ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

B.E. (COMPUTER SCIENCE AND ENGINEERING)
Curriculum – 2025

HAND BOOK
2025

FACULTY OF ENGINEERING AND TECHNOLOGY

VISION

To Providing world class quality education with strong ethical values to nurture and develop outstanding professionals fit for globally competitive environment.

MISSION

- Provide quality technical education with a sound footing on basic engineering principles, technical and managerial skills, and innovative research capabilities.
- Transform the students into outstanding professionals and technocrats with strong ethical values capable of creating, developing and managing global engineering enterprises.
- Develop a Global Knowledge Hub, striving continuously in pursuit of excellence in Education, Research, Entrepreneurship and Technological services to the Industry and Society.
- Inculcate the importance and methodology of life-long learning to move forward with updated knowledge to face the challenges of tomorrow.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

B.E. COMPUTER SCIENCE AND ENGINEERING

(Students Admitted from the Academic Year 2025-26)

VISION

To provide a congenial ambience for individuals to develop and blossom as academically superior, socially conscious and nationally responsible citizens.

MISSION

- **M1**: Impart high quality computer knowledge to the students through a dynamic scholastic environment wherein they learn to develop technical, communication and leadership skills to bloom as a versatile professional.
- **M2**: Develop life-long learning ability that allows them to be adaptive and responsive to the changes in career, society, technology, and environment.
- **M3**: Build student community with high ethical standards to undertake innovative research and development in thrust areas of national and international needs.
- **M4**: Expose the students to the emerging technological advancements for meeting the demands of the industry.

B. E. (CSE) - PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEOs	PEO Statements
PEO1	To equip the graduates with fundamental concepts and impart problem solving skills that will help them to pursue professional careers in Computer Science and Engineering.
PEO2	To provide the graduates with the requisite knowledge to pursue higher education and carry out research in the field of Computer Science and Engineering.
PEO3	To equip the graduates with the ability to acquire new skills in emerging areas of Computer Science and Engineering such as artificial intelligence, machine learning and data science and enable them to become successful professionals and entrepreneurs.
PEO4	To ensure that the graduates exhibit high levels of ethical and moral behavior as computer engineers in addressing societal problems and providing sustainable development for the betterment of society.

B.E. (CSE) – PROGRAMME OUTCOMES (PO)

After the successful completion of the B.E(CSE) degree program the students will be able to :

Sl. No.	Program Outcomes
PO1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
PO3	**Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO8	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO9	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO10	**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO11	**Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

B. E. (CSE) - PROGRAM SPECIFIC OUTCOMES (PSOs)

PSOs	Program Specific Outcome
PSO1	Ability to investigate challenging problems in various domains and exhibit programming skills to build automation solutions
PSO2	Ability to apply the algorithms and computational techniques to construct robust and resilient computer systems and applications.
PSO3	Ability to comprehend and implement the contemporary trends in industry and research environment paving the way for innovative solutions to existing and emerging problems

B.E. (COMPUTER SCIENCE & ENGINEERING)

CONSISTENCY OF PO WITH PEOS OF THE DEPARTMENT

POs / PEOs	PEO1	PEO2	PEO3	PEO4
PO1	✓	✓	✓	
PO2	✓	✓	✓	
PO3	✓		✓	✓
PO4		✓	✓	
PO5	✓	✓	✓	
PO6	✓			✓
PO7				✓
PO8	✓		✓	✓
PO9	✓	✓	✓	✓
PO10	✓		✓	✓
PO11	✓	✓	✓	✓

B.E. (COMPUTER SCIENCE & ENGINEERING)

CONSISTENCY OF PEOS WITH MISSION OF THE DEPARTMENT

PEOs	M1	M2	M3	M4
PEO 1	3	–	–	2
PEO 2	2	3	3	1
PEO 3	2	3	1	3
PEO 4	1	2	3	–

3-Strong Correlation 2-Moderate Correlation 1-Weak Correlation

FACULTY OF ENGINEERING AND TECHNOLOGY
B. E. (Four-Year) Degree Programme (FULL-TIME)
Choice Based Credit System (CBCS)
REGULATIONS 2025

1. Condition for Admission

Candidates for admission to the first year of the four year B.E. Degree programmes shall be required to have passed the final examination of the Higher Secondary Course (Plus 2) with Mathematics, Physics and Chemistry as courses of study and candidates who have passed the Higher Secondary Examination through vocational stream under Engineering, conducted by the Board of Secondary Education, Government of Tamil Nadu or an examination of any other authority accepted by the Syndicate of this University as equivalent thereto. They shall satisfy the conditions regarding qualifying marks, age and physical fitness as may be prescribed by the Syndicate of the Annamalai University from time to time.Candidates who have passed the Diploma programme in Engineering of the State Board of Technical Education, Tamil Nadu will be eligible for admission to the second year of the four year degree programme in B.E. under the lateral entry scheme provided they satisfy other conditions.

2. Branches of Study in B.E.

BRANCH I	-	Chemical Engineering
BRANCH II	-	Civil Engineering
BRANCH III	-	Civil and Structural Engineering
BRANCH IV	-	Computer Science and Engineering
BRANCH V	-	Computer Science and Engineering (Data Science)
BRANCH VI	-	Computer Science and Engineering (Artificial ntelligence and Machine Learning)
BRANCH VII	-	Electrical and Electronics Engineering
BRANCH VIII	-	Electronics and Communication Engineering
BRANCH IX	-	Electronics and Instrumentation Engineering
BRANCH X	-	Information Technology
BRANCH XI	-	Mechanical Engineering
BRANCH XII	-	Mechanical Engineering (Manufacturing)

3. Courses of Study and Scheme of Examinations

The courses of study with respective syllabi and the scheme of Examinations are given separately.

4. Choice Based Credit System (CBCS)

The curriculum includes Humanities, Social Sciences, Management, Basic Sciences, Engineering Sciences, Professional Core, Professional Electives and Open Electives in addition to Seminar & Industrial Training and Project. Each semester curriculum shall normally both theory and practical courses. The total credits for the entire degree Programme is **172 (130** for lateral entry students).

5. Eligibility for the Degree

A candidate shall be eligible for the degree of Bachelor of Engineering if the candidate has satisfactorily undergone the prescribed courses of study for a period of four academic years and has passed the prescribed examinations in all the four academic years. For the award of the degree, a student has to earn a minimum of 172 credits (130 for lateral entry students).

He / She should serve in any one of the following Co-curricular activities for at least one year.

- National Cadet Corps (NCC)
- National Service Scheme (NSS)
- National Sports Organization (NSO) and
- Youth Red Cross (YRC)

The students enrolled in any one of the co-curricular activities (NCC / NSS / NSO / YRC) will undergo training for about 80 hours and attend a camp of about seven days. The training shall include classes on hygiene and health awareness and also training in first-aid. While the training activities will normally be during weekends, the camp will normally be during vacation period.

(or)

Enrol as a student member of a recognized professional society such as

- Student Chapters of Institution of Engineers (India)
- Student Chapters of other Professional bodies like ICI, ISA, IIChE, IEEE, SAE, ASHRAE, CSI and IWS

5.1 B.E (Honours) Degree

A student shall be eligible to get Under Graduate degree with Honours, if he/she completes an additional 20 credits. Thus the total credits is 192. Out of 192 credits (150 credits for lateral entry students), 20 credits must be earned by studying honours electives offered by his/her branch of study in fifth, sixth and seventh semesters.

5.2 B.E Degree with Minor Engineering

A student shall be eligible to get Under Graduate degree with additional Minor Engineering, if he/she completes an additional 20 credits. Out of the 192 credits (150 credits for lateral entry students),20 credits must be earned from the courses offered by any other Department in the Faculty of Engineering and Technology in fifth, sixth and seventh semesters.

6. Assignment of Credits for Courses

Each course is normally assigned one credit per hour of lecture/tutorial per week and half credit for one hour for laboratory or practical or drawing course per week.

7. Duration of the Programme

A student is normally expected to complete the B.E. programme in four years but in any case not more than seven years from the time of admission.

8. Registration for Courses

A newly admitted student will automatically be registered for all the courses prescribed for the first and second semesters without any option.

Every other student shall enrol for the courses intended to be credited in the succeeding semester in the current semester itself by completing the registration form indicating the list of courses. This registration will be done a week before the last working day of the current semester.

A student is required to earn 172 (130 for lateral entry students) credits in order to be eligible for obtaining the degree. However the student is entitled to enjoy an option to earn either more or less than the total number of credits prescribed in the curriculum of a particular semester on the following guidelines:

8.1 Slow Learners

The **slow learners** may be allowed to withdraw certain courses with the approval by the Head of the Department and those courses may be completed by them in the fifth year of study and still they are eligible to be awarded with First Class. A student can withdraw a maximum of 2 courses per semester from IV semester to VII semester and take up those courses in the fifth year of study. However, courses withdrawn during odd semesters (V and VII) must be registered in the odd semester of fifth year and courses withdrawn during even semesters (IV and VI) must be registered in the even semester of fifth year.

8.2 Advanced Learners

The advanced learners may be allowed to take up the two professional elective courses of eighth semester in fifth/sixth/seventh semesters through SWAYAM/NPTEL with the approval of the Head of the concerned Department. On successful completion of two courses they are permitted to pursue industrial training/internship/project work in the entire eighth semester period.

9. Project Work

The student typically registers for project at the end of seventh semester and completes it at the end of the eighth semester along with the courses prescribed for study in the eighth semester. However a student who has registered and successfully completed the courses of eighth semester by acquiring additional credits in the earlier semesters can attempt to spend his/her period of study in an industry and complete his/her project work, submit the project report and appear for viva-voce examination at the end of eighth semester.

10. Mandatory Induction Programme

A 3-week long induction programme for the UG students entering the institution, right at the start is proposed. Normal classes start only after the induction programme is over. The following are the activities under the induction programme in which the student would be fully engaged throughout the day for the entire duration of the programme.

- Physical Activity
- Creative Arts
- Imparting Universal Human Values
- Literary Activities
- Conduct of crash courses on soft skills

- Lectures by Eminent People
- Visits to Local Area
- Familiarization to Dept./Branch & Innovative practices

11. Electives

The elective courses fall under two basic categories: Professional Electives and Open Electives.

11.1 Professional Elective Courses

The Professional Elective courses are offered in the concerned branch of specialization and a student can choose the Professional Elective courses with the approval of the Head of the Department concerned.

11.2 Open Elective Courses

Apart from the various professional elective courses, a student must study **three** open elective courses. The student has to study three open elective courses offered by other Departments in the Faculty with the approval of the Head of the concerned Department and the Head of the Department offering the courses or Naan Mudhalvan courses or SWAYAM/NPTEL courses in fifth, sixth and seventh semesters. In case the student opts to study an open elective course offered by other Department in the Faculty, it shall be handled by the faculty of that Department offering the chosen open elective.

11.3 MOOC (SWAYAM) Courses

The student can be permitted to study Massive Open Online Courses (MOOCs) offered through the SWAYAM/NPTEL with the approval of the Head of the Department concerned and the Dean of the Faculty. The courses will be considered as equivalent to professional elective / open elective courses from third to eighth semesters and the credits earned through MOOC courses may be transferred and considered for awarding Degree to the student concerned.

A student who earns 3 or more credits from a 12 week MOOC course through SWAYAM/NPTEL portal (Syndicate Resolution No.:14 dated 10.05.2019) shall be exempted from studying the elective course and permitted to transfer the credits. Besides the student may be permitted to claim for the conversion to the next higher grade in accordance with the Syndicate Resolution No.: 31 dated 09.09.2020

11.4 Value Added Courses

A student can study one or more value added courses being offered by the other Departments of Study either within the Faculty or any other Faculty in the University in any semester of the B.E degree programme except First Year, with the restriction that only one Value added Course can be registered at a time.

11.5 Extra One Credit Courses

One credit courses shall be offered by a Department with the prior approval from the Dean of the Faculty.

For one credit courses, a relevant potential topic may be selected by a committee consisting of the Head of the Department concerned and the Board of Studies member from the Department and a senior faculty member from the Department concerned. An expert from industry familiar with the topic chosen may be accordingly invited to handle classes for the students. The details of the syllabus, time table and the name of the industrial expert may be sent by the above committee to the Dean for approval. The credits earned through the extra one credit courses shall be over and above the total credit requirement prescribed in the curriculum for the award of the degree. Students can take a maximum of two extra one credit courses (one each in VI and VII semesters). They shall be allowed to take extra one credit courses offered in other Departments with the permission of Head of the Department offering the courses. A separate mark sheet shall be issued for extra one credit courses.

11.6 Naan Mudhalvan (Skill Related) Courses

A student may opt to study the courses listed in the Naan Mudhalvan (Skill Related) portal against the professional elective courses in third and fourth semesters and open elective courses in fifth, sixth and seventh semesters of study as part of acquiring skills in the specified field.

12. Assessment

12.1. Theory Courses

The break-up of Continuous Assessment for the theory courses relates to evaluating the performance under the five Course Outcomes uniformly with 5 Marks for each outcome spread over Two Mid-Semester tests and One Assignment, totalling to 25 Marks. Similarly the break-up mark for University End Semester exams involves evaluating the performance under the five Course Outcomes with 15 Marks for each Outcome, totalling to 75 Marks.

The break-up of continuous assessment and examination marks for theory courses is as follows:

First assessment (Mid-Semester Test-I Covering Units I & II)	8 marks
Second assessment (Mid-Semester Test-II Covering Units III, IV & V)	12 marks
Third Assessment (Assignment Covering Units I, II, III, IV & V)	5 marks
End Semester Examination	75 marks

12.2 Practical Courses

The break-up of Continuous Assessment for the practical courses involves evaluating the performance under the five Course Outcomes uniformly with 8 Marks for each outcome spread over Two tests and Record work, totalling to 40 Marks. Similarly the break-up mark for University End Semester exams relates to evaluating the performance under the five Course Outcomes with 12 Marks for each Outcome, totalling to 60 Marks

The break-up of continuous assessment and examination marks for Practical courses is as follows:

First Assessment (Test-I)	15 marks
Second Assessment (Test-II)	15 marks
Maintenance of Record book	10 marks
End Semester Examination	60 marks

12.3 Project Work

The continuous assessment marks for the project work will be 40 and to be assessed by a review committee consisting of the project guide and a minimum of two members nominated by the Head of the Department. One of the committee members will be nominated as the Chairman by the Head of the Department. The Head of the Department may be a member or the Chairman. At least two reviews should be conducted during the semester by the review

committee. The student shall make presentation on the progress made before the committee. 60 marks are allotted for the project work and viva voce examination at the end of the semester.

12.4 Industrial Internship

After attending the internship during the semester vacation of IV and VI semester for a period of 4 weeks duration in each year, the student has to submit a report and appear for the viva-voce exam along with the V and VII semester end semester examinations.

13. Substitute Assessment

A student, who has missed, for genuine reasons accepted by the Head of the Department, one or more of the assessments of a course other than the final examination, may take a substitute assessment for any one of the missed assessments. The substitute assessment must be completed before the date of the third meeting of the respective class committees.

A student who wishes to have a substitute assessment for a missed assessment must apply to the Dean / Head of the Department within a week from the date of the missed assessment.

14. Mentoring & Statutory Support for Students

14.1 Student Counsellors (Mentors)

To help the students in planning their course of study and for general advice on the academic programme, the Dean / Head of the Department will attach a certain number of students to a member of the faculty who shall function as student counsellor for those students throughout their period of study. Such student counsellors shall advise the students, give preliminary approval for the courses to be taken by the students during each semester and obtain the final approval of the Dean / Head of the Department.

14.2 POSH

Prevention of Sexual Harassment (POSH) Cell is established to ensure a safe and secure working / studying environment for Girls and Women in the University. More information about this cell can be accessed at the following link: https://annamalaiuniversity.ac.in/stud_posh.php

14.3 SC / ST Cell

A separate cell is functioning in the University to safeguard the rights and privileges of the students, belonging to SC/ST category. This cell also informs the students about the various scholarships and fellowships and encourages them to apply relevant ones. More information about this cell can be accessed at the following link: https://annamalaiuniversity.ac.in/stud_eoc_sccell.php

15. Class Committee

For all the branches of study during the first two semesters, a common class committee will be constituted by the Dean of the faculty. From among the various teachers teaching the same common course to different classes during each semester of the first year, the Dean shall appoint one of them as course coordinator.

The composition of the class committee during first and second semesters will be as follows:

- Course coordinators of all courses.
- All the Heads of the Sections, among whom one may be nominated as Chairman by the Dean.
- The Dean may opt to be a member or the Chairman.

For each of the higher semesters, separate class committees will be constituted by the respective Head of the Departments.

The composition of the class committees from third to eighth semester will be as follows:

- Teachers of the individual courses.
- A seminar coordinator (for seventh semester only) shall be appointed by the Head of the Department
- A project coordinator (for eighth semester only) shall be appointed by the Head of the Department from among the project supervisors.
- One Professor or Associate Professor, preferably not teaching the concerned class, appointed as Chairman by the Head of the Department.
- The Head of the Department may opt to be a member or the Chairman.

The class committee shall meet three times during the semester. The first meeting will be held within two weeks from the date of class commencement in which the type of assessment like test, assignment etc. for the third assessment and the dates of completion of the assessments will be decided.

The second meeting will be held within a week after the completion of the first assessment to review the performance and for follow-up action.

The third meeting will be held after all the assessments but before the University endsemester examinations are completed for all the courses, and at least one week before the commencement of the examinations. During this meeting the assessment on a maximum of 25 marks for theory/40 marks for seminar/ industrial training, practical and project work will be finalized for every student and tabulated and submitted to the Head of the Department (to the Dean in the case of I & II Semester) for approval and transmission to the Controller of Examinations.

16. Attendance Requirements

The students with 75% attendance and above are permitted to appear for the University examinations. However, the Vice Chancellor may give a rebate / concession not exceeding 10% in attendance for exceptional cases only on Medical Grounds.

17. Temporary Break of Study

A student is permitted to go on break of study for a maximum period of one year either as two breaks of one semester each or a single break of one year.

If a student wishes to apply for break of study, the student shall apply to the Dean in advance, in any case, not later than the last date of the first assessment period. The application duly filled by the student shall be submitted through the Head of the Department. In the case of short term employment/ training/ internship, the application for break of study shall be approved and forwarded by the Head of the Department concerned to the Dean.

However, the student must complete the entire programme within the maximum period of seven years.

18. Procedure for Withdrawing from the Examinations

A student can withdraw from all the examinations of the semester only once during the entire programme on valid grounds accepted by the University. Such withdrawal from the examinations of a semester will be permitted only if the candidate applies for withdrawal at least 24 hours before the commencement of the last examination. The letter grade ‘W’ will appear in the mark sheet for such candidates.

19. Passing and Declaration of Examination Results

All assessments of all the courses on an absolute marks basis will be considered and passed by the respective results passing boards in accordance with the rules of the University.

Thereafter, the Controller of Examinations shall convert the marks for each course to the corresponding letter grade as follows, compute the Grade Point Average (GPA), Cumulative Grade Point Average (CGPA) and prepare the mark sheets.

90 to 100 marks	:	Grade 'S'
80 to 89 marks	:	Grade 'A'
70 to 79 marks	:	Grade 'B'
60 to 69 marks	:	Grade 'C'
55 to 59 marks	:	Grade 'D'
50 to 54 marks	:	Grade 'E'
Less than 50 marks	:	Grade 'RA'
Withdrawn from the examination	:	Grade 'W'

A student who obtains less than 30 / 24 marks out of 75 / 60 in the theory / practical examinations respectively or is absent for the examination will be awarded grade RA.

A student who earns a grade of S, A, B, C, D or E for a course, is declared to have successfully completed that course. Such a course cannot be repeated by the student.

A student who is detained for lack of attendance must re-register for and repeat the courses in the respective semester.

A student who obtains letter grade RA in the mark sheet must reappear for the examination of the courses except for Honours courses.

A student who obtains letter grade W in the mark sheet must reappear for the examination of the courses.

The following grade points are associated with each letter grade for calculating the grade point average and cumulative grade point average.

S - 10; A - 9; B - 8; C - 7; D - 6; E - 5; RA - 0

Courses with grade RA / W are not considered for calculation of grade point average or cumulative grade point average.

A student can apply for re-evaluation of one or more of his examination answer papers within a week from the date of issue of mark sheet to the student on payment of the prescribed fee per paper. The application must be made to the Controller of Examinations with the recommendation of the Head of the Department.

After the results are declared, mark sheets will be issued to the students. The mark sheet will contain the list of courses registered during the semester, the grades scored and the grade point average for the semester.

GPA is the sum of the products of the number of credits of a course with the grade point scored in that course, taken over all the courses for the semester, divided by the sum of the number of credits for all courses taken in that semester.

OGPA/CGPA is similarly calculated considering all the courses taken from the time of admission.

20. Awarding Degree

After successful completion of the programme, the degree will be awarded based on OGPA/CGPA.

The conversion of OGPA/CGPA (from I semester to VIII Semester) to the corresponding Percentage of marks may be calculated as per the following formula:

Percentage of marks = (OGPA (or) CGPA - 0.25) x 10

Where $\text{OGPA(or)CGPA} = \frac{\sum C_i \text{GP}_i}{\sum C_i}$

C_i - Credit hours of a course GP_i- Grade Point of that course

20.1 Honours Degree

The student requires to earn a minimum of 192 credits within four years (150 credits within three years for lateral entry students) from the time of admission, pass all the courses in the first attempt from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students) and obtain a OGPA/CGPA of 8.25 or above to obtain the Honours Degree.

The Student is required to complete 6 elective courses, 2 each in the V, VI and VII semesters with a stipulation that 2 of the 6 courses need to be of 4 credits each, while the remaining 4 has to be of 3 credits each, thus totalling to 20 credits, the choice being approved by the Head of the Department concerned and the Dean of the Faculty.

However, if the student either does not clear the extra course(s) relating to become eligible for the Honours Degree or discontinues it in any of the semesters, then the student may revert to the category of the First Class with Distinction or First class, provided the student is eligible for that respective category. The student may claim for revised mark sheet, paying the stipulated fee in order that the unsuccessful appearance or discontinuity of the course(s) is not reflected in the new mark sheet.

