DAYANANDA SAGAR UNIVERSITY

SCHOOL OF ENGINEERING

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

COMPUTER SCIENCE & ENGINEERING

(CYBER SECURITY)

(CSE - CS)

(WITH EFFECT FROM 2020-21)

(I to VIII SEMESTERS)

DAYANANDA SAGAR UNIVERSITY

(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.

LEADERSHIPS

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

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

PREAMBLE

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

DEFINITIONS OF KEY WORDS

(i) **Academic Year:** Two consecutive odd, even semesters and a summer term for make up if required.

(ii) **Course:** Usually referred to as a subject, a course may consist of any of Lecture/Tutorials/Practical /Seminar/Mini project/Project work.

(iii) **Credit:** A unit by which the course work is measured. One credit is equivalent to one hour of lecture or one hour of tutorial or two hours of laboratory/practical/ workshop practice per week.

(iv) **Credit Point:** It is the product of grade point and number of credits per course.

(v) **Cumulative Grade Point Average (CGPA):** It is the measure of overall cumulative performance over all semesters. It is expressed upto two decimal places.

(vi) **First Attempt:** If a candidate has completed all formalities of academic requirement in a term and become eligible to attend the examinations and attend all the end semester examinations, such attempt shall be considered as first attempt.

(vii) **Grade Point:** It is a numerical weight allotted to each letter grade on a 10-point scale.

(viii) **Letter Grade:** It is an index of the performance in a said course. Grades are denoted by alphabets.

(ix) **Programme:** An educational activity leading to award a Degree or Certificate.

(x) **Semester Grade Point Average:** It is a measure of performance during a semester. It shall be expressed up to two decimal places.

(xi) **Transcript:** Based on the grades earned, a grade certificate shall be issued after every semester to the candidate registered

(xii) **Failure:** It is the case of appearing for Semester End Examinations, but fails to obtain minimum passing marks in Semester End Examinations.

(xiii) **Detain:** It is the case of not satisfying the eligibility criteria w.r.t Attendance /Internal Assessment in each course to appear for Semester End Examination.

(xiv) **Audit Course:** A course to be taken by the student without benefit of a grade or a credit.

(xv) **Not Fit For The Program (NFFTP):** It is the failure of satisfying the criteria laid down by regulations to continue the program of study, which leads to the termination from the University

RULES AND REGULATIONS

UG 1 All B.Tech programmes offered by the University shall be governed by the DSU B.Tech Rules and Regulations – 2021.

UG 2 The B. Tech. rules and regulations shall be applicable to any new discipline(s) that may be introduced in future.

UG 3 A candidate shall become eligible for the award of the B.Tech. Degree after fulfilling all the academic requirements as prescribed by the B.Tech. Rules and Regulations of DSU.

UG 4. ELIGIBILITY FOR ADMISSION

UG 4.1. Admission to First Year Bachelor of Technology shall be open to candidates who have passed the second year Pre-University or XII standard or equivalent examination recognized by the University.

UG 4.2. The candidate shall have studied and passed English as one of the courses and secured not less than forty five percent (45%) marks in aggregate with Physics and Mathematics as compulsory courses, along with any one of the following courses, namely, Chemistry, Bio- Technology, Computer Science, Biology and Electronics. Eligibility shall be 40% in optional courses in case of candidates belonging to SC/ST and OBC candidates from Karnataka.

UG 4.3. Admission to II year /III Semester Bachelor of Technology under Lateral entry shall be open to the candidates who have passed diploma or equivalent

UG 4.4. Admission to II year /III Semester Bachelor of Technology under Lateral entry shall be open to the candidates who have passed diploma or equivalent

UG 4.5. Diploma candidates seeking admission under Lateral entry shall take up bridge courses as prescribed in the Scheme of Teaching.

UG 4.6. Admission to II year /III Semester Bachelor of Technology shall be open to candidates who have passed B. Sc. degree from a recognized University or equivalent as recognized by the University and secure not less than 45% marks in aggregate (including all semesters). Eligibility shall be 40% in case of candidates belonging to SC/ST and OBC candidates from Karnataka.

UG 4.7. B.Sc. Graduates seeking admission under Lateral entry shall take up bridge Courses as prescribed in the Scheme of Teaching.

UG 5. ACADEMIC SESSION

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

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

UG 6. CHANGE OF BRANCH

UG 6.1. Normally a candidate admitted to a particular branch of the undergraduate programme will continue studying in that branch till completion.

UG 6.2. However, in special cases, the University may permit a candidate to change from one branch of studies to another after the first two semesters. Such changes will be permitted, in accordance with the provisions laid down hereinafter.

UG 6.3. Only those candidates will be considered eligible for change of branch after the second semester, who have completed all the credits required in the first two semesters of their studies in their first attempt, without having to pass any course requirement in the summer term examination.

UG 6.4. Applications for a change of branch must be made by intending eligible candidates in the prescribed form. The academic section will call for applications at the end of second semester of each academic year and the completed forms must be submitted by the last date specified in the notification.

UG 6.5. Candidates may enlist their choices of branch, in order of preference, to which they wish to change over. It will not be permissible to alter the choices after the application has been submitted.

