DAYANANDA SAGAR UNIVERSITY

Dayananda Sagar University

School of Engineering

Deverakaggalahalli, Harohalli, Bengaluru – 562 112

Department of

Computer Science and Engineering

(Cyber Security)

SCHEME AND SYLLABUS

B.Tech. PROGRAMME– 2022-26 BATCH

(With effective from - 2022-23)

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

(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.

Dayananda Sagar University

School of Engineering

Deverakaggalahalli, Harohalli, Bengaluru – 562 112

LEADERSHIPS

Sl. No	Name	Position
1	Dr. D. Hemachandra Sagar	Chancellor, DSU
2	Dr. D. Premachandra Sagar	Pro Chancellor, DSU
3	Mr. Galiswamy	Secretory
4	Dr. Amith R Bhatt	Vice Chancellor, DSU
5	Prof. Janardhan R	Pro Vice Chancellor, DSU
6	Dr. Puttamadappa C	Registrar, DSU
7	Dr. Uday Kumar Reddy	Dean, SOE, DSU
8	Dr. Kousalya Govardhanan	Dean, Research, DSU
9	Dr. Ramesh R. Galigekere	Dean, Academics
10	Dr. S Senthil	Professor & Dean, School of Computer Applications
11	Dr. Nagaraja S R	Professor and Chairman Department of Aerospace Engineering
12	Dr. Jayavrinda Vrindavanam	Professor and Chairman, Department of CSE (Artificial Intelligence and Machine Learning)
13	Dr. Girisha G S	Professor and Chairman, Department of Computer Science and Engineering
14	Dr. Durbadal Chattaraj	Associate Professor and Chairman, Department of CSE (Cyber Security)
15	Dr. Shaila S G	Professor and Chairman, Department of CSE (Data Science)
16	Dr. M Shahina Parveen	Professor and Chairperson Department of Computer Science & Technology
17	Dr. Arun Balodi	Professor and Chairman, Department of ECE
18	Dr. Vinayak B Hemadri	Professor and Chairman Department of Mechanical Engineering
19	Dr. Pramod Kumar Naik	Associate Professor and Chairman,Department of AI & Robotics

DAYANANDA SAGAR UNIVERSITY

Dayananda Sagar University

School of Engineering

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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 up to 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

Dayananda Sagar University

School of Engineering

Deverakaggalahalli, Harohalli, Bengaluru – 562 112

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.

(a) One credit per two hours for each Laboratory or Practical or work shop session.
(b) 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 & ELIGIBILITYFOR 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	-

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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.

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

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

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

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

$$\text{Percentage of Marks Scored} = (\text{CGPA Earned} - 0.75) \times 10$$

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 guanine 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

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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.

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 degreed 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 degreed 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.

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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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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 - 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 DESIGNTHINKING	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													
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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NOTE: **Total credits in each semester (from 5th to 7th Sem) shall range between 20- 24**

V 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	IPCC	22CY3501	Theory of Computation	CSE	3	1	0	0	03	60	40	100	**4**
2	IPCC	22CY3502	Security Engineering and Project Management	CSE (CY)	3	0	0	0	03	60	40	100	**3**
3	IPCC	22CY3503	Operating Systems	CSE	3	0	2	0	03	60	40	100	**4**
4	IPCC	22CY3504	Cryptography and Network Security	CSE (CY)	3	0	2	0	03	60	40	100	**4**
5	PCC -6	22CY3505	Security Operations and Cyber Defense	CSE (CY)	3	0	0	0	03	60	40	100	**3**
6	PEC - 1	22CY35XX	Professional Elective Course – I	CSE (CY)	3	0	0	0	03	60	40	100	**3**
7	SEC – I	22CY35XX	Skill Enhancement Course – II	CSE (CY)	1	0	2	0	01	100	--	100	**2**
8	TPC	22CY3506	Cognitive and Technical Skills-I	TPO	0	0	4	0	01	100	--	100	**2**
			Total		**19**	**01**	**10**	**0**		**560**	**240**	**800**	**25**

Professional Elective Course– I	
Course Code	**Course Name**
22CY3507	Wireless Security
22CY3508	Digital Forensics**
22CY3509	Big Data
22CY3510	Secure Coding

Skill Enhancement Course – II	
Course Code	**Course Name**
22CY3511	Open-Source Tools in Cyber Security
22CY3512	CySec Essentials with Cyber Range
22CY3513	Cyber Law**

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VI 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	HSMC	22CY3601	Innovation and Entrepreneurship	CSE	2	0	0	0	03	60	40	100	**2**
2	PCC-7	22CY3602	Cloud Security	CSE (CY)	3	0	2	0	03	60	40	100	**4**
3	PCC - 8	22CY3603	Tools and Techniques for Ethical Hacking	CSE (CY)	3	0	2	0	03	60	40	100	**4**
4	OEC	22OEXXXX	Open Elective – I	CSE (CY)	3	0	0	0	03	60	40	100	**3**
5	PEC - 2	22CY36XX	Professional Elective Course – II	CSE (CY)	3	0	0	0	03	60	40	100	**3**
6	PEC - 3	22CY36XX	Professional Elective Course – III/ MOOC Course	CSE (CY)	3	0	0	0	03	100	--	100	**3**
7	TPC	22CY3604	Cognitive and Technical Skills-II	TPO	0	0	4	0	01	100	--	100	**2**
8	INT	22CY3605	Internship	Evaluation – Resp. Dept.	-	-	-	-	-	-	-	-	**-**
			Total		**17**	**0**	**8**	**0**		**600**	**200**	**800**	**21**

Note: Internship is optional and the credit for Internship will transfer in 8th semester.

Open Elective – I	
Course Code	**Course Name**
22OE0046	Introduction to Cyber Security
22OE0047	Cyber Security Policies for Enterprises

Professional Elective Course– II	
Course Code	**Course Name**
22CY3606	Telecommunication Security
22CY3607	Cyber Security Programs and Policies for Enterprises
22CY3608	Internet of Things
22CY3609	Image Processing and Steganography

Professional Elective Course– III / MOOC Course	
Course Code	**Course Name**
22CY3610	Blockchain Technology
22CY3611	Application Security
22CY3612	MOOC COURSE (As per the courses listed on the NPTEL/ SWAYAM platform as designated by the department)
22CY3613	Hardware Security

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VII 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	PCC-9	22CY4701	Risk Management	CSE (CY)	3	0	0	0	03	60	40	100	**3**
2	PROJ	22CY4702	Capstone Project-Phase 1	Evaluation – Resp. Dept.	0	0	0	12	00	100	--	100	**6**
3	OEC	22OEXXXX	Open Elective – II	CSE (CY)	3	0	0	0	03	60	40	100	**3**
3	PEC - 4	22CY47XX	Professional Elective Course – IV	CSE (CY)	3	0	0	0	03	60	40	100	**3**
4	PEC - 5	22CY47XX	Professional Elective Course – V	CSE (CY)	3	0	0	0	03	60	40	100	**3**
			Total		**12**	**0**	**0**	**6**		**340**	**160**	**500**	**18**

Open Elective – II	
Course Code	**Course Name**
22OE0069	Classical Cryptography
22OE0070	Digital Forensics

Professional Elective Course– IV	
Course Code	**Course Name**
22CY4703	Vulnerability Management and Penetration Testing
22CY4704	End Point Security
22CY4705	IoT and IIoT Security
22CY4706	Operating System Security

Professional Elective Course– V	
Course Code	**Course Name**
22CY4707	Quantum Cryptography and Communication
22CY4708	Mobility Security
22CY4709	Big Data Security
22CY4710	Embedded System Security

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VIII 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	PROJ	22CY4801	Capstone Project-Phase II	Evaluation – Resp. Dept.	0	0	0	20	00	100	--	100	**10**
2	INT	22CY4802	Research Internship/ Industry Internship		-	-	-	8	00	100	--	100	**3**
			Total		**0**	**0**	**0**	**14**		**200**		**200**	**13**

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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**

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, 4th 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, 42nd 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-voltaic, doping of silicon by diffusion technique.

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 Lamberts 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).	

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	Total Hours	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 Taxonomy Level
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**
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 devises: 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.	

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
4. Thermal Management in Electronic Equipment, HCL Technologies, 2010
5. Robotics, Appu Kuttan KK K. International Pvt Ltd, volume 1

REFERENCES:

- An Introduction to Mechanical Engineering, Jonathan Wickert and Kemper Lewis, Third Edition, 2012
- Turbo Machines, M. S. Govindegowda and A. M. Nagaraj, M. M. Publications 7Th Ed, 2012
- Manufacturing Technology- Foundry, Forming and Welding, P. N. Rao Tata McGraw Hill 3rd Ed., 2003.
- Thermal Management of Microelectronic Equipment, L. T. Yeh and R. C. Chu, ASME Press, New York, 2002
- 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 OUTCOMS:

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 to3 phase systems.	
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 andconstruction 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 ElectricalEngineering', 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 andInstrumentation 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.	

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, rare 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 (ax2+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
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

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:
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.

14. Write a program using Bubble sort technique to sort an array of integer elements (Sorting technique, Const array arguments.)

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 prints 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

TEXT 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 Taxonomy Level
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 optimize 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**

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 OUTCOMS:

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, 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.

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 OUTCOMS:

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 Taxonomy Level
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

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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DAYANANDA SAGAR UNIVERSITY

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Deverakaggalahalli, Harohalli, Bengaluru – 562 112

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 Photodiode, 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

CO5	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 lead to Sensors and engineering devices	L3
CO7	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**

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 an NPN transistor in C-E configuration (Module2)

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	Total Hours	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 Taxonomy Level
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

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	**27 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	**38 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	

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 dimensions; 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, –
2. 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
6. 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 OUTCOMS:

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.	

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, Super heterodyne 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 Taxonomy Level
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)**

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 conversation 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 Taxonomy Level
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.	

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 Taxonomy Level
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:

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

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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 BJECTIVES:

- 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.

COURSEOUTCOMES:

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.	
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	

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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

1. Python program to evaluate Values, expressions, and statements, Conditional execution, and Functions Iterations

a. prompt the user to enter an integer and reverse it. And print the sum of the reversed integer.

b. Write a python program to find whether a number (num1) is a factor of 255.

c. Write a python program to find whether a number (num1) is a factor of 255.

d. Write a program to find the sum of the following series: I.
1 + 1/3 + 1/5 + 1/7 + up to 'N' terms.

ii. 1 + x/1! + x3/2! + x5/3! + x7/4 + ...x2n-1/n!

2. Python program to evaluate Python Collections

a. Write a Python Program to demonstrate the inbuilt functions of Strings, List, and sets.

b. Write a Python program for counting a specific letter 'o' in a given string; the number oftimes vowel 'o' appears.

c. Write a Python Program to find the frequency of each word in given strings/strings

d. Store the following for 'n' countries, using a dictionary:

i. Name of a country, country's capital, per capita income of the country.

ii. Write a program to display details of the country with the highest and second lowest per capita income.

3. 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.

4. 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

5. 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 St. Split (), and check whether the resulting list is valid:

a. If the input does not consist of 3 elements, raise a Formula Error, 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 Value Error that occurs, and instead raise a Formula Error

c. 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.

1. 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.
2. 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.
3. Generate one-hot encodings for an array in numpy.
4. 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, JeffreyElkner 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 them 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), Laplace Transforms of $e^{at}f(t)$, $t^n f(t)$ and $\frac{f(t)}{t}$, Periodic functions, Unit step function and impulse functions Inverse Laplace Transforms- By the method of Partial Fractions, Logarithmic and Trigonometric functions, Convolution Theorem, Inverse Laplace transform using Convolution Theorem Solution to Differential Equations by Laplace Transform.	

UNIT – II: Fourier Series	**09 Hours**
Periodic Functions, Trigonometric Series, Fourier series Standard function, Functions of any Period 2L, Even and Odd functions, Half-range Expansions. 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, Fourier transform of basic functions Fourier sine and cosine transforms.	
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, Runge-Kutta 4th order, Multistep Methods-Explanation of multistep methods (Adams-Bashforth, Adams–Moulton Methods), Second-Order ODE. Mass–Spring System (Euler Method, Runge–Kutta Methods)	
UNIT – V: Numerical Methods for Partial Differential Equations	**08 Hours**
Classification of PDEs (elliptic, parabolic, hyperbolic), Difference Methods (Laplace and Poisson Equations), Derivation of finite difference approximations, Crank–Nicolson Method, Method for Hyperbolic PDEs	

Course outcomes

At the end the course the student will be able to:

	Description	Bloom's Taxonomy Level
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
CO1	3	2	2	1					1					
CO2	3	2	2						1					
CO3	3	2	2	1					1					
CO4	3	2	2	1					1					
CO5	3	2	2	1					1					

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

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 analyzing 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.

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	

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

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.

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.
8. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the students' understanding.

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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. **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 Introduction to Verilog, Syntax of Verilog coding, Modelling styles in Verilog, Verilog Operators, Test bench for simulation	
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.	
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	

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.	
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.	

Laboratory Experiments

Experiments are conducted using Verilog tool /Kits	
1.	Introduction to Xilinx tool, FPGA flow
2.	Adder – HA, FA using data flow and behavior 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

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)**

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.

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. ***Textbook – 2: 1.1, 1.2; Textbook – 1: 7.1., 7.2, 7.3***	
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. ***Textbook – 1: 7.4., 7.5, 7.6, 3.2***	
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 ***Textbook-1: 4.1;6.1, 6.2;1.1***	
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. ***Textbook-1: 8.1, 8.2, 8.3, 8.4***	
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. ***Textbook-1: 8.5, 8.7, 8.8***	

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)**

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.

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)	

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

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.

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

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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.
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	:	**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.

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 them 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.	

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)**

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**

a. 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.
b. Data: The data consists of the number of customer arrivals recorded at the coffee shop during each 15-minute interval for the past month.
c. 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**
   a. 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.
   b. **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.
4. **case study 3:** testing independence between two categorical variables.

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	:		**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.

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)

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.

(Text Book-1: Chapter 5: 5.1 to 5.3, Chapter 6: 6.3 to 6.4, Chapter 7: 7.2 to 7.3)

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

(Text Book-2: Chapter 24: 24.1 to 24.3).

Minimum Spanning Trees: Prim's Algorithm, Optimal Tree problem: Huffman Trees;

Case study: Kruskal's Algorithm. Fractional Problem

(Text Book-1: Chapter 9: 9.1, 9.2, 9.4).

DYNAMIC PROGRAMMING:

General method, The Floyd-Warshall Algorithm, Johnson's algorithm for sparse graphs ***(Text Book-2: Chapter 25: 25.1 to 25.3)***,

The Knapsack problem ***(Text Book-1: Chapter 8: 8.4).***

UNIT – V	08 Hours

LIMITATIONS OF ALGORITHMIC POWER

P, NP and NP-complete problems ***(Text Book-1: Chapter 11: 11.3***)

BACKTRACKING:

General method, N-Queens problem, Subset-sum problem.

(Text Book-1: Chapter 12: 12.1)

BRANCH AND BOUND:

General method, Travelling Salesman problem, Approximation algorithms for TSP.

Case study: Knapsack Problem.

(Text Book-1: Chapter 12: 12.2, 12.3)

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

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, Konigsberg 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	:		**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.

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**

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

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	-	-	-	-	-	2	2	-	2	3	-
CO2	3	2	1	-	3	-	-	-	2	2	-	2	3	-
CO3	2	2	2	-	3	-	-	-	2	2	-	2	3	-
CO4	3	1	2	-	1	-	-	-	2	2	-	2	3	-
CO5	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, Mc-GrawHill, 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/

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	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

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	:	**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.

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):	
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)

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)
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	: 2	**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.

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

(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)**

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.

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.

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, ENDIANNES ***Text Book-1: 1.1 to 1.3; 2.1 to 2.6; 4; 5.3, 5.4, 5.5***	
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. ***(Text Book-1: 6.1 to 6.4; 7.1 to 7.4; 8.2 to 8.6; 10.1 to 10.5***	
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. ***(Text Book-1: 11.1 to 11.8; 14.1 to 14.4***	
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. ***Text Book-2: C.1 to C.7***	

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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 C**ontrast** 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)

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.