20.2 First Class with Distinction

To obtain B.E Degree First Class with Distinction, a student must earn a minimum of 172 Credits within four years (130 credits within three years for lateral entry students) from the time of admission, by passing all the courses in the first attempt from I Semester to VIII

Semester (III Semester to VIII Semester for lateral entry students) and obtain a CGPA of 8.25 or above.

20.3 First Class

To obtain B.E Degree First Class, a student must earn a minimum of 172 credits within ***five*** years (130 credits within ***four*** years for lateral entry students) from the time of admission and obtain a OGPA/CGPA of 6.75 or above for all the courses from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

20.4 Second Class

For Second Class, the student must earn a minimum of 172 credits within **seven** years (130 credits within **six** years for lateral entry students) from the time of admission.

20.5 B.E Degree with Minor Engineering

The student shall be given an option to earn a Minor Engineering Degree in another discipline of Engineering other than his/her branch of study provided the student clears all the subjects in the first year in the first attempt and secures a OGPA/CGPA of not less than 7.5

The Student is required to complete 6 elective courses, 2 each in the V, VI and VII semesters with a stipulation that 2 of the 6 courses need to be of 4 credits each, while the remaining 4 has to be of 3 credits each, thus totalling to 20 credits, the choice being approved by the Head of the Department concerned and the Dean of the Faculty.

The rules for awarding the B.E degree in First Class with Distinction or in First Class or in Second Class apply in the same manner for B.E Degree with Minor Engineering.

However the student who opts for Honours Degree is not entitled to pursue B.E Degree with Minor Engineering and vice-versa.

21. Ranking of Candidates

The candidates who are eligible to get the B.E. degree with Honours will be ranked together on the basis of OGPA/CGPA for all the courses of study from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

The candidates who are eligible to get the B.E. degree in First Class with Distinction will be ranked next after those with Honours on the basis of OGPA/CGPA for all the courses of study from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

The candidates passing with First Class will be ranked next after those with distinction on the basis of OGPA/CGPA for all the courses of study from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

The ranking of candidates will be done separately for each branch of study.

22. Transitory Regulations

The University shall have powers to revise or change or amend the regulations, the scheme of examinations, the courses of study and the syllabi from time to time.

Wherever there had been change of syllabi, examinations based on the existing syllabi will be conducted for three consecutive times after implementation of the new syllabi in order to enable the students to clear the arrears. Beyond that the students will have to take up their examinations in equivalent courses, as per the new syllabi, on the recommendations of the Head of the Department concerned.

DETAILS OF COURSE CODE

S. No	Code (3rd and 4th Digits)	Details	Code (5th and 6th Digits)	Details
1	ET	Common Course for the faculty	HS	Humanities Theory
2	CE	Civil Engg. Course	HP	Humanities Practical
3	CZ	Civil and Structural Engg. course	BS	Basic Science Theory
4	ME	Mechanical Engg. Course	BP	Basic Science Practical
5	MM	MechanicalEngg. (Manufacturing) Course	ES	Engineering Science Theory
6	EE	Electrical and Electronics Engg. Course	SP	Engineering Science Practical
7	EI	Electronics and Instrumentation Engg. course	PC	Professional Core Theory
8	CH	Chemical Engg. course	CP	Professional Core Practical
9	CS	Computer Science and Engg. course	PE	Professional Elective Theory
10	IT	Information Technology course	EP	Professional Elective Practical
11	EC	Electronics and Communication Engg. course	IT	Internship /Industrial Training
12	AI	Computer Science and Engineering (Artificial Intelligence and Machine Learning)	OE	Open Elective Theory
13	DS	Computer Science and Engineering (Data Science)	PV	Project and Viva-voce
14	YY	Code of the Program concerned (S. No 02 to S.No.13)	AC	Audit Course

The first two digits relate to the year from which the Regulations commence7th digit represents the semester and 8th and 9th digits represent the serial number of courses.

ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

B.E (Four Year) Degree Program

Choice Based Credit System (CBCS)

REGULATIONS 2025

CURRICULUM FOR GROUP 'A' BRANCHES

(Computer Science and Engineering, Electrical and Electronics, Electronics and Communication, Electronics and Instrumentation, Information Technology, CSE - Data Science, CSE – AI and ML)

SEMESTER I									
Course Code	**Category**	**Course**	**L**	**T**	**P/D**	**CA**	**FE**	**Total**	**Credits**
25ETBS101	BS-I	Physics	3	-	-	25	75	100	3
25ETBS102	BS-II	Mathematics-I	3	1	-	25	75	100	4
25ETHS103	HS-I	Technical English	2	-	-	25	75	100	2
25ETHS104	HS-II	Heritage of Tamils தமிழர் மரபு	1	-	-	25	75	100	1
25ETES105	ES-I	Basic Electrical and Electronics Engineering	2	-	-	25	75	100	2
25ETES106	ES-II	Basic Mechanical Engineering.	3	-	-	25	75	100	3
25ETBP107	BSP-I	Physics lab	-	-	3	40	60	100	1.5
25ETSP108	ESP-I	Design Thinking	1	-	2	40	60	100	2
25ETSP109	ESP-II	Programming for Problem Solving Lab	-	-	3	40	60	100	1.5
25ETAC110	AC	NCC /NSS/YRC/Sports							-
								Total Credits	20

SEMESTER II									
Course Code	**Category**	**Course**	**L**	**T**	**P/D**	**CA**	**FE**	**Total**	**Credits**
25ETBS201	BS-III	Chemistry	3	-	-	25	75	100	3
25ETBS202	BS-IV	Mathematics-II	3	1	-	25	75	100	4
25ETHS203	HS-III	Universal Human Values	2	-	-	25	75	100	2
25ETHS204	HS-IV	Tamils and Technology தமிழரும் தொழில்நுட்பமும்	1	-	-	25	75	100	1
25ETES205	ES-III	Basic Civil Engineering	3	-	-	25	75	100	3
25ETES206	ES-IV	Environmental Studies	2	-	-	25	75	100	2
25ETSP207	BSP-II	Chemistry Lab	-	-	3	40	60	100	1.5
25ETHP208	HSP-I	English Communication Lab	-	-	3	40	60	100	1.5
25ETSP209	ESP-III	Electrical Wiring and Earthing Practices Lab	-	-	2	40	60	100	1
25ETSP210	ESP-IV	Engineering Graphics & Design	1	-	4	40	60	100	3
								Total Credits	22

SEMESTER III									
Course Code	**Category**	**Course**	**L**	**T**	**P/D**	**CA**	**FE**	**Total**	**Credits**
25CSBS301	BS-V	Mathematics – III	3	-	-	25	75	100	3
25CSES302	ES-V	Fundamentals of Digital Computers	3	-	-	25	75	100	3
25CSPC303	PC-I	Data Structures and Algorithms	3	-	-	25	75	100	3
25CSPC304	PC-II	Object Oriented Programming	3	-	-	25	75	100	3
25CSPC305	PC-III	Computer Organisation and Architecture	3	-	-	25	75	100	3
25CSPC306	PC-IV	Database Management Systems	3	-	-	25	75	100	3
25CSPE307	PE-I		3	-	-	25	75	100	3
25CSCP308	PCP-I	Data Structures and Algorithms Lab	-	-	3	40	60	100	1.5
25CSCP309	PCP-II	Object Oriented Programming Lab	-	-	3	40	60	100	1.5
								Total Credits	24

SEMESTER IV									
Course Code	**Category**	**Course**	**L**	**T**	**P/D**	**CA**	**FE**	**Total**	**Credits**
25CSBS401	BS-VI	Discrete Mathematics	3	-	-	25	75	100	3
25CSES402	ES-VI	Python Programming	3	-	-	25	75	100	3
25CSPC403	PC-V	Operating Systems	3	-	-	25	75	100	3
25CSPC404	PC-VI	Design and Analysis of Algorithms	3	-	-	25	75	100	3
25CSPC405	PC-VII	Computer Graphics and Multimedia	3	-	-	25	75	100	3
25CSPC406	PC-VIII	Microprocessor and Microcontroller	3	-	-	25	75	100	3
25CSPE407	PE-II		3	-	-	25	75	100	3
25CSCP408	PCP-III	Operating System and Database Management System Lab	-	-	3	40	60	100	1.5
25CSCP409	PCP-IV	Computer Graphics and Multimedia Lab	-	-	3	40	60	100	1.5
								Total Credits	24

SEMESTER V									
Course Code	**Category**	**Course**	**L**	**T**	**P/D**	**CA**	**FE**	**Total**	**Credits**
25CSPC501	PC-IX	Theory of Computation	3	-	-	25	75	100	3
25CSPC502	PC-X	Computer Networks	3	-	-	25	75	100	3
25CSPC503	PC-XI	Software Engineering	3	-	-	25	75	100	3
25CSPC504	PC-XII	Machine Learning	3	-	-	25	75	100	3
25CSPE505	PE-III		3	-	-	25	75	100	3
25CSOE506	OE-I		3	-	-	25	75	100	3
25CSCP507	PCP-V	Computer Networks Lab	-	-	3	40	60	100	1.5
25CSCP508	PCP-VI	Machine Learning Lab	-	-	3	40	60	100	1.5
25ETIT509	IT-I	Industrial Training / Rural Internship/Innovation / Entrepreneurship	Four weeks during the summer vacation at the end of IV Semester				100	100	4
								Total Credits	25

SEMESTER VI									
Course Code	**Category**	**Course**	**L**	**T**	**P/D**	**CA**	**FE**	**Total**	**Credits**
25CSPC601	PC-XIII	Compiler Design	3	-	-	25	75	100	3
25CSPC602	PC-XIV	Data Analytics with R	3	-	-	25	75	100	3
25CSHS603	HS-V	Business Management	3	-	-	25	75	100	3
25CSPE604	PE-IV		3	-	-	25	75	100	3
25CSPE605	PE-V		3	-	-	25	75	100	3
25CSOE606	OE-II		3	-	-	25	75	100	3
25CSCP607	PCP-VII	Compiler Design Lab	-	-	3	40	60	100	1.5
25CSCP608	PCP-VIII	Data Analytics with R Lab	-	-	3	40	60	100	1.5
								Total Credits	21

SEMESTER VII									
Course Code	**Category**	**Course**	**L**	**T**	**P/D**	**CA**	**FE**	**Total**	**Credits**
25CSES701	ES-VII	Research Methodology	3	-	-	25	75	100	2
25CSPC702	PC-XV	Digital Image Processing	3	-	-	25	75	100	3
25CSPC703	PC-XVI	Internet of Things	3	-	-	25	75	100	3
25CSPE704	PE-VI		3	-	-	25	75	100	3
25CSPE705	PE-VII		3	-	-	25	75	100	3
25CSOE706	OE-III		3	-	-	25	75	100	3
25CSCP707	PCP-IX	Digital Image Processing Lab	-	-	3	40	60	100	1.5
25CSCP708	PCP-X	Internet of Things Lab	-	-	3	40	60	100	1.5
25ETIT709	IT-II	Industrial Training /Rural Internship/Innovation / Entrepreneurship	Four weeks during the summer vacation at the end of IV Semester				100	100	4
								Total Credits	24

SEMESTER VIII									
Course Code	**Category**	**Course**	**L**	**T**	**P/D**	**CA**	**FE**	**Total**	**Credits**
25CSOE801	OE-IV		3	-	-	25	75	100	3
25CSOE802	OE-V		3	-	-	25	75	100	3
25CSPV803	PV-I	Project Work and Viva Voce	-	PR 10	S 2	40	60	100	6
								Total Credits	12

L	No. of Lecture Hours	**PR**	No. of Hours for Discussion on Project work
T	No. of Tutorial Hours	**S**	No. of Seminar Hours on Industrial Training / Project
P	No. of Practical Hours	**FE**	Final Examination Marks
CA	Continuous Assessment Marks		
Credits	Credit points allotted to that course	**Total**	Total Marks

Code	Category
BS	Basic Science
BSP	Basic Science Practical
ES	Engineering Science
ESP	Engineering Science Practical
HS	Humanities and Social Science
HSP	Humanities and Social Science Practical
PC	Professional Core
PCP	Professional Core Practical
PE	Professional Elective
OE	Open Elective
IT	Industrial Training /Rural Internship/Innovation /Entrepreneurship
PV	Project Work and Viva Voce

Semester	Credits
I	20
II	22
III	24
IV	24
V	25
VI	21
VII	24
VIII	12
Total	**172**

Total Credits: 172

BS-20, BSP -3, ES-18, ESP-7.5, HS-9, HSP-1.5, PC-48, PCP-15, PE-21, OE-15, IT-8, PV-6.

(Note: The Naan Mudhalvan courses may be offered in PE-I/PE-II slots. The student must study Open Elective courses offered by other Departments in FEAT or Naan Mudhalvan courses or SWAYAM/NPTEL courses for the slots OE-I, OE-II, and OE-III. The student may opt to study SWAYAM/NPTEL courses or Open Elective courses offered in the concerned program for OE-IV and OE-V slots.)

PE - PROFESSIONAL ELECTIVES

1. Advanced Java Programming.
2. Web Application Framework.
3. Open Source Programming.
4. Java Full Stack Development.
5. NoSQL Databases.
6. Data Mining.
7. Mobile Computing.
8. Mobile App Development.
9. 5G and Wireless Communication.
10. Cryptography and Network Security.
11. NLP with Deep Learning.
12. Block Chain technology.
13. Big Data Analytics.
14. Web Analytics.
15. Android Security.
16. Engineering Ethics.

17. Soft Computing.
18. Software Engineering and Devops.
19. Edge Computing.
20. Quantum Computing.
21. Cloud Computing.

OE - OPEN ELECTIVES

1. Social Network analysis.
2. Industrial IOT
3. Robotic Process Automation.
4. Android Development
5. Robotics and its Applications.
6. E-commerce and Digital Marketing.
7. Privacy and Security in Internet of Things.
8. Generative Artificial Intelligence.
9. Data analysis using Open Source Tools
10. Entrepreneurship Innovation and Startup.
11. Machine Learning with Application to Objects Recognition (Naan Mudhalvan].
12. Augmented & Virtual Reality (AR & VR) Development [Naan Mudhalvan].
13. Block Chain [Naan Mudhalvan].
14. Cloud Essentials [Naan Mudhalvan].
15. Full Stack (Naan Mudhalvan).

HONORS ELECTIVES

S.No.	Course Coode	Course Name	Credits
1.	25CSHESCN	Software Project Management (or) Nano Computing	4
2.	25CSHESCN	Principles of Artificial Intelligence	4
3.	25CSHESCN	Graph Theory	3
4.	25CSHESCN	Deep Learning (or) Operation Research	3
5.	25CSHESCN	Parallel and Distributed Algorithms	3
6.	25CSHESCN	Digital Watermarking and Steganography	3

MINOR ENGINEERING ELECTIVE COURSE

S.No.	Course Coode	Course Name	Credits
1.	25CSMISCN	Object Oriented Programming	4
2.	25CSMISCN	Database Management Systems (or) Software Engineering	4
3.	25CSMISCN	Computer Networks	3
4.	25CSMISCN	Mobile App Development	3
5.	25CSMISCN	Internet of Things	3
6.	25CSMISCN	Big Data Analytics (or) Social Network Analysis	3

ONE CREDIT COURSES

1. Deep Learning Lab
2. Cloud Computing Lab
3. Data Visualization Lab
4. Mobile Application Development Laboratory
5. Professional Communications

VAC

1. Generative AI
2. IOT for Industry and Healthcare Applications
3. 5G Technologies

25ETBS101	PHYSICS	L	T	P/D	C
		3	0	0	3

Course Objectives:

- To understand the ray of light to undergo the phenomenon of interference and diffraction.
- To understand the principle and various application of Laser.
- To develop knowledge in crystal structure and its properties.
- To understand the energy quantization of subatomic particles like electron.
- Rationalize the law of conservation of energy in solar water heater and solar cells.

UNIT – I MECHANICAL PROPERTIES OF SOLIDS, OSCILLATIONS AND OPTICS

Introduction –Elastic behaviors of solids – Hooke's law – Young's Modulus – Applications of Elastic behaviors of materials –Rectilinear motion – Oscillations or Vibrations–Simple Harmonic motion –Reflection and Refraction of light waves – Total internal reflection – Interference – Newton's Rings – Michelson Interferometer – Theory of Air wedge and Experiment – Diffraction – Diffraction Grating.

UNIT – II LASERS

Introduction – Basic Principles –Energy levels – Ionization and Excitation potentials – Absorption – Spontaneous emission – Stimulated emission – Einstein's Coefficients – Characteristics – Population inversion – Pumping – Methods of Pumping – Active medium – Active center – Types of lasers: Rubylaser – He-Nelaser – Basic applications of lasers in industry..

UNIT – III CRYSTAL PHYSICS

Synthesizing user research - Point-of-view statements - Problem definition and opportunity framing - Design challenges and "How Might We" questions- Exercise on Problem Framing

UNIT – IV QUANTUM MECHANICS

Heisenberg uncertainty Principle –Dual nature of Matter and radiation – Properties of Matter waves – De Broglie's Wave length –De Broglie wavelength of an electron – The Schrödinger wave Equation – Schrödinger's time dependent and independent wave equations– The Wave function and its physical significance – The particle in a box Problem (one dimensional box)

UNIT – V ENERGY PHYSICS

Introduction to energy sources– Energy sources and their availability (Conventional and Non- conventional energy sources)solar energy – Methods of Harvesting solar energy – Solar heat collector – solar water heater and solar cells–Wind energy - Basic principle and components of Wind Energy Conversion System (WECS) – Application of wind energy – Biomass – Biogas Generation – Classification of Biogas plants –Properties and application of Biogas.

Text Books:

1. Arumugam. M., "Engineering Physics", Anuradha agencies, 2nd Edition, 1997.
2. John Twidell & Tony Weir, " Renewable Energy Resources", Taylor & Francis, 2005.
3. Avadhanulu. M.N. and Kshirsagar P.G., "A Text Book of Engineering Physics", S. Chand & Company Ltd., 7th Enlarged Revised Ed., 2005.
4. Gaur R.K. and Gupta S.L., "Engineering Physics", Dhanpat Rai Publishers, New Delhi, 2003.
5. Rai.G.D., "Solar Energy Utilization", Volume-1 & 2 by Khanna Publishers, New Delhi.
6. Pajput. R.K. Non–Conventional energy sources and Utilization – S.Chand Publication – 2013.

References:

1. Rajendran.V , "Engineering Physics", Tata McGraw Hill publishers, 2009.
2. Rai G.D., "Non-conventional Energy sources", Khauna Publications, 1993.
3. Mani. P. "Engineering Physics", Dhanam Publication, Chennai, 2011.
4. Agarwal.M.P, "Solar Energy", S.Chand& Co., I Edn, New Delhi, 1983..

Course Outcomes:

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

1. Explain the fundamental concepts of elasticity, oscillations, optics, crystal structures, quantum mechanics and energy sources relevant to engineering applications.
2. Apply the principles of oscillations, optics, laser technology and crystal physics to solve engineering and scientific problems.
3. Analyze the behavior of materials, wave phenomena, crystal structures and quantum mechanical systems using physical laws and mathematical models.
4. Evaluate the performance and applications of lasers, renewable energy systems and modern physical concepts in engineering practices.
5. Develop scientific approaches for applying modern physics concepts and sustainable energy technologies in mechanical and industrial engineering applications.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	–	–	–	2	–	–	–	–	1	3	1	1
CO2	3	3	2	2	–	2	–	–	–	–	1	3	3	2
CO3	3	3	2	2	1	2	–	–	–	–	1	3	3	2
CO4	3	3	2	2	–	2	–	–	–	2	1	3	3	2
CO5	2	3	3	2	3	2	1	1	–	2	2	3	3	3

25ETBS102	MATHEMATICS - I	L	T	P	C
		3	1	0	4

Course Objectives:

- To familiarize definite integrals and its application in finding area and volume.
- To introduce the fundamentals of functions of single variable.
- To make the student to learn infinite series and its nature.
- To introduce the fundamentals of Multivariable Differential Calculus
- To introduce the fundamentals of Multivariable Integral Calculus

UNIT – I BASIC CALCULUS

Curvature, Evolutes and Involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

UNIT – II SINGLE-VARIABLE CALCULUS (DIFFERENTIATION)

Rolle's Theorem, Mean value theorems and applications; Extreme values of functions; Indeterminate forms and L'Hospital's rule.

UNIT – III SEQUENCES AND SERIES

Convergence of sequence and series-tests for convergence: Comparison test (only for series with positive terms)-D'Alembert's ratio test-Cauchy's root test-Integral test-Leibnitz's test (Alternating series).

UNIT – IV MULTIVARIABLE CALCULUS (DIFFERENTIATION)

Limit, continuity and partial derivatives, total derivative; Euler's theorem; Jacobians; Taylor and Maclaurin series; Maxima, minima and saddle points; Method of Lagrange multipliers.

UNIT – V MULTIVARIABLE CALCULUS (INTEGRATION)

Double integrals (Cartesian)- change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: Area as a double integral. Triple integrals (Cartesian), Volume as a triple integral.

Text Books:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36thEdition, 2010

References:

1. Reena Garg, Mathematics-II (Calculus, Ordinary Differential Equations and Complex Variable), Khanna Book Publishing Co, 2023
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson publishers,,2002.
3. Erwin kreyszig, Advanced Engineering Mathematics, 9thEdition, John Wiley &Sons,2006.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi,11th Reprint, 2010.

5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint,2008.