UG 6.6. Change of branch shall be made strictly in the order of merit of the applicants. For this purpose, the CGPA obtained at the end of the second semester shall be considered. In case of a tie, SGPA of second semester followed by SGPA of first semester shall decide the tie.

UG 6.7. The applicants may be allowed a change in branch, strictly in order of merit, course to the limitation that the strength of a branch should not fall below the existing strength by more than ten percent and should not go above the sanctioned strength by more than ten percent. The minimum class strength of 75% should be maintained, while considering the change of branch.

UG 6.8. All changes of branch made in accordance with the above rules shall be effective from the third semester of the applicants concerned. No change of branch shall be permitted after this.

UG 7. COURSE STRUCTURE

UG 7.1. Medium of instruction, examination and project reports shall be in English except in case of any language audit courses.

UG 7.2. Teaching of the courses shall be reckoned in credits: Credits are assigned to the Courses based on the following general pattern:

(a) One credit for each lecture period.
(b) One credit for each tutorial period.

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

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

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

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

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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	-

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
Percentage of Marks Scored = (CGPA Earned − 0.75) × 10

UG 11. PROMOTION CRITERIA AND ENROLLMENTS TO HIGHER SEMESTERS

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

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

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

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

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

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

UG 11.2. In case of failure in Practical/Workshop practice course the candidate in any semester may clear it in the subsequent summer term examination or semester examination.

UG 11.3. In case a candidate fails in Practical/ Workshop practice he/she shall register when it is offered next either in the summer term or subsequent semester, as the case may be.

UG 11.4. Candidates may add and drop course(s) with the concurrence of the Faculty Advisor, and under intimation to the concerned course instructors and the academic section provided this is done within the date mentioned in the Academic Calendar.

UG 11.5. SUMMER TERM & MAKEUP EXAMINATIONS

UG 11.5.1. A summer term program may be offered by a department and with the approval of the Dean.

UG 11.5.2. Summer term courses will be announced by the Academic Affairs Office at the end of the even semester and before the commencement of the end semester examination. A candidate will have to register for summer term courses by paying the prescribed fees within the stipulated time in the announcement.

UG 11.5.3. The total number of contact hours in any summer term program will be the same as in the regular semester course. The assessment procedure in a summer term course will also be similar to the procedure for a regular semester course.

UG 11.5.4. Candidates granted semester drop by the Board of Governors, on medical ground, shall be allowed to clear the concerned courses in summer term course and subject to conditions as stated under clauses 11.5.1, 11.5.2.and 11.5.3.

UG 11.5.5. The Candidates with "NE" grade shall register for summer term by paying the prescribed fees.

UG 11.5.6. Candidates who are awarded 'F' grades in regular semester examinations have the option to register for the concerned courses in summer term examinations to the conditions as stated under clauses 11.5.1, 11.5.2.and 11.5.3above, or they can re-sit for subsequent semester/summer term examination only.

UG 11.5.7. Provision for make-up exam shall be available to the students who might have missed to attend the Semester / Annual end examinations of one or more courses for exceptional cases arising out of natural calamities / medical emergencies / death of a member in the family, with the permission of Faculty Advisor and Chairperson / Dean / Principal of the respective School/College. All such cases have to be exclusively to be approved by the Vice-Chancellor and ratified in the Academic Council / BOM / BOG. All such courses approved for makeup examinations are awarded a transitory grade "IC" (incomplete grade)

UG 11.5.8. The makeup examinations shall be held as notified in the academic calendar or through an exclusive notification duly approved by the Vice-chancellor.

UG 12. DURATION OF THE PROGRAMME

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

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

UG 13. TERMINATION FROM THE PROGRAMME

UG 13.1. A candidate may also be compelled to leave the Program in the University on disciplinary grounds.

UG 13.2. On having been found to have produced false documents or having made false declaration at the time of seeking admission.

UG 13.3. On having been found to be pursuing regular studies and/or correspondence courses (leading to degree or diploma) in any other college, university or an educational institution simultaneously.

UG 13.4. On having been found to be concurrently employed and performing duty or carrying out business in contravention to academic schedules of the University and without seeking approval from the University.

UG 13.5. If a student fails to earn a pass grade even after 4 attempts such a student is terminated from the university on the grounds of NOT FIT FOR THE PROGRAM (NFFTP).

UG 13.6. If a student secures a CGPA less than 4.0, 4 times during entire duration of the program of study, such a student is terminated from the university on the grounds of NOT FIT FOR THE PROGRAM (NFFTP).

UG 13.7. However, if the student appeals for reconsideration of termination from the university under NFFTP rule by providing the 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

Department of Computer Science and Engineering (Cyber Security)

VISION

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

MISSION

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

FACULTY LIST

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

PROGRAM OUTCOMES (PO'S):

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

- **PO1. Engineering knowledge:** Apply the information of arithmetic, science, engineering fundamentals, associate 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.

