPS.
4. **Deploy** the Cloud infrastructure using different methods from the scratch.
5. **Apply** and map theoretical knowledge of Cybersecurity to assess risk and vulnerability of a given system.

Teaching-Learning Process

1. **Lecture method** along with traditional lecture method, different *type of teaching methods* may be adopted to develop the course outcomes.
2. **Interactive Teaching:** incorporating brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Showing **Video/animation** films to explain functioning of various concepts.
4. Encourage **Collaborative** (Group Learning) Learning in the class.
5. To make **Critical thinking**, asking Higher order Thinking questions in the class in the form of Quiz and writing programs with complex solutions.
6. Showing the **different ways to solve** the same problem and encourage the students to come up with their own creative ways to solve them.



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MODULE 1: Cybersecurity Foundation	10Hrs
Modern Computing Trends, Application Threat Vectors, Cyber space, Cyber-attacks on business: Attacker profiles, Cyber-attack Life-cycle (CAL), High-profile Cybersecurity attacks, Advanced Persistent Threats (APTs), Types of malwares, vulnerabilities, and exploits: Spamming and Phishing attacks, Bot and Botnets, Zero Trust Design principles and Architecture: Perimeter-based network security strategies: Demilitarized security zone, Next Generation Firewall (NGFW) and Traps.	
MODULE 2: Network Security Fundamentals	7Hrs
Identification of common enterprise network devices: Topologies: Protocols in OSI and TCP model layers: Ports and packet filtering procedures: Routed versus Routing protocols: DNS, FQDN, and IoT: Structure and fields of an IP header, IPV4 and IPV6 addressing, Subnet mask, DHCP and Network Address Translation (NAT), Endpoint and network security technologies like SSH, SSL, and TLS.	
MODULE 3: Cloud Security Fundamentals	8Hrs
Cloud computing service, deployment, and shared responsibility models: cloud native technologies- virtual machines, containers and orchestration, and serverless computing: Cloud native security- Kubernetes security, DevOps, and DevSecOps- Security challenges like visibility, governance, and compliance: East-West and North-South traffic protection methods: Layers and capabilities in a Secure Access Service Edge (SASE).	
MODULE 4: Security Operations Fundamentals	7Hrs
Key elements of Security Operations (SecOps), SecOps processes: Log forwarding: Security Information and Event Management (SIEM), Security Analysis tools: Security Operations Center (SOC) Engineering: Security Orchestration, Automation, and Response (SOAR) for SecOps: Threat Intelligence: Vulnerability Profiles to secure Endpoints.	
MODULE 5: Modern Tools and Use Cases in Cyber Security	7Hrs
AutoFocus: Mindmeld: Cortex XDR: Cortex XSOAR: Cortex Data Lake: Normalization of Enterprise Security data with advanced Artificial Intelligence (AI) and Machine Learning (ML):	



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Reconnaissance Attacks: Mindmeld for threat intelligence gathering and response: Prisma Access architecture: Four pillars of Prisma Cloud: Next Generation Firewall to use Dynamic Block Lists.

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Summarize the fundamental concept of cybersecurity to design zero-trust and perimeter-centric robust security system.	L2
2	Apply the basic concept of network security and packet filtering techniques to protect end nodes in a public network.	L3
3	Summarize the fundamental concept of cloud security to develop a robust and secure cloud-centric application.	L3
4	Apply the knowledge of Security Operations (SecOps) utilizing Log forwarding, SIEM, SOAR to assess end-point vulnerabilities.	L3
5	Make use of different cyber security tools and techniques like AutoFocus, Mindmeld, Cortex XDR, Cortex XSOAR, Cortex Data Lake to detect and prevent cyber security threats.	L3

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2			1				1			1	2	1
CO2	2	1			2				1			2	2	2
CO3	2	1			1							1	2	1
CO4	2	2			2				1			2	2	2
CO5	2	1			3							1	2	1

3: Substantial (High) 2: Moderate (Medium)

1: Poor (Low)



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TEXT BOOKS:

1. Palo Alto Networks Cybersecurity Survival Guide Fundamental Principles & Best Practices, Fifth Edition, 2020.
2. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole and Sumit Belapure, Wiley, First Edition, 2011.