Course Outcomes:

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

1. Explain the fundamental concepts of calculus, sequences, series and multivariable differentiation and integration required for solving engineering problems.
2. Apply differential and integral calculus techniques to determine curvature, surface areas, volumes and extreme values in engineering applications.
3. Analyze the convergence of sequences and series using appropriate mathematical tests and interpret their significance in engineering computations.
4. Evaluate multivariable functions using partial differentiation, Jacobians, Taylor series and optimization techniques for engineering models.
5. Develop mathematical models using double and triple integrals for solving complex engineering problems involving area and volume computations.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	–	–	–	2	–	–	–	–	1	3	1	1
CO2	3	3	2	2	–	2	–	–	–	–	1	3	3	2
CO3	3	3	2	2	1	2	–	–	–	–	1	3	3	2
CO4	3	3	2	2	–	2	–	–	–	2	1	3	3	2
CO5	2	3	3	2	3	2	1	1	–	2	2	3	3	3

25ETHS103	**TECHNICAL ENGLISH**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

Course Objectives:

- To ensure the students with good vocabulary
- To make the students participate actively in writing activities
- To practice the unique qualities of professional writing style
- To develop the students the proficiency in communicative skills
- To ensure the students to face the demand of their profession

UNIT – I VOCABULARY BUILDING

1.1 The concept of Word Formation

1.2 Root words from Foreign languages (Greek, Latin and French) and their use in English

1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Count and Non count nouns.

1.4 Synonyms, antonyms and standard abbreviations.

1.5 Homophones, Homonyms, and one word substitution.

UNIT – II BASIC WRITING SKILLS

2.1 Use of phrases and clauses in sentences.
2.2 Sentence Structures and Transformation of Sentences.
2.3 Importance of proper punctuation.
2.4 Creating coherence and Techniques for writing precisely.
2.5 Note making Techniques

UNIT – III IDENTIFYING COMMON ERRORS IN WRITING

3.1 Subject-verb Agreement
3.2 Noun, Pronoun Agreement
3.3 Articles and Prepositions
3.4 Active and Passive voice
3.5 Common errors in writing

UNIT – IV NATURE AND STYLE OF SENSIBLE WRITING

4.1 Describing and Defining
4.2 Classifying and Providing Evidences and Examples with Introduction and Conclusion
4.3 Essay Writing–Writing analytical essays and issue-based essays.
4.4 Comprehension
4.5 Letter Writing – Formal, Informal and Job application with CV

UNIT – V WRITING PRACTICES AND ORAL COMMUNICATION

5.1 Dialogue Writing and conversation in the work place
5.2 Report Writing – Preparing agenda, Minutes of meeting and a Circular
5.3 Mechanics of Presentation
5.4 Public speaking and Interview Skills
5.5 E-mail– etiquette

Text-Cum-Reference Books

1. Practical English Usage, Michael Swan, Oxford University Press, 2016.
2. Remedial English Grammar, F.T.Wood.Macmillan, 2007.
3. On Writing Well, William Zinsser, Harper Resource Book, 2001
4. Study Writing, Liz Hamp-Lyonsand Ben Heasly, Cambridge University Press. 2006.
5. Communication Skills, Sanjay Kumar and Pushp Lata, Oxford University Press. 2011.
6. Exercises in Spoken English, Parts. I-III, CIEFL, Hyderabad. Oxford University Press.
7. Raman Meenakshi and Shama, Sangeetha –Technical CommunicationPrinciples and Practice, Oxford University Press, New Delhi, 2014.

Course Outcomes:

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

1. Comprehend, to write creatively and improve speaking skills. Get an exposure of vocabulary and gain a good glossary.
2. Get knowledge regarding the use of grammar while conversing and writing.
3. Acquire a knowledge of remembering, understanding, applying, analyzing, evaluating & creative writing.

4. Develop the skill to articulate effectively to a various of listeners.
5. Acquire ability to speak and write effectively in English.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	2	-	2	-	-	-	-	3	-	3	-	2	-
CO2	-	2	-	2	2	-	-	-	3	-	3	-	2	-
CO3	-	-	3	-	-	2	2	-	3	-	3	-	-	3
CO4	-	-	2	-	2	2	2	-	3	-	3	-	-	2
CO5	-	-	3	2	-	-	-	2	3	-	3	-	-	3

25ETHS104	HERITAGE OF TAMILS தமிழர் மரபு	L	T	P	C
		1	0	0	1

அலகு I: மொழி மற்றும் இலக்கியம்: 3

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் –சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II: மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை: 3

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள்– பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III: நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்: 3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு IV: தமிழர்களின் திணைக் கோட்பாடுகள்: 3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறை முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V: இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு: 3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் – தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

UNIT – I

Language and Literature: Language Families in India - Dravidian Languages -Tamil as a Classical Language - Classical Literature in Tamil - Secular Nature of Sangam Literature –Distributive Justice in Sangam Literature –Management Principles in Thirukural –Tamil Epics and Impact of Buddhism &Jainismin in Tamil Land –Bakthi Literature Azhwars and Nayanmars.- Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT – II

Heritage - Rock art paintings to modern art - Sculpture: Hero stone to modern sculpture –Bronze icons –Tribes and their handicrafts-Art of temple car making –Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT – III

Folk and Martial arts - Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT – IV

Thinai concept of Tamils -Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT – V

Contribution of Tamils to Indian National Movement and Indian Culture: Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India -Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine -Inscriptions & Manuscripts -Print History of Tamil Books.

Text-Cum-Reference Books

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
   கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
   பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
3. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL -(in print)
4. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

5. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of TamilStudies).
6. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of TamilStudies.)
7. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, TamilNadu)
8. StudiesintheHistoryofIndiawithSpecialReferencetoTamilNadu(Dr.K.K.Pillay)(Publishedby: The Author)
9. Porunai Civilization(JointlyPublishedbyDepartmentofArchaeology&TamilNaduText Book and Educational Services Corporation, TamilNadu)
10. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book

Course Outcomes:

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

1. Explain the evolution of Tamil language, literature, culture and heritage through Sangam literature, epics and Bhakti literature.
2. Apply the knowledge of Tamil heritage, arts, architecture and cultural traditions to understand the socio-economic development of Tamil society.
3. Analyze the significance of folk arts, martial arts, ancient trade practices and Thinai concepts in shaping Tamil civilization and cultural identity.
4. Evaluate the contribution of Tamil culture, Siddha medicine, inscriptions and freedom movements towards Indian society and national development.
5. Develop awareness and appreciation of Tamil cultural values, ethical principles and heritage for social harmony and lifelong learning.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	–	–	–	2	–	–	–	–	1	3	1	1
CO2	3	3	2	2	–	2	–	–	–	–	1	3	3	2
CO3	3	3	2	2	1	2	–	–	–	–	1	3	3	2
CO4	3	3	2	2	–	2	–	–	–	2	1	3	3	2
CO5	2	3	3	2	3	2	1	1	–	2	2	3	3	3

25ETES105	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**	**L**	**T**	**P/D**	**C**
		2	**0**	**0**	**2**

Course Objectives:

- Understand the fundamental principles of electrical circuits and their analysis
- Explore the construction, working principles, and applications of various electrical machines

- Gain knowledge of electrical measurement techniques and instrumentation used in the measurement of electrical parameters
- Develop an understanding of analog electronics and their applications
- To teach the basics of digital electronics.

UNIT – I ELECTRICAL CIRCUITS

DC Circuits-Basic circuit elements and sources-Ohm's law- Kirchhoff's laws- AC Circuits-Alternating voltages and currents-RMS, average, maximum values- real power, reactive power and apparent power- Power Factor- Three phase balanced systems-Star and delta connections (simple problems only)

UNIT – II ELECTRICAL MACHINES

Construction, working principle, types and applications of DC Machines, Transformers, Three phase Induction motors, Three-phase Alternators, Three-phase Synchronous Motors, Single phase induction motors and universal motor.

UNIT – III MEASUREMENTS AND INSTRUMENTATION

Functional elements of an instrument, Construction, Operating Principle, types-Moving Coil and Moving Iron meters, Dynamometer Wattmeter, Energy Meter, Instrument Transformers-CT and PT

UNIT – IV ANALOG ELECTRONICS

Characteristics: PN junction diode, Zener diode, BJT- Applications: Rectifier, Voltage regulator, Operational amplifier

UNIT – V DIGITAL ELECTRONICS

Number system – Logic Gates – Boolean Algebra– De-Morgan's Theorem – Half Adder and Full Adder – Flip Flops- multiplexers and de-multiplexers

Text Books:

1. Kandasamy P, Tilagavathy K and Gunavathy K, Engineering Mathematics", 6th edition, (Vol I & II) S. Chand & Co Ltd. New Delhi, 2006.
2. Ventakataraman M K, "Engineering Mathematics", The National Publishing Co., Chennai, 2003.

References:

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", McGraw Hill Education, 2019.
2. S. K. Bhattacharya, Basic Electrical and Electronics Engineering, Pearson India, 2017
3. R. K. Rajput, Basic Electrical and Electronics Engineering, Laxmi Publications, 2013

Course Outcomes:

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

1. Describe the fundamental principles, characteristics, operating concepts and applications of electrical circuits, machines, measuring instruments, analog devices and digital circuits.
2. Apply electrical, measurement, electronic and digital principles to solve basic problems involving circuits, machines, instrumentation, analog and digital systems.
3. Analyze the behaviour and performance of electrical circuits, machines, measurement systems, analog circuits and digital systems using appropriate engineering principles.
4. Evaluate the performance, accuracy, efficiency, suitability and limitations of electrical and electronic systems for specified engineering applications.
5. Design basic integrated electrical and electronic systems by combining circuit, machine, measurement, analog and digital concepts to meet specified requirements.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	–	–	–	–	–	–	1	1	–	3	1	1
CO2	3	3	2	2	2	–	1	–	1	1	–	3	3	2
CO3	3	3	2	3	2	–	1	–	1	1	–	3	3	2
CO4	3	3	3	2	2	1	2	1	1	1	1	3	3	2
CO5	3	3	3	2	3	2	2	1	2	2	2	3	3	3

25ETES106	BASIC ENGINEERING - MECHANICAL	L	T	P	C
		3	0	0	3

Course Objectives:

- To familiarize the functions of different types of Boilers and Turbines
- To provide basic knowledge about the functions of Internal Combustion Engines and Electric Vehicles
- To provide fundamental knowledge on the various conventional machining operations and Metal forming operations
- To illustrate the concepts of various metal joining techniques, brazing and soldering
- To understand the fundamentals of CNC machining and Additive Manufacturing process

UNIT – I

Steam generators: Boilers – Classification –Construction and working of Cochran boiler and Babcock & Wilcox boiler –Boiler Mountings and Accessories – Pressure gauge, Water level indicator, Safety valve— Applications of Boilers. Prime Movers: Steam turbines –Types – Working Principles of Impulse and Reaction turbines – Comparison – Gas turbines: Working Principles of Open cycle and Closed cycle gas turbines.

UNIT – II

Internal Combustion Engines: Classification – Description and of I.C. engines– Two stroke - Four stroke– Comparison – Petrol and diesel engines –Comparison - Fuel system for Petrol and Diesel engines – Concepts of CRDI and MPFI fuel injection systems – Applications– Electric Vehicles: Architecture - Battery Electric Vehicles (BEV) - Hybrid Electric vehicles (HEV).

UNIT – III

Metal Machining: Description and Types of operations performed on various machine tools -Lathe, Drilling machine and Milling machine. Metal Forming: Hot and cold working - Principle of forging –Types –Rolling: definition - roll mill configurations - Extrusion: Definition –Direct and indirect extrusion.

UNIT – IV

Metal Casting: Green Sand Molding –Principle - Steps – Solid and split pattern - Injection Molding Metal Joining: Gas welding -Oxy-acetylene welding – principle– Equipment - Advantages and Disadvantages – Arc welding: Shielded Metal Arc Welding (SMAW) - principle – Equipment - Advantages and Disadvantages. Brazing – Soldering - comparison.

UNIT – V

Computer Numerical Control (CNC)machining – Classifications – co-ordinates – codes - Applications – Advantages - Limitations – Machining centre – concept. Additive Manufacturing Process – Definition - Classifications - Stereo-lithography (SLA) process – Direct Metal Laser Sintering (DMLS) - Applications - Advantages – Disadvantages.

Text Books:

1. Prabhu, T, J.Jaiganesh Vand Jebaraj S. (2000).Basic Mechanical Engineering, Scitech Publications Pvt. Ltd., Chennai.
2. Venugopal and Prabhuraj T J. (1996). Basic Mechanical Engineering, ARS publishers, Sirkali.
3. P. Radhakrishnan, S.Subramanyan. (1994). CAD/CAM/CIM, New Age International Publishers pvt, Ltd, New Delhi.

References:

1. Hajra Choudhury S. K., Nirjhar Roy, Hajra Choudhury A. K.(2008). Elements of Workshop Technology (Vol 1 and Vol II), Media Promoters Pvt. Ltd.
2. RaoP.N.(2013).Manufacturing Technology: Foundry, Formingand Welding–Vol1, McGraw Hill Education.
3. Steven R.Schmid, SeropeKalpakjian. (2009). Manufacturing Processes for Engineering Materials (English), 5th Edition, Pearson India.

Course Outcomes:

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

1. Explain the working principles of boilers, turbines, internal combustion engines, manufacturing processes and modern machining techniques used in mechanical engineering.
2. Apply the concepts of thermal engineering, IC engines, machining and metal forming processes in manufacturing and industrial applications.
3. Analyze the performance and operational characteristics of thermal systems, machining operations, welding processes and metal forming techniques.
4. Evaluate suitable casting, joining, CNC machining and additive manufacturing methods for specific engineering and industrial requirements.
5. Develop engineering solutions using advanced manufacturing technologies, modern machining systems and sustainable thermal engineering practices.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	–	–	–	2	–	–	–	–	1	3	1	1
CO2	3	3	2	2	–	2	–	–	–	–	1	3	3	2
CO3	3	3	2	2	1	2	–	–	–	–	1	3	3	2
CO4	3	3	2	2	–	2	–	–	–	2	1	3	3	2
CO5	2	3	3	2	3	2	1	1	–	2	2	3	3	3

25ETBP107	PHYSICS LABORATORY	L	T	P/D	C
		0	0	3	1.5

Course Objectives:

- To develop a strong understanding of wave optics and interference phenomena by performing experiments such as Air Wedge, Newton's Rings, and Young's Double Slit.
- To gain hands-on experience with optical instruments like spectrometers and diffraction gratings for determining wavelengths and dispersive properties of light sources.
- To experimentally determine mechanical properties of materials, including Young's modulus, moment of inertia, and rigidity modulus using bending and torsion methods.
- To explore classical mechanics through pendulum-based experiments, enabling the calculation of time periods, acceleration due to gravity, and related physical constants.
- To investigate fluid and wave dynamics, including viscosity measurements and ultrasonic velocity in liquids using acoustic diffraction methods.
- To understand various materials, methods and special structures in the field of Civil Engineering.

LIST OF EXPERIMENTS

1. **Air-Wedge;** To determine the thickness(diameter) of a thin wire by forming interference fringes.

2. **Newtons rings;** To find the radius of curvature of the given plano convex lens by the Newton's rings.

3. **Dispersive power of the prism;** To find the dispersive power of the material of the prism using spectrometer.

4. **Spectrometer Grating;** To determine the wavelength of the prominent spectral lines of the Mercury(Hg) spectrum using grating.

5. **Laser Grating;** To determine the wavelength of a given laser source by using diffraction grating method

6. **Youngs Modulus - Non-Uniform bending;** To find the Young's modulus of the material of a uniform bar (metre scale) by non-uniform bending.

7. **Youngs Modulus -Uniform bending;** To determine the Youngs modulus of the beam (metre scale) by uniform bending

8. **Simple Pendulum;**To determine the time period of a simple pendulum for different lengths.

9. **Torsion Pendulum;** To determine (i) Moment of inertia of a disc and (ii) Rigidity modulus of a wire by torsional pendulum.

10. **Compound Pendulum;** To determine the value of acceleration due to gravity(g) using compound pendulum

11. **Acoustic diffraction grating;** To determine the ultrasonic velocity in liquid by acoustical grating method.

12. **Co-efficient of Viscosity by Stokes method;** To verify stokes law and hence to determine the co-efficient of viscosity of a highly viscous liquid.

13. **Youngs double slit experiment;** To determine the nature of the light by observing interference patterns using double slit.

Course Outcomes:

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

1. Explain the fundamental principles of optics, elasticity, oscillations, acoustics and viscosity involved in physics laboratory experimnts.
2. Perform physics experiments using standard laboratory instruments to determine optical, mechanical and acoustic properties of materials and systems.
3. Analyze experimental observations and measurement data to evaluate physical parameters such as wavelength, Young's modulus, viscosity and rigidity modulus.
4. Evaluate the accuracy, precision and reliability of experimental results through error analysis and interpretation of physical phenomena.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	–	–	–	2	–	–	–	–	1	3	1	1
CO2	3	3	2	2	–	2	–	–	–	–	1	3	3	2
CO3	3	3	2	2	1	2	–	–	–	–	1	3	3	2
CO4	3	3	2	2	–	2	–	–	–	2	1	3	3	2
CO5	2	3	3	2	3	2	1	1	–	2	2	3	3	3

25ETSP108	DESIGN THINKING	L	T	P/D	C
		1	0	2	2

Course Objectives:

- To introduce the concept and principles of design thinking.
- To develop empathy and understanding of users through observation and research.
- To foster creative problem-solving and ideation skills.
- To equip students with prototyping and testing techniques.
- To encourage a user-centered mindset in real-world problem solving.

UNIT – I INTRODUCTION TO DESIGN THINKING

Definition, history, and evolution - Principles and mindset of design thinking - Design thinking vs. traditional problem-solving - Overview of the 5-step process: Empathize, Define, Ideate, Prototype, Test.

UNIT – II EMPATHIZE – UNDERSTANDING USERS

Importance of empathy in design - User research methods: interviews, observation, shadowing - Empathy mapping - Identifying user pain points and needs-Exercise on Empathizing.

UNIT – III DEFINE – FRAMING THE PROBLEM

Synthesizing user research - Point-of-view statements - Problem definition and opportunity framing - Design challenges and "How Might We" questions- Exercise on Problem Framing

UNIT – IV IDEATE – GENERATING IDEAS

Divergent and convergent thinking - Brain storming techniques - Story boarding and sketching ideas - Evaluating and selecting ideas. Edward de Bono's Lateral Thinking: Random Entry Idea Generation; Challenge and Provocation Techniques, Concept Extraction-Exercise on Idea Generation.

UNIT – V PROTOTYPE AND TEST

Importance of prototyping in design thinking - Types: low-fidelity vs high-fidelity, digital vs physical - Storyboards, wireframes, role-playing- User testing methods: Think-Aloud, A/B testing-Iterative improvement cycles-Reflecting and learning loops.

Text Books:

1. Brown, Tim. “Change by Design: How Design Thinking Creates New Alternatives for Business and Society”, Harvard Business Review Press, 2009.
2. Liedtka, Jeanne, and Tim Ogilvie. “Designing for Growth: A Design Thinking Tool Kit for Managers”, Columbia University Press, 2011.
3. De Bono, Edward, “Lateral Thinking: Creativity Step by Step”, Harper Perennial, 2015.

References:

1. Kolko, Jon. “Well-Designed: How to Use Empathy to Create Products People Love”.Harvard Business Review Press, 2014.
2. Cross, Nigel.“Design Thinking: Understanding How Designers Think and Work”. Berg Publishers, 2011.
3. Ball, Philip. “Critical Mass: How One Thing Leads to Another”. Farrar, Straus and Giroux, 2006.
4. Norman, Donald A, “The Design of Everyday Things”, Basic Books, RevisedEdition,2013.

Course Outcomes:

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

1. Explain the principles, stages and importance of design thinking in solving engineering and societal problems.
2. Apply empathy and user research techniques to identify customer needs, user pain points and design challenges effectively.
3. Analyze engineering problems using problem-framing, brainstorming and lateral thinking techniques to generate innovative ideas.
4. Evaluate alternative design solutions through prototyping, testing and iterative improvement methods for user-centered applications.
5. Develop creative and sustainable engineering solutions using design thinking methodologies and collaborative practices for real-world problems.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	–	–	–	2	–	–	–	–	1	3	1	1
CO2	3	3	2	2	–	2	–	–	–	–	1	3	3	2
CO3	3	3	2	2	1	2	–	–	–	–	1	3	3	2
CO4	3	3	2	2	–	2	–	–	–	2	1	3	3	2
CO5	2	3	3	2	3	2	1	1	–	2	2	3	3	3

25ETSP109	**PROGRAMMING FOR PROBLEM SOLVING LABORATORY**	**L**	**T**	**P/D**	**C**
		0	**0**	**3**	**1.5**

Course Objectives:

- To enable students to code, compile and test C programs.
- To enable students to design algorithms using appropriate programming constructs for problem solving.
- Identify tasks in which the numerical techniques learned are applicable and apply them to write programs.
- To enable students to segregate large problems into functions using modular programming concepts.
- To enable students to apply pointer and structures in programs effectively.