SCHEME - B.TECH – 2020-21 ONWARDS

I SEM - CHEMISTRY CYCLE

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

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SCHEME - B.TECH – 2020-21 ONWARDS

I SEM - PHYSICS CYCLE

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

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SCHEME - B.TECH – 2020-21 ONWARDS

II SEM - PHYSICS CYCLE

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

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SCHEME - B.TECH – 2020 -21 ONWARDS

II SEM - CHEMISTRY CYCLE

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

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SCHEME - B.TECH – 2020-21 ONWARDS

III SEM - COMPUTER SCIENCE & ENGINEERING (CYBER SECURITY)

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

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SCHEME - B.TECH – 2020-21 ONWARDS

IV SEM - COMPUTER SCIENCE & ENGINEERING (CYBER SECURITY)

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

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V SEM - COMPUTER SCIENCE & ENGINEERING (CYBER SECURITY)

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

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V SEM-PROFESSIONAL ELECTIVE – I

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

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VI SEM - COMPUTER SCIENCE & ENGINEERING (CYBER SECURITY)

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

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VI SEM-PROFESSIONAL

ELECTIVE – II

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

VI SEM-PROFESSIONAL

ELECTIVE – III

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

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SCHEME - B. TECH – 2020-21 ONWARDS

VII SEM - COMPUTER SCIENCE & ENGINEERING (CYBER SECURITY)

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

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VII SEM-PROFESSIONAL

ELECTIVE – IV

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

VII SEM-PROFESSIONAL

ELECTIVE – V

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

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

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

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VIII SEM-PROFESSIONAL

ELECTIVE – VI

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

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

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

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

Course Objectives

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

Course Outcomes

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

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

Student Learning Outcomes

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

Module: 1 LINEAR EQUATIONS 8 hours

Introduction - The Geometry of Linear Equations - Row reduction and echelon forms- Gaussian Elimination - Solution sets of linear equations – LU decomposition - Inverse of amatrix by Gauss Jordan method.
Self Learning Component : Algebra of Matrices.

Module: 2 VECTOR SPACES AND SUBSPACES 8 hours

Linear spaces – Subspaces - Linear independence – Span - Bases and Dimensions -Finite dimensional vector space.
Self Learning Component : Examples of vector spaces and subspaces, Rank of a matrix.

Module3 LINEAR TRANSFORMATIONS AND ORTHOGONALITY 8 hours

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

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

Self-Learning Component: Inner Products

Module 4 EIGEN VALUES AND EIGEN VECTORS 10 hours

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

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

Module 5 APPLICATIONS OF LINEAR EQUATIONS 6 hours

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

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

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

Text Book(s)

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

Reference Books

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

SCILAB components

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

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

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

SEMESTER/YEAR : II SEM/1
COURSE CODE : 20EN1201
TITLE OF THE COURSE : ENGINEERING MATHEMATICS – II
L: T/A: P: C : 3: 1: 0: 4

Course Objectives

1. To provide the requisite and relevant background necessary to understand theother important engineering mathematics courses offered for Engineers and Scientists.
2. To introduce important topics of applied mathematics, namely Single and Multivariable Calculus and Vector Calculus etc.
3. To impart the knowledge of Laplace transform, an important transform technique for Engineers which requires knowledge of integration

Expected Course Outcomes

At the end of this course the students should be able to
1. apply single variable differentiation and integration to solve applied problemsin engineering and find the maxima and minima of functions
2. evaluate partial derivatives, limits, total differentials, Jacobians, Taylor seriesand optimization problems involving several variables with or without constraints
3. evaluate multiple integrals in Cartesian, Polar, Cylindrical and Sphericalcoordinates.
4. understand gradient, directional derivatives, divergence, curl and Greens', Stokes, Gausstheorems

Student Learning Outcomes

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

Module: 1 Application of Single Variable Differential Calculus 8 hours

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

Module: 2 MULTI VARIABLE DIFFERENTIAL CALCULUS 8 hours

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

Module 3 MULTI VARIABLE INTEGRAL CALCULUS 8 hours

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

Line integrals, Vector Fields and Line integrals.

Module 4 VECTOR CALCULUS 10 hours

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

Module 5 LAPLACE TRANSFORM 6 hours

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

Tutorial
- Variety of minimum 10 problems to be worked out bystudents in every Tutorial Class
- Another set of 5 problems per Tutorial Class to be given forself-solving.

Text Book(s)

1.Thomas' Calculus, George B.Thomas, D.Weir and J. Hass, 2014, 13th edition, Pearson.

2. Erwin Kreyszig, Advanced Engineering Mathematics, 2015, 10th Edition, Wiley India.

Reference Books

1. Higher Engineering Mathematics, B.S. Grewal, 2015, 43rd Edition, Khanna Publishers.

2. Higher Engineering Mathematics, John Bird, 2017, 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.

SCILAB components

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

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

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

Course learning objectives:

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

Course outcome:

1. Appreciate the basic principles of electrochemistry, use of different types of electrodes in analysis and evaluate cell potential for different cell reactions.

2. Know construction, working and applications of various energy storage devices suchas batteries, fuel cells and super capacitors.

3. Understand basic principles of corrosion and apply suitable techniques for corrosioncontrol. Also know the technological importance and processes involved in metal finishing.

4. Understand and interpret phase equilibria of one and two-component systems.

5. Know the synthesis, structure –property relationship and applications of commercially important polymers and polymer composites. Understand properties and applications of nanomaterials. Also learn the principles of green chemistry for asustainable and eco-friendly world.