E-Resources:

1. https://onlinecourses.swayam2.ac.in/cec23_cs16/preview
2. https://onlinecourses.swayam2.ac.in/nou23_ge65/preview
3. [Introduction to Cyber Security - Course \(swayam2.ac.in\)](https://onlinecourses.swayam2.ac.in/introduction-to-cyber-security)
4. <https://www.coursera.org/learn/introduction-to-cybersecurity-foundations/>



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EMBEDDED SYSTEM DESIGN

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV

Subject Code	: 22CY2405	Credits	: 04
Hours / Week	: 03 Hours	Total Hours	: 39(Th) + 26(P) Hours
L-T-P-J	: 3-0-2-0		

Course Learning Objectives:

This Course will enable students to:

1. **Understand** the fundamental concepts of embedded system design.
2. Gain **knowledge** of various hardware and software components used in embedded systems.
3. **Develop** skills to design and implement embedded systems for different applications.
4. Learn to **analyze** and optimize the performance of embedded systems.
5. **Enhance** problem-solving and critical thinking abilities in the context of embedded system design.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. **Interactive Lectures:** Engage students through discussions, case studies, and real-life examples.
2. **Hands-on Projects:** Assign practical projects to students to enhance their understanding and application of concepts.
3. **Group Discussions:** Encourage collaborative learning and problem-solving through group discussions and brainstorming sessions.
4. **Case Studies:** Analyze real-world embedded system designs to understand their challenges and solutions.
5. **Simulations and Virtual Labs:** Use simulation tools and virtual labs to provide a virtual hands-on experience.
6. **Guest Lectures:** Invite industry experts to share their experiences and provide insights into real-world embedded system design practices.



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7. **Online Forums:** Establish an online platform for students to discuss and share their ideas and questions related to the course.
8. **Demonstrations:** Conduct live demonstrations of embedded system prototypes to showcase practical implementations.
9. **Assignments and Assessments:** Assign regular assignments and assessments to evaluate students' understanding and progress.
10. **Industry Visits:** Organize visits to embedded system manufacturing companies to expose students to real-world applications.

UNIT - I

05 Hours

INTRODUCTION TO EMBEDDED SYSTEMS

Introduction: What is an Embedded System, Embedded Systems VS. General Computing Systems, History of Embedded Systems, Classification of Embedded Systems, Major Application Areas of Embedded Systems, Purpose of Embedded Systems, Wearable Devices—The Innovative Bonding of Lifestyle with Embedded Technologies (*Text Book-3: Chapter 1*)

Characteristics and Quality Attributes of Embedded Systems: Characteristics of an Embedded System, Quality Attributes of Embedded Systems (*Text Book-3: Chapter 3*)

Embedded Systems—Application- and Domain-Specific: Washing Machine—Application-Specific Embedded System, Automotive–Domain Specific Examples of Embedded System (*Text Book-3: Chapter 4*)

UNIT - II

10 Hours

EMBEDDED SYSTEM HARDWARE DESIGN

Embedded System Core: General Purpose and Domain Specific Processors, Application Specific c Integrated Circuits (ASICs), Programmable Logic Devices (PLDs), Commercial off-the-shelf Components (COTS)

(*Text Book 3: Chapter 2.1*)

Memory: Overview on Various Types of memory sub systems used in Embedded systems and their selection

(*Text Book 3: Chapter 2.2*)

Sensors and Actuators: interfacing of LEDs, 7-segment LED Displays, Piezo Buzzer, Stepper Motor, Relays, Optocouplers, Matrix keyboard, Push button switches, Programmable Peripheral Interface Device (e.g. 8255 PPI), etc. with the I/O subsystem of the embedded system



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(Text Book 3: Chapter 2.3)

Communication Interface: I2C, SPI, CAN, UART, 1-wire, parallel bus, etc. RS-232C, RS-485, Parallel Port, USB, IEEE 1394, Infrared (IrDA), Bluetooth, Wi-Fi, ZigBee, GPRS, etc.

(Text Book 3: Chapter 2.4)

Other System Components: Reset Circuit, Brown-out protection circuit, Oscillator Unit, Real-Time Clock (RTC), Analog to Digital Converter (ADC), Timers and Watchdog Timer unit

(Text Book 3: Chapter 2.6)

Arm Cortex Mx Processor family Overview: Features, Architecture, Memory System, Exception and Interrupts, Low Power Features **(Text Book 1: Chapter 3)**

UNIT - III

10 Hours

EMBEDDED SYSTEM SOFTWARE DESIGN

Programming Concepts and Embedded Programming in C: High-Level Language C programming, C program elements (compiler build stages, macros, functions, Bitwise Operations, Looping constructs, Pointers and AAPCS)

(Reference Book 2: Chapter 5.1 to 5.6)

Embedded Firmware Design and Development: Embedded Firmware Design Approaches **(Text Book 3: Chapter 9.1)**

UNIT - IV

10 Hours

REAL-TIME OPERATING SYSTEMS

Operating System Basics: The Kernel, Types of Operating Systems, Tasks, Process and Threads **(Text Book 3: Chapter 10.1, 10.2, 10.3)**

Thread Management: Introduction to RTOS, Function pointers, Thread Management, Semaphores, Thread Synchronization, Process Management, Dynamic loading and linking **(Text Book 2: Chapter 3)**