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THEORY OF COMPUTATION

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – V

Subject Code	:	22CY3501	**Credits**	:	04
Hours / Week	:	03 Hours	**Total Hours**	:	52 Hours
L–T–P–S	:	3–1–0–0			

Course Learning Objectives:

This course will enable students to:

1. **Understand** the Automata Theory and Formal Languages to build efficient design of FA
2. **Identify** Regular Expression and recognize the properties that make a language regular and construct the FA of the language.
3. **Devise** the technique to minimize DFA and understand the importance of minimization in optimizing automata for efficient language recognition.
4. **Get the idea** to Interpret and design different PDA for a given language
5. **Describe** the finite automata and formal languages, equipping them with the knowledge and skills necessary to analyse and design TM for language recognition tasks.

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 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	**08 Hours**

INTRODUCTION TO FINITE AUTOMATA:

Study and Central Concepts of Automata Theory, Finite Automata -Yet Another Method for Defining Languages, Deterministic and Nondeterministic Finite Automata, Finite Automata with Epsilon – transitions. An application: Text Search.

(Text Book-1: Chapter 1: 1.1, 1.7, Chapter 2: 2.2 to 2.5)

(Text Book-2: Chapter 5: Page no: 52)

UNIT – II	08 Hours

REGULAR EXPRESSION AND LANGUAGES:

Regular Expressions, Finite Automata and Regular Expressions, Algebraic Laws of Regular expressions, Applications of Regular Expressions, Properties of Regular Languages -Pumping Lemma, Applications of the Pumping Lemma, Closure Properties of Regular languages, Equivalence and minimization of Automata.

(Text Book-1: Chapter 3: 3.1 to 3.4, Chapter 4: 4.1, 4.2, 4.4)

UNIT – III	09 Hours

CONTEXT – FREE GRAMMARS AND LANGUAGES:

Context-Free Grammars, Parse Trees, Ambiguity in Grammars and Languages, Properties of Context free languages-Normal Forms of Context-Free Grammars, The Pumping Lemma for Context Free Languages, Closure Properties of Context-Free Languages.

(Text Book-1: Chapter 5: 5.1 to 5.2.3, 5.4, Chapter 7: 7.1 to 7.3)

UNIT -IV	

PUSHDOWN AUTOMATA:

Definition of the Pushdown automation (PDA), The Language of PDA, Equivalence of PDA's and CFG's-From Grammars to Push Down Automata and PDA to Grammars, Deterministic Pushdown Automata

(Text Book-1: Chapter 6: 6.1 to 6.4)

UNIT - V	

INTRODUCTION TO TURING MACHINE:

Problems that Computers Cannot Solve, The Turing Machine, Programming Techniques for Turing Machine, Extensions to the Basic Turing Machine.

(Text Book-1: Chapter 8: 8.1, 8.4)

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	**Utilize** the basic concepts of formal languages of finite automata techniques such as DFA, NFA and E-NFA	L3
2	**Develop** Finite Automata for different Regular Expressions and Languages and minimization of Finite Automata to Regular Expression.	L3
3	**Analyze** context-free grammars, ambiguity and Chomsky normal form grammars to design computer languages	L4
4	**Construct** context free, regular, Interpret and design different PDA for a given language	L5
5	**Design** Turing machine to solve problems.	L6

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	3									2		3
CO2	3	3	3									2		3
CO3	1	1		3	1							1		2
CO4	2	2	3	3	1							2		3
CO5	1	2	3	3	3							3		3

3: Substantial (High) **2: Moderate (Medium)** **1: Poor**

(Low) TEXT BOOKS:

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

REFERENCE BOOKS:

1. K.L.P. Misra and N. Chandrashekaran. 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 2ndEdn, TMH, New Delhi, 2000.

Activity Based Learning (Suggested Activities in Class)

1. Real world problem solving and puzzles using group discussion. E.g., Fake coin identification, Cabbage puzzle, Konigsberg bridge puzzle etc.,
2. Demonstration of solution to a problem through programming.

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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 an b n c n where n>0.

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SECURITY ENGINEERING AND PROJECT MANAGEMENT

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – V

Subject Code	:	22CY3502	**Credits**	:	03
Hours / Week	:	03 Hours	**Total Hours**	:	39 Hours
L–T–P–S	:	3–0–0–0			

Course Learning Objectives:

This course will enable students to:

1. Students will **understand** the importance of identifying and engaging with the security project sponsor, learning to effectively communicate and manage stakeholder expectations throughout the project lifecycle.
2. Students will learn to **identify** the project's critical path and manage it effectively to ensure the project stays on schedule and meets its deadlines.
3. **Develop and document** the processes and methodologies to be followed throughout the project lifecycle.
4. Students will **identify and understand** the key skills required for successfully executing a wireless security project, including technical, analytical, and project management skills.
5. Students will **develop and apply** methods for measuring and evaluating software security to ensure robust protection against vulnerabilities and threats.

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.
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	**07 Hours**

Defining the Security Project: Defining the Security Problem, Network Security and the CIA, Defining Potential Security Project Solutions, Applying Security Project Constraints, Identifying the Security Project Sponsor. **(Text book1: chapter 2)**

UNIT – II	**08 Hours**

Organizing the IT Security Project*:* Identifying the IT Security Project Team, Identifying IT Security Project Stakeholders**,** Defining IT Security Project Requirements**,** Defining IT Security Project Objectives, Defining IT Security Project Processes. ***(Text Book-1: chapter 3)***

UNIT – III	08 Hours
Planning the IT Security Project*:* Defining Project Tasks and Sub-tasks, Checking Project Scope**,** Developing Task Details**,** Identifying and Working with the Critical Path***. (Text Book-2: Chapter6)***	
UNIT – IV	**08 Hours**
Wireless Security Project Plan*:* Types of Wireless Network Components and Devices, Wireless Technologies, Types of Threats, Risk Assessment, Wireless Security Project Parameters, Scope, Schedule, Budget, Key Skills Needed. ***(Text Book-1: chapter 12)***	
UNIT – V	**08 Hours**
Security and project management: Project scope, Project plan, Resources, estimating nature and duration of required resources**,** Project and product risk, Measuring software security. ***(Text Book-2: chapter 7).***	

Course Outcomes:

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

1. Students will accurately identify and articulate specific security issues within an organization, understanding their implications.
2. Students will develop and implement structured processes and methodologies to guide the project from start to finish, ensuring effective management and execution.
3. Students will identify the critical path and manage it to ensure timely project completion, addressing potential delays and resource constraints.
4. Students will identify and understand the key technical and project management skills required to successfully execute a wireless security project.
5. Students will develop and utilize techniques to measure and evaluate the security of software systems, ensuring that security measures are effective and aligned with best practices.

TEXT BOOKS:

1. S Snedaker - IT Security Project Management Handbook-Syngress
2. Julia H. Allen - Software Security Engineering_ A Guide for Project Managers_ A Guide for Project Managers (SEI Series in Software Engineering)-Addison-Wesley Professional (2008).

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OPERATING SYSTEMS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – V

Subject Code	:	22CY3503	**Credits**	:	04
Hours / Week	:	03 Hours	**Total Hours**	:	52(Th)+26(P) Hours
L–T–P–S	:	3–0–2–0			

Course Learning Objectives:

This course will enable students to:

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

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.
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**

OS Overview and System Structure

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.

UNIT – II	**12 Hours**

Process Management:

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

UNIT – III	10 Hours
Process Coordination 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.	
UNIT – IV	**10 Hours**
Memory Management 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	
UNIT – V	**10 Hours**
File System and Secondary Storage Structure 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.	

Course Outcomes:

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

1. **Summarize** basic concepts of operating systems and identify its variants.
2. **Apply** FIFO, SJF, SRT, Priority, Round Robin algorithms to solve process scheduling.
3. **Summarize** process coordination and apply Banker's algorithm to prevent inter-process deadlock.
4. **Distinguish** contiguous and virtual memory management.
5. **Apply** the page replacement algorithms to detect page fault appear in virtual memory.
6. **Apply** FCFS, SSTF, SCAN, C-SCAN, Look and C-Look algorithms to solve I/O scheduling.

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		2
CO2	2	2	2	2								2		2
CO3	2	2	2	2								2		2
CO4	2	2	2	1								2		2
CO5	2	2	2	2								2		2
CO6	2	2	2	2								2		2

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

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.

E-Resource:

1. https://onlinecourses.nptel.ac.in/noc24_cs80/preview
2. https://onlinecourses.nptel.ac.in/noc24_cs108/preview
3. https://www.coursera.org/learn/codio-intro-to-operating-systems-2-memory-management
4. Modern Operating Systems by Andrew S. Tanenbaum - Known for its comprehensive coverage of modern operating systems principles and design.
5. Operating System Fundamentals - Course (nptel.ac.in)
6. Introduction to Operating Systems - Course (nptel.ac.in)
7. Intro to Operating Systems 1: Virtualization | Coursera
8. Intro to Operating Systems 3: Concurrency | Coursera
9. Intro to Operating Systems 2: Memory Management | Coursera

Activity Based Learning (Suggested Activities in Class)

1. Implementing Operating System concepts by doing Mini projects.
2. Case study to compare various Operating Systems and their performance.
3. Present real-world case studies or problems related to operating systems design and performance optimization, encouraging students to apply theoretical knowledge to analyze and propose solutions.

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LABORATORY EXPERIMENTS

Total Contact Hours: 26

1. 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. 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. Write a C program to simulate producer-consumer problem using semaphores.
7. 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. 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. 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

open-ended experiments

1. Write a program to simulate dynamic memory allocation using malloc () and free ().
2. Set up and manage virtual machines using VirtualBox or VMware.
3. Write a program to navigate and manipulate file directories.

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CRYPTOGRAPHY AND NETWORK SECURITY
[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – V

Subject Code	:	22CY3504	**Credits**	:	04
Hours / Week	:	03 Hours	**Total Hours**	:	42(Th)+26(P) Hours
L–T–P–S	:	3–0–2–0			

Course Learning Objectives:

This course will enable students to:

1. Understand OSI security architecture and classical encryption techniques.
2. Acquire fundamental knowledge on the concepts of finite fields and number theory.
3. Understand various block cipher and stream cipher models.
4. Describe the principles of public key cryptosystems, hash functions and digital signature.

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.
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	**07 Hours**
Overview: Services, Mechanisms and attacks, the OSI security architecture, Network security model. Classical Encryption Techniques: Symmetric cipher model, Substitution Techniques, Transposition Techniques, Steganography.	

UNIT – II	**09 Hours**
Finite Fields and Number Theory: Groups, Rings, Fields, Modular Arithmetic, Euclid's Algorithm, Finite Fields, Polynomial Arithmetic, Prime Numbers, Fermat's and Euler's Theorem, Testing for Primality, The Chinese Remainder Theorem, Discrete Logarithms. Block Cipher principles, Data Encryption Standard (DES), Triple DES, Block Cipher Modes of Operation, Advanced Encryption Standard (AES).	

UNIT – III	**09 Hours**
Public key cryptography: Principles of public key cryptosystems, The RSA algorithm, El Gamal Cryptosystem, Elliptic Curve Arithmetic, ECC. Symmetric Key Agreement: Diffie Hellman Key exchange, Key management and Distributions. Hash function, SHA, MAC, Authentication requirement, Authentication function, Security of MAC, HMAC, CMAC.	

UNIT – IV	08 Hours
Digital signature: EI Gamal, Schnorr, DSS. Authentication applications, One-way Authentication, Mutual Authentication, Kerberos, X.509 Authentication services.	
UNIT – V	**09 Hours**
Electronic Mail security, PGP, S/MIME, IP security, Web Security, System Security, Intruders, Malicious software, viruses, Firewalls.	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	**Analyze** the concepts of services, mechanisms, and attacks within the OSI security architecture and network security model and **Evaluate** the classical encryption techniques like substitution techniques, transposition techniques, and steganography.	L5
2	**Analyze** advanced mathematical concepts and cryptographic algorithms, such as modular arithmetic, finite fields, and block cipher principles, to solve complex problems in information security and encryption.	L4
3	**Evaluate** the security and efficiency public key cryptosystems like RSA, ElGamal, and Elliptic Curve Cryptography (ECC) and **Make use of** key distribution principles to establish session key between two keys.	L5
4	**Apply** cryptographic hash functions, such as SHA, to ensure data integrity in practical scenarios, and implement Message Authentication Codes (MAC), including HMAC and CMAC, to achieve data authentication in secure communication systems.	L3
5	**Analyze** different digital signature algorithms such as ElGamal, Schnorr, and DSS (Digital Signature Standard).	L4
6	**Analyze** the effectiveness of various security measures, including PGP, S/MIME, IP security, Web Security, System Security, Intruders, Malicious software, viruses, and Firewalls, in protecting electronic communication and information systems.	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	3	3										2	1
CO2	3	2	1		2			1				2	2	2
CO3	3	3	3		2			1				2	2	2
CO4	3	1	1		2			1				2	2	2
CO5	3	2	1		2			1				2	2	2
CO6	3	1						1s				2	2	1

3: Substantial (High) **2: Moderate (Medium)** **s1: Poor (Low)**

TEXT BOOKS:

1. William Stallings, Cryptography and Network Security: Principles and Practice, Pearson, 8thEdition, 2019, ISBN: 9780135764039,0135764033.

REFERENCE BOOKS:

1. BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.
2. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd
3. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition.

E-Resources:

1. https://onlinecourses.swayam2.ac.in/cec24_cs16/preview
2. https://www.coursera.org/learn/crypto
3. https://www.coursera.org/learn/cryptography
4. https://www.coursera.org/specializations/applied-crypto

LABORATORY EXPERIMENTS

Total Contact Hours: 26

1. Implement Ceaser cipher using C program.
2. Write a C program to implement transposition cipher.
3. Write a C program that contains a string (char pointer) with a value \Hello World'. The programs should XOR each character in this string with 0 and display the result.
4. Write a C program to implement the Euclid Algorithm to generate the GCD.
5. Write a program to perform encryption and decryption using the following algorithms:
   i. Ceaser Cipher
   ii. Substitution Cipher
   iii. Hill Cipher
6. Write a Java program to implement the DES algorithm logic.
7. Write a C/JAVA program to implement the Blowfish algorithm logic.
8. Write a C/JAVA program to implement the Rijndael algorithm logic.
9. Write a Java program to implement RSA Algorithm.
10. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript.

open-ended experiments

1. Write a C program to implement the signature scheme - Digital Signature Standard.
2. To calculate the message digest of a text using the SHA-1 algorithm in Java.
3. Write a program to implement Rail fence Cipher technique

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SECURITY OPERATIONS AND CYBER DEFENSE

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – V

Subject Code	:	22CY3505	**Credits**	:	03
Hours / Week	:	03 Hours	**Total Hours**	:	39 Hours
L–T–P–S	:	3–0–0–0			

Course Learning Objectives:

This course will enable students to:

1. Understand the role and functions of a Security Operations Center (SOC) in an organization's cybersecurity strategy.
2. Analyze various types of cyber threats and attack vectors, and their implications for security operations.
3. Apply techniques and tools for threat detection, incident response, and threat intelligence.
4. Evaluate the effectiveness of different security operation strategies and frameworks.
5. Design a security operation plan that includes incident response, threat management, and continuous monitoring.

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.
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**

SECURITY OPERATIONS AND CHALLENGES IN MODERN DAY:

Introduction, Security Breaches, Common Security Threats: Malware, Phishing, Spear Phishing, Man in the Middle (MitM), Trojans, Ransomware, Denial-of-Service Attack, Distributed Denial-of-Service Attack (DDoS), Attacks on IoT Devices, Data Breaches.

Security Challenges in Modern Day: Cloud Computing, Social Media, Smart Phones, General Data Protection Regulations (GDPR), Attacks Based on Machine Learning and AI, Attacks against Cryptocurrencies and Blockchain Systems, Switching to DevOps, and DevSecOps, Biometric Authentication, File-based and File-less Malware.

(Text Book-1: Chapter 1, 1.1 to 1.4).