Module 1

Chemical Energy Source Engineering Chemistry

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

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

Solar Energy:

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

Module 2

Energy Science and Technology

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

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

Module3

Corrosion Science:

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

Surface Modification Techniques:

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

Note: Video lecture on surface modification using polymer

Module: 4

High Polymers:

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

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

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

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

Module: 5

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

Analysis:
Instrumental methods of analysis, Principles of spectroscopy-Beer's 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) and viscometer.

Text Books

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

Reference Books

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

ENGINEERING CHEMISTRY- LABORATORY

Volumetric Analysis and Preparations

1. Evaluation of quality of water in terms of total hardness by Complexometic 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 (Groupexperiment)

Reference books:

1. Dayanada Sagar University laboratory manual.

2. J. Bassett, R.C. Denny, G.H. Jeffery, Vogels, Text book of quantitative inorganic analysis, 4th Edition.

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

Course objective:

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

Course outcomes:

After completing this course, students will be able to:

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

Course Content:

Module 1 - 14 Hours

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

Module 2. 14 Hours

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

Module 3. 14 Hours

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

Module 4. 14 Hours

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

Module 5. 14 Hours

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

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

Textbook:

Brian W. Kernigham and Dennis M. Ritchie, (2012) "The C Programming Language", 2ndEdition, PHI.

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

COURSE OBJECTIVE:

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

COURSE OUTCOME:

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

Module 1: Semiconductors

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

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

Module 2: Amplifiers

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

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

Module 3: Operational Amplifiers

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

Module 4: Logic Circuits

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

Module 5: Radio

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

Text book(s)

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

Reference book(s)

1. Robert. L. Boylestad and L.Nashelsky, Electronic Devices and circuit Theory, Pearson Education,9th edition, 2005.

2. David A Bell, Electronic Devices and Circuits, PHI, 5th edition 2007.

3. Millman & Halkias, Electronics Devices and Circuits, McGraw Hill.

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

Course Summary

The course 'Design Thinking and Innovation' gives an overview of design thinking to helps students in understanding design thinking as a problem-solving approach. Ideas are developed through these processes and then applied to a basic approach to understand their value in the market place.
This course integrates the laboratory component into the theory enabling students to understand different phases of Design thinking by creating models using various workbenches from Autodesk Fusion 360 platform.
This course also aims at developing skillsets by using different design approaches to create components that can provide solutions to various engineering problems. It also enables students to use the tool proficiently to create their engineering models independently.

Course Objectives

Theory Component:

The objectives of the Course are to:

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

Lab Component:

To impart knowledge and skills to use various workbenches in Autodesk Fusion360.
To provide hands-on training on different commands to create part models inAutodesk Fusion 360.

Course Outcomes (CO):

After undergoing this course students will be able to:

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

Module 1: Introduction to Design Thinking & Innovation

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

Module 2: Scope of Design Process

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

Module 3: Morphology of Design Process

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

Module 4: Analysis of Design Problem

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

Module 5: Communication & Presentation

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

Text Book(s)

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

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

References(s)

1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation (Harper Business, 2009)

2. Bruce Hannington and Bella Martin, Universal Methods of Design: 100 Ways toResearch Complex Problems, Develop Innovative Ideas, and Design Effective Solutions (Rockport Publishers, 2012)

3. Ian C. Wright, Design Methods in Engineering & Product Design, McGraw-Hill, 1998.

4. M. A. Parameswaran, an Introduction to Design Engineering, Narosa, 2004.

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

Course Summary

The course 'Elements of Mechanical Engineering' aims at introducing principles of energy resources, thermodynamics, prime movers, pumps, materials science & composites, mechanical design, power transmission, manufacturing techniques (metal cutting, joining & foundry), mechatronics, 3D printing, robotics, electric mobility and applications.
This course integrates the laboratory component into the theory enabling students to understand the working and application of various mechanical systems. Students belonging to all branches of engineering are introduced to fundamental topics related to mechanical engineering.
This course also aims at developing skills by using workshop tools, equipment's and materials to create various physical models. The course deals with basic manufacturingprocesses like fitting, sheet metal work, welding, soldering, machining, carpentry, casting and smithy useful for industries.

Course Objectives:

The objectives of the Course are to:

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

Course Outcomes (CO):

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

Module 1: Energy Conversion

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

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

Module 2: Prime Movers & Pumps Gas and Vapour cycles

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

Introduction to pumps-working of centrifugal and reciprocating

Module 3: Materials & Mechanical Design Materials

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

Module 4: Manufacturing Processes Metal cutting:

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

Module 5: Advanced Technologies in Mechanical Engineering

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

Lab Component

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

Demonstration of

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

Text book(s)

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

Reference(s)

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

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

Course learning objectives:

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

Course Objectives:-

The Objectives of the Course are:

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

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

Course Outcomes (CO's):