List of Experiments:

1. Familiarization with programming environment
2. Simple computational problems using arithmeticexpressions
3. Problems involving if-then-else structures
4. Iterative problems e.g., sum of series
5. 1D Arrays: searching, sorting
6. 2D arrays and Strings
7. Simple functions
8. Programming for solving Numerical methods
9. Pointers, structures and dynamic memory allocation

1. File handling

Tutorial 1: Problem solving using computers
Lab1: Familiarization with programming environment
Tutorial 2: Variable types and type conversions
Lab 2: Simple computational problems using arithmetic expressions
Tutorial 3: Branching and logical expressions
Lab 3: Problems involving if-then-else structures
Tutorial 4: Loops, while and for loops
Lab 4: Iterative problems e.g., sum of series
Tutorial 5: 1D Arrays: searching, sorting
Lab 5: 1D Array manipulation
Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations
Tutorial 7: Functions, call by value:
Lab 7: Simple functions
Tutorial 8 and 9: Numerical methods (Root finding, numerical differentiation, numerical integration)
Lab 8 and 9: Programming for solving Numerical methods
Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions
Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures
Tutorial 12: File handling
Lab 12: File operations

Course Outcomes:

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

1. Explain the fundamentals of programming concepts, data types, control structures and problem-solving techniques using computers.
2. Apply programming constructs, arrays, functions and file handling techniques to solve computational and engineering problems.
3. Analyze engineering and numerical problems using appropriate programming logic, recursion, pointers and data structures.
4. Evaluate suitable algorithms, numerical methods and programming approaches for efficient problem solving and software development.
5. Develop structured computer programs using modular programming concepts and dynamic memory techniques for engineering and scientific applications.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	1	–	–	–	–	–	1	–	2	–
CO2	3	3	2	1	2	–	–	–	–	–	–	1	3	1
CO3	2	3	1	2	2	–	–	–	–	–	1	2	3	2
CO4	2	2	2	3	2	–	–	–	–	–	1	–	2	2
CO5	2	2	3	2	2	–	–	–	–	–	1	2	2	3

25ETBS201	CHEMISTRY	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand water treatment techniques and basic knowledge on surface chemistry.
- To provide knowledge on electrochemical cells and chemistry involved in corrosion.
- To learn various processes involved in fuel refining and mechanism involved in energy storage devices.
- To develop knowledge about synthesis of various types of polymers, nano materials and Phase rule.
- To get basic knowledge on Refractories, Lubricants, Spectroscopical techniques and Explosives

UNIT – I WATER CHEMISTRY AND SURFACE CHEMISTRY

Hardness of water–Types –Units - Estimation of hardness by EDTA method. Softening of hard water by Ion exchange method and Zeolite method. Desalination of brackish water by Reverse Osmosis. Boiler feed water–boiler troubles – Internal treatment methods. Municipal water treatment –Sedimentation, Coagulation, Filtration, Sterilization –– Break point chlorination.Adsorption –Types of Adsorption –Freundlich and Langmuir adsorption isotherms –Applications of adsorption.

UNIT – II ELECTROCHEMISTRY AND CORROSION

Electrode potential–Electrochemical cell–Measurement of EMF–Nernst equation for cell EMF– Concentration cells– Electrochemical series – Conductometry – Conductance, Specific conductance (molar and equivalent), Cell constant–Conductometric titrations (types of acid-base titrations). Potentiometry–Principle, Acid–base titration.Corrosion – Dry and wet corrosion – Galvanic and Concentration cell corrosion (Pitting) – Control of corrosion – Cathodic Protection (Sacrificial anodic method, Impressed voltage method) – Metal coatings –Galvanizing and Tinning.

UNIT – III FUELS AND STORAGE DEVICES

Fuels– Calorific values (HCV and LCV)– Classification– Coal - Analysis of coal (Proximate and Ultimate analysis)– Crude Petroleum- Refining and fractional distillation- Cracking of heavy oil (Fixed bed Method)– Synthetic petrol (Fischer–Tropsch process). Gaseous Fuel (Producer gas, Water gas LPG, CNG). Flue gas analysis using Orsat apparatus. Batteries– Primary cell- Dry cell (Leclanche cell, Alkali cell)- Secondary cell (Lead acid storage battery, Ni-Cd battery, Lithium -ion battery)– Flow Cell (H_2-O_2 fuel cell and Solid oxide fuel cell).

UNIT – IV POLYMERS, NANO MATERIALS AND PHASE RULE

Polymers – Polymerization – Types (Addition, condensation and copolym0.erization) – Mechanismof addition polymerization (Free radical). Plastics– Types (Thermoplastics and Thermosetting plastics) – Preparation, properties and uses of polyethylene, polyvinyl chloride, polystyrene, Nylon and Bakelite. Elastomers – Vulcanization – Synthetic Rubber (Buna-S, Buna-N, Neoprene) – Silicone Rubber.Nanochemistry – Introduction to nano-materials– Synthesis (Precipitation, sol-gel, Electro deposition and chemical vapour deposition methods) - Carbon nano tubes, Fullerenes, Nano wires and Nano rods.Phase Rule– Introduction, Definition of terms with examples. One component system (Water and Sulphur).

UNIT – V ENGINEERING MATERIALS SPECTROSCOPIC TECHNIQUES AND EXPLOSIVES

Refractories – Classification, characteristics (Refractoriness, RUL, Thermal spalling, porosity) and uses, Lubricants – Classification, properties (cloud and pour point, flash and fire point, viscosity index) and applications. Principles of spectroscopy – Beer – Lambert's Law– UV Visible and IR spectroscopy– Basic principles and instrumentation (block diagram).Explosives– Structure, Preparation, properties and uses of some important explosives (Lead azide, Dynamite, TNT, PETN and RDX).

Text Books:

1. Jain, P.C. and Monica Jain (2010) "Engineering Chemistry" Dhanpat Rai &Sons, New Delhi
2. Dara, S.S. and Umare, S.S. (2014) "Text Book of Engineering Chemistry" S. Chand & Co. Ltd., New Delhi.
3. Gopalan, R., Venkappaya, D. and Nagarajan, S. (2008) "Engineering Chemistry"Tata Mc Graw Publications Ltd., New Delhi.
4. Puri, B.R., Sharma, L.R. and Pathania, M.S. (2013) "Principles of Physical Chemistry" Vishal Publication Company, New Delhi.
5. Sharma, Y.R. (2010) "Elementary Organic Spectroscopy, Principle and Chemical Applications" S. Chand Publishers, New Delhi.
6. Asim K Das and Mahua Das (2017) "An Introduction to Nanomaterials and Nanoscience" CBS Publishers & Distributors Pvt. Ltd., New Delhi.

Course Outcomes:

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

1. Explain the principles of water treatment methods, adsorption phenomena, electrochemical processes, corrosion mechanisms and engineering materials used in mechanical engineering applications.
2. Apply water softening, desalination, electrochemical and corrosion control techniques for solving engineering problems related to industrial and municipal applications.
3. Analyze the characteristics and performance of fuels, batteries, fuel cells, polymers and nanomaterials for suitable mechanical engineering applications.
4. Evaluate the properties, performance and suitability of engineering materials, lubricants, refractories and spectroscopic techniques for industrial and research applications.
5. Develop appropriate material selection, energy storage and corrosion prevention strategies using modern engineering concepts for sustainable mechanical engineering systems.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	–	–	–	2	–	–	–	–	1	3	1	1
CO2	3	3	2	2	–	2	–	–	–	–	1	3	3	2
CO3	3	3	2	2	1	2	–	–	–	–	1	3	3	2
CO4	3	3	2	2	–	2	–	–	–	2	1	3	3	2
CO5	2	3	3	2	3	2	1	1	–	2	2	3	3	3

25ETBS202	MATHEMATICS – II	L	T	P	C
		3	1	0	4

Course Objectives:

- To familiarize linear system of equation and matrices.
- To solve ordinary differential equations of first and second order.
- To make the student to learn vector differentiation and integration.
- To acquaint the student with the techniques in the theory of analytic functions.
- To Introduce the fundamentals of complex integrations.

UNIT – I MATRICES

Linear Systems of Equations; Linear Independence; Rank of a Matrix; Determinant, Inverse of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigenvalues and eigenvectors; Orthogonal transformation; Diagonalization of matrices; Cayley-Hamilton Theorem.

UNIT – II ORDINARY DIFFERENTIAL EQUATIONS

Exact, linear and Bernoulli's equations. Second order linear differential equations with constant coefficients, Second order linear differential equations with variable coefficients: Euler-Cauchy equations, solution by variation of parameters

UNIT – III VECTOR CALCULUS

Vectors-Gradient, divergence and curl- Directional derivative-unit normal vector-Irrotational and Solenoidal vectors- Line, Surface and Volume integrals - Gauss divergence theorem (without proof) - Green's theorem in the plane (without proof) – Stokes theorem (without proof).Verification of the above theorems.

UNIT – IV COMPLEX VARIABLE – DIFFERENTIATION

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

UNIT – V COMPLEX VARIABLE – INTEGRATION

Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof).

Text Books:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36thEdition, 2010.

References:

1. Reena Garg, Engineering Mathematics, Khanna Book Publishing Company, 2022.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson publishers, Reprint,2002.
3. Erwin kreyszig, Advanced Engineering Mathematics,9thEdition, John Wiley &Sons,2006.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi,11th Reprint, 2010.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

Course Outcomes:

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

1. Explain the fundamental concepts of matrices, differential equations, vector calculus and complex variables used in engineering mathematics.
2. Apply matrix methods, differential equations and vector calculus techniques to solve engineering and scientific problems.
3. Analyze systems of linear equations, eigenvalue problems, vector fields and complex functions using mathematical principles and transformations.
4. Evaluate mathematical models and analytical methods involving complex integration, conformal mapping and differential equation techniques for engineering applications.
5. Develop mathematical solutions and analytical approaches for solving complex mechanical and engineering problems using advanced calculus and linear algebra concepts.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	–	–	–	2	–	–	–	–	1	3	1	1
CO2	3	3	2	2	–	2	–	–	–	–	1	3	3	2
CO3	3	3	2	2	1	2	–	–	–	–	1	3	3	2
CO4	3	3	2	2	–	2	–	–	–	2	1	3	3	2
CO5	2	3	3	2	3	2	1	1	–	2	2	3	3	3

25ETHS203	UNIVERSAL HUMAN VALUES	L	T	P	C
		2	0	0	2

Course Objectives:

- To impart of a holistic perspective based on self-exploration about themselves (human being), family, society and nature / existence.
- To develop clarity about the harmony within the human being, as well as in the family, society and nature / existence.
- To strengthen the capacity of self-reflection.
- To foster commitment and courage to act to act in alignment with universal human values.
- To equip students with the knowledge and skills to address problems through sustainable and ethical solutions.

UNIT – I **COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION**

1.1 Purpose and motivation for the course, recapitulation from Universal Human Values-I.

1.2 Self-Exploration–what is it? - Its content and process; Natural Acceptance and Experiential Validation- as the process for self-exploration.

1.3 Continuous Happiness and Prosperity- A look at basic Human Aspirations.

1.4 Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority.

1.5 Understanding happiness and Prosperity correctly-A critical appraisal of the current scenario.

1.6 Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

UNIT – II UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF!

2.1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'.

2.2. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility.

2.3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer).

2.4. Understanding the characteristics and activities of 'I' and harmony in ' I'.

2.5. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.

2.6. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs. dealing with disease

UNIT – III UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMAN-HUMAN RELATIONSHIP

3.1 Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure. mutual happiness; Trust and Respect as the foundational values of relationship.

3.2 Understanding the meaning of Trust; Difference between intention and competence.

3.3 Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.

3.4 Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals.

3.5 Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life example, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

UNIT – IV UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE

4.1 Understanding the harmony in the Nature.

4.2 Interconnectedness and mutual fulfilment among the four orders of nature-recyclability and self- regulation in nature.

4.3 Understanding Existence as Co-existence of mutually interacting units in all-pervasive space.

4.4 Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT – V IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS

5.1 Natural acceptance of human values.
5.2 Definitiveness of Ethical Human Conduct.
5.3 Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.
5.4 Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
5.5 Case studies of typical holistic technologies, management models and production systems.
5.6 Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers. At the level of society: as mutually enriching institutions and organizations.
5.7 Sum up. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.

Text Books/ References:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria,ExcelBooks, New Delhi,2010
2. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak,1999.
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi,2004.
4. The Story of Stuff(Book).
5. TheStoryofMyExperimentswithTruth- byMohandasKaramchandGandhi
6. Small is Beautiful - E. FSchumacher.
7. Slow is Beautiful – CecileAndrews
8. Economy of Permanence – JCKumarappa
9. Bharat Mein Angreji Raj -PanditSunderlal
10. Rediscovering India – byDharampal
11. Hind Swaraj or Indian Home Rule - by Mohandas K.Gandhi
12. India Wins Freedom - Maulana Abdul KalamAzad
13. Vivekananda - Romain Rolland(English)
14. Gandhi - Romain Rolland(English)

Course Outcomes:

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

1. Explain the concepts of human values, harmony, ethical living and professional responsibility for individual and societal well-being.
2. Apply the principles of self-exploration, harmony and human relationships to develop responsible personal and professional conduct.
3. Analyze the interrelationship between individuals, society, nature and existence for sustainable and harmonious living.
4. Evaluate ethical issues, professional responsibilities and societal challenges in engineering practices using human value-based approaches.
5. Develop socially responsible, eco-friendly and value-based engineering practices for sustainable development and universal human welfare.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	–	–	–	2	–	–	–	–	1	3	1	1
CO2	3	3	2	2	–	2	–	–	–	–	1	3	3	2
CO3	3	3	2	2	1	2	–	–	–	–	1	3	3	2
CO4	3	3	2	2	–	2	–	–	–	2	1	3	3	2
CO5	2	3	3	2	3	2	1	1	–	2	2	3	3	3

25ETHS204	TAMILS AND TECHNOLOGY தமிழரும் தொழில்நுட்பமும்	L	T	P/D	C
		1	0	0	1

அலகு I: நெசவு மற்றும் பானைத் தொழில்நுட்பம்: 3

சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் – கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு II: வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: 3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு– சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் – மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ–சாரோசெனிக் கட்டிடக் கலை.

அலகு III: உற்பத்தித் தொழில் நுட்பம்: 3

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV: வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: 3

அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

அலகு V: அறிவியல் தமிழ் மற்றும் கணித்தமிழ்: 3

அறிவியல் தமிழின் வளர்ச்சி –கணித்தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின்பதிப்பு செய்தல் 3 தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் V தமிழ் மின் நூலகம் 3 இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.

TOTAL : 15 PERIODS

UNIT – I WEAVING AND CERAMIC TECHNOLOGY

Weaving Industry during Sangam Age - Ceramic technology - Black and Red Ware Potteries (BRW) - Graffiti on Potteries.

UNIT – II DESIGN AND CONSTRUCTION TECHNOLOGY

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age - Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple) -Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT – III MANUFACTURING TECHNOLOGY

Art of Ship Building - Metallurgical studies - Iron industry-Iron smelting, steel - Copper and gold - Coinsassource of history - Minting of Coins - Beads making - Industries Stone beads - Glass beads - Terracotta beads - Shell beads/bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT – IV AGRICULTURE AND IRRIGATION TECHNOLOGY

Dam, Tank, ponds, Sluice, Significance of KumizhiThoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries - Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT – V SCIENTIFIC TAMIL & TAMIL COMPUTING

Development of Scientific Tamil - Tamil computing - Digitalization of Tamil Books - Development of Tamil Software - Tamil Virtual Academy -Tamil Digital Library - Online Tamil Dictionaries - Sorkuvai Project.

Text-Cum-Reference Books:

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL -(in print)
6. Social Life of the Tamils The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of theTamils (Dr.S.V.Subatamanian,Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of theTamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilizationon the bank so friver Vaigai'(Jointly Published by: Department of Archaeology &Tamil Nadu Text Book and Educational Service Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Outcomes:

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

1. Explain the scientific, technological and architectural contributions of ancient Tamils in the fields of weaving, ceramics, construction, manufacturing and agriculture.
2. Apply the knowledge of traditional Tamil technologies, irrigation practices, material processing and scientific advancements to contemporary engineering and societal contexts.

3. Analyze the technological developments, construction methods, manufacturing techniques and maritime practices of ancient Tamil civilization using historical and engineering perspectives.
4. Evaluate the significance of Tamil scientific heritage, indigenous technologies and digital Tamil advancements in sustainable development and modern applications.
5. Develop awareness and innovative approaches for preserving, promoting and integrating traditional Tamil scientific knowledge with modern engineering practices.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	–	–	–	2	–	–	–	–	1	3	1	1
CO2	3	3	2	2	–	2	–	–	–	–	1	3	3	2
CO3	3	3	2	2	1	2	–	–	–	–	1	3	3	2
CO4	3	3	2	2	–	2	–	–	–	2	1	3	3	2
CO5	2	3	3	2	3	2	1	1	–	2	2	3	3	3

25ETES205	**BASIC CIVIL ENGINEERING**	**L**	**T**	**P/D**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To inculcate a knowledge on essentials of Civil Engineering.
- To impart knowledge on construction materials and their properties.
- To expose the students on the role, significance and contributions of Civil Engineering in satisfying the social needs.
- To understand the basic knowledge on building construction.
- To understand various materials, methods and special structures in the field of Civil Engineering.

UNIT – I INTRODUCTION TO CIVIL ENGINEERING

Introduction to Civil Engineering - Various disciplines of Civil Engineering – Various components of Residential Building or Structure – Functions of a building - Types of buildings – NBC – Selection of site for buildings – Orientation of a building – Introduction to Surveying - Simple definitions – Plinth area, Carpet area, Built-up area, Floor area – Floor Space Index – Undivided Divided Share (UDS).

UNIT – II CONSTRUCTION MATERIALS

Introduction to various building materials - Stone – Bricks - Steel - Cement - Aggregates - Timbers - Plywood – Glass - Tiles - Paints - Other building materials – Properties, Characteristics, types and uses of materials – Merits and Demerits.

UNIT – III MASONRY, ROOF AND FLOOR

Definitions and terms used in masonry – Brick masonry - Characteristics requirements of good masonry – Bonds in brick work – Header, Stretcher, English, Flemish – Stone masonry

- Characteristics requirements of stone masonry – Walls – Types of walls – Concrete block walls – Types of building blocks. Types of roofs – Flat, Sloped and Curved – Types of Roof coverings – Aluminum and iron sheets – Drainage in roofs – Floors - Types of floors and finishes – Finishing materials and types - Advantages and Disadvantages

UNIT – IV BUILDING CONSTRUCTION

Building construction – Foundations – Bearing Capacity of Soil – Types of foundations - Centre line marking – Columns and Beams – Lintel and Sunshades – Functions – Structural systems - Load transfer mechanism - Plastering – Electrical works – Plumbing works - Finishing – Septic Tank – Water supply and Sanitation – Water treatment and Sewage disposal – Conservation of water and Rain water harvesting.

UNIT – V SPECIAL STRUCTURES IN CIVIL ENGINEERING

Introduction to different types of structures coming under Civil Engineering – Industrial structures - Irrigation structures - Highways and Railways - Harbour and Ports – Retaining walls – Underground and Overhead Water Tanks - Bridges and Dams - Underground and Multi-storeyed structures – Tunnels - etc.

Text Books:

1. Building Construction by Punmia et al., Laxmi publications Ltd., 2023
2. Building Construction by S.C.Rangwala, Charotar publishing Housr (P) Ltd., 2022
3. Building Materials by Duggal SK, New Age International (P) Ltd., 2019
4. Construction Materials by Vargheese PC, Prentice Hall India P.Ltd.,2015

References:

1. Palanichamy M.S., Basic Civil Engineering, Tata McGraw Hill Publishing Company Ltd, 2000
2. Ramamrutham V, Basic Civil Engineering, DhanpatRai Publishing Co. (P) Ltd., 1999.
3. Natarajan K V, Basic Civil Engineering, Dhanalakshmi Publications, Chennai, 2005.
4. Civil Engineering Materials and Construction Practice by RK. Gupta and Jain, Charotar Publishing House, 2019
5. Building Materials by Surendra Singh, Vikas Publishing Company, 1996
6. Civil Engineering Materials by Neil Jhonson and Dhir, RK.Mcmillan Publishers Ltd., 1997
7. Building Construction by Vargheese PC, Prentice Hall India P.Ltd.,2017
8. Building Construction by SP.Arora and Sp.Bindra. Dhanpat Rai Publications, 2014
9. National Building Code.

Course Outcomes:

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

1. Explain the fundamentals of civil engineering, building components, construction materials and structural systems used in engineering practice.
2. Apply the properties and selection criteria of construction materials, masonry techniques and building practices for residential and industrial structures.
3. Analyze the functions and performance of foundations, roofs, floors, water supply systems and sanitation facilities in building construction.
4. Evaluate different civil engineering structures, construction methods and water conservation techniques for sustainable infrastructure development.
5. Develop basic engineering solutions related to building planning, structural components and public utility systems considering safety, functionality and sustainability.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	–	–	–	2	–	–	–	–	1	3	1	1
CO2	3	3	2	2	–	2	–	–	–	–	1	3	3	2
CO3	3	3	2	2	1	2	–	–	–	–	1	3	3	2
CO4	3	3	2	2	–	2	–	–	–	2	1	3	3	2
CO5	2	3	3	2	3	2	1	1	–	2	2	3	3	3

25ETES206	ENVIRONMENTAL STUDIES	L	T	P	C
		2	0	0	2

Course Objectives:

- To realize the importance of environment for engineering students.
- To understand the basis of ecosystems
- To make aware the student about global environmental problems and natural disasters.
- To give the ideas about advance technologies of Engineering that will useful to protect environment.

UNIT – I MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Definition, scope and importance - Need for public awareness. Natural resources - Forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification - Role of an individual in conservation of natural resources- Equitable use of resources for sustainable lifestyles.

UNIT – II ECOSYSTEMS

Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem -Ecological succession - Food chains, food webs and ecological - pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem - Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT – III BIODIVERSITY AND ITS CONSERVATION

Introduction – Definition: genetic, species and ecosystem diversity - Bio geographical classification of India - Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels - India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - Endangered and endemic species of India - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – IV ENVIRONMENTAL POLLUTION

Definition - Cause, effects and control measures of Air pollution - Water pollution - Soil pollution - Marine pollution- Noise pollution - Thermal pollution - nuclear hazards- Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Disaster management: floods, earthquake, cyclone and landslides. Sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, and watershed management - Resettlement and rehabilitation of people; its problems and concerns. - Environmental ethics: Issues and possible solutions - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.

Wasteland reclamation - Consumerism and waste products - Environment Protection Act - Air (Prevention and Control of Pollution) Act - Water (Prevention and control of Pollution) Act - Wildlife Protection Act - Forest Conservation Act - Issues involved in enforcement of environmental legislation.

UNIT – V HUMAN POPULATION AND THE ENVIRONMENT

Population growth, variation among nations - Population explosion – Family Welfare Programme - Environment and human health - Human Rights - Value Education - HIV/AIDS - Women and Child Welfare - Role of Information Technology in Environment and human health -Case Studies.