Time Management: Cooperation, blocking semaphores, First In First Out Queue, Thread sleeping, Deadlocks, Monitors, Fixed Scheduling **(Text Book 2: Chapter 4)**

Real-time Systems: Data Acquisition Systems, Priority scheduler, Debouncing a switch, Running event threads as high priority main threads, Available RTOS **(Text Book 2: Chapter 5)**



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UNIT - V

04 Hours

EMBEDDED SYSTEM TESTING AND DEBUGGING

Integration and Testing of Embedded Hardware and Firmware: Integration of Hardware and Firmware, Board Bring up (*Text Book 3: Chapter 12*), Tools used for testing and debugging: (*Text Book 3: Chapter 13*)

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Apply knowledge of embedded system design principles to solve real-world problems.	Apply - Level 4
2	Design and implement embedded systems using appropriate hardware and software components.	Synthesis - Level 5
3	Analyze and evaluate the performance of embedded systems through testing and debugging techniques.	Analyze - Level 4
4	Demonstrate effective teamwork and communication skills in the development of embedded system projects.	Apply - Level 4
5	Critically assess the ethical and societal implications of embedded system design.	Evaluate - Level 6

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3								2	2	3	3	
CO2	3	3	3		3	2	2	1	3			2	3	3	
CO3	3	3	1		3							2	3	2	
CO4	3	3	3		3	2							3	3	
CO5						3	3	3							3

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)



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TEXT BOOKS:

1. Joseph Yiu, "The Definitive Guide to ARM® Cortex®-M3 and Cortex®-M4 Processors", 3rd Edition, Newnes, 2013
2. Jonathan Valvano, "Embedded Systems: Real-Time Operating Systems for ARM Cortex-M Microcontrollers", 2nd Edition, CreateSpace Independent Pub, 2012.
3. K.V. Shibu, "Introduction to Embedded Systems", 2nd Edition, McGraw Hill Education, 2017.

REFERENCE BOOKS:

1. James K. Peckol, "Embedded Systems: A Contemporary Design Tool", Wiley, 2009.
2. Raj Kamal, "Embedded Systems- Architecture, Programming and Design", 3rd Edition, McGraw Hill Education, 2017.

E-Resources:

1. MOOC Course: "Introduction to Embedded Systems" by University of California, Irvine (Link: [www.coursera.org/embedded-systems])
2. Website: Embedded.com (Link: [www.embedded.com])
3. Online Tutorial: "Embedded Systems Tutorial" by Tutorials point (Link: [www.tutorialspoint.com/embedded_system])
4. ARM Procedure Call Standard (AAPCS) Standard documentation (Link: [<https://developer.arm.com/documentation/dui0041/c/ARM-Procedure-Call-Standard>])

Activity Based Learning (Suggested Activities in Class)

1. **Project-based Learning:** Assign a semester-long project where students design and implement an embedded system for a specific application.
2. **Hackathons:** Organize hackathons where students work in teams to solve a given problem using embedded system design techniques.
3. **Guest Speaker Series:** Invite professionals from the industry to share their experiences and projects related to embedded system design.
4. **Case Studies:** Provide students with real-world case studies of successful embedded system designs and ask them to analyze and present their findings.



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5. **Prototyping Sessions:** Conduct hands-on sessions where students build and test small-scale embedded system prototypes using development boards and sensors.

LABORATORY EXPERIMENTS

Total Contact Hours: 26

1. Introduction to Microcontrollers: Familiarize students with microcontroller architecture and programming.
 2. C as implemented in Assembly: Modify and compile a C program and observe the assembly listing and the map file.
 3. General purpose I/O Lab: Implement a simple C program to read from and write to IO pins in the microcontroller.
 4. Interrupt Handling: Understand interrupt handling and implement interrupt-driven tasks.
 5. Analog-to-Digital Conversion: Learn how to perform analog-to-digital conversion using microcontrollers
 6. Timer Lab Exercise: Signal Generator with precision Timing and Buffering
 7. PWM Generation: Generate Pulse Width Modulation signals for controlling motor speed.
 8. Communication Protocols: Implement I2C or SPI communication protocols between microcontrollers
 9. Wireless Communication: Implement wireless communication between two or more embedded systems.
 10. Power Management Techniques: Design power-efficient embedded systems using sleep modes and power management techniques
 11. Real-Time Operating Systems: Implement a simple real-time task scheduler on a microcontroller.
 12. System Debugging and Testing: Learn techniques for debugging and testing embedded systems.
 13. Embedded System Project: Design and implement a complete embedded system project, integrating various hardware and software components.
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COMPUTER ORGANIZATION AND ARCHITECTURE

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV

Course Code : 22CY2406

Credits : 03

Hours / Week : 03 Hours

Total Hours : 39 Hours

L-T-P-J : 3-0-0-0

Course Learning Objectives:

This Course will enable students to:

1. **Understand** the Architecture and programming of ARM microprocessor.
2. **Develop** program using Arm instruction set and appreciate the advanced features provided in the ARM
3. **Understand** the exception handling techniques.
4. **Study in** detail the concept of instruction level parallelism and concepts of pipelining.
5. **Understand** various cache memory mapping techniques and memory Organization.