On completion of the Course the Students are able to

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

Module 1: Introduction to Basics of Classical mechanics

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

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

Module 2: Introduction to Engineering materials

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

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

Module 3: Semiconductor Physics

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

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

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

Module 4: LASER PHYSICS

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

Module 5: Thin films technology

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

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

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

Lab component

1. **I-V characteristics of a Zener Diode**
   I–V Characteristics of a Zener diode in forward and reverse bias condition
2. **Four probe technique**
   Measurement of resistivity of a semiconductor using Four probe technique
3. **Newton's Rings**
   Measurement of radius of curvature of a plano-convex lens using Newton's Rings
4. **Dielectric constant**
   Determination of dielectric constant of a dielectric material
5. **Torsional Pendulum**
   Determination of moment of inertia of a circular disc using torsional pendulum
6. **Band gap energy**
   Determination of energy gap of an intrinsic semiconductor

7. Diffraction grating

Determination of wavelength of a laser light using diffraction grating

8. Planck's constant

Measurement of Planck's constant using LED

9. LCR series and parallel resonance

Study the frequency response of a series and parallel LCR circuit

10. Transistor characteristics

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

Text Book(s)

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

Reference Book(s)

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

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

COURSE OBJECTIVE:

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

COURSE OUTCOME:

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

Module 1: Introduction to Electrical Engineering

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

Module 2: Magnetic Circuits

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

Module 3: Alternating Quantities

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

Module 4: DC Machines

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

Module 5: Transformers

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

Text Book(s)

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

Reference book(s)

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

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

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

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

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

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

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

Text Book(s)

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

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

Course Aim and Summary

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

Course Objectives

The objectives of the Course are:

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

Course Outcomes

After undergoing this course students will be able to:

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

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

Course content

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

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

3. TEAM & TEAM BUILDING
Definition, Importance, Types of Team; Team Building& Team Dynamics. Leadership: Styles of Leadership; Characteristics of a good leader, Influence of differentforces on leadership.

4. JOB Application
Covering Letter; Resume/CV Writing; Difference between JobApplication & Resume.

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

6. ICE Breaking activity and JAM sessions

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

8. Tenses and Subject Verb Concord

9. Extempore, Public Speaking, Debates.

10. Data Interpretation.

Reference(s)

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

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

Course Aim & Summary:

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

Course Objectives

The objectives of the Course are:

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

Course Outcomes

After undergoing this course students will be able to:

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

Module 1:

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

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

Module 2:

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

Module 3:

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

Module 4:

Sections of Solids: Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other, obtaining true shape of section.
Development of Surfaces: Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

Module 5:

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

Module 6:

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

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

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

Text Book(s)

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

Reference(s)

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

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

Course Aim

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

Course Objectives

The objectives of the Course are:

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

Course Outcomes

After undergoing this course students will be able to:

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

Course content

Module 1: Basic Concepts of Environment

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

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

Module 2: Water Treatment

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

Module 3: Energy

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

Module 4: Disasters & Management

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

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

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

Text Book(s)

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

Reference(s)

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

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

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

Course objectives

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

Course outcomes

At the end of the course student will be able

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

Introduction to the Constitution of India, The Making of the Constitution and Sailent features of the Constitution. Preamble to the Indian Constitution Fundamental Rights& its limitations.
Directive Principles of State Policy & Relevance of Directive Principles State Policy fundamental Duties.
Union Executives – President, Prime Minister Parliament Supreme Court of India. State Executives – Governor Chief Minister, State Legislature High Court of State.

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

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

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

Text Books:

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

Reference Books:

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

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

Course Learning Objectives:

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

Lesson 1 : Introducing each other – 1. Personal Pronouns, Possessive forms, Interrogativewords.
Lesson 2 : Introducing each other – 2. Personal Pronouns, Possessive forms, Yes/No Type Interrogation
Lesson 3 : About Ramanaya. Possessive forms of nons, dubitive question, Relative nouns
Lesson 4 : Enquiring about a room for rent. Qualitative and quantitative adjectives.
Lesson 5 : Enquiring about the college. Predicative forms, locative case.Lesson
6 : In a hotel Dative case defective verbs.
Lesson 7 : Vegetable market. Numeral, plurals.
Lesson 8 : Planning for a picnic. Imperative, Permissive, hortative.
Lesson 9 : Conversation between Doctor and the patient. Verb- iru, negation – illa, non –past tense.
Lesson 10: Doctors advise to Patient. Potential forms, no – past continuous.
Lesson 11: Discussing about a film. Past tense, negation.
Lesson 12: About Brindavan Garden. Past tense negation.
Lesson 13: About routine activities of a student. Verbal Participle, reflexive form, negation.
Lesson 14: Telephone conversation. Past and present perfect past continuous and theirnegation.
Lesson 15: About Halebid, Belur. Relative participle, negation.
Lesson 16: Discussing about examination and future plan. Simple conditional and negative
Lesson 17: Karnataka (Lesson for reading)
Lesson 18: Kannada Bhaashe (Lesson for reading) Lesson
19: Mana taruva Sangati alla (Lesson for reading)Lesson
20: bEku bEDagaLu (lesson for reading)

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

ಕನ್ನಡ ಭಾಷಾ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

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

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

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

ಪಠ್ಯಪುಸ್ತಕಗಳು

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

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

COURSE CONTENT:

MODULE 1	**9Hrs**

RELATIONS AND FUNCTIONS:

Relation and Types of relations, Closure Properties, Equivalence Relations, Partial Ordering Relations, n-ary relations, Functions: one-to-one, onto and invertible functions, sequences, indexed classes of sets, recursively defined functions, cardinality Counting Principles: Permutation, combination, the pigeon hole principle,inclusion-exclusion principle Self – Learning Component: Set theory definition and Properties

MODULE 2	**8Hrs**

LOGIC:

Propositions and truth tables, tautologies and contradictions, logical equivalence, algebra of propositions, logical implications, predicate logic, theory of inference for propositional logic and predicate logic. Introduction to Predicate Calculus.