FIELD WORK

Visit to a local area to document environmental assets-river/forest/grassland hill/mountain - Visit to a local polluted site-Urban/Rural/Industrial/Agricultural - Study of common plants, insects, birds -Study of simple ecosystems-pond, river, hill slopes, etc. (Field work equal to 5 lecture hours)

Text Books:

1. Agarwal, K.C. Environmental Biology, Nidi Publ, Ltd. Bikaner, 2001
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.,Ahmedabad – 380 013, India, Email:mapin@icenet.net

References:

1. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
2. Clark R.S., Marine Pollution, Clanderson Press Oxford
3. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001,
4. Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
5. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
6. Down to Earth, Centre for Science and Environment
7. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev.,
8. Environment &Security.StockholmEnv.Institute Oxford Univ. Press. 473p.
9. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural
10. History Society, Bombay
11. Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment.
12. Cambridge Univ. press 1140p.
13. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. HimalayaPub. House, Delhi 284 p.
14. Mckinney, M.L. & School, R.M. 1996. Environmental Science systems &Solutions,Web enhanced edition. 639p.
15. Mhaskar A.K., Matter Hazardous, Techno-Science Publication
16. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co.
17. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
18. Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt.

19. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut Survey of the Environment, The Hindu (M)
20. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science.
21. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliancesand Standards, Vol I and II, Enviro Media.
22. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication.
23. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia,USA 499p..

Course Outcomes:

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

1. Explain the concepts of ecosystems, biodiversity, natural resources, environmental pollution and sustainable development relevant to environmental science and engineering.
2. Apply environmental management practices, conservation methods and pollution control measures for sustainable utilization of natural resources.
3. Analyze environmental issues related to ecosystems, biodiversity loss, pollution, climate change and population growth using scientific and engineering approaches.
4. Evaluate environmental protection strategies, disaster management practices and legislative measures for maintaining ecological balance and public welfare.
5. Develop sustainable and eco-friendly solutions for environmental conservation, resource management and societal well-being through responsible engineering practices.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	–	–	–	2	–	–	–	–	1	3	1	1
CO2	3	3	2	2	–	2	–	–	–	–	1	3	3	2
CO3	3	3	2	2	1	2	–	–	–	–	1	3	3	2
CO4	3	3	2	2	–	2	–	–	–	2	1	3	3	2
CO5	2	3	3	2	3	2	1	1	–	2	2	3	3	3

25ETSP207	CHEMISTRY LABORATORY	L	T	P/D	C
		0	0	3	1.5

Course Objectives:

- To list the water quality standards.
- To assess the composition of an alloy.
- To appreciate the practical significance of acidimetry, alkalimetry, permananganometry, conductometry and potentiometry.
- To analyze quantitatively the amount of a substance present in a given sample.

List of Experiments:

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water
5. Determination of the rate constant of a reaction
6. Determination of cell constant and conductance of solutions
7. Potentiometry - determination of redox potentials and emfs
8. Saponification/acid value of an oil
9. Determination of the partition coefficient of a substance between two immiscible liquids
10. Adsorption of acetic acid by charcoal
11. Volumetric analysis

Course Outcomes:

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

1. Explain the principles, procedures and safety practices involved in chemical analysis and laboratory experiments related to engineering applications.
2. Apply volumetric, electrochemical and analytical techniques to determine physical and chemical properties of engineering materials and water samples.
3. Analyze experimental data obtained from chromatography, adsorption, conductometry and reaction kinetics experiments for engineering interpretations.
4. Evaluate the accuracy and suitability of analytical methods and experimental results for industrial and engineering applications.
5. Develop practical laboratory skills to perform chemical experiments systematically with professional ethics, teamwork and scientific reporting practices.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	–	–	–	2	–	–	–	–	1	3	1	1
CO2	3	3	2	2	–	2	–	–	–	–	1	3	3	2
CO3	3	3	2	2	1	2	–	–	–	–	1	3	3	2
CO4	3	3	2	2	–	2	–	–	–	2	1	3	3	2
CO5	2	3	3	2	3	2	1	1	–	2	2	3	3	3

25ETHP208	ENGLISH COMMUNICATION LAB	L	T	P/D	C
		0	0	3	1.5

Course Objectives:

- To facilitate computer assisted multimedia instruction enabling individualized and Independent Language Learning.
- To sensitize the students to the nuances of English speech sounds, word accent, Intonation and Rhythm.
- To bring about a consistent accent and intelligibility in student pronunciation of English by providing an opportunity for practice in speaking.
- To improve the fluency of students in spoken English
- To train students to use Language appropriately for public speaking, group discussion and interviews.

THEORETICAL SESSION (INTERNAL ASSESSMENT ONLY)

1. English sound pattern and Sounds of English
2. Pronunciation, Stress and Intonation
3. Common Situations – Conversations and Dialogues
4. Communication at work place
5. Oral presentations – Prepared or Extempore
6. 'Just a Minute' sessions (JAM)
7. Interviews
8. Formal Presentations

Suggested Software Package: EWL and Globarena Package for communicative English.
The Globarena Package consists of the following exercises.

1. Reading comprehension
2. Listening comprehension
3. Vocabulary exercises
4. Phonetics
5. Role Play in dialogues
6. Auto Speak

Text Books:

1. Daniel Jones Current," English Pronouncing Dictionary", Edition with CD.
2. R. K. Bansal and J. B. Harrison, "Spoken English ",Orient Longman 2006 Edn.
3. J.Sethi, Kamlesh Sadanand& D.V. Jindal, "A Practical course in English Pronunciation, (with two Audio cassettes)", Prentice-Hall of India Pvt. Ltd., New Delhi.
4. T.Balasubramanian," A text book of English Phonetics for Indian Students", (Macmillan).
5. "English Skills for Technical Students", WBSCTE with British Council, OL.

Course Outcomes:

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

1. Student will heighten their awareness of correct usage of English Grammar in writing and speaking.
2. Acquire speaking ability in English both in terms of fluency and comprehensibility.

3. Enhance competence in the four modes of literacy; Writing, Speaking, Reading and listening.
4. Ensure student to improve their accuracy and fluency in producing and understanding spoken and written English
5. Exposure of the grammatical forms of English and the use of these forms in specific communicative contexts

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	3	2		-	-	2	-	2	-	3	3	1	1
CO2	-	3	2	2	-	-	-	-	3	-	3	3	3	2
CO3	-	-	2	-	-	2	-	-	3	-	3	3	3	2
CO4	-	2	-	-	-	-	-	2	3	-	3	3	3	2
CO5	-	-	3	-	-	-	2	-	3	2	3	3	3	3

25ETSP209	ELECTRICAL WIRING AND EARTHING PRACTICE LABORATORY	L	T	P/D	C
		0	0	2	1

Course Objectives:

- To create an awareness on the electrical safety in industrial and commercial environment.
- To enable the understanding on the principles of different types of electrical wiring.
- To offer exposure on the need for earthing and earthing practices.
- To provide practical knowledge on the various types of lighting circuits.
- To introduce methods for measuring the variables in electric circuits.

LIST OF EXPERIMENTS

1. Residential Wiring
2. Fluorescent lamp wiring
3. Staircase Wiring
4. Godown Wiring
5. Ceiling fan wiring
6. Industrial Wiring
7. Series and Parallel Lamp Circuits
8. Measurement of Earth Resistance
9. Measurement of Parameter sin a Single-Phase AC Circuit
10. Measurement of Voltage, Current, Power and Power factor in a Resistive Circuit
11. SolderingPractice-Componentsdevicesandcircuits-usinggeneralpurposePCB
12. Corridor Wiring
13. Test the operation and control circuit for LED Flourescent Lamp(18W)
14. Study of various categories of Fuses and Insulators
15. Study and test the operation of Automatic Iron Box
16. Testing the buck/boost functions of the domestic stabilizer

Course Outcomes:

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

1. Identify various categories of fuses, insulators, and domestic appliances like automatic iron boxes and stabilizers to understand electrical safety components.
2. Demonstrate residential, industrial, and specialized wiring layouts—including staircase, go-down, corridor, and ceiling fan circuits—using appropriate wiring principles.
3. Analyze the operational parameters of series and parallel lamp circuits and single-phase AC circuits, including voltage, current, power, and power factor.
4. Test the performance of earth resistance, the control circuits of LED fluorescent lamps, and the buck/boost functions of domestic stabilizers to evaluate system safety and efficiency.
5. Build and solder electronic components and circuits on general-purpose PCBs by integrating practical knowledge of wiring and safety practices

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	–	2	–
CO2	3	-	3	-	2	2	-	-	3	-	-	1	3	1
CO3	2	3	2	2	-	-	-	-	3	-	-	2	3	2
CO4	2	2	-	3	2	2	-	-	3	-	-	–	2	2
CO5	2	2	3	2	3	-	-	-	3	-	-	2	2	3

25ETSP210	ENGINEERING GRAPHICS AND DESIGN	L	T	P/D	C
		1	0	4	3

TRADITIONAL ENGINEERING GRAPHICS

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Reading a Drawing; Sectional Views; Dimensioning, True Length, Angle.

COMPUTER GRAPHICS

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM).

(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)

Course Objectives:

- To develop the ability to produce simple engineering drawing and sketches based on current practice
- To develop the means for communication of ideas, thoughts and design of objects, related to engineering applications, to others though drawing

- To develop the skills to read manufacturing and construction drawings used in industry
- To develop a working knowledge of the layout of plant and equipment
- To develop skills in abstracting information from calculation sheets and schematic diagrams to produce working drawings for manufacturers, installers and fabricators

UNIT – I INTRODUCTION TO ENGINEERING DRAWING

Introduction to Engineering Drawing: Lettering, Dimensioning and use of drawing instruments. Conic sections: Eccentricity method of/for drawing ellipse, parabola and hyperbola- Tangent and Normal from a point on the curve.

UNIT – II ORTHOGRAPHIC PROJECTIONS

Orthographic projections: Introduction -Projections of points Projections of Straight lines: Determination of true length and true angle of inclinations using half cone and trapezoidal methods -drawing the projections of straight lines using half cone method from true length and true angle of inclinations.

UNIT – III PROJECTIONS OF REGULAR SOLIDS

Projections of solids in simple position: Projections of cube, Tetrahedron, prisms, Pyramids, cone and cylinder. Projections of solids: Auxiliary projections -projections of prisms, pyramids, cylinder and cone when the axis is inclined to only one plane.

UNIT – IV SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS

Sections of solids: Sections of prisms, pyramids, cylinder and cones -true shape of section. Developments of solids: Developments of lateral surfaces of solids using parallel and radial line methods.

UNIT – V ISOMETRIC PROJECTIONS

Isometric projections: Projections of simple solids. Conversion of pictorial view of simple objects into orthographic projections (only elevation and plan)

OVERVIEW OF COMPUTER GRAPHICS COVERING

Introduction to CAD software: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars). The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.

CUSTOMIZATION & CAD DRAWING

Consisting of setup of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines and other basic geometric entities.

ANNOTATIONS, LAYERING & OTHER FUNCTIONS

Applying dimensions to objects and annotations to drawings; Setting up and use of Layers, Printing document stop a per using the print command; orthographic projection techniques Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation;

Text Books:

1. Bhatt, N.D., Panchal V.M.& Ingle P.R.,(2014), Engineering Drawing, Charotar Publishing House.

2. Shah, M.B. &Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.
3. Agrawal B. &Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.(Corresponding set of) CAD Software Theory and User Manuals.

Course Outcomes:

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

1. Utilize drawing instruments effectively and able to present engineering drawings and sketches.
2. Describe the concept of orthographic, isometric projections of points, lines and regular solids.
3. Visualize the images and drawings in engineering perspective
4. Practice sectioning of bodies like machines and equipment's
5. Develop their technical communication skills and promote life-long learning.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	2	-	2	-	-	-	2	-	2	-	-	2
CO2	3	3	3	2	2	-	-	2	2	-	2	3	3	3
CO3	2	-	2	-	-	-	-	-	-	-	-	2	-	2
CO4	3	2	2	2	-	-	-	-	-	-	-	3	2	2
CO5	-	-	-	-	-	-	-	-	3	-	3	-	-	-

25CSBS301	MATHEMATICS-III	L	T	P	C
		3	0	0	3

Course Objectives:

- To familiarize the basic concepts of partial differential equation which is helpful in solving real world problems.
- To introduce Fourier series which is very useful in the study of computing.
- To solve boundary value problems which is helpful in investigation of the important features of electromagnetic theory.
- To provide basics of Fourier transform which is useful in solving problems in frequency response of a filter and signal analysis.
- To impart knowledge about z-transform which can played important role in the development of communication engineering.

UNIT – I PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations byeliminating arbitrary constants and arbitrary functions - Solution of standard type of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second order with constant coefficients.

UNIT – II FOURIER SERIES

Dirichle's conditions - General Fourier series - Odd and Even functions - Half range sine series - Half range cosine series - Complex form of Fourier series – Parseval's identity.

UNIT – III BOUNDARY VALUE PROBLEMS

Solutions of one dimensional wave equation – One dimensional heat equation (without derivation) – Fourier series solutions in Cartesian co-ordinates.

UNIT – IV FOURIER TRANSFORM

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem - Parseval's identity.

UNIT – V Z-TRANSFORM

Elementary properties – Inverse Z – Transform - Convolution theorem –Solution of difference equations using Z – Transform.

Text Books:

1. Kandasamy P, Tilagavathy K and Gunavathy K, Engineering Mathematics", 6th edition, (Vol I & II) S. Chand & Co Ltd. New Delhi, 2006.
2. Ventakataraman M K, "Engineering Mathematics", The National Publishing Co., Chennai, 2003.

References:

1. Ramana B V., Higher Engineering Mathematics., 2007, Tata Mc Graw Hill Pub.
2. Veerarajan,T., Engineering Mathematics, 3rd edition, 2005, Tata Mc Graw Hill Pub.
3. Vairamanickam.k., Nirmala.P., Tamilselvan.S., Transforms and Partial Differential Equations., 2014, Scitech Publications (India) Pvt. Ltd
4. Singaravelu, A., Engineering Mathematics, Meenakshi Publications, Chennai, 2004.

Course Outcomes:

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

1. Explain the mathematical principles of partial differential equations, Fourier series, Fourier transforms, and Z-transforms for engineering problem solving.
2. Apply analytical techniques to solve engineering problems involving partial differential equations, boundary value problems, Fourier methods, and Z-transforms.
3. Analyze mathematical models using transform techniques and differential equations to interpret engineering system behavior.
4. Evaluate appropriate analytical methods for solving engineering problems based on computational efficiency and mathematical suitability.
5. Develop mathematical models and analytical solutions for engineering applications using differential equations and transform techniques.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	1	–	–	–	–	–	1	–	2	–
CO2	3	3	2	1	2	–	–	–	–	–	–	1	3	1
CO3	2	3	1	2	2	–	–	–	–	–	1	2	3	2
CO4	2	2	2	3	2	–	–	–	–	–	1	–	2	2
CO5	2	2	3	2	2	–	–	–	–	–	1	2	2	3

25CSES302	**FUNDAMENTALS OF DIGITAL COMPUTERS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives

- To familiarize with Digital signals, Logic operations, Boolean algebra, number systems, codes and digital ICs with TTL and CMOS logic,
- To describe the simplification of logic functions using K-map & Q-M method andalso design the logic circuits such as Multiplexer, De-multiplexer/Decoders, Adders, Subtractor, digital comparator and parity checker/generator,
- To demonstrate operations of flip-flops including clockedSR, J-K,TandD-type,shift registers and Synchronous /Asynchronous counters.
- To educate the concepts of ADC and DAC convertors.
- To explain the classification and characteristics of memory organization and illustrate the design of PLD & CPLDS.

UNIT – I NUMBER SYSTEM AND CODES

Decimal Numbers, Binary Numbers, Decimal to Binary Conversions, Binary Arithmetic, 1's and 2's complements of Binary Numbers, Signed Numbers, Arithmetic Operations with Signed numbers, Hexadecimal Numbers, Octal Numbers, Digital Codes -BCD, XS-3, Gray code, alphanumeric codes (ASCII, EBCDIC, UNICODE), Error Detection Codes.

UNIT – II LOGIC GATES

The Inverter, The AND gate, The OR gate, The NAND gate, NOR gate, The Exclusive–OR gate and Exclusive-NOR gate; Boolean Algebra and Logic Simplification - Boolean

Operations and Expressions, Laws and Rules, DeMorgan's Theorems, Boolean Expressions and Truth Tables, The Karnaugh Map, SOP minimizations.

UNIT – III COMBINATIONAL LOGIC ANALYSIS

Basic combinational Logic Circuits, Implementing Combinational Logic, The Universal Property of NAND and NOR Gates. Functions of Combinational Logic - Basic Adder, Parallel Binary Adders, Comparators, Decoders, Encoders, Code Converters, Multiplexers, Parity Generator/Checkers.

UNIT – IV LATCHES AND FLIP-FLOPS

Latches, Edge Triggered RS, D, JK and T Flip-Flops, Flip-Flop Applications, Shift Registers, Types of shift register – SISO, SIPO, PISO, PIPO and Applications of shift Register, Counters – Classification – Asynchronous counter, 3-bit asynchronous ripple counter, Synchronous counter, 3 bit Up/Down counter, Applications of counters.

UNIT – V MEMORY AND STORAGE

Memory Basics, The RAM, The ROM, Programmable Logic Devices (PLDs) such as Programmable ROMs, Programmable Logic Array (PLA), Programmable Array Logic (PAL), Flash Memory, Memory Expansion, Special Types of Memories, Magnetic and Optical Storage.

Text Books:

1. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education India, 2016.
2. Floyd, Thomas L, "Digital Computer Fundamentals", 10th Edition, University Book Stall, 1997.

References:

1. Malvino, Paul Albert and Leach, Donald P, "Digital Principles and Applications", 4th Edition, TMH, 2000.
2. Malvino, Paul Albert and Leach, Donald P, "Digital Computer Fundamentals", 3rd Edition, TMH, 1995.
3. Bartee, Thomas C, "Digital Computer Fundamentals", 6th Edition, TMH, 1995.

Course Outcomes:

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

1. Explain the principles of digital number systems, Boolean algebra, logic circuits, sequential circuits, and memory organization for digital computing applications.
2. Apply Boolean algebra and digital logic design techniques to implement combinational and sequential circuits for engineering applications.
3. Analyze the functionality and performance of digital logic circuits, memory systems, and storage architectures to solve computational problems.
4. Evaluate digital circuit design alternatives based on logic optimization, functional requirements, and implementation efficiency.
5. Design digital systems by integrating combinational logic, sequential circuits, and memory components for reliable computing applications.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	2	–	–	–	–	–	1	1	2	–
CO2	3	3	2	–	3	–	–	–	–	–	–	2	3	1
CO3	2	3	1	2	2	–	–	–	–	–	1	2	3	2
CO4	2	2	2	3	2	–	–	–	–	–	1	1	3	2
CO5	2	2	3	2	3	–	–	–	–	–	1	2	3	3

25CSPC303	DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce fundamental concepts of linear and non-linear data structures.
- To develop problem-solving abilities using data structures and algorithm design.
- To provide knowledge of advanced data structures such as AVL Trees, Heaps, Hashing, and Graphs.
- To analyze and compare various searching, sorting, and traversal algorithms.
- To apply appropriate data structures for solving real-world computational problems.

UNIT – I INTRODUCTION TO DATA STRUCTURES AND ALGORITHM ANALYSIS

Data Structures Overview: Classification, Need, and Applications, Algorithm Analysis: Time and Space Complexity, Asymptotic Notations (Big-O, Omega, Theta).Recursion and its Applications. Searching Techniques: Linear Search, Binary Search with complexity analysis.

UNIT – II LINEAR DATA STRUCTURES - STACKS, QUEUES, AND THEIR APPLICATIONS

Abstract Data Type (ADT) - Stack: Operations, Expression Evaluation, Parenthesis Matching. Queue: Operations, Circular Queue, Deque, Priority Queue. Applications and Complexity Analysis.

UNIT – III LINKED LISTS

Singly Linked Lists: Creation, Insertion, Deletion, Traversal, Doubly Linked Lists: Operations and Complexity. Circular Linked Lists: Operations. Linked Representation of Stacks and Queues. Applications and Complexity Analysis.

UNIT – IV TREES AND HEAPS

Trees: Terminology, Binary Trees, Binary Search Trees (BST) - Operations and Applications.Balanced Trees: AVL Trees - Rotations, Operations, and Analysis.Heaps: Binary Heaps, Min-Heap, Max-Heap, Heap Operations, Priority Queues, Applications.Tree Traversals: In-order, Pre-order, Post-order (Recursive and Non-Recursive approaches).

UNIT – V GRAPHS, HASHING AND SORTING ALGORITHMS

Graphs: Terminologies, Representations (Adjacency Matrix/List).Graph Traversals: BFS, DFS, Applications. Hashing: Hash Functions, Collision Resolution Techniques (Chaining, Open Addressing).Sorting Techniques: Bubble Sort, Insertion Sort, Selection Sort, Merge Sort, Quick Sort, Heap Sort, Radix Sort.Complexity and Performance Comparisons.

Text Books:

1. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures", Computer Science Press, Second Edition,2006.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson, Fourth Edition ,2013.

References:

1. RSSalaria,"DataStructures",KhannaPublishing House,5th edition,2017.
2. Yashwant Kanetkar, "Data Structures through C", BPB Publications,2nd edition, 2009.
3. RBPatel,"ExpertDataStructureswithC++", Khanna Publications, 2nd edition,2012.