Teaching-Learning Process

7. **Lecture method** along with traditional lecture method, different *type of teaching methods* may be adopted to develop the course outcomes.
8. **Interactive Teaching:** *incorporating* brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
9. Showing **Video/animation** films to explain functioning of various concepts.
10. Encourage **Collaborative** (Group Learning) Learning in the class.
11. To make **Critical thinking**, asking Higher order Thinking questions in the class in the form of Quiz and writing programs with complex solutions.
12. Showing the **different ways to solve** the same problem and encourage the students to come up with their own creative ways to solve them.



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UNIT – I	05 Hours
An Overview of Computing Systems: History of Computers, The Computing Device, The ARM7TDMI Programmers' Model: Introduction, Data types, Processor Modes, Registers, Program Status Registers, The vector Table. Assembler Rules and Directives: Structure of Assembly Language Modules, Registers, Directives and Macros. Loads, Stores and Addressing: LODS and STORES instructions, Operand Addressing , ENDIANNESS <i>Text Book-1: 1.1 to 1.3; 2.1 to 2.6 ; 4; 5.3, 5.4, 5.5</i>	
UNIT – II	05 Hours
Constants and Literal Pools: The ARM Rotation Scheme, Loading Constants and address into Registers Logic and Arithmetic: Flags and their Use, Compare instructions, Data Processing Instructions Loops and Branches: Branching, Looping, Conditional Execution, Straight-Line Coding Subroutines and Stacks: Stack, Subroutines, Passing parameters to subroutines, The ARM APCS. <i>(Text Book-1: 6.1 to 6.4; 7.1 to 7.4; 8.2 to 8.6; 10.1 to 10.5</i>	
UNIT – III	05 Hours
Mixing C and Assembly Language: Inline Assembler Embedded Assembler, Calling Between C and Assembly. Exception Handling: Interrupts, Error Conditions, Processor Exception Sequence, The Vector Table, Exception Handlers, Exception Priorities, Procedures for Handling Exceptions. <i>(Text Book-1: 11.1 to 11.8; 14.1 to 14.4</i>	
UNIT – IV	12 Hours
Pipelining: Basic and Intermediate Concepts Introduction, The Major Hurdle of Pipelining, How Pipelining Implemented, What makes Pipelining hard to Implement, Extending the MIPS Pipeline to Handle Multicycle Operations, The MIPS R4000 Pipeline, Crosscutting Issues. <i>Text Book-2: C.1 to C.7</i>	



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UNIT - V

12 Hours

Memory Hierarchy:

Introduction, Cache Performance, Six basic cache Optimizations, Virtual Memory, Protection and examples of Virtual Memory, Fallacies and Pitfalls.

Text Book-2: B.1 to B.6

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Apply knowledge of the internal architecture and organization of ARM microprocessors to utilize their components and functionalities.	L3
2	Apply the instruction set of ARM Microprocessor by writing Assembly language programs.	L3
3	Analyze and compare the various exception handling techniques.	L4
4	Examine the concept of instruction-level parallelism and analyze the principles of Pipelining techniques.	L4
5	Compare and Contrast memory hierarchy and its impact on computer cost/performance.	L4

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3		2										2	
CO2	3		3		1								2	
CO3	3	3	1										2	
CO4	3	3	1										2	
CO5	3	3	1										2	

3: Substantial (High) 2: Moderate (Medium)

1: Poor (Low)



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TEXT BOOKS:

1. William Hohl, "ARM Assembly Language", 2nd Edition, CRC Press, 2009.
2. John L Hennessy, David A Patterson, "Computer Architecture, A Quantitative Approach", 5th Edition, Morgan Kaufmann publishers, 2012.

REFERENCE BOOKS:

1. David A Patterson, John L Hennessy, "Computer Organization and Design", 4th Edition, Morgan Kaufmann publishers, 2010.
2. Steve Furber, "ARM System-on-chip Architecture", 2nd Edition, Pearson Publications, 2000.
3. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", 5th Edition, Tata McGraw Hill, 2002.

E-Resources:

1. <https://www.udemy.com/topic/arm-cortex-m/>
2. <https://www.edx.org/school/armeducation>
3. https://onlinecourses.nptel.ac.in/noc22_cs93/preview

Activity Based Learning (Suggested Activities in Class)

1. Mini project implementation using Assembly Language Programming.
2. Demonstration of solution to a problem through programming.