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

TEXT BOOKS :

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

REFERENCES:

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

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

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	I/II	20EN1103	FUNDAMENTALS OF PROGRAMMING

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

TEXT BOOKS :

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

REFERENCES :

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

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

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

COURSE OBJECTIVES :

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

COURSE OUTCOMES :

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

COURSE CONTENT:	
MODULE 1	**9Hrs**
NUMBER SYSTEMS: BCD number representation, Unsigned and signed number representation, Binary arithmetic. **BOOLEAN ALGEBRA AND SIMPLIFICATION:** Laws of Boolean algebra, Theorems of Boolean algebra, Boolean/Switching functions and their implementation. **SIMPLIFICATION OF BOOLEAN EXPRESSIONS AND FUNCTIONS:** Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets,Karnaugh Simplifications, Don't-care Conditions. Product-of-sums Method, Product-of-sums simplifications, Simplification by Quine-McClusky Method.	
MODULE 2	**8Hrs**
DESIGN OF COMBINATIONAL LOGIC CIRCUITS: Modular combinational logic elements- Multiplexers and Demultiplexers, Decoders,Magnitude comparator, BCD converter, Encoders, Priority encoders.	
MODULE3	**7Hrs**
PROGRAMMABLE LOGIC: Programmable Logic Arrays, Design of Combinational Circuits using Programmable Logic Devices (PLDs): Programmable Read Only Memories (PROMs), Programmable Logic Arrays (PLAs), Programmable ArrayLogic (PAL) devices.	
MODULE 4	**9Hrs**
INTRODUCTION TO SEQUENTIAL CIRCUITS : Introduction to Sequential Circuits. Combinational Vs sequential circuits, Clock, Clock Triggering, Memory elements and their excitation functions – Latches, T flip-flop, D flip-flop, R-S flip-flop. JK flip-flop and their excitation requirements, State diagram,state table and state equation, Design of synchronous sequential circuits like Sequence Detectors and binary counters**.**	
MODULE 5	**9Hrs**
APPLICATION OF LOGIC CIRCUITS SEQUENTIAL CIRCUITS (REGISTERS AND COUNTERS): Registers-Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In -Parallel Out, Universal Shift Register, Applications of Shift Registers, Asynchronous and Synchronous Counters	

TEXT BOOKS :

1 M. Morris Mano and Michael D. Ciletti, "Digital Design", 6th Edition,N.Pearson Education, 2018

2 Donald.P. Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015

REFERENCES :

1 D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2010.

2 Charles H. Roth: Fundamentals of Logic Design, Jr., 7th Edition, Cengage Learning, 2014

3 John M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.

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

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

COURSE OBJECTIVES :

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

COURSE OUTCOMES

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

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

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

COURSE OBJECTIVES :

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

COURSE OUTCOMES:

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

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

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

TEXT BOOKS:

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

REFERENCES :

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

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

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

COURSE OBJECTIVES :

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

COURSE OUTCOMES:

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

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

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

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

TEXT BOOKS :

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

REFERENCES :

1 Scrum and XP from the Trenches Henrik Kniberg 2nd Edition, 2015, Published by C4Media, publisher of InfoQ.com

2 Agile Project Management: Creating Innovative Products, Second Edition By Jim Highsmith, Addison-Wesley Professional, 2009

3 Agile Project Management: Managing for Success, By James A. Crowder, Shelli Friess, Springer, 2014

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

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

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

COURSE OBJECTIVES :

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

COURSE OUTCOMES:

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

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

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

TEXT BOOKS :

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

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

List of Laboratory/Practical Experiments activities to be conducted

Writing C programs:

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

Open-Ended Experiments

1. A man in an automobile search for another man who is located at some point of acertain 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 mightbe 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 minimizethe 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 serviceproviders due to the need to maintain the computing infrastructure. What data structure will you use for allocating resources which addresses the issue of energysaving? Why? Design the solution.

3. Mini-Project on applying suitable data structure to a given real-world problem

Textbooks

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

Reference Books

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

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

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

COURSE OBJECTIVES :

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

COURSE OUTCOMES:

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

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

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

TEXT BOOKS :

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

REFERENCES :

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

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

TEXT BOOK:

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

REFERENCES:

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

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

COURSE CONTENT:	
MODULE 1	**8Hrs**
Introduction to Microprocessor & its Architecture: Introduction-Evolution of Microprocessor, The Microprocessor-Based Personal Computer Systems, Internal Microprocessor Architecture, Real mode memory addressing, Memory paging, 8086 pin diagram, Internal Architecture of 8086,Registers, Addressing Modes-Immediate addressing, Register addressing, direct addressing, indirect addressing, relative addressing, Instruction formats	
MODULE 2	**12 Hrs**
Programming 8086: Assembler directives, Data Movement Instructions, String Data Transfers, Miscellaneous Data Transfer Instructions, Arithmetic and Logic Instructions, BCD and ASCII Arithmetic, Basic Logic Instructions, Shift and Rotate, String Comparisons. Program Control Instructions: The Jump Group, Assembly language programming with 8086, macros, procedures	
MODULE 3	**12 Hrs**
Processor Organization: Basic organization of computers, Block level description of the functional units as related to the execution of a program; Fetch, decode and execute cycle. Execution cycle in terms machine instructions. Information representation, Floating point representation (IEEE754), computer arithmetic and their implementation; **Data Part Design:** Fixed-Point Arithmetic-Addition, Subtraction, Multiplication and Division, Arithmetic Logic Units control and data path, data path components, design of ALU and data-path, **Control Part Design:** Control unit design; Hardwired and Micro programmed Control unit. Discussions about RISC versus CISC architectures.	
MODULE 4	**12 Hrs**
Memory Technology: Memory hierarchy, static and dynamic memory, RAM and ROM chips, Memory address map, Auxiliary Memory, Associative Memory, Cache Memory and organization. **Input/Output Organization:** Peripheral devices, Input-Output Interface; I/O Bus and Interface Modules, Isolated versus Memory-Mapped I/O, Example of an l/0 interface unit, keyboard interface, Modes of Transfer; Programmed I/O, Interrupt-initiated I/O, Direct memory access (DMA)	
MODULE 5	**12Hrs**
Pipelining: Basic Concepts, Arithmetic Pipeline, Instruction Pipeline; Four-Segment Instruction Pipeline, Pipeline hazards and their resolution, **Parallel Processing;** Flynn's classification, Multicore architectures, Introduction to Graphics Processing Units, Example: NVIDIA GPU Architecture	

TEXT BOOK:

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

REFERENCES:

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

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

TEXT BOOKS :

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

REFERENCES :

1. K.L.P. Misra and N. 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.

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

TEXT BOOK:

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

REFERENCES:

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

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

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

COURSE OBJECTIVES :

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

COURSE OUTCOMES:

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

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

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

TEXT BOOKS :

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

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

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

COURSE OBJECTIVES :

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

COURSE OUTCOMES :

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

List of Laboratory/Practical Experiments activities to be conducted

Part-A: Software Programs Using Microprocessor Trainer Kit

i) Programs involving : arithmetic operations, sorting

ii) Programs on : code conversion (BCD TO HEX, Binary to ASCII, Binary to Gray)

iii) Programs involving - Bit manipulation like checking:

1. Whether given data is positive or negative
2. Whether given data is odd or even
3. Logical 1‟s and 0‟s in a given data

Part- B: Software Programs Using MASM/TASM software
i) Programs on : searching and sorting
ii) Programs on : palindrome, string comparison
iii)Programs on : current time display, Decimal up-counter display

Part-C: Hardware Programs to interface microprocessor with various peripherals Using Microprocessor Trainer Kit
i) DC Motor Interface
ii) Stepper Motor Interface
iii) Matrix Keypad Interface
iv) 7 Segment Display Interface

TEXT BOOKS :

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

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

List of Laboratory/Practical Experiments activities to be conducted

PART A

1. Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped.
2. Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
3. Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
4. Implement simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets.
5. Implement and study the performance of GSM on NS2/NS3 (Using MAC layer) orequivalent Environment.
6. Implement and study the performance of CDMA on NS2/NS3 (Using stack calledCall net) or equivalent environment.

PART B

Implement the following in Java:

7. Write a program for error detecting code using CRC.
8. Write a program to find the shortest path between vertices using bellman-fordalgorithm.
9. Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present. Implement the above program using as message queues or FIFOs as IPC channels.
10. Write a program on datagram socket for client/server to display the messages on client side, typed at the server side.
11. Write a program for simple RSA algorithm to encrypt and decrypt the data.
12. Write a program for congestion control using a leaky bucket algorithm.

TEXT BOOKS:

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

REFERENCES:

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

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

TEXT BOOK:

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

REFERENCES:

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

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO 1	Demonstrate need for OS and different types of OS	L2
CO 2	Analyze the performance of scheduling algorithms for thegiven problems	L4
CO 3	Demonstrate Process Coordination and synchronizationtechniques.	L2
CO4	Apply the deadlock handling mechanisms to solve thegiven problem	L3
CO 5	Apply suitable techniques for management of differentResources	L3
CO 6	Understand the principles of protection and securityMechanisms	L2

COURSE CONTENT:	
MODULE 1: OS Overview and System Structure	**10 Hrs**
Introduction to operating systems, System structures: What operating systems do; ComputerSystem 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 systemcalls; System programs; Operating system design and implementation; Operating System structure; Virtual machines;	

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

TEXT BOOKS:

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

REFERENCES:

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

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

COURSE OBJECTIVES:

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

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

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

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

List of Laboratory/Practical Experiments activities to be conducted

1. Design and develop payment fraud detection model using logistic regression.
2. Develop a program for spam E-mail detection using Naïve Bayes algorithm.
3. Write a program for spam E-mail detection using Blacklist. Consider the requireddataset.
4. Perform Anomaly detection using Elliptic Envelope Fitting for simple normallydistributed datasets.
5. Know the difference between Complied Execution and Interpreted Execution with Malware Analysis Code program execution.