Course Outcomes:

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

1. Explain the principles of data structures, algorithm analysis, and computational complexity for efficient engineering problem solving.
2. Apply appropriate data structures and algorithmic techniques to develop efficient solutions for computational problems.
3. Analyze the performance and suitability of data structures and algorithms for diverse computational and real-world applications.
4. Evaluate alternative data structures and algorithms based on computational complexity, efficiency, and application requirements.
5. Design efficient algorithmic solutions by integrating appropriate data structures to solve complex real-world computational problems.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	2	–	–	–	–	–	1	2	2	–
CO2	3	3	2	–	3	–	–	–	–	–	–	3	3	2
CO3	2	3	1	2	2	–	–	–	–	–	1	2	3	2
CO4	2	2	2	3	2	–	–	–	–	–	1	2	3	2
CO5	2	2	3	2	3	–	–	–	–	–	1	3	3	3

25CSPC304	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the basic concepts of object-oriented programming approaches and its features.
- To prepare the students to write program solve mathematical and scientific problems using functions and overloading of functions
- To make the student to learn the advance features of inheritance and virtual function
- To impart knowledge on object-oriented programming concepts using java advanced features.
- To train the student to develop application program using multi-threading and multitasking concept.

UNIT – I INTRODUCTION

Traditional Versus Object Orientation Approach – Benefits and applications of OOP – Characteristics of Object-Oriented Programming Languages- C++ Programming Basics: Overview–C++ Data Types–Basics of object and class in C++ – Program structure– Member Functions and Member Variable – Techniques for Creating and Initializing Objects –Data Hiding – Namespace– Identifiers– Variables – Constants– Operators– Typecasting– Control structures– Loops and Decisions.

UNIT – II MEMBER FUNCTIONS AND OVERLOADING

Constructors and their types – Destructor – Access specifiers: Private Public and Protected members. C++ Functions: Simple functions- Arguments passed by value and by reference- Overloading of functions – Constructor Overloading-Inline functions - Passing and returning of objects- friend function - Friend Classes - Static Functions - Operator Overloading: Overloading Unary Operators- Overloading Binary Operators - Data Conversion: Conversions Between Objects and Basic Types -Conversions Between Objects of Different Classes.

UNIT – III INHERITANCE

Concept of Inheritance –Types of Inheritance: Single –Multiple – Multilevel – Hierarchical –Hybrid – Virtual Functions: Normal Member Functions Accessed with Pointers – Virtual Member Functions Accessed with Pointers – Abstract Classes and Pure Virtual Functions – Virtual Destructors –Virtual Base Classes – THIS Pointer.

UNIT – IV OOP IN JAVA

Characteristics of Java - The Java Environment -Java Source File -Structure – Compilation- Fundamental Programming Structures in Java -Defining classes in Java –constructors-method access specifiers - Packages - Interfaces -defining an Interface- implementing interface - differences between classes and interfaces and extending interfaces-packages.

UNIT – V THREADS

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups.

Text Books:

1. Robert Lafore, "Object -Oriented Programming in C++", Sams Publication, 4th edition, 2002.

2. Balaguruswamy. E, “Programming with Java”, Tat McGraw- Hill Publication, 5th edition, 2014.

References:

1. Balaguruswamy. E, “Object Oriented Programming with C++”, Tata McGraw- Hill Publication, 6th edition,2013.
2. R.S. Salaria, “Mastering Object-Oriented Programming with C++”, Khanna Book Publishing, N. Delhi, 6th edition,2016.
3. D. Samantha, “Object Oriented Programming in C++ and Java”, PHI, 1st edition, 2004.
4. Tanweer Alam, “Internet and Java Programming”, Khanna Publishing House,1st edition,2012.

Course Outcomes:

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

1. Explain object-oriented programming principles and programming constructs for developing modular and reusable software solutions.
2. Apply object-oriented programming techniques to implement efficient software solutions using classes, functions, inheritance, and Java programming features.
3. Analyze object-oriented program designs to select appropriate programming constructs for solving computational problems.
4. Evaluate object-oriented design approaches based on software quality, reusability, maintainability, and application requirements.
5. Develop object-oriented applications by integrating advanced programming features for reliable and scalable software systems.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	2	–	–	–	–	–	1	2	2	–
CO2	3	3	2	–	3	–	–	–	–	–	–	3	3	2
CO3	2	3	2	2	2	–	–	–	–	–	1	2	3	2
CO4	2	2	3	2	2	–	–	–	–	–	1	2	2	2
CO5	2	2	3	2	3	–	–	–	–	–	1	3	3	3

25CSPC305	**COMPUTER ORGANIZATION AND ARCHITECTURE**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce the concepts of Bus structure and functional units of a computer.
- To familiarize the working of ALU with its structure and functions.
- To impart the knowledge on hierarchical memory system including cache memories and virtual memory.

- To describe the significance of Semiconductor RAM and ROM memories on Computer.
- To teach the concept of parallel processing on Computer.

UNIT – I INTRODUCTION

Functional Units – Basic operational concepts – Bus structures – Performance and metrics– Instructions and instruction sequencing – Instruction set architecture – Addressing modes

UNIT – II FUNDAMENTAL CONCEPTS

ALU design – Execution of a complete instruction – Multiple bus organization Hardwired control – Micro programmed control – Nano programming.

UNIT – III MEMORY

Semiconductor RAM – ROM – Speed – Size and cost – Cache memories – Improving cache performance – Virtual memory – Memory management requirements – Associative memories – Secondary storage devices.

UNIT – IV I/O DEVICES

Accessing I/O devices – Programmed I/O – Interrupts – Direct memory access–Buses– Interface Circuits – Standard I/O interfaces (PCI, SCSI, and USB) – I/O Devices and processors.

UNIT – V PARALLEL PROCESSING

Concept of parallel processing, Pipelining, Forms of parallel processing, interconnect network - Data hazards – Instruction hazards – Influence on instruction sets – Data path and control considerations – Performance considerations – Exception handling.

Text Books:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, “Computer Organization”, McGraw-Hill, 5th edition, Reprint2012.
2. David A. Patterson and John L. Hennessy, “Computer Architecture-A Quantitative Approach”, Elsevier, a division of reed India Private Limited, 5th edition,2012.

References:

1. William Stallings, “Computer Organization and Architecture – Designing for Performance”, 6th Edition, Pearson Education, 2003.
2. Hayes, J.P., “Computer Architecture and Organization”, 3rd Edition, Tata Mc-Graw Hill, 1998.
3. Ghosh T. K., “Computer Organization and Architecture”, Tata McGraw-Hill, 3rd edition, 2011.
4. Behrooz Parahami, “Computer Architecture”, Oxford University Press, 8th Impression, 2011.
5. Heuring, V.P. and Jordan, H.F., “Computer Systems Design and Architecture”, 2nd edition, Pearson Education, 2004.

Course Outcomes:

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

1. Explain the organization and architecture of computer systems, including processor, memory, input/output, and parallel processing concepts for computing applications.
2. Apply computer organization principles to analyze instruction execution, memory management, and input/output operations for efficient system performance.

3. Analyze computer architecture components and processing techniques to evaluate system performance and resource utilization.
4. Evaluate architectural design alternatives based on performance, memory hierarchy, input/output mechanisms, and parallel processing requirements.
5. Design efficient computer system solutions by integrating processor organization, memory hierarchy, input/output interfaces, and parallel processing techniques.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	2	–	–	–	–	–	1	1	2	–
CO2	3	3	2	–	3	–	–	–	–	–	–	2	3	2
CO3	2	3	2	2	2	–	–	–	–	–	1	2	3	2
CO4	2	2	3	2	2	–	–	–	–	–	1	1	2	2
CO5	2	2	3	3	3	–	–	–	–	–	1	2	3	3

25CSPC306	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

- To explain the fundamentals of DBMS and ER Model.
- To provide a strong foundation in relational model and SQL.
- To develop knowledge for designing normalized relational schemas.
- To introduce transaction management and recovery mechanisms.
- To familiarize students with query processing and advanced databases.

UNIT – I INTRODUCTION TO DATABASE SYSTEMS

Purpose of Database Systems – File System Vs Database System – Data Models – Database Languages – Schemas and Instances – DBMS Architecture – Centralized and Client/Server Architecture – Database Applications– ER Models – Enhanced Entity Relationship Model.

UNIT – II RELATIONAL MODEL

Relational Model Concepts – Constraints – Keys – Dependencies – Relational Algebra : Fundamental Operations, Additional Operations – SQL– Data Definition – Data Manipulation and Retrieval Queries – Set operations – Aggregate Functions – Null values– Nested Queries – Derived Relations – Joins – Views– Cursors – Procedures – Functions – Triggers – Embedded and Dynamic SQL.

UNIT – III RELATIONAL DATABASE DESIGN

Features of good Relational Database Design – Decomposition using Functional Dependencies – Normal Forms - Normalization using Functional Dependencies – Normalization using Multi-valued Dependencies – Normalization using Join Dependencies – Domain-Key Normal form.

UNIT – IV TRANSACTIONS AND RECOVERY

Transaction Processing – Concepts and States – Need for Concurrency Control and Recovery– ACID Properties – Implementation of Atomicity and Durability – Schedules and Serializability – Concurrency Control Techniques: Lock-Based Protocols, Timestamp-

Based protocols – Deadlock Handling – Recovery Techniques: Log Based Recovery, Shadow Paging, ARIES Recovery Algorithm.

UNIT – V QUERY PROCESSING AND ADVANCED CONCEPTS

Query Processing Overview – Estimation of Query Processing Cost – Query Processing and Optimization – File Structures : Heap, Sorted, Hashed – Indexing: Single-level, Multi-level, B-Trees and B+ trees – Sorting and Joins – Introduction to Spatial and Temporal Databases, OO Databases, Distributed Databases, NoSQL.

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, Tata McGraw Hill, 2020.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson/Addison – Wesley, 2017.

References:

1. C.J. Date, A. Kannan and S. Swamynathan, “An Introduction to Database Systems”, Pearson Education, Eighth Edition, 2006.
2. Raghu Ramakrishnan and Johannes Gehrke, “Database Management Systems”, Third Edition, McGraw Hill, 2014.
3. Andreas Meier, Michael Kaufmann, “SQL & NoSQL Databases: Models, Languages, Consistency Options and Architectures for Big Data Management”, 1st Edition 2019.

Course Outcomes:

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

1. Explain database management system principles, data models, relational concepts, and transaction processing for efficient data management.
2. Apply database design principles and SQL techniques to develop normalized and efficient database solutions for engineering applications.
3. Analyze database schemas, query processing strategies, and transaction mechanisms to improve data integrity and system performance.
4. Evaluate database design alternatives, indexing methods, concurrency control, and query optimization techniques for efficient database management.
5. Design robust database systems by integrating relational design, transaction management, query optimization, and advanced database technologies.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	2	–	–	–	–	–	1	2	2	–
CO2	3	3	2	–	3	–	–	–	–	–	–	3	3	2
CO3	2	3	2	2	2	–	–	–	–	–	1	2	3	2
CO4	2	2	3	2	2	–	–	–	–	–	1	2	2	2
CO5	2	2	3	3	3	–	–	–	–	–	1	3	3	3

25CSCP308	DATA STRUCTURES AND ALGORITHMS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To develop hands-on programming skills for implementing linear and non linear data structures.
- To apply and debug searching, sorting, and traversal algorithms in solving computational problems.
- To demonstrate the effective use of data structures for real-world problem solving through programming.

LIST OF EXERCISES

1. Write a program to create a Stack using arrays and perform push, pop, peek, and display operations.
2. Write a program to implement a Singly Linked List and perform insert, delete, search, and reverse operations.
3. Write a program to implement a Circular Queue using arrays and perform enqueue and dequeue operations.
4. Write a program to implement Linear Search on an unsorted array and display the position of the searched element.
5. Write a program to implement Binary Search on a sorted array using both iterative and recursive methods.
6. Write a program to perform Breadth-First Search (BFS) and Depth-First Search (DFS) traversals on a graph.
7. Write a program to create a Binary Search Tree (BST) and perform insertion, deletion, and search operations.
8. Write a program to perform In-order, Pre-order, and Post-order traversals on a Binary Tree.
9. Write a program to implement Bubble Sort, Selection Sort, and Insertion Sort algorithms and compare their performance.
10. Write a program to implement Quick Sort, Merge Sort, and Heap Sort algorithms and compare their performance.

Course Outcomes:

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

1. Explain the principles and implementation of linear and non-linear data structures for efficient computational problem solving through programming.
2. Apply appropriate data structures and algorithmic techniques to implement, test, and debug efficient solutions for computational and real-world applications.
3. Analyze the performance of data structures and algorithms to select efficient solutions for engineering applications.

CO–PO/PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	2	–	–	–	–	–	1	2	3	–
CO2	2	3	2	–	3	–	–	–	–	–	–	3	3	1
CO3	2	3	–	2	2	–	–	–	–	–	2	2	3	–

25CSCP309	OBJECT ORIENTED PROGRAMMING LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To teach programs to implement data abstraction, encapsulation, data hiding, Inheritance, dynamic programming using C++.
- To educate the concepts of interfaces, multithreads and exceptions to develop programs in Java SDK environment.

LIST OF EXERCISES

C++ PROGRAM

1. Write a C++ program to design a class having static function names show count () which has the property of displaying the number of objects created of the class.
2. Write a C++ program to find maximum of two numbers using friend function.
3. Write a C++ program using copy constructor to copy data of an object to another object.
4. Write a C++ program to design a class representing complex numbers and having functionality of performing addition and multiplication of two complex numbers using operator overloading.
5. Write a C++ program to design a student class representing student roll no. and a teats class (derived class of student) representing the scores of the student in various subjects and sports class representing the score in sports. The sport and test class should be inherited by the result class having the functionality to add the scores and display the final result for the student.
6. Write a C++ program to maintain the records of the person with details (Name and Age) and find the eldest among them. The program must use this pointer to return the result.
7. Write a C++ program to illustrate the use of virtual function in a class.
8. Write a C++ program showing data conversion between objects of different classes.

JAVA PROGRAM

1. Simple Java Applications
   a. Understanding References to an Instant of a Class
   b. Handling Strings
2. Simple Package Creation
   a. Creating User Defined Packages
   b. Creating User Defined Packages - Array of Objects
3. Interfaces
   a. Implementing User Defined Interfaces
   b. Implementing Pre-Defined Exceptions
4. Threading
   a. Creation of Threading
   b. Multi -Threading
5. Exception Handling Mechanism in Java
   a. Implementing Predefined Exceptions
   b. Implementing User Defined Exceptions

Course Outcomes:

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

1. Explain object-oriented programming principles and language-specific constructs to develop modular and reusable software solutions using C++ and Java.
2. Apply object-oriented programming concepts and programming techniques to implement, test, and debug software applications using C++ and Java.
3. Analyze object-oriented design approaches and programming constructs to develop efficient, reliable, and maintainable software applications.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	2	–	–	–	–	–	1	2	2	–
CO2	2	3	3	–	3	–	–	–	–	–	–	3	2	1
CO3	2	3	2	2	2	–	–	–	–	–	2	2	2	2

25CSBS401	DISCRETE MATHEMATICS	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the basic concepts of Mathematical Logic that deals with the method of reasoning.
- To impart knowledge about sets and relations.
- To provide basic understanding of Boolean Algebra.
- To familiarize the basic properties and concepts of general algebraic systems.
- To illustrate graph theory and its application to Computer Science.

UNIT – I MATHEMATICAL LOGIC

Propositions – Connectives – Tautology and contradiction – Equivalence of prepositions – Tautological Implication – Normal Forms – Theory of Inference – Rules of Inference.

UNIT – II SET THEORY AND RELATIONS

Set operations – Ordered pairs and Cartesian product – Relations – Type of relations – Operations or relations – Properties of relations – Equivalence classes – Partition of set – Matrix and Graphical representation of relation.

UNIT – III LATTICE AND BOOLEAN ALGEBRA

Partial ordered set– Hasse diagram – Lattices – Properties of Lattices – Boolean Algebra – Karnaugh map method.

UNIT – IV GROUP AND GROUP CODE

Algebraic systems – Semi groups and Monoids – Groups – Permutation Group – Subgroups – Coding Theory – Group codes – Hamming codes – Procedure for Encoding and Decoding Group codes.

UNIT – V GRAPH THEORY

Graphs – Special simple graphs – Matrix representation of graphs – Path cycles and connectives – Eulerian and Hamiltonian graphs – Shortest path algorithms.

Text Books:

1. VeerarajanT, "Discrete Mathematics with Graph Theory and Combinatorics", Tata McGraw Hill Publishing Company Ltd, 2014.
2. Discrete Mathematics and Its Applications, S.K .Chakraborty and B.K. Sarkar, Oxford, 2011.

References:

1. Venkataraman MK, "Discrete Mathematics", The National Publishing Company, 2008.
2. Kolman Busby Ross, "Discrete Mathematical Structures", Pearson Education Pvt Ltd, 2000.
3. Trembley J P and Manohar R P, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Publishing Company Ltd, 2005.

Course Outcomes:

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

1. Explain the principles of discrete mathematical structures for logical reasoning and computational problem solving.
2. Apply discrete mathematical techniques to formulate solutions for computational problems involving logical, algebraic, and graph-based models.
3. Analyze discrete mathematical structures to interpret relationships and solve problems in computer science applications.
4. Evaluate appropriate discrete mathematical methods based on their suitability and efficiency for computational problem solving.
5. Develop mathematical models using discrete structures to design efficient solutions for computer science and engineering applications.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	1	–	–	–	–	–	1	–	2	–
CO2	3	3	2	1	2	–	–	–	–	–	–	2	3	1
CO3	2	3	2	2	2	–	–	–	–	–	1	2	3	2
CO4	2	2	2	3	2	–	–	–	–	–	1	1	2	2
CO5	2	2	3	2	2	–	–	–	–	–	1	2	2	3

25CSES402	**PYTHON PROGRAMMING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce data types, operators, input/output and assignment statements.
- To familiarize the conditional/decision-making and looping statements used in Python programming.
- To provide in-depth knowledge about the functions, lists, tuples, sets and dictionaries.
- To illustrate the use of open-source Python packages NumPy, Pandas, and Matplotlib.
- To study the applications of open-source Python packages TKinter and Oracledb.

UNIT – I INTRODUCTION TO PYTHON PROGRAMMING

History of Python - Getting started with python - Programming style- Programming errors. Elementary Programming: Writing a simple program - Reading input from the console – Identifiers - Variables, Assignment statements, and expressions - Simultaneous assignments - Named constants - Numeric data types and operators - Evaluating expressions and operator precedence - Augmented assignment operators - Type conversion and rounding.

UNIT – II CONDITIONAL AND LOOPING STATEMENTS

Boolean types, values, and expressions - Generating random numbers, if statements – if-else statements – Nested if and multi-way if-elif-else statements – Logical operators – Conditional expressions – Operator precedence and associativity - while loop - for loop – Nested loops - break and continue keywords.

UNIT – III FUNCTIONS, LISTS, TUPLES, SETS AND DICTIONARIES

Common Python function - Strings and characters - Introduction to objects and methods. Defining a function – Calling a function – Functions with/without return values – Positional and keyword arguments – Passing arguments by reference values - Modularizing code - Returning multiple values - List basics - Processing two dimensional lists - Introduction to tuples, sets and dictionaries.

UNIT – IV STANDARD PYTHON PACKAGES (NumPy, Pandas and Matplotlib)

NumPy (Numerical Computing): Basics - Array creation - Printing arrays - Basic operations - Universal functions - Indexing, slicing and iterating - Shape manipulation - Copies and views. Pandas (Data Manipulation and Analysis): Basic data structure in pandas - Object creation - Viewing data - Importing and exporting data. Matplotlib (Data visualization): Simple example - Parts of a figure - Types of inputs to plotting functions - Coding styles - Styling artists - Labeling plots - Axis scales and ticks.

UNIT – V PYTHON PACKAGES FOR GUI AND DATABASE PROGRAMMING (Tkinter, and Oracledb)

Tkinter: Introduction - First (real) example - TK concepts - Basic widgets - More widgets - Grid geometry manager - Event loop – Menus - Windows and dialogs - Organizing complex interfaces - Fonts, colors, images – Canvas – Text – Tree view - Styles and themes.

Oracledb: Introduction to the Python driver for Oracle database - Initializing python-oracledb - Connecting to Oracle database - Executing SQL - Executing PL/SQL - Managing transactions.

Text Books:

1. Y. Daniel Liang, Introduction to Programming using Python, Pearson Education, 2013.
2. NumPy user guide, https://numpy.org/doc/stable/user/
3. Pandas user guide, https://pandas.pydata.org/docs/user_guide/
4. Matplotlib user guide, https://matplotlib.org/stable/users/
5. Tkinter tutorial, https://tkdocs.com/tutorial/
6. Oracledb user guide, https://python-oracledb.readthedocs.io/en/latest/

References:

1. Mark Lutz, Learning Python, 5th Edition, O'Reilly Media, 2013.
2. Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, & Jupyter, 3rd Edition, O'Reilly Media, 2022.
3. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, 2nd Edition, O'Reilly Media, 2015.
4. Alejandro Rodas de Paz, Tkinter GUI Application Development Cookbook, Packt Publishing, 2018.

Course Outcomes:

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

1. Explain Python programming concepts, language constructs, and standard libraries for developing computational solutions.
2. Apply Python programming techniques to develop applications using functions, data structures, and standard programming practices.
3. Analyze Python-based solutions using appropriate libraries for data processing, visualization, graphical interfaces, and database applications.
4. Evaluate Python programming approaches and library features to select efficient solutions for diverse application requirements.
5. Develop Python applications by integrating programming constructs, open-source libraries, graphical user interfaces, and database connectivity.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	2	–	–	–	–	–	1	2	2	–
CO2	3	3	2	–	3	–	–	–	–	–	–	3	3	2
CO3	2	3	2	2	3	–	–	–	–	–	1	2	3	2
CO4	2	2	3	2	2	–	–	–	–	–	1	2	2	2
CO5	2	2	3	3	3	–	–	–	–	–	1	3	3	3

25CSPC403	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

- To explain the basic concepts of operating system and perform Case study on UNIX and WINDOWS Operating System.
- To introduce the concept of process, Threads and process scheduling.
- To teach the concepts of Critical Section, semaphores, IPC and deadlocks.
- To describe memory management techniques.
- To provide an overview of I/O hardware, I/O software, file managements and directories management.