UNIT – II	08 Hours
ADVANCED PERSISTENT THREAT (APT) AND CYBER DEFENCE MECHANISMS: Introduction to APT attacks, How an APT attack works, Some Instances of APTs, Characteristics of APTs. **Preventive Measures**: Identify the Threats, Cyber Defence Mechanisms & Cybercrimes, Observe All Stakeholders, Usage of Two-Factor Authentication, Auditing, Credit Sign-Off Policy, Protect Vital Data, Risk Assessments, Cybercrime, Risk Factors, Threat Modelling, Role of a Threat Analyst. ***(Text Book-1: Chapter 1, 1.5 to 1.9).***	
UNIT – III	**08 Hours**
CYBER-PHYSICAL SYSTEMS: Introduction, Background Knowledge of CPS, Application Areas of Cyber-Physical System (CPS), Philosophical Issues of CPS, Principle of CPS Operation, Architecture of CPS Layers, Security Threats of CPS, Attacks on CPS, Attacks and Its Consequences, Adversaries Characteristics. ***(Text Book-1: Chapter 3, 3.1 to 3.11).***	
UNIT – IV	**07 Hours**
SECURITY THREAT ANALYSIS AND CYBERWARFARE ASSOCIATED TECHNOLOGIES Introduction, Survivability Network Architecture, SONET and Self-Healing Ring Transportation, Single- Access and Multi-Access Optical Network Ring Architecture, Optical Network Ring Architecture, Channel Demand Routing Ring Architecture, Cyberwar – A New Weapon of Mass Effect, Cyberthreat Intelligence, Countermeasures. ***(Text Book-1 Chapter 2: 2.1 to 2.5, Text Book-2 Chapter 2: 1 to 4***)	
UNIT – V	**06 Hours**
CYBER DEFENCE AND CRITICAL NATIONAL INFRASTRUCTURE (CNI) Introduction, Cyber Operations as a Domain of Warfare, CNI Case Studies in the Energy and Healthcare Sector, Ukraine Power Grid, CNI Attacks Through ICS, SCADA Systems, Cyber Weapons, and Evolution in the Digital Age. ***(Text Book- 2: Chapter 1***)	

Course Outcomes:

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

1. Analyze common security threats like malware, phishing, ransomware, attacks on IoT devices and AI-based attacks, to develop effective strategies for mitigating these threats.
2. Apply appropriate cyber defense mechanisms to mitigate the risks associated with Advanced Persistent Threat (APT) attacks by identifying the threats, performing risk assessments, and implementing two-factor authentication, auditing, and data protection strategies.
3. Analyze the architecture and operation of Cyber-Physical Systems (CPS) to identify and evaluate potential security threats and vulnerabilities.
4. Evaluate survivable network architectures, including SONET and self-healing ring technologies, to ensure robust and resilient communication networks in the context of cyberwarfare and security threats.
5. Analyze the vulnerabilities and threats associated with critical national infrastructure (CNI) in sectors such as energy and healthcare.

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		1				2	2		2	3	
CO2	3	3	2		1				2	2		2	3	
CO3	3	2	1		1				2	2		2	3	
CO4	3	1			1				2	2		2	3	
CO5	2	1	3		1				2	2		2	3	

3: Substantial (High) 2 : Moderate (Medium) 1: Poor (Low)

TEXT BOOKS:

1. Gautam Kumar, Dinesh Kumar Saini, and Nguyen Ha Huy Cuong, "Cyber Defense Mechanisms Security, Privacy, and Challenges", CRC Press, 2021.
2. Hamid Jahankhani, Stefan Kendzierskyj, Nishan Chelvachandran, and Jaime Ibarra, "Cyber Defence in the Age of AI, Smart Societies and Augmented Humanity", Advanced Sciences and Technologies for Security Applications, Springer, 2020.

REFERENCE BOOKS:

1. The Security Operations Center: Building, Operating, and Maintaining your SOC" by Joseph Muniz and Gary McIntyre
2. "Blue Team Handbook: Incident Response Edition" by Don Murdoch
3. "Cybersecurity Ops with bash: Attack, Defend, and Analyze from the Command Line" by Paul Troncone and Carl Albing
4. Various online resources, industry reports, and current articles on cyber defense and security operations

E-Resources:

1. https://www.coursera.org/learn/in-the-trenches-security-operations-center
2. https://www.udemy.com/course/cyber-security-operations-center-csoc-soc-analyst/
3. https://www.udemy.com/course/cyber-security-operations-and-technology-solutions/

Activity Based Learning (Suggested Activities in Class)

1. Modern tools in Security Operation and Cyber Defence.
2. Practical demonstration of cyber defence using various modern tools like firewalls and honeypots.

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WIRELESS SECURITY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – V

Subject Code	:	22CY3507	**Credits**	:	03
Hours / Week	:	03 Hours	**Total Hours**	:	39 Hours
L–T–P–S	:	3–0–0–0			

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.
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	**08 Hours**
Security Issues in Mobile Communication: Mobile Communication History, Security – Wired Vs Wireless, Security Issues in Wireless and Mobile Communications, Security Requirements in Wireless and Mobile Communications, Security for Mobile Applications, Advantages and Disadvantages of Application – level Security. (***Text Book-1: Chapter 1: 1.1 to 1.6).***	
UNIT – II	**08 Hours**
Security of Device, Network, and Server Levels: Mobile Devices Security Requirements, Mobile Wireless network level Security, Server Level Security. ***(Text Book-1: Chapter 2: 2.1 to 2.3)*** Application-Level Security in Wireless Networks: Application of WLANs, Wireless Threats, Some Vulnerabilities and Attach Methods over WLANs, Security for 1G Wi-Fi Applications, Security for 2G Wi-Fi Applications, Recent Security Schemes for Wi-Fi Applications. ***(Text Book-1: Chapter 3: 3.1 to 3.6).***	
UNIT – III	**08 Hours**
Application-Level Security in Cellular Networks: Generations of Cellular Networks, Security Issues and attacks in cellular networks, GSM Security for applications, GPRS Security for applications, UMTS security for applications, 3G security for applications, Some of Security and authentication Solutions. ***(Text Book-1: Chapter 4: 4.1 to 4.7)***	
UNIT – IV	**08 Hours**
Application-Level Security in MANETs: MANETs, Some applications of MANETs, MANET Features, Security Challenges in MANETs, Security Attacks on MANETs, External Threats for MANET applications, Internal threats for MANET Applications, Some of the Security Solutions. ***(Text Book-1: Chapter 5: 5.1 to 5.8)***	

Application-Level Security in Ubiquitous Networks: Ubiquitous Computing, Need for Novel Security Schemes for UC, Security Challenges for UC, and Security Attacks on UC networks, Some of the security solutions for UC. ***(Text Book-1: Chapter 6: 6.1 to 6.5)***

UNIT – V	**07 Hours**
Application-Level Security: Introduction, Some of the Heterogeneous Wireless Network, Heterogeneous Network Application in Disaster Management, Security Problems and Attacks in Heterogeneous Wireless Networks, Some Security Solutions for Heterogeneous Wireless Networks. ***(Text Book-1: Chapter 7: 7.1 to 7.5)***	

Course Outcomes:

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

1. **Analyze** security requirements and issues in wireless and mobile communications, comparing and contrasting these with wired communication security, and **evaluate** the advantages and disadvantages of application-level security for mobile applications.
2. **Evaluate** application-level security in wireless networks, identifying vulnerabilities, threats, and security schemes for various generations of Wi-Fi applications.
3. **Identify** common security issues and attacks, and **apply** appropriate security and authentication solutions for GSM, GPRS, UMTS, and 3G applications.
4. **Analyze** and **evaluate** the security challenges and threats in Mobile Ad-hoc Networks (MANETs) and Ubiquitous Computing (UC) environments, and propose appropriate security solutions to mitigate these threats.
5. **Analyze** and address security challenges in heterogeneous wireless networks by understanding their applications in disaster management, identifying potential security threats and attacks.

TEXT BOOKS:

1. Pallapa Venkataram, Satish Babu: "Wireless and Mobile Network Security", 1st Edition, Tata McGraw Hill,2010.

REFERENCE BOOKS:

1. Frank Adelstein, K. S. Gupta: "Fundamentals of Mobile and Pervasive Computing", 1st Edition, Tata McGraw Hill 2005.
2. KavehPahlavan and Prashant Krishnamurthy, "Principles of Wireless Networks", Prentice Hall, 2006.
3. Randall k. Nichols, Panos C. Lekkas: "Wireless Security Models, Threats and Solutions", 1st Edition, Tata McGraw Hill, 2006.

E-Resources:

1. https://www.udemy.com/course/wireless-security/?couponCode=IND21PM
2. https://www.udemy.com/course/learn-wireless-security-from-scratch-2021/?couponCode =IND21PM
3. https://iisecurity.in/courses/wireless-security-course
4. https://www.coursera.org/learn/sscp-4th-ed-course-6

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.

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DIGITAL FORENSICS

SEMESTER – V

Subject Code	:	22CY3508	**Credits**	:	03
Hours / Week	:	03 Hours	**Total Hours**	:	39 Hours
L–T–P–S	:	3–0–0–0			

Course Learning Objectives:

This course will enable students to:

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

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.
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	**08 Hours**

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)**

UNIT – II	**08 Hours**

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).**

UNIT – III	08 Hours
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)**	
UNIT – IV	**08 Hours**
CLOUD FORENSICS: Cloud Computing Models Defining Cloud Forensics, Server-Side Forensics, ClientSide 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)**	
UNIT – V	**07 Hours**
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)**	

Course Outcomes:

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

1. Summarize the cyber forensics tools and techniques to interpret cybercrimes.
2. Build a good cyber forensic report by utilizing evidence acquisition and data preparation methodologies.
3. Inspect the network forensic tools and techniques like Wireshark, Network Miner, Xplico to detect and prevent intrusions.
4. Survey the cloud forensic techniques associated with Google Drive, Dropbox and WhatsApp.
5. Summarize different hardware specific tools and techniques like Slack Space, RAM Slack, Drive Slack, Swap File to investigate cybercrime.

TEXT BOOKS:

1. Albert J. Marcella Jr., Frederic Guillossou, "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 publication.
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.

REFERENCE BOOKS:

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

E-Resources:

1. https://onlinecourses.swayam2.ac.in/cec21_ge10/preview
2. Cyber Forensics case study from India
3. https://www.eccouncil.org/academia/digital-forensics-essentials-dfe
4. https://www.ifsedu.in/cyber-forensics

Activity Based Learning (Suggested Activities in Class)

1. Use of Network forensics tools like Wireshark, Network Miner, Xplico to detect and prevent intrusions.
2. Collaborative Activity is case study with a team of 4 students.

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BIG DATA

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – V

Subject Code	:	22CY3509	**Credits**	:	03
Hours / Week	:	03 Hours	**Total Hours**	:	39 Hours
L–T–P–S	:	3–0–0–0			

Course Learning Objectives:

This course will enable students to:

1. **Develop** a comprehensive understanding of the key concepts, principles, and technologies underlying Big Data.
2. **Gain** proficiency in using major Big Data platforms and tools such as Hadoop, Spark, and NoSQL databases.
3. **Develop** the skills to perform data analysis on large datasets using statistical and machine learning methods, and visualize Big Data insights using tools like Tableau, Power BI, or custom visualization techniques.
4. **Understand** how to optimize performance for Big Data applications, including the use of parallel and distributed computing techniques.
5. **Gain** practical experience by applying Big Data techniques to solve real-world problems in various domains such as finance, healthcare, and social media.

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.
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	**08 Hours**

Introduction to the World of Big Data: Understanding Big Data, Evolution of Big Data, Failure of Traditional Database in Handling Big Data, 3Vs of Big Data, Sources of Big Data, Different Types of Data, Big Data Infrastructure, Big Data Life Cycle, Big Data Technology, Big Data Applications. ***(T1: Chapter 1)***

UNIT – II	08 Hours
Big Data Storage Concepts: Cluster Computing, Distribution Models, Distributed File System, Relational and Non-Relational Databases , Scaling Up and Scaling Out Storage. **NoSQL Database**: Introduction to NoSQL, Why NoSQL, CAP Theorem, ACID, BASE 56, Schema less Databases, NoSQL (Not Only SQL), Migrating from RDBMS to NoSQL. ***(T1: Chapter 2 and Chapter 3)***	
UNIT – III	**08 Hours**
Processing, Management Concepts, and Cloud Computing: ***Part I: Big Data Processing and Management Concepts***-Data Processing, Shared Everything Architecture, Shared-Nothing Architecture, Batch Processing, Real-Time Data Processing Parallel Computing, Distributed Computing, Big Data Virtualization, ***Part II: Managing and Processing Big Data in Cloud Computing*** - Introduction, Cloud Computing Types, Cloud Services, Cloud Storage, Cloud Architecture **(T1: Chapter 4)**	
UNIT – IV	**08 Hours**
Driving Big Data with Hadoop Tools and Technologies: Apache Hadoop, Hadoop Storage, Hadoop Computation, Hadoop 2.0, HBASE, Apache Cassandra, SQOOP, Flume, Apache Avro, Apache Pig, Apache Mahout, Apache Oozie, Apache Hive, Hive Architecture, Hadoop Distributions ***(T1: Chapter 5)***	
UNIT – V	**07 Hours**
Big Data Analytics with Machine Learning: Introduction to Machine Learning, Machine Learning Use Cases, Types of Machine Learning **Big Data Visualization:** Introduction to Big Data Visualization, Conventional Data Visualization Techniques, ***Tableau*** -Bar Chart in Tableau, Line Chart, Pie Chart, Bubble Chart, Box Plot, Tableau Use Cases, ***Installing R and Getting Ready***-Data Structures in R, Importing Data from a File, Importing Data from a Delimited Text File, Control Structures in R, Basic Graphs in R. ***(T1: Chapter7 and Chapter 10)***	
Course Outcomes: At the end of the course the student will be able to: 1. **Analyze** complex big data sets to identify patterns and trends. 2. **Design** effective data models to optimize storage and retrieval of big data. 3. **Formulate** strategies for managing and securing large-scale data infrastructures. 4. **Evaluate** the performance of different big data tools and technologies. 5. **Analyze** the advanced algorithms to process and extract valuable insights from big data.	

TEXT BOOKS:

1. Balamurugan Balusamy, Nandhini Abirami. R, "Big Data - Concepts, Technology, and Architecture", Wiley Publications, first edition -2021, ISBN 978-1-119-70182-8.

Reference Books:

1. The Lazy-Programmer "Big Data, MapReduce, Hadoop, and Spark with Python Master Big Data Analytics and Data Wrangling with MapReduce Fundamentals using Hadoop, Spark, and Python".
2. Vince Reynolds, "Big Data for Beginners"
3.

E-Resources:

1. https://www.ibm.com/topics/endpoint-security
2. https://www.coursera.org/articles/endpoint-security
3. https://skillsforall.com/course/endpoint-security?courseLang=en-US
4. https://www.sans.org/cyber-security-courses/security-essentials-network-endpoint-cloud/

Activity Based Learning (Suggested Activities in Class)

1. ***Case Study Analysis:*** Students analyze real-world case studies of companies that have
2. ***Group Project on Big Data Infrastructure:*** In groups, students design a big data infrastructure for a hypothetical company, including data storage, processing, and analysis components.
3. ***Hands-on Lab with Big Data Technologies:*** Students use tools like Hadoop, Spark, or NoSQL databases to perform data processing and analysis tasks.
4. ***Data Visualization Exercise:*** Students create visualizations from a large dataset using tools like Tableau or Power BI.
5. ***Data Cleaning and Preprocessing Workshop:*** Students work on cleaning and preprocessing a messy dataset to prepare it for analysis.

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SECURE CODING

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – V

Subject Code	: 22CY3510	**Credits**	: 03
Hours / Week	: 03 Hours	**Total Hours**	: 39 Hours
L–T–P–S	: 3–0–0–0		

Course Learning Objectives:

This course will enable students to:

1. Understand the secure software development lifecycle (SDLC) and best practices in secure coding.
2. Identify and define security requirements for software projects.
3. Recognize common software vulnerabilities and implement preventive measures.
4. Apply secure coding standards and practices during software development and maintenance.
5. Conduct security code analysis and review to ensure robust and secure applications.