TEXT BOOK:

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

REFERENCES:

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

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

List of Laboratory/Practical Experiments activities to be conducted

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

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

TEXT BOOK:

1. Levitin A, "Introduction to the Design And Analysis of Algorithms", PearsonEducation, 2008.
2. T. H. Cormen, Leiserson, Rivest and Stein, "Introduction of Computeralgorithm," , 3rd Edition, The MIT Press, 2015

REFERENCES:

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

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

List of Laboratory/Practical Experiments activities to be conducted		
Exp. No	Division of Experiments	List of Experiments
1	System Calls	Write a C program to create a new process that exec a new program usingsystem 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 copycontents of one file to another file

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

TEXT BOOKS:

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

REFERENCES:

1. Operating Systems-Internals and Design Principles, William Stallings, 6th Edition, Pearson Education, 2009.

2. Operating Systems: A Modern Perspective, Gary J. Nutt, Addison-Wesley, 1997

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

TEXT BOOK:

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

REFERENCES:

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

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

TEXT BOOK:

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

REFERENCES:

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

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

TEXT BOOK:

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

REFERENCES:

1. Muhammad Tahir, Kashif Javed, ARM Microprocessor Systems: Cortex-M Architecture, CRC Press 2017
2. Richard Blum, "Arduino Programming in 24 Hours", Sams Teach Yourself, PearsonEducation, 2017.
3. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1stEdition, VPT, 2016
4. Srinivasa K G, Internet of Things,CENGAGE Leaning India, 2017

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

TEXT BOOK:

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

REFERENCES:

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

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

TEXT BOOK:

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

REFERENCES:

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

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

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

COURSE OBJECTIVES:

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

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

COURSE OUTCOMES:

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

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

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

TEXT BOOK:

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

REFERENCES:

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

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

TEXTBOOKS:

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

REFERENCES:

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

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

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

Course objectives: This course will enable students to

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

Course Outcomes:

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

Lab Experiments:

PART A

1. Implement the encryption and decryption of 8-bit data using 'Simplified DES Algorithm'
2. Configure a mail agent to support Digital Certificates, send a mail and verify the correctness ofthis system using the configured parameters.
3. Implement the Euclid Algorithm to generate the GCD
4. Using Java Cryptography, encrypt the text "Hello world" using BlowFish. Create your own key using Java key tool
5. Implementation of Advanced Encryption Standard (AES)

PART B

1. Learn to install Wine/Virtual Box/ or any other equivalent s/w on the host OS
2. Perform an experiment to grab a banner with telnet and perform the task using Netcat
3. Perform an experiment how to use DumpSec.
4. Perform a wireless audit of an access point / router and decrypt WEP and WPA (software's netstumbler or airsniff).
5. Install IPCop on a Linux system and learn all the function available on the software. Install Rootkits and study variety of opt.

REFERENCES:

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

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

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

Course objectives:

This course will enable students to

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

Course Outcomes:

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

Lab Experiments:

PART A

1. Encryption and Decryption program for Caesar Cipher without input.
2. Program to generate Pseudo Random numbers in a range
3. Program for XOR Encryption and Decryption
4. Program for Vernam Cipher
5. Program for RSA Algorithm by inputting value of two prime numbers
6. Implement the encryption and decryption of 8-bit data using 'Simplified DES Algorithm'

PART B

1. Commands for Data and Network Security
   "ipconfig, ping, tracert, nbtstat, telnet, netstat, tasklist, getmac, hostname, pathping, route, fc, sfc, recimg, cipher, arp, net view" [More Commands can be Discussed]
2. Introduction to CRYPTOOL
3. Implement Digital Signature Visualization
4. Implement on Hash Value Creation
5. Implement on HMAC Calculation

REFERENCES:

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

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

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

COURSE OBJECTIVES

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

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

COURSE OUTCOMES:

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

TEXT BOOK:

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

REFERENCES:

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

TEXT BOOKS:

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

REFERENCES:

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

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

TEXT BOOK:

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

REFERENCES:

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

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

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

COURSE OBJECTIVES:

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

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

COURSE OUTCOMES:

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

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

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

TEXT BOOK:

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

REFERENCES:

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

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

TEXT BOOKS:

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

REFENCE BOOKS:

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

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

COURSE OBJECTIVES:

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

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

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

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

TEXT BOOK:

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

REFERENCE BOOKS:

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

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

TEXT BOOKS:

1. Albert J. Marcella Jr., Frederic 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 publications.
3. Albert J. Marcella, Jr., Doug Menendez, “Cyber Forensics A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes”, Second Edition, Auerbach Publications.

REFERENCES:

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

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

TEXT BOOK:

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

REFERENCES:

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

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

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

TEXT BOOK:

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

REFERENCES:

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

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

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

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

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

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

TEXT BOOK:

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

REFERENCE BOOKS:

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

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

COURSE OBJECTIVES:

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

COURSE OBJECTIVES:

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

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

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

TEXT BOOK:

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

REFERENCE BOOKS:

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

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

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

COURSE OBJECTIVE:

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

COURSE OUTCOMES:

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

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

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

TEXT BOOK:

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

REFERENCES:

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