UNIT – I INTRODUCTION

Introduction: Batch, iterative, time sharing, multiprocessor, distributed, cluster and real- time systems, UNIX system introduction and commands. Operating system structures: Computer system structure, Network structure, I/O Structure, Storage Structure, Dual mode operation, System components, Operating- System Services, System Calls, System Programs, System structure, Virtual Machines, System Design and Implementation, System Generation.

UNIT – II PROCESSES

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads. Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling Criteria, Scheduling algorithms, multi processor scheduling.

UNIT – III PROCESS SYNCHRONIZATION

Process Synchronization: Inter- process Communication: Critical Section, Race Conditions, Mutual Exclusion, Peterson‘s Solution, classical problems of synchronization: The Bounded buffer problem, Producer/Consumer Problem, reader‘s & writer problem, Dinning philosopher‘s problem. Semaphores, Event Counters, Monitors, Message Passing. Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Methods for Handling deadlocks: Deadlock prevention, Deadlock Avoidance: Banker‘s algorithm, Deadlock detection and Recovery.

UNIT – IV MEMORY MANAGEMENT

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation, fragmentation, and Compaction; Paging: Principle of operation–Page allocation–Hardware support for paging, structure of page table, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory–Hardware and control structures–Locality of reference, Page fault, Working Set, Dirty page/Dirty bit–Demand paging, Page Replacement algorithms, Trashing.

UNIT – V FILE MANAGEMENT

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods, Free-space management, directory implementation, efficiency, and performance. Secondary-Storage Structure: Disk structure, Disk scheduling algorithms, Disk Management, RAID structure.

Text Books:

1. Avi Silberschatz, Peter Galvin, Greg Gagne, Operating System Concepts Essentials, 10th Edition (Asia Student Edition), Wiley, 2023
2. William Stallings, Operating Systems: Internals and Design Principles, 9th Edition (India), Pearson / Prentice Hall, 2023
3. Maurice Bach, Design of the Unix Operating System, 9th Edition, Prentice Hall of India, 2022
4. Daniel P. Bovet, Marco Cesati, Understanding the Linux Kernel, 4th Edition, O’Reilly Media, 2022
5. Naresh Chauhan, Principles of Operating Systems, Oxford University Press, 2023

References:

1. Dhananjay Dhamdhere, Operating Systems: A Concept Approach, 4th Edition, McGraw Hill Education, 2021
2. Paul Deitel & Harvey Deitel, Operating Systems, 4th Edition, Pearson Education India, 2021.

Course Outcomes:

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

1. Explain operating system principles, process management, memory organization, file systems, and resource management for computing environments.
2. Apply operating system concepts to implement efficient process scheduling, synchronization, memory management, and file management solutions.
3. Analyze operating system mechanisms to improve process coordination, resource utilization, and overall system performance.
4. Evaluate operating system strategies based on scheduling, synchronization, memory management, and storage efficiency for computing applications.
5. Design operating system–based solutions by integrating process management, memory management, synchronization, and file system techniques.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	2	–	–	–	–	–	1	2	2	–
CO2	3	3	2	–	3	–	–	–	–	–	–	3	3	2
CO3	2	3	2	2	2	–	–	–	–	–	1	2	3	2
CO4	2	2	3	2	2	–	–	–	–	–	1	2	2	2
CO5	2	2	3	3	3	–	–	–	–	–	1	3	3	3

25CSPC404	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	0	3

Course Objectives:

- To explain algorithm analysis, performance measurements of algorithms and their application domains.
- To provide knowledge on major algorithmic strategies.
- To make the students understand the various graph and tree algorithms.
- To introduce the notation of computational complexity of problems.
- To teach the advanced algorithm on computational complexity theory.

UNIT – I INTRODUCTION

Overview of algorithm- Classification of algorithm-Characteristics of algorithm – Analysis of algorithms: step count-operation count-Asymptotic analysis of complexity bounds – best, average and worst-case behavior-Space complexity analysis- Analysis of recursive algorithms through recurrence relations: Substitution method - Recursion tree method and Masters' theorem- Introduction to time and space trade-off.

UNIT – II FUNDAMENTAL ALGORITHMIC STRATEGIES

Brute-Force Approach – Greedy Algorithms - Dynamic Programming- Branch- and-Bound technique and Backtracking method for the design of algorithms - Illustrations of these techniques for Problem-Solving - Knap Sack, Travelling Sales Person and N-Queen's problem.

UNIT – III GRAPH AND TREE ALGORITHMS

Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS) Shortest path algorithms - Transitive closure - Minimum Spanning Tree - Topological sorting, Network Flow Algorithm.

UNIT – IV TRACTABLE AND INTRACTABLE PROBLEMS

Computability of Algorithms – Decision problems and Turing machine -Complexity classes: P, NP, NP complete and NP hard -Theory of NP-complete problems - Satisfiability problem and Cook's theorem - Reduction techniques.

UNIT – V ADVANCED TOPICS

Introduction to Approximation algorithms – Types of Approximation algorithms –Vertex cover problem - Introduction to Randomized algorithms - Types of Randomized algorithms - Randomized Quick sort - Class of problems beyond NP : P SPACE.

Text Books:

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein,"Introduction to Algorithms", MIT Press/McGraw-Hill, 4th Edition, 2014.
2. Gajendra Sharma, "Design & Analysis of Algorithms", Khanna Publishing House, New Delhi, 4th edition, 2016.

References:

1. Jon Kleinberg and ÉvaTardos, Pearson, "Algorithm Design",1stEdition, 2012.
2. Michael T Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, Analysis, and Internet Examples", Wiley, 3rd Edition,2009.
3. S. Sridhar, "Design & Analysis of Algorithms", Oxford, 1st edition,2014.

Course Outcomes:

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

1. Explain algorithm design principles, complexity measures, and computational models for solving engineering problems efficiently.
2. Apply appropriate algorithmic strategies to develop efficient solutions for computational and optimization problems.
3. Analyze algorithms based on correctness, complexity, and computational feasibility for diverse problem domains.
4. Evaluate algorithmic approaches and computational complexity to determine suitable solutions for engineering applications.
5. Design efficient algorithms by integrating advanced algorithmic techniques to solve complex computational problems.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	2	–	–	–	–	–	1	2	2	–
CO2	3	3	2	1	3	–	–	–	–	–	–	3	3	2
CO3	2	3	2	2	2	–	–	–	–	–	1	2	3	2
CO4	2	2	3	2	2	–	–	–	–	–	1	2	2	2
CO5	2	2	3	3	3	–	–	–	–	–	1	3	3	3

25CSPC405	**COMPUTER GRAPHICS AND MULTIMEDIA**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To educate the basics of graphics system and algorithms to implement graphics primitives.
- To provide knowledge about 2D transformations and clipping techniques.
- To impart knowledge about 3D transformations and Open GL programming.
- To make the students to understand various aspects of multimedia.
- To impart knowledge on concept of sound, images and videos and familiar with blender graphics.

UNIT – I INTRODUCTION

Overview of Graphics System – Coordinate Representation – Graphics Output Primitives – Attributes of Graphics Primitives – Implementation Algorithms for Graphics Primitives – Introduction to OpenGL – OpenGL functions for Graphics Primitives.

UNIT – II TWO DIMENSIONAL CONCEPTS

2D Transformations – 2D Viewing – Window Viewport Transformation – Line, Polygon, Curve and Text Clipping Algorithms – OpenGL Functions for 2D Transformations and 2D Viewing.

UNIT – III THREE DIMENSIONAL CONCEPTS

3D Concepts: 3D Transformations – 3D Viewing – 3D Object Representations – Spline Representation – Visible Surface Detection Methods – Color Models – OpenGL Functions for 3D Transformations and 3D Viewing.

UNIT – IV MULTIMEDIA SYSTEMS DESIGN

Multimedia Basics − Multimedia Applications − Multimedia System Architecture − Evolving Technologies for Multimedia − Defining Objects for Multimedia Systems − Multimedia Data Interface Standards − Multimedia Databases.

UNIT – V MULTIMEDIA FILE HANDLING AND HYPERMEDIA

Compression and Decompression − Data and File Format Standards − Multimedia I/O Technologies − Digital Voice and Audio − Video Image and Animation − Full Motion Video − Storage and Retrieval Technologies – Multimedia Authoring and User Interface − Hypermedia Messaging - Case Study: Blender Graphics - Blender Fundamentals - Drawing basic shapes - modelling - shading and textures.

Text Books:

1. Donald D. Hearn, M. Pauline Baker and Warren Carithers, “Computer Graphics with OpenGL”, Fourth Edition, Pearson Education,2010.(Unit I, II and III)
2. Andleigh, P. K and Kiran Thakrar, “Multimedia Systems and Design”PHI, 2003.(Unit IV and V)

References:

1. Francis S Hill Jr. and Stephen M Kelley, “Computer Graphics Using OpenGL 3rd Edition, Prentice Hall,2007.
2. Foley, Vandam, Feiner and Huges,“Computer Graphics: Principles an Practice”, 2nd Edition, Pearson Education, 2003.
3. Ralf Steinmetz and Klara Steinmetz, "Multimedia Computing, communications and Applications", Pearson Education,2004.
4. Judith Jeffcoate,“Multimedia in practice: Technology and Applications”PHI, 1998.
5. http://www.blender.org/support/tutorials/

Course Outcomes:

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

1. Explain computer graphics and multimedia principles for developing interactive visual computing applications.
2. Apply graphics transformations, OpenGL programming, and multimedia techniques to develop visual computing solutions.
3. Analyze graphics algorithms, multimedia components, and rendering techniques for efficient visual information processing.
4. Evaluate graphics and multimedia methods based on performance, visualization quality, and application requirements.

5. Design multimedia applications by integrating computer graphics, visualization, animation, and multimedia technologies for real-world applications.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	2	–	–	–	–	–	1	2	2	–
CO2	3	3	2	1	3	–	–	–	–	–	–	3	3	2
CO3	2	3	2	2	2	–	–	–	–	–	1	2	3	2
CO4	2	2	3	2	2	–	–	–	–	–	1	2	2	2
CO5	2	2	3	3	3	–	–	–	–	–	1	3	3	3

25CSPC406	MICROPROCESSOR AND MICROCONTROLLER	L	T	P	C
		3	0	0	3

Course Objectives:

- To familiarize with the architecture of 8086 microprocessor including stacks, procedures, interrupts and instruction set.
- To impart knowledge on 8086,80186,80286,80386,80486 and Pentium processors.
- To demonstrate the Memory interfacing and I/O interfacing with the case studies.
- To explain the architecture of 8031/8051 and16 bit controller.
- To analyze the role of 8051microcontroller in ADC, DAC, Stepper Motor and Waveform generation.

UNIT – I INTRODUCTION TO 8086

Microprocessor architecture–Addressing modes–Instruction set and assembler directives – Assembly language programming – Modular Programming – Linking and Relocation – Stacks – Procedures – Macros – Interrupts and interrupt service routines–Byte and String Manipulation.

UNIT – II 8086 PROCESSOR

8086 Architecture –Basic Configuration – 8086 Minimum and Maximum mode configurations – Addressing modes – Basic Instructions – System bus timing – System design using 8086 – IO programming – Introduction to Multiprogramming – System Bus Structure — 8086 Interrupts – Assembly levels programming – Introduction to 80186 – 80286 – 80386 – 80486 and Pentium processors.

UNIT – III INTERFACING

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface – Timer – Keyboard/display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display, LCD display, Keyboard display interface and Alarm Controller.

UNIT – IV MICROCONTROLLER

Architecture of 8031/ 8051 – Special Function Registers (SFRs) – I/O Pins Ports and Circuits – Instruction set – Addressing modes – Assembly language programming - Introduction to 16 bit Microcontroller.

UNIT – V ADVANCED TOPICS

Programming 8051 Timers – Serial Port Programming – Interrupts Programming – LCD & Keyboard Interfacing–ADC, DAC& Sensor Interfacing –External Memory Interface- Stepper Motor and Waveform generation.

Text Books:

1. Yu-Cheng Liu, Glenn A. Gibson, "Microcomputer Systems: The 8086 / 8088 Family –Architecture, Programming and Design", Prentice Hall of India, 2nd Edition,2007.
2. Muhammed Ali Mazidi, Janice Gillispie Mazidi, RolinMcKinlay," The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Pearson Education,Edition,2011.

References:

1. Doughlas V. Hall, "Microprocessors and Interfacing, Programming and Hardware", TMH, 2012.
2. Ramesh S. Gaonkar, "Microprocessor Architecture Programming and Applications with 8085", Penram International Publishing, 4th Edition, 2000.
3. Kenneth J. Ayala., "The 8051 Microcontroller Architecture Programming and Applications", Penram International Publishing (India), 1996.

Course Outcomes:

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

1. Explain the architecture, instruction sets, and operational principles of microprocessors and microcontrollers for embedded computing applications.
2. Apply assembly language programming and interfacing techniques to develop microprocessor- and microcontroller-based solutions.
3. Analyze processor architectures, memory organization, and peripheral interfacing to improve embedded system performance.
4. Evaluate microprocessor and microcontroller architectures based on application requirements, performance, and hardware interfacing constraints.
5. Design embedded system solutions by integrating microprocessors, microcontrollers, peripheral interfaces, and control applications.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	2	–	–	–	–	–	1	2	2	–
CO2	3	3	2	1	3	–	–	–	–	–	–	3	3	2
CO3	2	3	2	2	2	–	–	–	–	–	1	2	3	2
CO4	2	2	3	2	2	–	–	–	–	–	1	2	2	2
CO5	2	2	3	3	3	–	–	–	–	–	1	3	3	3

25CSCP408	OPERATING SYSTEM AND DATABASE MANAGEMENT SYSTEM LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To prepare the students to write C programs to understand the concepts of operating system.
- To impart programming skills in shell programming.
- To provide hands-on experience in designing and querying relational databases using SQL.

LIST OF EXERCISES

1. Job Scheduling Techniques.
2. Disk Scheduling Techniques.
3. Memory Allocation Techniques.
4. Memory Management Techniques.
5. Page Replacement Techniques.
6. Producer Consumer Problem and Dining Philosophers Problem.
7. Bankers Algorithm.
8. Shell Script to Perform File Operations using UNIX Commands.
9. Shell Script to Perform nCr Calculation using Recursion.
10. Shell Script to Sort Numbers and Alphabets from a Text File using Single ‘awk’ Command.
11. Data Definition and Data Manipulation Language.
12. Data Control and Transaction Control Language.
13. Basic to Advanced SQL Queries (joins, aggregation, sub queries, set operations).
14. Database Objects (synonym, sequences, views and index).
15. Cursor.
16. Functions and Procedures.
17. Trigger.
18. Exceptions.

Course Outcomes:

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

1. Explain operating system concepts, shell programming constructs, and relational database principles for developing system-level and database applications.
2. Apply operating system algorithms, shell scripting, and SQL programming techniques to implement, test, and debug efficient computing solutions.
3. Analyze operating system resource management strategies and database programming techniques to develop efficient and reliable software solutions.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	2	–	–	–	–	–	1	2	2	–
CO2	2	3	2	–	3	–	–	–	–	–	–	3	3	1
CO3	2	3	2	2	2	–	–	–	–	–	2	2	2	2

25CSCP409	COMPUTER GRAPHICS AND MULTIMEDIA LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To provide knowledge on implementation of 2D and 3D shape drawing algorithms, transformations and its applications.
- To impart knowledge on implementation of color models and fractal images.
- To demonstrate various aspects of image, sound and video editing tools such as GIMP, Audacity, Windows Movie Maker, Swish, Flash, etc.

LIST OF EXERCISES

1. Implementation of Line drawing Algorithm:
   (a) Bresenham's line drawing algorithm.
   (b) DDA (Digital Differential Analyser) Line drawing Algorithm.
2. Implementation of Circle drawing Algorithm:
   (a) Midpoint Circle drawing Algorithm.
   (b) Bresenham's Circle drawing Algorithm.
3. Implementation of Bresenham's Ellipse Drawing Algorithm.
4. Implementation of 2D Transformations:
   (a) Translation,Rotation,Scaling.
   (b) Reflection and Shearing.
5. Implementation of 2D Line Clipping Algorithm:
   (a) Cohen-Sutherland Algorithm.
   (b) Liang-Barsky Algorithm.
6. Polygon clipping using Sutherland-Hodgeman Algorithm.
7. Implementation of 3D Transformations - Translation, Rotation, Scalin
8. Implementation of 2D Animation (using Timer, Loop, simple animation):
   (a) Bouncing Ball.
   (b) Car movement.
9. Implementation of 3D Animation - Human Facial Expressions:
   (a) Smile
   (b) Sad
   (c) Surprise.
10. Drawing Three Dimensional Objects and Scenes using OpenGL.

GIMP

1. Creating Logos.
2. Simple Text Animation.

Audacity

1. Silencing, Trimming and Duplicating the Audio Signal.
2. Giving the Advanced Effect to the Audio Signal.

Windows Movie maker

1. Applying Effect to Video.
2. Creating Titles in Video.

Swish

1. Text Effects.

2. Pre-Loader.

Flash

1. Changing the shape of the Object.
2. Imaging Viewing using Mask.

Photo Impact

1. Text Effects.
2. Image Slicing.

Other Tools

1. To develop a presentation for a product using techniques like guide layer, masking and onion skin using authoring tools.
2. To create a Jpeg image that demonstrates various features of an image editing tool.

Course Outcomes:

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

1. Explain computer graphics principles, multimedia concepts, and graphical transformations for developing interactive visual applications using graphics and multimedia tools.
2. Apply computer graphics algorithms and multimedia editing techniques to implement, test, and create interactive graphical and multimedia applications.
3. Analyze graphics algorithms, transformations, and multimedia design techniques to develop efficient and visually effective applications for real-world scenarios.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	2	–	–	–	–	–	1	2	2	–
CO2	2	3	3	–	3	–	–	–	–	–	–	3	2	1
CO3	2	3	2	2	2	–	–	–	–	–	2	2	2	2

25CSPC501	**THEORY OF COMPUTATION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce and explain the method of constructing Regular Expression, NBA, DFA and Minimal DFA.
- To learn types of grammars and eliminate useless symbols, unit and null productions.
- To familiarize the concepts of pushdown automata.
- To provide in-depth understanding of Turing machine and its applications.
- To impart knowledge about decidable and undecidable problems.

UNIT – I FINITE AUTOMATA

Introduction- Basic Mathematical Notation and techniques- Finite State systems – Basic Definitions – Finite Automaton – DFA and NDFA – Finite Automaton with €- moves – Regular Languages- Regular Expression – Equivalence of NFA and DFA – Equivalence of NDFA's with and without €-moves – Equivalence of finite Automaton and regular

expressions –Minimization of DFA- - Pumping Lemma for Regular sets – Problems based on Pumping Lemma.

UNIT – II GRAMMARS

Grammar Introduction– Types of Grammar - Context Free Grammars and Languages– Derivations and Languages – Ambiguity- Relationship between derivation and derivation trees – Simplification of CFG – Elimination of Useless symbols - Unit productions – Null productions – Greibach Normal form – Chomsky normal form – Problems related to CNF and GNF.

UNIT – III PUSHDOWN AUTOMATA

Definitions – Moves – Instantaneous descriptions – Deterministic pushdown automata – Equivalence of Pushdown automata and CFL - pumping lemma for CFLproblems based on pumping Lemma.

UNIT – IV TURING MACHINES

Definitions of Turing machines – Models – Computable languages and functions – Techniques for Turing machine construction – Multi head and Multi tape Turing Machines - The Halting problem – Partial Solvability – Problems about Turing machine- Chomskian hierarchy of languages.

UNIT – V UNSOLVABLE PROBLEMS AND COMPUTABLE FUNCTIONS

Primitive recursive functions –Recursive and recursively enumerable languages Universal Turing machine. Measuring and Classifying Complexity: Tractable and Intractable problems- Tractable and possibly intractable problems – P and NP completeness - Polynomial time reductions

Text Books:

1. Hopcroft J.E., Motwani R. and Ullman J.D, “Introduction to Automata Theory, Languages and Computations”, Pearson Education, 2nd edition, 2008 (UNIT 1, 2,3).
2. John C Martin, “Introduction to Languages and the Theory of Computation”, Tata McGraw Hill Publishing Company, 3 rd edition, New Delhi, 2007 (UNIT 4,5).

References:

1. Mishra K L P and Chandrasekaran N, “Theory of Computer Science - Automata, Languages and Computation”, Prentice Hall of India, 3rdedition,2004.
2. Harry R Lewis and Christos H Papadimitriou, “Elements of the Theory of Computation”, Pearson Education, 2nd edition, New Delhi,2003.
3. Peter Linz, “An Introduction to Formal Language and Automata”,NarosaPublishers, 3rd edition, New Delhi, 2002.
4. Kamala Krithivasan and Rama. R, “Introduction to Formal Languages, Automata Theory and Computation”, Pearson Education,2009.

Course Outcomes:

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

1. Explain automata, formal grammars, and computability principles for modeling computational systems and languages.
2. Apply formal language and automata techniques to construct computational models for language recognition and problem solving.
3. Analyze computational models, grammars, and complexity classes to determine language properties and computational feasibility.
4. Evaluate computational problems using automata, Turing machines, and complexity theory to assess decidability and tractability.

5. Formulate formal computational models for solving language recognition and computation problems using automata theory principles.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	1	–	–	–	–	–	1	1	2	–
CO2	3	3	2	1	2	–	–	–	–	–	–	2	3	1
CO3	2	3	2	3	2	–	–	–	–	–	1	2	3	1
CO4	2	3	1	3	2	–	–	–	–	–	1	1	3	2
CO5	2	2	3	2	2	–	–	–	–	–	1	3	2	2

25CSPC502	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives:

- To impart knowledge on layered approach that makes design, implementation and operation of extensive networks possible.
- To teach the components required to build networks.
- To provide basic concepts related to network addressing and routing.
- To educate students on the concepts of end-to-end flow of information and congestion control.
- To familiarize with the concepts of electronic mail, HTTP, DNS and SNMP.

UNIT – I DATA COMMUNICATION COMPONENTS

Data Communications, Networks, Networks Types, Protocols Layering, TCP/IP Protocol Suite, OSI model, Performance, Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum, Transmission Media, Switching.