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.
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	**08 Hours**
Secure software development life-cycle: Software development life cycle (Microsoft, McAfee, OWASP etc.), development team, Quality and Security, Application Guidelines, (ISC) 2 Ten best practices of secure software development, Security principles, Security Standards Three pillars of software security, Seven Touch points of software security, Security Methodologies, Security Framework, Security Models	

UNIT – II	**08 Hours**
Secure Software Requirements: Introduction, Objective, Sources, Types of Security Requirements, Requirements Engineering for Secure Software, Concepts of Misuse and Abuse, SQUARE Process Model, SQUARE Sample Outputs, Requirements Elicitation and Prioritization, Object Modeling, Threat Modeling	

UNIT – III	08 Hours
Secure Software Implementation, : Introduction to Software Vulnerability and Preventive/ Defensive techniques , Vulnerability description, types, Vulnerability Databases, OWASP top 10, NVD, CWE, Common Software Vulnerabilities and Controls, Defensive Coding Practices—Concepts and Techniques :Buffer Overrun, Format String Problems, Integer Overflow, and Injection flaws : SQL Injection, Command Injection, Failure to Handle Errors, Cross Site Scripting, Broken Authentication and Session Management, Magic URLs, Insecure De-serialization	
UNIT – IV	**08 Hours**
Secure Coding Standards: Memory Management, Exception management, Development tools, IDEs tools, Versioning tools, Networking tools, Coding in the cube: Functions, procedures and code blocks, Structuring for Validation, Structured Programming, Debugging, Coding and applying security requirements during maintenance,	
UNIT – V	**07 Hours**
Security code analysis and review: Code review with a tool (fortify, coverty etc.) Code analysis Securing Server, Database, Network and their secure configuration, Firewalls. Case Study: Recent Software vulnerabilities due to insecure programming and how to prevent them during design and implementation.	

Course Outcomes:

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

1. Describe and implement secure software development lifecycle practices.
2. Analyze and specify security requirements for software projects.
3. Identify common software vulnerabilities and apply appropriate defensive techniques.
4. Implement secure coding standards and practices in software development.
5. Perform security code analysis and review, and secure configuration of servers, databases, and networks

TEXT BOOKS:

1. Paul, M. (2016). Official (ISC) 2 Guide to the CSSLP. CRC Press.
2. SEACORD, R. (2013). Secure Coding in C and C++ (2 nd Edition). SEI Series in Software Engineering.
3. Howard, Michael, David LeBlanc, and John Viega. "24 Deadly Sins of Software Security.
4. Programming Flaws and How to Fix Them (2010). McGraw-Hill Education.

REFERENCE BOOKS:

1. Ransome, J., & Misra, A. (2018). Core software security: Security at the source. CRC press.
2. Bishop, M. (2019). Computer Security (2 nd Edition). Addison-Wesley Professional.
3. McGraw, G. (2006). Software security: building security in (Vol. 1). Addison- Wesley Professional
4. John Veiga, Gary Mc Graw, “Building Secure Software: How to Avoid Security Problems the Right
5. Way”, Addison-Wesley Professional Computing Series, 2001.

E-Resources:

1. https://owasp.org/
2. https://nvd.nist.gov/
3. https://www.microsoft.com/en-us/securityengineering/sdl/

Activity Based Learning (Suggested Activities in Class)

1. Secure Code Review and Analysis
2. Secure Coding Hackathon

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IINOVATION AND ENTREPRENEURSHIP

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – VI

Subject Code	:	22CY3601	**Credits**	:	02
Hours / Week	:	02 Hours	**Total Hours**	:	39 Hours
L–T–P–S	:	2–0–0–0			

Course Learning Objectives:

This course will enable students to:

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

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.
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	**08 Hours**

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 entership22. Case Study: Successful Entrepreneurs Narayana Murthy Infosys.

UNIT – II	08 Hours
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	
UNIT – III	**08 Hours**
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)	
UNIT – IV	**08 Hours**
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/	
UNIT – V	**07 Hours**
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/	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Demonstrate knowledge of the key elements of the entrepreneurial Process	L2
2	Employ strategies to generate new ideas for startups	L3
3	Outline how to protect IP legally	L2
4	Examine different ways of generating funding	L4
5	Explain organizing managing people, finance and customers	L2

TEXT BOOKS:

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

E-Resources:

3. https://www.mygreatlearning.com/academy/learn-for-free/courses/entrepreneurial-management
4. https://www.careers360.com/courses/mba-in-entrepreneurship-management

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CLOUD SECURITY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – VI

Subject Code	:	22CY3602	**Credits**	:	04
Hours / Week	:	03 Hours	**Total Hours**	:	39(Th) +26 (P)Hours
L–T–P–S	:	3–0–2–0			

Course Learning Objectives:

This course will enable students to:

1. Master cloud basics, architecture, and deployment models to improve how your organization manages its IT infrastructure and operations.
2. Master the essential principles and practices of securing cloud-based systems to safeguard data confidentiality, integrity, and availability.
3. Understand and address security risks in cloud computing environments.
4. Understand how to effectively secure cloud computing environments through principles of architecture, trusted methodologies, identity management, and access control.
5. Demonstrate cloud computing life cycle issues, standards, and security measures, and to develop incident response plans.

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.
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	**08 Hours**

Cloud Computing Fundamentals: Essential Characteristics, Architectural Influences, Technological Influences, Operational Influences, Outsourcing, IT Service Management. **Cloud Computing Architecture: Cloud** Delivery Models, Cloud Software as a Service (SaaS), Cloud Platform as a Service (PaaS), Cloud Infrastructure as a Service (IaaS), Cloud Deployment Models-Public Clouds, Community Clouds, Private Clouds, Hybrid Clouds, Alternative Deployment Models, Expected Benefits- Flexibility and Resiliency, Reduced Costs, Centralization of Data Storage, Reduced Time to Deployment.

UNIT – II	08 Hours
Cloud Computing Software Security Fundamentals: ***Cloud Information Security Objectives***, Confidentiality, Integrity, and Availability, Confidentiality, Integrity, Availability, ***Cloud Security Services***-Authentication, Authorization, Auditing, Accountability, ***Secure Cloud Software Requirement***-Secure Development Practices, Approaches to Cloud Software Requirements Engineering, Cloud Security Policy Implementation, NIST 33 Security Principles, ***Secure Cloud Software Testing-***Testing for Security Quality Assurance, Cloud Penetration Testing, Regression Testing.	
UNIT – III	**08 Hours**
Cloud Computing Risk Issues and Security Challenges: The CIA Triad, Privacy and Compliance Risks, Threats to Infrastructure, Data, and Access Control, Cloud Service Provider Risks, ***Cloud Computing Security Challenges-***Security Policy Implementation, Computer Security Incident Response Team (CSIRT).	
UNIT – IV	**08 Hours**
Cloud Computing Security Architecture: Introduction, ***Architectural Considerations***- General Issues, Trusted Cloud Computing, Secure Execution Environments and Communications, Microarchitectures, ***Identity Management and Access Control***-Identity Management, Access Control, Autonomic Security	
UNIT – V	**07 Hours**
Cloud Computing Life Cycle Issues: Standards, The Distributed Management Task Force (DMTF), The International Organization for Standardization (ISO), The European Telecommunications Standards, The Organization for the Advancement of Structured, Storage Networking Industry Association (SNIA), Open Grid Forum (OGF), The Open Web Application Security Project (OWASP), Incident Response.	

Course Outcomes:

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

1. **Analyze** cloud computing fundamentals and architecture to optimize resource utilization and enhance organizational efficiency.
2. **Implement** cloud security measures effectively, including authentication, authorization, and auditing, to ensure confidentiality, integrity, and availability of data in cloud computing environments.
3. **Identify** cloud computing risks and security challenges, applying the CIA triad and privacy regulations. **Evaluate** threats to infrastructure, data, and access control, cloud service providers.
4. **Evaluate** cloud security principles, design secure environments and communications, integrate robust identity management, and enforce access controls for autonomic security.
5. **Assess** and **Analyze** cloud computing life cycle issues, standards from DMTF, ISO, ETSI, SNIA, OGF, and OWASP, and develop incident response plans.

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	2	3
CO2	3		2		3							2	3	3
CO3	3	3	2		2							2	1	2
CO4	3	2			2							2	2	2
CO5	3	2	2		3			3				2	2	2

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

1. Ronald L. Krutz, Russell Dean Vines "Cloud Security A Comprehensive Guide to Secure Cloud Computing" Wiley Publishing. INC.

REFERENCE BOOKS:

1. Sirisha Potluri et.al. "Cloud Security Techniques and Applications (Smart Computing Applications)".
2. Chris Dotson, "Practical Cloud Security A Guide for Secure Design and Deployment". O'Riley Publishing.

E-Resources:

1. National Institute of Standards and Technology (NIST) - Cloud Computing Security: https://www.nist.gov/topics/cloud-computing-security
2. OWASP Cloud Security Top 10: https://owasp.org/www-project-cloud-security-top-10/
3. SANS Institute - Cloud Security: https://www.sans.org/white-papers/cloud-security/
4. Coursera - "Cloud Security Basics" by Google Cloud: https://www.coursera.org/learn/cloud-security-basics
5. edX - "Cloud Computing Security" by University of Maryland: https://www.edx.org/professional-certificate/cloud-computing-security
6. Pluralsight - "Cloud Security" learning path: https://www.pluralsight.com/paths/cloud-security
7. Cybrary - "Cloud Security Fundamentals" course: https://www.cybrary.it/course/cloud-security-fundamentals/

Activity Based Learning (Suggested Activities in Class)

1. Cloud Security as a group Case study.
2. Collaborative Activity is minor project development with a team of 4 students.

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LABORATORY EXPERIMENTS

Total Contact Hours: 26

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.
11. Set up AWS CloudTrail and CloudWatch, and perform basic log analysis.
12. Collect and analyze logs from Google Cloud Platform (GCP) to investigate a simulated security incident.

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TOOLS AND TECHNIQUES FOR ETHICAL HACKING

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – VI

Subject Code	:	22CY3603	**Credits**	:	04
Hours / Week	:	03 Hours	**Total Hours**	:	39 (Th)+26(P)Hours
L–T–P–S	:	3–0–2–0			

Course Learning Objectives:

This course will enable students to:

1. To understand and analyze Information security threats & countermeasures
2. To perform security auditing & testing
3. To understand issues relating to ethical hacking
4. To study & employ network defense measures
5. To understand penetration and security testing issues

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.
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	**08 Hours**

ETHICAL HACKING OVERVIEW & PENETRATION TESTING

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.

UNIT – II	**08 Hours**

FOOTPRINTING & PORT SCANNING

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.

UNIT – III	08 Hours
SYSTEM HACKING8 cracking, Keystroke Loggers, Understanding Sniffers, Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing	
UNIT – IV	**08 Hours**
HACKING WEB SERVICES & SESSION HIJACKING 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.	
UNIT – V	**07 Hours**
HACKING WIRELESS NETWORKS Introduction to 802.11, Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless DOS attacks, WLAN Scanners, WLAN Sniffers, Hacking Tools, Securing Wireless Networks.	

Course Outcomes:

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

1. **Outline** the influence of security, penetration testing and vulnerability assessment on ethical hacking.
2. **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.
3. **Utilize** brute force, key logger, sniffing and spoofing techniques to assess the computational security of a system.
4. **Summarize** sql injection, cross-site scripting and session hijacking techniques to secure e-commerce-based web services.
5. **Perceive** network packets of WLAN using modern tools like WLAN Scanners and WLAN Sniffers.

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			3				2	3	3
CO2	3	3	2	2	3		2	3				2	2	3
CO3	3	3	2	2	3		2	3				2	2	2
CO4	3	2		1	2		2	3				2	2	2
CO5	3	2	1	1	3		1	3				2	2	2

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

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

REFERENCE BOOKS:

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

E-Resources:

1. https://onlinecourses.nptel.ac.in/noc24_cs94/preview
2. https://www.udemy.com/course/complete-ethical-hacking-bootcamp-zero-to-mastery/
3. https://www.coursera.org/projects/metasploit-for-beginners-ethical-penetration-testing
4. https://www.coursera.org/learn/kali-linux

Activity Based Learning (Suggested Activities in Class)

1. vulnerability scanning on a controlled network environment using tools like Nmap, OpenVAS, or Nessus.
2. Organize a Capture the Flag (CTF) competition where students solve various hacking challenges, including web exploitation, cryptography, reverse engineering, and forensics.
3. Create a phishing simulation where students design and execute a phishing campaign within ethical and controlled boundaries.
4. Role-play various social engineering scenarios where students must gather information through techniques like pretexting, baiting, or tailgating.
5. Analyze real-world hacking incidents, discussing the techniques used, the impact, and the countermeasures that could have been implemented.

REFERENCE BOOKS:

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

E-Resources:

5. https://onlinecourses.nptel.ac.in/noc24_cs94/preview
6. https://www.udemy.com/course/complete-ethical-hacking-bootcamp-zero-to-mastery/
7. https://www.coursera.org/projects/metasploit-for-beginners-ethical-penetration-testing
8. https://www.coursera.org/learn/kali-linux

Activity Based Learning (Suggested Activities in Class)

6. vulnerability scanning on a controlled network environment using tools like Nmap, OpenVAS, or Nessus.
7. Organize a Capture the Flag (CTF) competition where students solve various hacking challenges, including web exploitation, cryptography, reverse engineering, and forensics.
8. Create a phishing simulation where students design and execute a phishing campaign within ethical and controlled boundaries.
9. Role-play various social engineering scenarios where students must gather information through techniques like pretexting, baiting, or tailgating.
10. Analyze real-world hacking incidents, discussing the techniques used, the impact, and the countermeasures that could have been implemented.

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LABORATORY EXPERIMENTS

Total Contact Hours: 26

1. Study the use of network reconnaissance tools like WHOIS, dig, traceroute, nslookup, ipconfig/ifconfig, ping 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. Using Nmap scanner perform the following ping scan like ping scan, don't ping, ack ping, syn ping, udp ping, icmp ping, icmp echo ping, arp ping for host discovery.
5. Study of packet sniffer tools like wireshark and tcpdump.
6. Use the Nessus tool to scan the network for vulnerabilities.
7. Detect ARP spoofing using open-source tool ARPWATCH.
8. Perform ARP Poisoning.
9. Session impersonation using Firefox and Tamper Data add-on.
10. Create a simple keylogger using python.

Open-Ended Experiments

1. Conduct research to identify potential zero-day vulnerabilities in a specific software or hardware system. Document the research methodology, tools used, and any findings. Discuss ethical considerations and responsible disclosure practices.
2. Perform a comprehensive penetration test on a simulated network.
3. Analyze and improve password security.

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TELECOMMUNICATION SECURITY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – VI

Subject Code	:	22CY3606	**Credits**	:	03
Hours / Week	:	03 Hours	**Total Hours**	:	39 Hours
L–T–P–S	:	3–0–0–0			

Course Learning Objectives:

This course will enable students to:

1. **Identify** the basic components and functions of various telecommunication systems.
2. **Describe** the architecture and security mechanisms of mobile networks such as GSM, UMTS, LTE, and 5G**.**
3. **Explain** the functionality of the TCP/IP suite in the context of mobile networks.
4. **Identify** future challenges and opportunities in the field of telecommunication security**.**

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.
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	**08 Hours**

An Overview of Wireless Systems: Introduction, First- and Second-Generation Cellular Systems, Cellular Communications from 1G to 3G, Road Map for Higher Data Rate Capability in 3G, Wireless 4G Systems, Future Wireless Networks, Standardization Activities for Cellular Systems.

(***Text Book-1: Chapter 1: 1.1 to 1.7).***

Teletraffic Engineering: Introduction, Service Level, Traffic Usage, Call Capacity, Definitions of Terms, Data Collection, Office Engineering Considerations.

(***Text Book-2: Chapter 1: 2.1 to 2.10).***

UNIT – II	08 Hours
Fundamentals of Cellular Communications: Introduction, Cellular Systems, Hexagonal Cell Geometry, Cell Splitting, Adjacent Channel Interference (ACI), Segmentation. (***Text Book-1: Chapter 5: 5.1 to 5.3, 5.8 to 5.10).*** Multiple Access Techniques: Introduction, Narrowband Channelized Systems, Wideband Systems, Comparisons of FDMA, TDMA, and DS-CDMA, Random Access Methods. (***Text Book-1: Chapter 6: 6.1 to 6.5, 6.11).***	
UNIT – III	**08 Hours**
Wireless Application Protocol: Introduction, WAP and the World Wide Web (WWW), Introduction to Wireless Application Protocol, The WAP Programming Model, WAP Architecture, Traditional WAP Networking Environment, WAP Advantages and Disadvantages, Applications of WAP. (***Text Book-1: Chapter 18: 18.1 to 18.8)***	
UNIT – IV	**08 Hours**
Security in Wireless Systems: Introduction, Security and Privacy Needs of a Wireless System, Required Features for a Secured Wireless Communications System, Methods of Providing Privacy and Security in Wireless Systems, Wireless Security and Standards, IEEE 802.11 Security, Security in North American Cellular/PCS Systems, Security in GSM, GPRS, and UMTS, Data Security, Air Interface Support for Authentication Methods, Summary of Security in Current Wireless Systems. (***Text Book-1: Chapter 13: 13.1 to 13.11).***	
UNIT – V	**07 Hours**
Mobile Network and Transport Layer: Introduction, Concept of the TCP/IP Suite in Internet, Network Layer in the Internet, TCP/IP Suite, Transmission Control Protocol, Mobile IP (MIP) and Session Initiation Protocol (SIP), Internet Reference Model. (***Text Book-1: Chapter 14: 14.1 to 14.7)***	

Course Outcomes:

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

1. **Summarize** the progression of wireless systems and optimize the teletraffic networks.
2. **Analyze** and design cellular networks with considerations for cell geometry, interference, and segmentation and evaluate and compare multiple access techniques.
3. **Analyze** the WAP a
4. Architecture and its comparison with traditional web protocols
5. **Summarize** the security mechanisms in North American Cellular/PCS Systems, GSM, GPRS, and UMTS.
6. **Summarize** the operation of Transmission Control Protocol (TCP) and its importance in ensuring reliable communication.

TEXT BOOKS:

1. Vijay K. Garg: "WIRELESS COMMUNICATIONS AND NETWORKING", Elsevier Inc., 2007.

REFERENCE BOOKS:

1. Roger L. Freeman: "Telecommunication System Engineering", 4th Edition, John Wiley & Sons, Inc.,2004.
2. "Telecommunication Networks: Protocols, Modeling and Analysis" by Mischa Schwartz.
3. "Network Security Essentials: Applications and Standards" by William Stallings.
4. "Cryptography and Network Security: Principles and Practice" by William Stallings.
5. "Mobile and Wireless Networks Security and Privacy" by Man Ho Au and Raymond Choo.

E-Resources:

1. https://www.udemy.com/course/5g-4g-lte-3g-2g-cellular-mobile-communications-wireless
2. https://www.coursera.org/learn/business-considerations-for-5g-with-edge-iot-and-ai
3. https://www.coursera.org/learn/network-security-communications-sscp

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CYBERSECURITY PROGRAMS AND POLICIES FOR ENTERPRISES

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – VI

Subject Code	: 22CY3607	**Credits**	: 03
Hours / Week	: 03 Hours	**Total Hours**	: 39 Hours
L–T–P–S	: 3–0–0–0		

Course Learning Objectives:

This course will enable students to:

1. **Understand** the polices established IT governance.
2. **Audit** vulnerabilities based on the IT security standards.
3. **Analyse** business case studies for IT security.
4. **Explain** managing of security models using information security standards.
5. **Design** strategy to safeguard an organization's information assets.

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.
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	**08 Hours**

INTRODUCTION TO INFORMATION SECURITY POLICIES:

About Policies, why Policies are Important, when policies should be developed, How Policy should be developed, Policy needs, identify what and from whom it is being protected, Data security consideration, Backups, Archival storage and disposal of data, Intellectual Property rights and Policies, Incident Response and Forensics, Management Responsibilities, Role of Information Security Department, Security Management and Law Enforcement, Security awareness training and support;

(Text Book-1: Chapter 1: 1.1 to 1.3)

UNIT – II	**08 Hours**

POLICY DEFINITIONS:

Physical Security, Computer Location and Facility Construction, Facilities Access Controls, Contingency Planning, General Computer Systems Security, Periodic System and Network Configuration Audits, Staffing Considerations;

(Text Book-1: Chapter 2.1: 2.1.1 to 2.1.7)

UNIT – III	08 Hours

INTERNET SECURITY POLICIES:

Understanding the Door to the Internet, Administrative Responsibilities, User Responsibilities, World Wide Web Policies, Application Responsibilities, VPNs, Extranets, Intranets, and Other Tunnels, Modems and Other Backdoors, Employing PKI and Other Controls, Electronic Commerce;

(Text Book-1: Chapter 2.3: 2.3.1 to 2.3.9)

UNIT – IV	08 Hours

PRIVACY & ONLINE RIGHTS:

Email Security Policies, Rules for Using Email, Administration of Email, Use of Email for Confidential Communication, Software Development Policies, Software Development Processes, Testing and Documentation, Revision Control and Configuration Management, Third-Party Development, Intellectual Property Issues;

(Text Book-1: Chapter 2.4: 2.4.1 to 2.4.3, Chapter 2.7: 2.7.1 to 2.7.5)

UNIT – V	07 Hours

Maintaining the Policies:

Acceptable Use Policies, Writing the AUP, User Login Responsibilities, Use of Systems and Network, User Responsibilities, Organization's Responsibilities and Disclosures;

(Text Book-1: Chapter 3: 3.1.1 to 3.1.6)

Course Outcomes:

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

1. **Determine** which governance framework your organization follows. Common frameworks include COBIT (Control Objectives for Information and Related Technologies).
2. **Define** the scope of the audit, including the systems, networks, applications, and data that will be assessed for vulnerabilities.
3. **Analyze** the security measures or solutions that the organization implemented in response to the identified challenges.
4. **Describe** effectively security management that integrates with the organization's overall business processes and objectives.
5. **Develop** a formal incident response plan outlining procedure for detecting, responding to, and mitigating security incidents.

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		1				2	2		2	3	
CO2	3	2	1		1				2	2		2	3	
CO3	3	2	1		1				2	2		2	3	
CO4	3	2	1		1				2	2		2	3	
CO5	3	2	2		1				2	2		2	3	

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

1. Scott Barman, Writing Information Security Policies, Sams Publishing 2002

REFERENCE BOOKS:

1. Thomas R Peltier, Justin Peltier, Information Security Fundamentals, John Backley CRC Press, 2005
2. Harold F. Tipton and Micki Krause, Information Security Management Handbook Auerbach publications, 5th Edition, 2005.

E-Resources:

1. https://www.fcc.gov/communications-business-opportunities/cybersecurity-small-businesses
2. https://www.gsa.gov/technology/government-it-initiatives/cybersecurity/cybersecurity-programs-and-policy

Activity Based Learning (Suggested Activities in Class)

1. Security awareness training and support, interaction and discussion.

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INTERNET OF THINGS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – VI

Subject Code	:	22CY3608	**Credits**	:	03
Hours / Week	:	03 Hours	**Total Hours**	:	39 Hours
L–T–P–S	:	3–0–2–0			

Course Learning Objectives:

This course will enable students to:

1. **Explain** the basic concepts of IoT M2M, and WSN.
2. **Apply** the ARM and CISCO-IRM Models for creating and designing IoT applications for the real-world problems.
3. **Develop** IoT Platforms and Applications using C++ and Python language with Arduino and Raspberry Pi.
4. **Differentiate** IoT, M2M and WSN to construct routing protocols.
5. **Demonstration** of cloud and Big Data-centric modern tools to store and aggregate the IoT Data.
6. **Summarize** IoT-centric security, privacy, and trust issues.

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.
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	07 Hours

FUNDAMENTAL OF IOT:

The Internet of Things, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Hardware Design challenges, Software Development challenges, Security and Privacy challenges.

UNIT – II	07 Hours

IOT AND M2M:

Introduction, Some Definitions, 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, An IoT architecture outline, Standards considerations. Merits and Demerits of M2M and IoT.

UNIT – III	08 Hours

WIRELESS SENSOR NETWORKS AND IOT:

Network and Communication aspects, Topology and Coverage, Wireless medium access issues, MAC protocol, Routing protocols, Sensor deployment and Node discovery, Data aggregation and dissemination.

UNIT – IV	08 Hours

IOT PLATFORM DESIGN ARCHITECTURE:

Introduction, Architecture Reference Model (ARM), CISCO IoT Reference Model, IoT Application Design Principles Architecture– Introduction, Process Specification, Information Specification, Knowledge Specification, Functional View, Deployment and Operational View, Other Relevant architectural views, Data Analytics for IoT, IoT application design using Arduino Uno/Nano, Raspberry Pi, ESP-32, ESP-8266.

IOT SYSTEM MANAGEMENT:

Introduction, SNMP, Limitation of SNMP, NETCONF-YANG, NETOPEER

UNIT – V	09 Hours

IOT APPLICATIONS FOR VALUE CREATIONS

Introduction, IoT Applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, 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, Advanced Metering Infrastructure (AMI), Smart Inverters, Remote control operation of energy consuming devices.

IOT PRIVACY, SECURITY AND GOVERNANCE

Introduction, Overview of Governance, Privacy and Security Issues, Trust in IoT-Data-Platforms for Smart Cities, Steps Towards a Secure Platform Design, Data Aggregation for the IoT in smart cities, Blockchain and Distributed Ledger Technology for IoT Security.

Course Outcomes:

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

1. **Make use of** IoT and its characteristics, ARM and CISCO-IRM models to **develop** IoT applications.
2. **Differentiate** IoT, M2M and WSN plaforms to construct novel routing protocols**.**
3. **Develop** IoT Platforms and Applications using C++ and Python language with Arduino Uno/Nano, ESP-32, and Raspberry Pi support**.**
4. **Apply** Cloud and Big Data-based modern tools to collect and aggregate IoT-centric data.
5. **Summarize** the security, privacy, and trust issues in the domain of IoT, M2M and WSN with real-time examples.

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	3	1	2				2	1		2	3	
CO2	3	3	3	1	2				2	1		2	3	
CO3	3	3	1	1	2				2	1		3	3	
CO4	3	1	1	1	2				2	1		2	3	
CO5	2	1	1	1	1				2	1		2	3	

3: Substantial (High) 2: Moderate (Medium) 1: Poor (Low)

TEXT BOOKS:

1. "Internet of Things: Principles and Paradigms" by Rajkumar Buyya, Amir Vahid Dastjerdi.
2. "Building the Internet of Things" by Maciej Kranz.
3. "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things" by David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry.

REFERENCE BOOKS:

1. "Internet of Things: A Hands-On Approach" by Arshdeep Bahga and Vijay Madisetti

E-Resources:

1. https://onlinecourses.nptel.ac.in/noc24_cs115/
2. https://onlinecourses.swayam2.ac.in/ntr24_ed44/
3. https://www.udemy.com/course/internet-of-things-iot-fundamentals/
4. https://www.udemy.com/course/complete-guide-to-build-iot-things-from-scratch-to-market/

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Deverakaggalahalli, Harohalli, Bengaluru – 562 112

IMAGE PROCESSING AND STEGANOGRAPHY

SEMESTER – VI

Subject Code	:	22CY3609	**Credits**	:	03
Hours / Week	:	03 Hours	**Total Hours**	:	39 Hours
L–T–P–S	:	3–0–0–0			

Course Learning Objectives:

This course will enable students to:

1. **Explain** the concept of image representation and formation.
2. **Apply** the principals of morphological processing**.**
3. **Differentiate** various reversible steganography techniques.
4. **Summarize** various quantum steganographic techniques.
5. **Get the idea** of digital media steganalysis.

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.
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	08 Hours

Digital Image Representation: What is an image? Resolution and quantization, Image formats, Colour spaces, Images in Matlab, System Engineering and Vulnerability Evaluation; ***(Text Book-1: Chapter 1: 1.1 to 1.5)***

Digital Image Formation: How is an image formed? The mathematics of image formation, The engineering of image formation; ***(Text Book-1: Chapter 2: 2.1 to 2.3)***

UNIT – II	08 Hours

Pixels: What is a pixel?, Operations upon pixels, Point-based operations on images, Pixel distributions: histograms, Technology: Passive and Active Cyber ISR; ***(Text Book-1: Chapter 5: 5.1 to 5.5)***

Morphological processing: Introduction, Binary images: foreground, background and connectedness, Structuring elements and neighbourhoods, Dilation and erosion, Effects and uses of erosion and dilation, Morphological opening and closing, Boundary extraction, Region filling; ***(Text Book-1: Chapter 8: 8.1 to 8.4, 8.7 to 8.11)***

UNIT – III	08 Hours
Introduction to digital image steganography: Introduction, Applications of steganography, Challenges facing steganography, Steganographic approaches, Performance evaluation; ***(Text Book-2: Chapter 1: 1.1 to 1.5)*** **Reversible steganography techniques: A survey:** Introduction, Difference Expansion (DE) schemes, Histogram-Shifting (HS) schemes, Pixel-Value-Ordering (PVO) schemes, Dual-image-based schemes, Interpolation-based schemes ***(Text Book-2: Chapter 10: 10.1 to 10.6***)	
UNIT – IV	**08 Hours**
Quantum steganography: Introduction, —Information Security, Goals and tools of quantum steganography, Quantum steganography with depolarizing noise, Steganographic encoding in error syndromes, encoding in the binary symmetric channel, Encoding in the 5-qubit "perfect" code, Secrecy and security, Asymptotic rates in the noiseless case, Asymptotic rates in the noisy case. ***(Text Book-2 Chapter 11: 11.1 to 11.9***)	
UNIT – V	**07 Hours**
Digital media steganalysis: Introduction, Image steganalysis, Audio steganalysis, Video steganalysis, Text steganalysis, Mission Planning and Force Execution, Mission Assessment. ***(Text Book-2: Chapter 12: 12.1 to 12.5***)	

Course Outcomes:

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

1. **Explain** the fundamental concepts in computer vision and image processing.
2. **Describe** preprocessing of images before more complex tasks such as object detection, classification, or measurement using morphological processing.
3. **Analyze** and apply reversible steganography techniques.
4. **Describe** various quantum steganographic techniques.
5. **Explain** the concept of digital media steganalysis.

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		1				2	2		2	3	
CO2	3	2	2		1				2	2		2	3	
CO3	3	2	1		1				2	2		2	3	
CO4	3	1	1		1				2	2		2	3	
CO5	3	1	3		1				2	2		2	3	

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

1. Chris Solomon and Toby Breckon (2011), "Fundamentals of Digital Image Processing", Wiley
2. Mahmoud Hassaballah (2020), "Digital Media Steganography (Principles, Algorithms, and Advances)", Elsevier

REFERENCE BOOKS:

1. Shraddha N. Zanjat (2023). "Introduction to Digital Image Processing", International Publication House.
2. Fabien A. P. Petitcolas and Stefan Katzenbeisser (2000) "Information Hiding Techniques for Steganography and Digital Watermaking", Artech House Books, DOI:10.1201/1079/43263.28.6.20001201/30373.5

E-Resources:

1. https://dl.ebooksworld.ir/motoman/Digital.Image.Processing.3rd.Edition.www.EBooksWorld.ir.pdf
2. https://homepages.inf.ed.ac.uk/rbf/CVonline/LOCAL_COPIES/TUDELFT/FIP2_3.pdf
3. http://www.cs.umsl.edu/~sanjiv/classes/cs5420/lectures/intro.pdf

Activity Based Learning (Suggested Activities in Class)

1. Image representation in Matlab, interaction and discussion.
2. Implementation of Stegnographic techniques using Matlab.

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BLOCKCHAIN TECHNOLOGY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – VI

Subject Code	: 22CY3610	**Credits**	: 03
Hours / Week	: 03 Hours	**Total Hours**	: 39 Hours
L–T–P–S	: 3–0–0–0		

Course Learning Objectives:

This course will enable students to:

1. Learn the underlying principles and techniques associated with blockchain technologies.
2. Understand and describe how blockchain works.
3. Familiarize the Ethereum, smart contracts and related technologies, and solidity language.
4. Understand the application of blockchain in various domain.

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.
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	**08 Hours**
Introduction to Blockchain: Distributed systems, P2P network Architecture of Blockchain, Generic elements of a blockchain: How blockchain works, Benefits, features, and limitations of blockchain How blockchain accumulates blocks, types of blockchain, Distributed ledger, Consensus Mechanisms-Proof of work, Proof of Stake, Proof of Authority, CAP theorem, Decentralization, Disintermediation, Ecosystem - Storage, Communication and Computation.	

UNIT – II	**08 Hours**
Cryptography and Smart Contracts: Symmetric cryptography (DES, AES), Asymmetric cryptography, Public and Private keys, Algorithms - RSA, Hash functions, SHA, SHA-256 Smart contracts - Benefits of Smart contracts, Solidity Programming-Types, Literals, Enums, write basic program using Solidity, Compile, verify and deploy.	

UNIT – III	08 Hours
Ethereum Blockchain: The Ethereum network, Ethereum Virtual Machine Execution Environment, Opcodes and their meaning, Structure of a Block, Genesis Block, Merkle tree, Geth, Transactions, Transaction receipts, Nonce, Gas - gasPrice, gasLimit, Ether, Mining, Wallets, Ethereum network (main net, test net), Metamask	
UNIT – IV	**08 Hours**
Ethereum Development: Infura, Web3.0 for Blockchain, Web3J -Java frontend, Creating Blockchain network and peering, Truffle - build contract, migrate and deploy, Ganache CLI	
UNIT – V	**07 Hours**
Hyperledger: Projects under Hyperledger, Hyperledger reference architecture, Hyperledger design principles, Hyperledger Fabric, Hyperledger Sawtooth, Case study: Blockchain in IoT	

Course Outcomes:

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

1. Outline the basic concepts of blockchain and cryptography, mining, merkle tree concepts used in blockchain to develop decentralized applications.
2. Use solidity programming for smart contract development in real world applications such as library management system, student management system, employee management system.
3. Implement Ethereum blockchain applications using geth, metamask, ganache, truffle blockchain tools.
4. Develop Block chain Application for IoT smart home, healthcare using hyperledger platform.
5. Adapt the advanced concepts of blockchain programming language and tools to develop complex blockchain application

TEXT BOOKS:

1. Mastering Blockchain, Third Edition, Published by Packt Publishing Ltd, Published 2020, Imran Bashir.
2. Solidity Programming Essentials, First Edition, Published by Packt Publishing Ltd, April 2018.
3. Blockchain for Dummies, Manav Gupta, IBM Limited Edition, John Wiley & Sons, Inc. 2017.

REFERENCE BOOKS:

1. Baxv Kevin Werbach, The Blockchain and the new architecture of Trust, MIT Press, 2018.
2. Joseph J. Bambara and Paul R. Allen, Blockchain – A practical guide to developing business, law, and technology solutions, McGraw Hill, 2018.

E-Resources:

1. https://www.coursera.org/specializations/blockchain.
2. https://www.coursera.org/learn/cryptocurrency.

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APPLICATION SECURITY

SEMESTER: VI

Subject Code	: 22CY3611	**Credits**	: 03
Hours / Week	: 03 Hours	**Total Hours**	: 39 Hours
L–T–P–S	: 3–0–0–0		

Course Learning Objectives:

This course will enable students to:

1. Understand the principles and practices of secure programming.
2. Identify and mitigate security risks in web applications.
3. Apply security measures to protect applications from common threats and attacks.
4. Explore advanced topics and applications of security in various contexts.

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.
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	06 Hours

Introduction to Application Security

Overview of Application Security, Importance and Need for Application Security, - Secure Software Development Lifecycle (SDLC), Secure Requirements Gathering and Analysis, Secure Design Principles, Code Review and Testing for Security.

UNIT – II	08 Hours

WEB AND MOBILE APPLICATION SECURITY

INTRODUCTION, LET'S HACK A WEBSITE, HOW BROWSERS WORK, HOW THE INTERNET WORKS, HOW WEB SERVERS WORK, HOW PROGRAMMERS WORK, SESSION HIJACKING, INFORMATION LEAKS, ENCRYPTION, XML ATTACKS, DON'T BE AN ACCESSORY, DENIAL-OF-SERVICE ATTACKS, INJECTION ATTACKS, THIRD-PARTY CODE, CROSS-SITE SCRIPTING ATTACKS, CROSS-SITE REQUEST FORGERY ATTACKS, COMPROMISING AUTHENTICATION, MOBILE EXPLOITS AND MALWARE, IOS SECURITY MODEL, ANDROID SECURITY MODEL, COMPARING PERMISSION MODELS, WI-FI SECURITY: EVIL TWIN, JASAGER, SSLSTRIP.

UNIT – III	08 Hours

PROMPT ENGINEERING SECURITY:

THE POWER OF PROMPT ENGINEERING, FINE-TUNING THE PROMPT WITH TECHNIQUES, PROMPTING FOR TEXT GENERATION, PROMPTING FOR QUESTION ANSWERING, PROMPTING FOR CODE GENERATION, EVALUATING AND TESTING PROMPTS, ETHICAL CONSIDERATIONS IN PROMPT ENGINEERING, SECURITY AND PRIVACY PRESERVING PROMPT ENGINEERING-ISSUES AND CHALLENGES.

UNIT – IV	10 Hours
SUPPLY CHAIN SECURITY INTRODUCTION, BENEFITS OF INVESTING IN SUPPLY CHAIN SECURITY, SUPPLY CHAIN SECURITY MANAGEMENT, MEASURING THE VALUE CREATED BY SUPPLY CHAIN SECURITY, ISO 28000 AND SIX SIGMA, FIVE STEPS OF THE SIX SIGMA PROJECT (DMAIC), OVERVIEW OF CONTEMPORARY SUPPLY CHAIN SECURITY INITIATIVES, SUPPLY CHAIN SECURITY TECHNOLOGIES & THEIR APPLICATIONS: SMART CONTAINERS, TRACKING SYSTEMS, BAR CODE & RFID TAGS, INTRUSION DETECTION SENSORS, ACCESS POINTS, FENCING, IDENTITY MANAGEMENT SYSTEMS (IDMS), ELECTRONIC ACCESS CONTROL SYSTEM (EACS), VEHICLE ELECTRONIC ACCESS CONTROL SYSTEM (VEACS), CONTAINER DETECTION AND SCREENING EQUIPMENT.	
UNIT – V	**08 Hours**
API SECURITY UNDERSTANDING APIS- GROWING THE API ECONOMY- SECURING APIS WITH TRADITIONAL APPROACHES- MODERN APPROACHES TO SECURING APIS- BENEFITTING FROM AN API SECURITY FRAMEWORK: AUTOMATING YOUR API SECURITY FRAMEWORK- DEVOPS AND DEVSECOPS.	
Course Outcomes: At the end of the course, the student will be able to: 1. Apply secure programming practices to develop robust and secure applications 2. Identify vulnerabilities and implement security measures in web applications 3. Understand and implement security throughout the software development lifecycle 4. Explore advanced topics and applications of security in various domains 5. Analyze and evaluate emerging trends and technologies in application security	

TEXT BOOKS:

1. Web Application Hacker's Handbook: Finding and Exploiting Security Flaws by Dafydd Stuttard and Marcus Pinto.
2. API Security for Dummies by Emily Freeman, John Wiley & Sons Inc., 2020.
3. Supply Chain Security Management, Initiatives & Technologies, Thomas Miller, First Edition, 2010.
4. Prompt Engineering Playbook by GovTech Data Science & AI Division, 2023.

REFERENCE BOOKS:

1. "OWASP Testing Guide v4" by OWASP Foundation, 2014.
2. "**Mobile Application Security**: Protecting Mobile Devices and Their Applications" by Himanshu Dwivedi, Chris Clark, and David Thiel, 2012.
3. "**Building Secure and Reliable Systems**: Best Practices for Designing, Implementing, and Maintaining Systems" by Heather Adkins, Betsy Beyer, Paul Blankinship, and Ana Oprea.
4. **Secure Coding:** Principles and Practices by Mark G. Graff and Kenneth R. van Wyk.

E-Resources:

1. OWASP (https://owasp.org/)
2. NIST (https://www.nist.gov/)
3. https://www.ncsc.gov.uk/collection/supply-chain-security
4. https://project.linuxfoundation.org/hubfs/CNCF_SSCP_v1.pdf
5. https://www.developer.tech.gov.sg/products/collections/data-science-and-artificial-intelligence/playbooks/prompt-engineering-playbook-beta-v3.pdf
6. https://terrorgum.com/tfox/books/security_engineering_a_guide_to_building_dependable_distributed_systems.pdf
7. https://datasciencehorizons.com/pub/Mastering_Generative_AI_Prompt_Engineering_Data_Science_Horizons_v2.pdf
8. https://arxiv.org/pdf/2404.06001
9. https://www.cybertalk.org/wp-content/uploads/2024/04/The-cyber-security-professionals-guide-to-prompt-engineering_.pdf
10. https://owasp.org/www-project-mobile-app-security/
11. https://www.itu.int/en/ITU-D/Regional-Presence/AsiaPacific/SiteAssets/Pages/Events/2019/ITUPITA2018/ITU-ASP-CoE-Training-on-/Mobile%20Apps%20Security_fv.pdf
12. https://www.dhs.gov/sites/default/files/publications/2019_mobilesecurity_rd_programguide_vol3.pdf

Activity Based Learning (Suggested Activities in Class)

1. Hands-on coding exercises to implement secure programming practices
2. Web application vulnerability assessment and remediation exercises.
3. Case studies and group discussions on real-world security incidents and solutions

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HARDWARE SECURITY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – VI

Subject Code	:	22CY3613	**Credits**	:	03
Hours / Week	:	03 Hours	**Total Hours**	:	39 Hours
L–T–P–S	:	3–0–0–0			

Course Learning Objectives:

This course will enable students to:

1. **Understanding** the hardware security principles, recognize the importance of hardware security in computing systems, and apply knowledge of hardware vulnerabilities and countermeasures to design and evaluate secure hardware systems.
2. **Explore** various countermeasures and mitigation techniques to prevent, detect, and mitigate hardware trojan attacks.
3. **Identify** and assess potential security risks and threats associated with hardware IP piracy, reverse engineering, and IP-based design methodologies.
4. **Understand** the challenges and opportunities associated with integrating nano-scale components into PCB designs for improved security and performance**.**
5. **Explore** countermeasures and defense mechanisms to mitigate system-level attacks and protect the integrity and confidentiality of hardware systems.

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.
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	**08 Hours**

Hardware Security Principles and Random Number Generators:

Introduction to Hardware Security, Hardware Vulnerabilities, Countermeasures, Random Number Generators (RNGs) ***(Text Book-1: Chapter 1: 1.1 to 1.5, Text Book-2: chapter 5).***

UNIT – II	08 Hours
Hardware Trojans: Understanding SoC design flow and the nature of hardware Trojans, identifying hardware Trojans in FPGA designs, categorizing different types of hardware Trojans and implementing countermeasures. ***(Text Book-1: Chapter 5: 5.1 to Chapter 5.5.8).***	
UNIT – III	**07 Hours**
Hardware IP Piracy and Reverse Engineering: Understanding the concept of hardware IP and the associated security issues in IP-based SoC design, Addressing security concerns specific to FPGA designs. ***(Text Book-1: Chapter 7:7:1 to 7.7).***	
UNIT – IV	**08 Hours**
Side-Channel Attacks and PCB Security Challenges*:* Exploring various types of side-channel attacks, including power analysis, electromagnetic, fault injection, and timing attacks, Understanding security challenges and attack models for PCB, with practical experiments like bus snooping attacks**,** ***(Text Book-1: Chapter 8:8.1 to 8.6, Chapter 11:11.1.to 11.3).***	
UNIT – V	**08 Hours**
Countermeasures and Emerging Trends*:* Implementing hardware security primitives and obfuscation techniques, designing for security and evaluating trust in hardware systems, Exploring the latest trends in hardware attacks and protections, and understanding system-level attacks and countermeasures, ***(Text Book-1: Chapter 16:16:1 to 16.5).***	

Course Outcomes:

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

1. Ability to analyse common hardware vulnerabilities, implement effective countermeasures, and apply theoretical knowledge of random number generators (RNGs) in practical settings.
2. Understanding the Hardware Trojans, including their detection and prevention in both SoC and FPGA designs. Students will gain practical experience through hands-on experiments, enhancing their ability to address hardware security challenges in real-world scenarios.
3. Students with the knowledge and skills to address security challenges in IP-based SoC design and FPGA-based systems, ensuring the integrity and confidentiality of hardware designs and intellectual property.
4. Students with know-how to create safe hardware primitives, investigate cutting-edge technologies to improve hardware security, and assess and mitigate security risks in hardware designs.
5. Students should be equipped with the knowledge and skills necessary to analyse, design, and implement secure hardware systems, as well as identify and mitigate various hardware-level security threats and vulnerabilities.

TEXT BOOKS:

1. Hardware Security: Design, Threats, and Safeguards Debdeep Mukhopadhyay, Rajat Subhra Chakraborty
2. Hardware Security: A Hands-On Learning Approach" by Swarup Bhunia, Mark Tehranipoor, and Cliff Wang.

REFERENCE BOOKS:

1. Introduction to Hardware Security and Trust" by Mohammad Tehranipoor and Cliff Wang.
2. Principles of Hardware Security" by Wayne Burleson and Cynthia A. Pasquale

E-Resources:

1. https://www.coursera.org/learn/hardware-security
2. https://onlinecourses.nptel.ac.in/noc22_cs48/preview

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RISK MANAGEMENT

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – VII

Subject Code	:	22CY4701	**Credits**	:	03
Hours / Week	:	03 Hours	**Total Hours**	:	39 Hours
L–T–P–S	:	3–0–0–0			

Course Learning Objectives:

This course will enable students to:

1. Provides well understanding of the basics of risk management, covering definitions, types, description methods, inherent risk assessment, and classification systems.
2. Learn different risk management frameworks and standards.
3. Identify and assess various types of risks.
4. Develop risk mitigation and response strategies.
5. Apply risk management principles to real-world scenarios.

UNIT – I	**08 Hours**
Introduction to Risk Management: ***Approaches to defining risk*-**Definitions of risk, Types of risks, Risk description, Inherent level of risk, Risk classification systems. ***Impact of risk on organizations***-Level of risk, Impact of hazard risks, Attachment of risks, Risk and reward, Attitudes to risk, Risk and triggers.	
UNIT – II	**08 Hours**
Types of risks-Four types of risk: Embrace opportunity risks, manage uncertainty risks, mitigate hazard risks, Minimize compliance risks. ***Scope of risk management***: Origins of risk management, Development of risk management Specialist areas of risk management, Simple representation of risk management, Enterprise risk management, Levels of risk management sophistication. z	

UNIT – III	08 Hours

Approaches to risk management:

Risk management standards-Scope of risk management standards, Risk management process, Risk management context, COSO ERM cube, Revised ISO 31000 (2018), Updating of RM terminology.

Enterprise risk management- Enterprise-wide approach, Definitions of ERM, ERM in practice ERM and business continuity, ERM in energy and finance, Integrating strategy and performance.

UNIT – IV	08 Hours

Risk assessment:

Risk assessment considerations - Importance of risk assessment, Approaches to risk assessment, Risk assessment techniques, Nature of the risk matrix.

Risk classification systems - Short-, medium- and long-term risks, Nature of risk classification systems, Examples of risk classification systems, FIRM risk scorecard, PESTLE risk classification system. Risk analysis and evaluation - Application of a risk matrix, Inherent and current level of risk Control confidence, 4Ts of hazard risk response, Risk significance, Risk capacity.

UNIT – V	07 Hours

Mitigation of Risks:

Risk management Strategy: Architecture, strategy and protocols, Risk architecture, Risk management strategy, Risk management protocols, Risk management manual, Risk management documentation

Risk control techniques: Types of controls, Control of selected hazard risks: Cost of risk controls, Learning from controls, Control of financial risks, Control of infrastructure risks, Control of reputational risks, Control of marketplace risks. Risk Assurance Techniques, Internal audit activities, Reporting on risk management.

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	3	3	2			2	2	2		1	2	2
CO2	3	3	3					2	2	2		1	2	2
CO3	3	2	3	3	3			2	2	2		2	1	2
CO4	3		3	2				2	2	2			2	3
CO5	3	2	3	1	2			3	3	3		2	3	3

Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

1. Paul Hopkin "Fundamentals of Risk Management - Understanding, evaluating and implementing effective risk management", fifth edition, Kogan Page Limited.

REFERENCE BOOKS:

1. FISMA and the risk management framework: the new practice of federal cyber security / edited by Stephen D. Gantz, Daniel R. Philpott—1st ed, Elsevier-Syngress.

E-Resources:

1. Cybersecurity Risk Management Frameworks | Coursera
2. Introduction to Cybersecurity & Risk Management | Coursera
3. Play It Safe: Manage Security Risks | Coursera
4. Identifying, Monitoring, and Analyzing Risk and Incident Response and Recovery | Coursera
5. RITx: Cybersecurity Risk Management | edX

Activity Based Learning (Suggested Activities in Class)

1. Cyber Security Risk Management Policy Writing as a group Case study.
   Collaborative Activity is minor project development with a team of 4 students.

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CLASSICAL CRYPTOGRAPHY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – VII

Course Code	: 22OE0069	**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 foundational concepts of computer security, including the OSI security architecture, security services, and security mechanisms.
2. **Apply** classical encryption techniques such as substitution, transposition, and steganography to secure information.
3. **Analyze** modern symmetric encryption algorithms, including the Data Encryption Standard (DES) and Advanced Encryption Standard (AES), and understand their operational modes.
4. **Evaluate** the use of public-key cryptographic algorithms such as RSA, Diffie-Hellman, and ElGamal for secure key exchange and data encryption.
5. **Demonstrate** the use of cryptographic hash functions, message authentication codes, and digital signatures to ensure message integrity and authenticity.
6. **Understand** key distribution mechanisms and the role of digital certificates and public key infrastructure (PKI) in real-world security systems.

Teaching-Learning Process

1. ***Lecture Method:*** Use whiteboard/presentation-based sessions to explain theoretical concepts such as OSI security architecture, symmetric/asymmetric encryption, and cryptographic models.
2. ***Interactive Sessions:*** Conduct group discussions and Q&A sessions on classical vs. modern encryption techniques, stream vs. block ciphers, and key exchange challenges.
3. ***Hands-on Labs:*** Implement encryption/decryption algorithms (Caesar cipher, DES, AES, RSA, SHA) using programming tools (Python, Java). Use tools like CrypTool and OpenSSL for simulation.
4. ***Video Demonstrations:*** Showcase short videos or animations to explain topics like AES transformations, RSA key generation, Diffie-Hellman key exchange, and digital signatures.
5. ***Case Study Analysis:*** Review real-world scenarios such as SSL/TLS implementation, compromised keys in public infrastructure, or ransomware using weak encryption—discuss preventive cryptographic strategies.
6. ***Assignments and Quizzes:*** Assign problem sets on manual encryption, numerical examples of RSA/AES, and key scheduling. Include short quizzes for quick reinforcement of learned concepts.
7. ***Mini Projects/Problem Solving:*** Assign small-scale projects to implement secure messaging, digital signature verification, or hash-based authentication using Python or any programming language.

MODULE 1:	**8Hrs**
Overview of Cryptography: Computer Security Concept, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security. Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography.	
MODULE 2:	**8Hrs**
Block Cipher and Data Encryption Standard: Block Cipher Principles, The Data Encryption Standard, A DES Example. Advance Encryption Standard: Finite Field Arithmetic, AES Structure, AES Transformation Functions, AES Key Expansion, An AES Example.	
MODULE 3:	**7Hrs**
Block Cipher Operation: ECB, CBC, CFB, OFB and Counter Mode. Pseudo number generation and Stream Cipher: Pseudo number generation, Stream Cipher, RC4.	
MODULE 4:	**8Hrs**
Public Key Cryptography: Principles of Public-Key Cryptosystems, The RSA Algorithm, Diffie-Hellman Key Exchange, Elgamal Cryptographic System. Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Secure Hash Algorithm.	
MODULE 5:	**8Hrs**
Message Authentication Code: Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MACs. Digital Signature: Elgamal Digital Signature Scheme, Digital Signature Scheme using RSA. Key distribution, X.509 certificates, Public Key Infrastructure.	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Summarize the basic concepts of information hiding utilizing Cryptography tools and techniques	L2
2	Apply Data Encryption Standard (DES), Advanced Encryption Standard (AES) and RSA algorithms to assess data confidentiality.	L3
3	Analyse different modes of block cipher operations like Electronic Code Book (ECB), Cipher Block Chaining Mode (CBC), Cipher Feedback Mode (CFB), Output Feedback Mode (OFB), Counter Mode to encrypt and decrypt files.	L4
4	Examine different Cryptographic one-way hash function like SHA-160, SHA-256 and SHA-512 to ensure the data integrity.	L4
5	Make use of key distribution principles to establish session key between two keys.	L3
6	Experiment with Message Authentication Code, Digital Signature and Digital Certificate to assess the authenticity and non-repudiation of a user.	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	3											3	
CO2	3		3										3	
CO3		3	3										3	
CO4		3		3									3	
CO5	3		3											3
CO6	3				3									3

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

1. William Stallings, Cryptography and Network Security: Principles and Practice, Pearson, 8thEdition, 2019, ISBN: 9780135764039,0135764033.

E-Resources:

1. Cryptography I | Coursera
2. Introduction to Applied Cryptography | Coursera
3. Introduction to Applied Cryptography Specialization [4 courses] (CU) | Coursera
4. nptel.ac.in/courses/106106221

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Dayananda Sagar University

School of Engineering

Deverakaggalahalli, Harohalli, Bengaluru – 562 112

DIGITAL FORENSICS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – VII

Course Code	:22OE0070	**Credits**	:03
Hours / Week	: 03 Hours	**Total**	: 39 Hours
L–T–P-J	: 3–0–0-0		

Course Learning Objectives:

This Course will enable students to:

1. Understand the fundamentals of digital forensics, cybercrime, and forensic science principles.
2. Analyze cybercrime scenes and comprehend the legal procedures for electronic evidence collection.
3. Apply evidence management and forensic investigation methodologies in digital crime scenarios.
4. Use forensic tools and techniques for computer, mobile, and network-based investigations.
5. Evaluate the role of cyber laws and legal frameworks such as the IT Act in digital investigations.

Teaching-Learning Process

1. Lecture method: Use whiteboard/presentation-based sessions to introduce theoretical concepts such as digital forensics fundamentals, types of cybercrime, forensic investigation steps, and legal aspects (IT Act, PKI, etc.).
2. Interactive sessions: Conduct group discussions, Q&A, and brainstorming activities on real-world cybercrime incidents, ethical challenges, and case evaluations.
3. Hands-on labs: Simulate digital forensics procedures using tools like Autopsy, FTK Imager, Wireshark, and mobile forensic tools to practice evidence collection, analysis, and reporting.
4. Video demonstrations: Showcase animations and videos explaining crime scene procedures, forensic imaging, chain of custody, and legal proceedings related to digital evidence.
5. Case study analysis: Review and dissect real-life digital crime investigations (e.g., email fraud, ransomware attack), analysing the forensic techniques used and lessons learned.
6. Assignments and quizzes: Assign tasks such as preparing forensic reports, file recovery exercises, and IT Act analysis. Conduct regular quizzes to reinforce learning and application.
7. Roleplay and mock trials: Conduct simulated courtroom trials or crime scene investigations to demonstrate evidence handling, legal documentation, and expert testimony in a digital forensics context.
8. Seminars and presentations: Organize student-led presentations on emerging trends in mobile/network forensics, forensic tools, or updates in cyber laws to promote independent research and communication skills.

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MODULE 1:	**8Hrs**
Digital Forensics Science: Forensics science, computer forensics, and digital forensics. Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber-criminalistics area, holistic approach to cyber-forensics.	
MODULE 2:	**6Hrs**
Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.	
MODULE 3:	**8Hrs**
Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, explain what the normal case would look like, define who should be notified of a crime, parts of gathering evidence, define and apply probable cause.	
MODULE 4:	**10Hrs**
Computer Forensics: Prepare a case, begin an investigation, understand computer forensics workstations and software, conduct an investigation, complete a case, Critique a case. Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.	
MODULE 5:	**7Hrs**
Mobile Forensics: mobile forensics techniques, mobile forensics tools. Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008. Recent trends in mobile forensic technique and methods to search and seizure electronic evidence.	

Course Outcome	**Description**	**Bloom's Taxonomy Level**
At the end of the course the student will be able to:		
1	Explain the core principles of digital forensics, cybercrime types, and criminal investigation.	L2
2	Analyze crime scene procedures and legal documentation involved in cyber investigations.	L4
3	Apply evidence acquisition, preservation, and presentation techniques using forensic practices.	L3
4	Demonstrate use of computer, mobile, and network forensic tools for solving forensic cases.	L3
5	Evaluate the role of legal frameworks (IT Act, X.509, PKI) in enforcing digital forensics.	L5

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											3	
CO2	3		3										3	
CO3		3	3										3	
CO4		3		3									3	
CO5	3		3											3
CO6	3				3									3

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

1. B. Nelson, A. Phillips, and C. Steuart, Guide to Computer Forensics and Investigations, 4th Edition, Course Technology, 2010.
2. John Sammons, The Basics of Digital Forensics, 2nd Edition, Elsevier, 2014 2. John Vacca, Computer Forensics: Computer Crime Scene Investigation, 2nd Edition, Laxmi Publications, 2005.

REFERENCE BOOKS:

1. John Sammons, The Basics of Digital Forensics, 2nd Edition, Elsevier, 2014.
John Vacca, Computer Forensics: Computer Crime Scene Investigation, 2nd Edition, Laxmi Publications, 2005.

E-Resources:

1. Digital Forensic - Course
2. Digital Forensics Certification Online | DFE Course | EC-Council
3. Digital Forensics Concepts | Coursera
4. Digital Forensics and Incident Response (DFIR) Training, Courses, Certifications and Tools | SANS Institute
5. Incident Response and Digital Forensics | Coursera

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Vulnerability Management and Penetration Testing

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – VII

Course Code	: 22CY4703	**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 evolving tools, tactics and procedures used by cybercriminals to breach networks.
2. Understand the implications of common vulnerabilities and recommend ways to rectify or mitigate.
3. Understand the legal aspects, industry ethics and the approaches and methodologies used when performing a penetration test.
4. Use the appropriate penetration testing tools for a given scenario and understand their output.

Teaching-Learning Process

1. Lecture method: Use whiteboard/presentation-based sessions to introduce theoretical concepts such as digital forensics fundamentals, types of cybercrime, forensic investigation steps, and legal aspects (IT Act, PKI, etc.).
2. Interactive sessions: Conduct group discussions, Q&A, and brainstorming activities on real-world cybercrime incidents, ethical challenges, and case evaluations.
3. Hands-on labs: Simulate digital forensics procedures using tools like Autopsy, FTK Imager, Wireshark, and mobile forensic tools to practice evidence collection, analysis, and reporting.
4. Video demonstrations: Showcase animations and videos explaining crime scene procedures, forensic imaging, chain of custody, and legal proceedings related to digital evidence.
5. Case study analysis: Review and dissect real-life digital crime investigations (e.g., email fraud, ransomware attack), analysing the forensic techniques used and lessons learned.
6. Assignments and quizzes: Assign tasks such as preparing forensic reports, file recovery exercises, and IT Act analysis. Conduct regular quizzes to reinforce learning and application.
7. Roleplay and mock trials: Conduct simulated courtroom trials or crime scene investigations to demonstrate evidence handling, legal documentation, and expert testimony in a digital forensics context.
8. Seminars and presentations: Organize student-led presentations on emerging trends in mobile/network forensics, forensic tools, or updates in cyber laws to promote independent research and communication skills.

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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:	**6Hrs**
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:	**10Hrs**
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.	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Illustrate the significance of risk, security and vulnerability assessment.	L2
2	Analyze penetration testing strategies for diagnosing security of web application using OWASP standards	L2
3	Identify the types of vulnerability assessment policies to evaluate system security.	L2
4	Apply modern tools and techniques like Metasploit, RouterSploit, Backdoor, remote access to gather active and passive information of a system.	L3
5	Apply web application security concepts to design application portfolio for reducing risk and vulnerabilities.	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	3											3	
CO2	3		3										3	
CO3		3	3										3	
CO4		3		3									3	
CO5	3		3											3
CO6	3				3									3

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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END POINT SECURITY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – VII

Subject Code	:	22CY4704	**Credits**	:	03
Hours / Week	:	03 Hours	**Total Hours**	:	39 Hours
L–T–P–S	:	3–0–0–0			

Course Learning Objectives:

This course will enable students to:

1. **Spot Threats:** Learn to find and understand common dangers that could target your devices.
2. **Pick the Right Tools:** Figure out which security tools work best for keeping your devices safe.
3. **Use Safety Plans:** Make plans to keep your devices safe and put them into action.
4. **Deal with Problems:** Learn how to handle it if something bad happens to your device.
5. **Study Real Stories:** Look at real examples of what can go wrong with device security and learn from them.

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.
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	**08 Hours**
Introduction: Special Points of Interest, Windows Endpoints, Non-Windows Endpoints Embedded Endpoints, Mobile Phones and PDAs, MAC OS, ios, Windows CE—Windows Mobile, Android OS-Blackberry, Disappearing Perimeter—Humbug. **Why Security Fails:** Vendors Drive Process, Viruses, Worms, Trojans, and Bots, Predictably Poor Results, Define Network as Control Problem, Identifying Control Nodes	
UNIT – II	**08 Hours**
Missing Link Failures: Two Data Points Hint at a Solution, Endpoints Look Like the Link, What Needs to Happen, Network Access Control **Endpoints and Network Integration:** Architecture Is Key, Basics, Do I Need a Forklift? Endpoint Support, Vulnerabilities and Remediation, Contractors and Visitors **Trustworthy Beginnings:** Include Some Tools, Threat Vectors- Protecting the Operating System, "Killer" Applications	

UNIT – III	08 Hours
MICROSOFT WINDOWS: Initial Health Check, Hardening the Operating System, Applications Enterprise Security, Servers, Closing the Loop, Tools and Vendors. **Apple OS X:** Initial Health Check, Hardening the Operating System, Applications, Networking, Tools and Vendors	
UNIT – IV	**08 Hours**
Linux: Special Points of Interest, Initial Health Check, Hardening the Operating System, Applications, Networking, Enterprise Management, Tools and Vendors, Closing the Loop. **PDAs and Smartphones:** Points of Interest, Operating Systems, Securing Handhelds, Applications, Networking, Tools and Vendors **Embedded Devices:** Special Points of Interest, What Is an Embedded System? Where Are Embedded Systems? Why Should I Worry? Embedded Threats, Initial Health Check, Applications, Networking, Tools and Vendors, Embedded Security, Closing the Loop, Key Points.	
UNIT – V	**07 Hours**
Case Studies of Endpoint Security Failures: **CASE STUDY 1**-A large commercial manufacturer of computer products, **CASE STUDY 2** - A large package-shipping company, **CASE STUDY 3** - Manufacturer of satellite-based communications equipment, **CASE STUDY 4** - Large software company that specializes in security software	

Course Outcomes:

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

1. **Analyze** why security fails by examining vendor-driven processes, the impact of malware, and defining networks as control problems to identify key nodes.
2. **Develop** a strategy to secure network access by integrating endpoints, assessing vulnerabilities, and using trusted tools to protect against threats.
3. **Assess** the security of Microsoft Windows and Apple OS X by checking system health, strengthening the OS, securing applications, and using the right tools and vendors**.**
4. **Evaluate** end point security measures for Linux, PDAs, smartphones, and embedded devices**.**
5. **Critique** the effectiveness of endpoint security measures and **evaluate** the common patterns in endpoint security failures among different industries.

Text TEXTBOOKS:

1. Mark Kadrich, “Endpoint Security”, Addison-Wesley — 1st ed. ISBN 0-321-43695-4
2. Practical Mobile Forensics" by Rohit Tamma, Heather Mahalik, and Satish Bommisetty.

E-Resources:

1. https://www.ibm.com/topics/endpoint-security
2. https://www.coursera.org/articles/endpoint-security
3. https://skillsforall.com/course/endpoint-security?courseLang=en-US
4. https://www.sans.org/cyber-security-courses/security-essentials-network-endpoint-cloud/

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Devarakaggalahalli, Harohalli, Bengaluru – 562 112

IOT AND IIOT SECURITY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – VII

Subject Code	:	22CY4705	**Credits**	:	03
Hours / Week	:	03 Hours	**Total Hours**	:	39 Hours
L–T–P–S	:	3–0–0–0			

Course Learning Objectives:

This course will enable students to:

1. **Interpret** the impact and challenges posed by IoT networks leading to new architectural models.
2. **Compare** and contrast the deployment of smart objects and the technologies to connect them to network.
3. **Appraise** the role of IoT protocols for efficient network communication.
4. **Elaborate** the need for Data Analytics and Security in IoT.
5. **Illustrate** different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

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.
6. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the student's understanding.

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UNIT – I	08 Hours
EMERGENCE OF IOT: Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components. **IOT PROCESSING TOPOLOGIES AND TYPES:** Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading.	
UNIT – II	**08 Hours**
Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies; ***(Text Book-2: Chapter 3: 3.1 to 3.2)*** **Connecting Smart Objects:** Communications Criteria, Range, Frequency Bands, Power Consumption, Topology, Constrained-Node Networks, Data Rate and Throughput, Latency and Determinism, Overhead and Payload; ***(Text Book-2: Chapter 4: 4.1)***	
UNIT – III	**08 Hours**
Application Protocols for IoT: The Transport Layer, IoT Application Transport Methods, Application Layer Protocol Not Present, SCADA, Background on SCADA, Adapting SCADA for IP, Tunneling Legacy SCADA over IP Networks, SCADA Protocol Translation, SCADA Transport over LLNs with MAP-T, Generic Web-Based Protocols, IoT Application Layer Protocols, CoAP CRUD Operations. ***(Text Book-2 Chapter 6: 6.1, 6.2, 6.2.1 to 6.2.10***)	
UNIT – IV	**10 Hours**
IOT Challenges in Data Security: Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment. ***(Text Book-2: Chapter 7: 7.1 to 7.5)***	
UNIT – V	**08 Hours**
Securing IoT: A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment; (***Text Book-2: Chapter 8: 8.1 to 8.5)***	

Course Outcomes:

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

1. **Compare** and contrast the deployment of smart objects and the technologies to connect them to network.
2. **Appraise** the role of IoT protocols for efficient network communication.
3. **Elaborate** the need for Data Analytics and Security in IoT.
4. **Illustrate** different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

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		1				2	2		2	3	
CO2	3	3	2		1				2	2		2	3	
CO3	3	2	2		1				2	2		2	3	
CO4	3	2	1		1				2	2		2	3	
CO5	3	2	2		1				2	2		2	3	

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

1. Sudip Misra, Anandarup Mukherjee, Arijit Roy, “Introduction to IoT”, Cambridge University Press 2021.
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT

REFERENCE BOOKS:

1. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014. (ISBN: 978-8173719547)
ıings: Architecture and Design Principles”, 1st Edition, McGraw Hill
)78-9352605224)

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E RESOURCES:

1. https://www.cisco.com/c/en/us/solutions/internet-of-things/
2. https://www.sap.com/india/products/scm/industry-4-0/what-is-iiot.html

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Operating System Security

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – VII

Course Code	:	22CY4706	**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. Outline the models of protection and techniques to enforce security in operating systems.
2. Describe the impact of security features and access control mechanisms used in secure operating systems.
3. Summarizes a variety of ways that commercial operating systems have been extended with security features by using case studies.

Teaching-Learning Process

1. Lecture method: Use whiteboard/presentation-based sessions to introduce theoretical concepts such as digital forensics fundamentals, types of cybercrime, forensic investigation steps, and legal aspects (IT Act, PKI, etc.).
2. Interactive sessions: Conduct group discussions, Q&A, and brainstorming activities on real-world cybercrime incidents, ethical challenges, and case evaluations.
3. Hands-on labs: Simulate digital forensics procedures using tools like Autopsy, FTK Imager, Wireshark, and mobile forensic tools to practice evidence collection, analysis, and reporting.
4. Video demonstrations: Showcase animations and videos explaining crime scene procedures, forensic imaging, chain of custody, and legal proceedings related to digital evidence.
5. Case study analysis: Review and dissect real-life digital crime investigations (e.g., email fraud, ransomware attack), analysing the forensic techniques used and lessons learned.
6. Assignments and quizzes: Assign tasks such as preparing forensic reports, file recovery exercises, and IT Act analysis. Conduct regular quizzes to reinforce learning and application.
7. Roleplay and mock trials: Conduct simulated courtroom trials or crime scene investigations to demonstrate evidence handling, legal documentation, and expert testimony in a digital forensics context.
8. Seminars and presentations: Organize student-led presentations on emerging trends in mobile/network forensics, forensic tools, or updates in cyber laws to promote independent research and communication skills.

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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	
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	
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.	
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	
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, and Security in Other Virtual Machine Systems.	

Course Outcome	**Description**	**Bloom's Taxonomy Level**
At the end of the course the student will be able to:		
1	Identify and explain operating system security preliminaries	L2
2	Explain the major and distinct approaches to build secure operating systems	L2
3	Identify the types of vulnerability assessment policies to evaluate system security.	L3
4	Identify secure capability systems and virtual machine systems	L3
5	Compare and contrast Separation and VAX VMM Security Kernel	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	3											3	
CO2	3		3										3	
CO3		3	3										3	
CO4		3		3									3	
CO5	3		3											3
CO6	3				3									3

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

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

REFERENCE BOOKS:

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.

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Quantum Cryptography and Communication

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – VII

Course Code	:	22CY4707	**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. To apply techniques of linear algebra to quantum mechanics.
2. To analyze basic quantum circuits.
3. To explore the techniques of quantum communication.
4. To study the protocols of quantum cryptograph.

Teaching-Learning Process

1. Lecture method: Use whiteboard/presentation-based sessions to introduce theoretical concepts such as digital forensics fundamentals, types of cybercrime, forensic investigation steps, and legal aspects (IT Act, PKI, etc.).
2. Interactive sessions: Conduct group discussions, Q&A, and brainstorming activities on real-world cybercrime incidents, ethical challenges, and case evaluations.
3. Hands-on labs: Simulate digital forensics procedures using tools like Autopsy, FTK Imager, Wireshark, and mobile forensic tools to practice evidence collection, analysis, and reporting.
4. Video demonstrations: Showcase animations and videos explaining crime scene procedures, forensic imaging, chain of custody, and legal proceedings related to digital evidence.
5. Case study analysis: Review and dissect real-life digital crime investigations (e.g., email fraud, ransomware attack), analysing the forensic techniques used and lessons learned.
6. Assignments and quizzes: Assign tasks such as preparing forensic reports, file recovery exercises, and IT Act analysis. Conduct regular quizzes to reinforce learning and application.
7. Roleplay and mock trials: Conduct simulated courtroom trials or crime scene investigations to demonstrate evidence handling, legal documentation, and expert testimony in a digital forensics context.
8. Seminars and presentations: Organize student-led presentations on emerging trends in mobile/network forensics, forensic tools, or updates in cyber laws to promote independent research and communication skills.

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MODULE 1:	**9Hrs**
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:	**8Hrs**
State Space, Evolution, Measurement, Distinguishing Quantum States, Projective Measurements and POVMs	
MODULE 3:	**7Hrs**
Universal set of gates, quantum circuits, Solovay-Kitaev theorem, Deutsch-Jozsa algorithm, Shor's factoring, Grover Algorithm and HHL Algorithm	
MODULE 4:	**9Hrs**
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:	**6Hrs**
Private Key Cryptography, Privacy Amplification, Quantum Key Distribution, Privacy and Coherent Information, Security of Quantum Key Distribution	

Course Outcome	**Description**	**Bloom's Taxonomy Level**
At the end of the course the student will be able to:		
1	Examine the tools and techniques of linear algebra to the quantum mechanics problems	L2
2	Design and analyze basic quantum circuits and quantum computing algorithms	L3
3	Utilize the quantum communication tools to analyse quantum gates	L2
4	Design quantum cryptography protocol using quantum mechanics	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	3											3	
CO2	3		3										3	
CO3	3	3	3										3	
CO4	3	3		3									3	
CO5	3		3											3
CO6	3				3									3

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

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.

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Mobility Security

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – VII

Course Code	:	22CY4708	**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. To provide a detailed, in-depth, state-of-the-art description of vehicle connectivity and cybersecurity with respect to developments, technologies, inventions, and services.

Teaching-Learning Process

1. Lecture method: Use whiteboard/presentation-based sessions to introduce theoretical concepts such as digital forensics fundamentals, types of cybercrime, forensic investigation steps, and legal aspects (IT Act, PKI, etc.).
2. Interactive sessions: Conduct group discussions, Q&A, and brainstorming activities on real-world cybercrime incidents, ethical challenges, and case evaluations.
3. Hands-on labs: Simulate digital forensics procedures using tools like Autopsy, FTK Imager, Wireshark, and mobile forensic tools to practice evidence collection, analysis, and reporting.
4. Video demonstrations: Showcase animations and videos explaining crime scene procedures, forensic imaging, chain of custody, and legal proceedings related to digital evidence.
5. Case study analysis: Review and dissect real-life digital crime investigations (e.g., email fraud, ransomware attack), analysing the forensic techniques used and lessons learned.
6. Assignments and quizzes: Assign tasks such as preparing forensic reports, file recovery exercises, and IT Act analysis. Conduct regular quizzes to reinforce learning and application.
7. Roleplay and mock trials: Conduct simulated courtroom trials or crime scene investigations to demonstrate evidence handling, legal documentation, and expert testimony in a digital forensics' context.
8. Seminars and presentations: Organize student-led presentations on emerging trends in mobile/network forensics, forensic tools, or updates in cyber laws to promote independent research and communication skills.

MODULE 1:	**9Hrs**
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:	**8Hrs**
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 InVehicle Network (IVN).	
MODULE 3:	**7Hrs**
Overview, Introduction, Threat Models for the Automotive Domain, Applying the Adapted Threat Models to the Automotive Domain, Results.	
MODULE 4:	**9Hrs**
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 160 Encryption in VANET, Blockchain in V2X Communication, Safety Standards for IAV	
MODULE 5:	**5Hrs**
Overview, Internet of Vehicles, Machine Learning in Vehicular Networks, Vehicular Social Network.	

Course Outcome	**Description**	**Bloom's Taxonomy Level**
At the end of the course the student will be able to:		
1	Explain the need of Cyber Security in Automotive industry.	L2
2	Identify various security threats for security-critical vehicular applications and In Vehicular Network (IVN).	L3
3	Identify the causes of the threats by analyzing threat incentives, attackers, and threat models.	L3
4	Explain security risk and vulnerabilities in the domain of Vehicular Ad-hoc Network (VANET) and Internet of Vehicle (IoV).	L2

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											3	
CO2	3		2										3	
CO3	3	3	2										3	
CO4	3	3											3	
CO5	3		2											3
CO6	3													3

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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BIG DATA SECURITY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – VII

Subject Code	:	22CY4709	**Credits**	:	03
Hours / Week	:	03 Hours	**Total Hours**	:	39 Hours
L–T–P–S	:	3–0–0–0			

Course Learning Objectives: This course will enable students to:

1. To understand the significance of privacy, ethics in big data environment
2. Analysing the steps to secure big data
3. To integrate the big data analytics in to the enterprise and its eco system
4. To understand the security concerns of big-data.

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.
6. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the student's understanding.

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UNIT – I	08 Hours
INTRODUCTION TO BIG DATA: Arrival of analytics - Big Data Reaches Deep - Obstacles Remain - Data Continue to Evolve- Realizing Value - The Case for Big Data - The Rise of Big Data Options - Beyond Hadoop - Big Data Sources Growing.	
UNIT – II	**08 Hours**
SECURITY, COMPLIANCE, AUDITING & PROTECTION: Pragmatic Steps to Securing Big Data - Classifying Data - Protecting Big Data Analytics - Big Data and Compliance - The Intellectual Property Challenge - Big Data: The Modern Era - Today, Tomorrow, and the Next Day - Changing Algorithms	
UNIT – III	**08 Hours**
INTEGRATING BIG DATA ANALYTICS INTO THE ENTERPRISE: The Strategic Plan for Technology Adoption Standardize Practices for Soliciting Business User Expectations - Acceptability for Adoption: Clarify Go/No-Go Criteria - Prepare the Data Environment for Massive Scalability - Promote Data Reuse - Institute Proper Levels of Oversight and Governance - Provide a Governed Process for Mainstreaming Technology- Considerations for Enterprise Integration.	
UNIT – III	**08 Hours**
INTEGRATING BIG DATA ANALYTICS INTO THE ENTERPRISE: The Strategic Plan for Technology Adoption Standardize Practices for Soliciting Business User Expectations - Acceptability for Adoption: Clarify Go/No-Go Criteria - Prepare the Data Environment for Massive Scalability - Promote Data Reuse - Institute Proper Levels of Oversight and Governance - Provide a Governed Process for Mainstreaming Technology- Considerations for Enterprise Integration.	
UNIT – IV	**08 Hours**
SECURITY ANALYTICS I: Introduction to Security Analytics – Techniques in Analytics – Analysis in everyday life – Challenges in Intrusion and Incident Identification – Analysis of Log file – Simulation and Security Process.	
UNIT – V	**07 Hours**
SECURITY ANALYTICS II: Access Analytics – Security Analysis with Text Mining – Security Intelligence – Security Breaches.	

Course Outcomes:

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

1. Understand the foundational concepts and evolving landscape of big data, including its sources and technologies beyond Hadoop.
2. Implement security measures for big data, ensuring compliance, data protection, and adaptability to changing technologies.
3. Develop strategic plans and standardized practices for integrating scalable big data analytics into enterprise operations.
4. Apply security analytics techniques to identify and address security incidents and analyze log files and simulation processes.
5. Perform access analytics, text mining for security, develop security intelligence, and respond to security breaches.

Text Books

1. Frank Ohlhorst John Wiley & Sons, "Big Data Analytics: Turning Big Data into Big Money", John Wiley Sons, 2013.
2. Mark Talabis, Robert McPherson, I Miyamoto and Jason Martin, "Information Security Analytics: Finding Security Insights, Patterns, and Anomalies in Big Data", Syngress Media, U.S., 2014
3. David Loshin, "Big data analytics: From Strategic planning to enterprise integration with tools, techniques NoSQL, and Graph, Elsevier,2013.

REFERENCE BOOKS:

1. Behrouz A. Forouzan, "Cryptography and Network Security", Tata McGraw Hill Education, 2nd Edition, 2010.
2. Douglas R. Stinson, "Cryptography Theory and Practice", Chapman & Hall/CRC, 3rd Edition, 2006.

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EMBEDDED SYSTEM SECURITY

SEMESTER – VII

Subject Code	: 22CY4710	**Credits**	: 03
Hours / Week	: 03 Hours	**Total Hours**	: 39 Hours
L–T–P–S	: 3–0–0–0		

Course Learning Objectives:

This course will enable students to:

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 systems and its privacy risks.
3. To familiarize with biometric interfaces and biometric applications.

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.
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	08 Hours
Introduction to Embedded System Security: 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.	
UNIT – II	**08 Hours**
Secure Boot and Integrity Firmware: 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 154 firmware update mechanisms and over-the-air (OTA) updates.	
UNIT – III	**08 Hours**
Embedded System Authentication and Authorization: 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	
UNIT – IV	**08 Hours**
Embedded System Security Testing and Evaluation: 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.	
UNIT – V	**07 Hours**
Embedded System Security Case Studies and Emerging Trends: 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.	

Course Outcomes:

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

1. 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
2. Determine security, energy efficiency, risk, reliability, availability, and sustainability metrics for a given embedded system.
3. Develop secure firmware and trusted embedded devices or electronic gadgets using Raspberry Pi, Python, and Embedded C programming language.
4. Design secure IoT applications and deploy the same on various embedded platforms to analyze the attack surface.
5. Create vendor-specific secure embedded systems through research-based internships, project-based activities, and life-long learning.

TEXT BOOKS:

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..

REFERENCE BOOKS:

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, aaMorgan Kaufmann Publisher, 2019.