UNIT – II DATA LINK LAYER AND MEDIUM ACCESS SUB LAYER

Introduction of Data Link Layer, Link Layer Addressing, Error Detection and Error Correction - DLC Services, Data Link Layer Protocols, HDLC, PPP- Media Access Control, wired LANs - Ethernet, Wireless LANs:- Introduction, IEEE 802.11, Bluetooth - Connecting Devices.

UNIT – III NETWORK LAYER

Network Layer Services - Packet switching - Performance - IPV4 Addresses - Forwarding of IP Packets - Network Layer Protocols: IP, ICMP v4 - Unicast Routing Algorithms - Protocols - Multicasting Basics - IPV6 Addressing - IPV6 Protocol.

UNIT – IV TRANSPORT LAYER

Introduction - Transport Layer Protocols - Services - Port Numbers - User Datagram Protocol - Transmission Control Protocol - SCTP.

UNIT – V APPLICATION LAYER

WWW and HTTP - FTP - Email - Telnet - SSH - DNS - SNMP.

Text Books:

1. Behrouz A. Forouzan, "Data Communications and Networking", 6th Edition, McGraw Hill, 2021.
2. William Stallings, "Data and Computer Communications", 11th Edition, Pearson.
3. James F. Kurose & Keith W. Ross, "Computer Networking: A Top-Down Approach", 8th Edition, Pearson, 2021.
4. Larry L. Peterson & Bruce S. Davie, "Computer Networks: A Systems Approach", 6th Edition, Morgan Kaufmann, 2021.

References:

1. Nader F. Mir, "Computer and Communication Networks", 3rd Edition, Wiley.
2. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", 5th Edition, Morgan Kaufmann Publishers Inc., 2012.
3. William Stallings, "Data and Computer Communications", 10th Edition, Pearson Education, 2013.
4. Nader F. Mir, "Computer and Communication Networks", 2nd Edition, Prentice Hall, 2014.
5. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill Publisher, 2011.
6. James F. Kurose, Keith W. Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", 6th Edition, Pearson Education, 2013.

Course Outcomes:

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

1. Explain computer networking principles, layered architectures, communication protocols, and data transmission mechanisms for reliable network communication.
2. Apply networking protocols, addressing schemes, routing techniques, and transport services to support efficient data communication.
3. Analyze network protocols, error control, routing, congestion management, and communication performance in interconnected systems.
4. Evaluate network architectures and protocol mechanisms to determine appropriate solutions for reliable and scalable communication systems.
5. Design network solutions by integrating communication protocols, addressing, routing, transport, and application layer services for real-world networking environments.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	2	–	–	–	–	–	1	1	2	1
CO2	2	3	2	2	3	–	–	–	–	–	–	2	3	2
CO3	2	3	2	3	2	–	–	–	–	–	1	2	3	2
CO4	2	2	3	2	2	1	–	–	–	–	1	2	2	3
CO5	2	2	3	2	3	1	–	–	1	–	1	3	2	3

25CSPC503	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

- To impart knowledge on the Software Process Models and Requirement analysis.
- To familiarize the concepts of Architectural Design, component level design, user interface design, pattern based design, web app design and web app interface design
- To disseminate the knowledge of Software Quality management , Review techniques and Software Quality Assurance
- To educate Software Configuration Management Repository with its metrics
- To illustrate the concept of Software Project estimation, Risk Management and Review engineering.

UNIT – I SOFTWARE PROCESS

The Software process- A Generic Process Model- Perspective Process Models-Specialized Process Models- The Unified Process-Personal and team process models-Agile Development-Extreme Programming (XP)- Requirements Engineering-Requirements Analysis-Establishing the Groundwork- Eliciting Requirements- Developing Use Cases-Negotiating Requirements- Validating Requirements-Requirements Analysis-Scenario-Based Modeling.

UNIT – II DESIGN CONCEPTS

Design concepts-The Design Process-Design Concepts-The Design Model- Architectural Design- Assessing Alternative Architectural Designs- Architectural Mapping Using Data Flow-Component- level design-Designing Class-Based Components-Conducting Component-Level Design-User Interface design-User Interface Analysis and Design-Interface Analysis-Pattern based Design- WebApp design-WebApp Design Quality-WebApp Interface design.

UNIT – III QUALITY MANAGEMENT

Quality Management- Software Quality- The Software Quality Dilemma- Achieving Software Quality- Review techniques-Cost Impact of Software Defects-Defect Amplification and Removal- Review Metrics and Their Use-Informal Reviews-Formal Technical Reviews-Software Quality Assurance- Test Strategies for Conventional Software-Test Strategies for Object-Oriented Software- SQA Tasks, Goals, and Metrics-Statistical Software Quality Assurance-A Strategic Approach to Software Testing-System Testing-The Art of Debugging

UNIT – IV SOFTWARE CONFIGURATION MANAGEMENT

Software Configuration Management-The SCM Repository-The SCM Process-Configuration Management for Web Apps-A Framework for Product Metrics-Metrics for the Requirements Model- Metrics for the Design Model- Project Management concepts- The management spectrum-People-The Product- The Process-Metrics in the Process and Project Domains

UNIT – V PROJECT ESTIMATION

Software Project Estimation-Decomposition Techniques-Empirical Estimation Models-The Make/Buy Decision-Project Scheduling-Defining a Task Set for the Software Project-Defining a Task Network-Reactive versus Proactive Risk Strategies-Risk Identification-Risk Projection-Risk Refinement-The RMMM Plan-Business Process Reengineering-Software Reengineering-Reverse Engineering-Restructuring-Forward Engineering-The SPI Process-The CMMI-The People CMM-SPI Return on Investment-SPI Trends.

Text Books:

1. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Seventh Edition, Mc Graw-Hill International Edition, 2010.
2. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.
3. Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI Learning Private Limited, 2009.

References:

1. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.
2. Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007.
3. Stephen R.Schach, "Software Engineering", Tata McGraw-Hill Publishing Company Limited, 2007.

Course Outcomes:

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

1. Explain software engineering principles, development processes, requirements engineering, design methodologies, and quality assurance practices for software development.
2. Apply software engineering methods, design models, quality practices, and project management techniques to develop reliable software solutions.
3. Analyze software requirements, architectures, quality metrics, project risks, and process performance for effective software development.
4. Evaluate software processes, quality assurance strategies, project estimation techniques, and configuration management practices to improve software quality and productivity.
5. Develop software engineering solutions by integrating software processes, design practices, quality management, configuration management, and project planning for real-world applications.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	–	–	2	–	1	–	–	–	1	1	2	2
CO2	2	2	3	2	3	–	–	–	–	2	–	2	2	3
CO3	2	3	2	3	2	–	–	–	–	1	1	2	2	3
CO4	1	2	2	3	2	1	2	–	–	2	1	1	2	2
CO5	2	2	3	2	2	1	1	2	1	3	1	3	2	3

25CSPC504	**MACHINE LEARNING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce fundamentals of machine learning, regression and normal densities.
- To provide in-depth knowledge about the classification algorithms used in machine learning.

- To understand the clustering algorithms and methods of reducing the dimension of feature vectors.
- To familiarize the different deep learning architectures
- To understand the methods of combining evidence from two or more machine learning techniques.

UNIT – I LINEAR AND LOGISTIC REGRESSION AND NORMAL DISTRIBUTION

Machine perception - feature space and feature vectors - classification, clustering, and regression - types of machine learning - discriminant functions - Bayesian decision theory - linear and logistic regression - univariate and multivariate normal densities.

UNIT – II CLASSIFICATION ALGORITHMS

Perceptron and back propagation neural network - k-nearest-neighbour rule. Support vector machine: multi category generalizations - Regression. Decision trees: classification and regression tree - random forest.

UNIT – III COMPONENT ANALYSIS AND CLUSTERING ALGORITHMS

Principal component analysis -Linear discriminant analysis - k-means clustering - fuzzy k-means clustering - Expectation-maximization algorithm-Gaussian mixture models – auto associative neural network.

UNIT – IV DEEP LEARNING ARCHITECTURES AND APPLICATIONS

Convolutional neural network (CNN) - Layers in CNN – standard CNN architectures. Recurrent Neural Network – Introduction to LSTM and GRU. Applications: image classification- Speech-to-text conversion - time series prediction.

UNIT – V COMBINING MULTIPLE LEARNERS

Generating diverse learners - model combination schemes - voting - error-correcting output codes - bagging - boosting - mixture of experts revisited - stacked generalization - fine-tuning an ensemble – cascading.

Text Books:

1. R. O. Duda, E. Hart, and D.G. Stork, Pattern classification, Second edition, John Wiley &Sons, Singapore, 2012.
2. Francois Chollet, Deep Learning with Python, Manning Publications, Shelter Island, NewYork, 2018.

References:

1. Ethem Alpaydin, Introduction to Machine Learning, 3rdEdition, MIT Press, 2014.
2. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006
3. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.
4. Navin Kumar Manaswi, Deep Learning with Applications using Python, Apress, New York, 2018.

Course Outcomes:

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

1. Explain the fundamental concepts, mathematical foundations, and learning paradigms of machine learning for computational problem solving.
2. Apply appropriate machine learning algorithms to develop predictive models for classification, regression, and clustering applications.
3. Analyze the performance of machine learning models using feature transformation, dimensionality reduction, and model evaluation techniques.

4. Evaluate deep learning architectures and ensemble learning techniques for solving complex real-world intelligent system problems.
5. Design intelligent machine learning solutions by integrating suitable learning models for diverse engineering applications.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	1	–	–	–	–	–	1	–	2	1
CO2	2	3	3	2	3	–	–	–	–	–	–	3	2	2
CO3	2	3	–	3	2	–	–	–	–	–	1	2	3	2
CO4	2	2	3	2	3	1	–	–	–	–	1	2	2	3
CO5	2	2	3	2	3	1	1	–	–	–	2	3	2	3

25CSCP507	COMPUTER NETWORKS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To understand the basic networking command, client/server concept and network programming using TCP/IP.
- To provide an opportunity to do to acquire knowledge of protocol, techniques used for data transmission from client to server and to identify methods for creating distributed applications.

LIST OF EXERCISES

1. Networking Commands.
2. Implementation of Socket program for Echo.
3. Implementation of client and server for chat using TCP.
4. File transfer between client and server using TCP/IP.
5. Implementation of Remote command execution.
6. Client and Server application using UDP.
7. Implementation of Address Resolution Protocol.
8. Socket Program to dow
9. Implementation of Remote method Invocation.
10. Implementation of server in C and Client in Java.

Course Outcomes:

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

1. Explain computer networking principles, communication protocols, and client–server programming concepts for developing reliable network-based applications.
2. Apply socket programming and network communication techniques to implement, test, and debug client–server and distributed applications using TCP/IP protocols.
3. Analyze networking protocols and distributed programming approaches to develop efficient and reliable communication solutions for real-world applications.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	2	–	–	–	–	–	1	2	2	–
CO2	2	3	2	–	3	–	–	–	–	–	–	3	3	1
CO3	2	3	2	2	2	–	–	–	–	–	2	2	2	2

25CSCP508	MACHINE LEARNING LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To understand Gaussian densities, regression and method of reducing the dimension of feature vector and its implementation using Python.
- To implement classification and clustering algorithms in Python.
- To solve challenging research problems in the area of speech and image processing using convolutional neural network and recurrent neural network.

LIST OF EXERCISES

1. Linear and logistic regression with error estimation
2. Implementation of univariate and multivariate Gaussian densities
3. Dimensionality reduction using principal component analysis (PCA)
4. Clustering using
   a) k-means
   b) Gaussian mixture modeling (GMM)
5. Classification using
   a) Back propagation neural network (BPNN)
   b) Support vector machine (SVM)
6. Construction of decision tree and random forest
7. Implementation of convolutional neural network (CNN) for handwritten digit recognition
8. Object recognition using CNN
9. Face detection and tracking
10. Sequence prediction using recurrent neural network (RNN)
11. Isolated-word speech recognition

Course Outcomes:

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

1. Explain machine learning principles and statistical learning techniques for developing intelligent systems using Python.
2. Apply machine learning algorithms and deep learning techniques to implement, test, and evaluate intelligent solutions for real-world applications.
3. Analyze machine learning models and deep learning approaches to develop efficient predictive solutions for engineering and research applications.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	2	–	–	–	–	–	1	2	2	1
CO2	2	3	3	2	3	–	–	–	–	–	–	3	3	2
CO3	2	3	2	2	2	–	–	–	–	–	2	2	2	2

25ETIT509	INDUSTRIAL TRAINING/RURAL INTERNSHIP/ INNOVATION/ENTREPRENEURSHIP	L	TR	S	C
		0	1	2	4

Note:*- Four weeks during the summer vacation before the end of fourth semester

Course Objectives:

- To expose the students to understand technical and professional skill requirements in IT industries.
- To impart professional skills for solving problems in industries.
- To train the students to design innovative solutions for a problem.
- To motivate the students to become an Entrepreneur.
- To develop communication and technical report writing skill.

The students will work for two periods per week guided by student counselor. They will be asked to present a seminar of not less than 15 minutes and not more than 30 minutes on any technical topic of student's choice related to Computer Science and Engineering and to engage in discussion with audience. They will defend their presentation. A brief copy of their presentation also should be submitted. Evaluation will be done by the student counselor based on the technical presentation, the report and also on the interaction shown during the seminar.

The students will individually undertake a training program in reputed concerns in the field of Computer Science and Engineering during summer vacation (at the end of sixth semester) for a minimum stipulated period of four weeks. At the end of training the student has to submit the detailed report on the training undertaken within ten days from the commencement of the seventh semester. The student will be evaluated by a team of staff members nominated by the Head of the Department through a viva-voce examination.

Course Outcomes:

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

1. Explain contemporary computing technologies, industrial practices, and professional skills through technical presentations and industrial training experiences.
2. Apply technical knowledge and professional practices to analyze engineering problems encountered during seminars and industrial training.
3. Analyze industrial problems and emerging technologies to propose effective engineering solutions supported by technical evidence.
4. Evaluate engineering practices, industrial workflows, and technological solutions through technical discussions, presentations, and professional reporting.

5. Develop innovative technical solutions and professional reports by integrating industrial exposure, communication skills, and entrepreneurial perspectives.

CO - PO / PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	–	–	–	–	2	2	–	1	–	2	–	–	1
CO2	2	2	2	–	2	–	1	2	3	–	1	2	2	–
CO3	2	3	3	2	1	1	–	–	1	–	1	3	2	2
CO4	–	2	2	3	–	1	1	–	3	2	1	–	1	2
CO5	1	2	3	2	2	1	1	–	2	3	2	2	2	3

25CSPC601	COMPILER DESIGN	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand and list the different stages in the process of compilation.
- To Identify different methods of lexical analysis.
- To design top-down and bottom-up parsers.
- To identify synthesized and inherited attributes.
- To develop algorithms to generate code for a target machine.

UNIT – I INTRODUCTION TO COMPILERS

Programming Language basics-Language processors – Analysis of the source program– Translators-Compilation and Interpretation- The Phases of Compiler- Errors Encountered in Different Phases-The Grouping of Phases-Compiler Construction Tools – Applications of Compiler Technology.

UNIT – II LEXICAL ANALYSIS

Lexical Analysis – Role of the lexical analysis – Input Buffering – Specification of tokens-Recognition of tokens – Lexical analyzer generator- LEX- Finite Automata Regular Expression to an NFA – Conversion of an NFA to a DFA –Optimization of DFA based pattern matchers.

UNIT – III SYNTAX ANALYSIS

Need and Role of the Parser – Context-Free Grammars – Writing a Grammar –Top-Down Parsing- Recursive-Descent Parsing FIRST and FOLLOW– LL(1) Grammars-Non recursive Predictive Parsing- Error Recovery in Predictive Parsing Bottom-Up Parsing – Shift-Reduce Parsing –Introduction to LR parsing – SLR Parser Canonical LR Parser – LALR- Parser Generators- YACC.

UNIT – IV SYNTAX - DIRECTED TRANSLATION & RUN TIME ENVIRONMENT

Syntax directed Definitions-Construction of Syntax Tree-Bottom-up Evaluation of S-Attribute-Definitions- Design of predictive translator – Type Systems- Specification of a simple type checker-Equivalence of Type Expressions-Type Conversions. Runtime environments –Storage organizations-stack allocation of space –Access to nonlocal data on the stack- Heap Management- Introduction to Garbage Collection.

UNIT – V CODE GENERATION

Intermediate-code generation - Variants of Syntax Trees – Three-Address Code–Types and Declarations – Translation of Expressions – Type Checking – Control Flow–Backpatching – Switch-Statements –Intermediate Code for Procedures. Code generation: Issues in the Design of a Code Generator The Target Language – Addresses in the target Code– Basic Blocks and Flow Graphs – Principal Sources of Optimization- Optimization of Basic Blocks – Loops in flow graphs – A Simple Code Generator –Peephole Optimization.

Text Books:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, “Compilers: Principles, Techniques and Tools”, Pearson Publishers, 2008.
2. Allen I. Holub, “Compiler Design in C”, Prentice Hall of India, 2003.
3. Bennet J.P., Introduction to Compiler Techniques, Tata McGraw-Hill, 2nd edition, 2003.

References:

1. Henk Alblas and Albert Nymeyer, “Practice and Principles of Compiler Building with C”, Prentice Hall of India, 2001.
2. Kenneth C. Louden, “Compiler Construction: Principles and Practice”, Thompson Learning, 2003.
3. Charles N. Fischer, Richard. J. LeBlanc, “Crafting a Compiler with C”, Pearson Education, 2008.

Course Outcomes:

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

1. Explain compiler design principles and language processing techniques for translating source programs into executable machine code.
2. Apply lexical, syntax-directed, and parsing techniques to construct compiler components for programming language processing.
3. Analyze compiler design strategies to evaluate parsing, runtime environment, and intermediate code generation for efficient program translation.
4. Evaluate compiler optimization and code generation techniques to improve execution efficiency and target machine performance.
5. Design an integrated compiler framework by applying lexical analysis, parsing, semantic processing, optimization, and code generation techniques.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	2	–	–	–	–	–	–	2	–	–
CO2	3	3	2	–	2	–	–	–	–	–	–	2	1	–
CO3	2	3	–	2	2	–	–	–	–	–	–	2	2	–
CO4	2	3	2	2	2	–	–	–	–	–	–	1	2	–
CO5	2	2	3	–	3	–	–	–	–	–	–	2	3	–

25CSPC602	DATA ANALYSIS WITH R	L	T	P	C
		3	0	0	3

Course Objectives:

- Gain the basic concepts of Univariate, Multivariate data and relationships between two variables.
- Learn Null hypothesis and Alternative hypothesis significance testing for two means and more than two means.
- Understand the different types of Bayesian methods and its independent samples t-test.
- Learn the predictive analysis by various regression statistical methods.
- Handle missing data gracefully using multiple imputation; Identify and manage problematic data points.

UNIT – I INTRODUCTION TO DATA AND ITS RELATIONSHIP

Basics: Navigating the basics - Getting help in R – Vectors – Functions – Matrices – Loading data into R - Working with packages. The Shape of Data: Univariate data - Frequency distributions - Central tendency - Spread - Populations, samples, and estimation - Probability distributions - Visualization methods. Describing Relationships: Multivariate data - Relationships between a categorical and continuous variable - Relationships between two categorical variables - The relationship between two continuous variables - Visualization methods.

UNIT – II PROBABILITY AND HYPOTHESIS TESTING

Basic probability - Sampling from distributions - The normal distribution. Using Data to Reason: Estimating means - The sampling distribution - Interval estimation - Smaller samples. Testing Hypotheses: The null hypothesis significance testing framework - Testing the mean of one sample - Testing two means - Testing more than two means - Testing independence of proportions.

UNIT – III BAYESIAN METHODS AND BOOTSTRAP

Bayesian Methods: The big idea behind Bayesian analysis - Choosing a prior - Who cares about coin flips - Enter MCMC - stage left - Using JAGS and run jags - Fitting distributions the Bayesian way - The Bayesian independent samples t-test. The Bootstrap: Performing the bootstrap in R - Confidence intervals - A one-sample test of means - Bootstrapping statistics other than the mean - Busting bootstrap myths.

UNIT – IV PREDICTIVE ANALYSIS

Predicting Continuous Variables: Linear models - Simple linear regression - Simple linear regression with a binary predictor - Multiple regression - Regression with a non-binary predictor - Kitchen sink regression - The bias-variance trade-off - Linear regression diagnostics. Predicting Changes with Time: Creating and plotting time series - Components

of time series - Time series decomposition - White noise - Autocorrelation - Smoothing - ETS and the state space model - Interventions for improvement. Predicting Categorical Variables: k-Nearest neighbors - Logistic regression - Decision trees - Random forests - Choosing a classifier.

UNIT – V IMPLEMENTATION OF DATA ANALYSIS

Sources of Data: Relational databases – Using JSON – XML – Other data formats – Online repositories. Dealing with Missing Data: Analysis with missing data – Visualizing missing data – Types of missing data – Unsophisticated methods for dealing with missing data. Dealing with Messy Data: Checking unsanitized data - Regular expressions - Other tools for messy data. Dealing with Large Data: Wait to optimize - Using a bigger and faster machine - Be smart about the code - Using optimized packages - Using another R implementation - Using parallelization - Using Rcpp. Working with Popular R Packages: The data. Table package - Using dplyr and tidyr to manipulate data - Functional programming as a main tidy verse principle - Reshaping data with tidyr. Reproducibility and Best Practices: R scripting - R projects - Version control - Communicating results.

Text Books:

1. Tony Fischetti, “Data Analysis with R”, O’Reilly Packt Publisher, Second Edition, 2018.
2. Richard Cotton, “Learning R: A Step-by-Step Function Guide to Data Analysis”, O'Reilly Media, First Edition, 2013.

References:

1. Dr. Bharti Motwani, “Data Analytics with R”, Willey, First Edition, 2019.
2. Joseph Schmuller, “Statistical Analysis with R for Dummies”, Dummies First Edition, 2017.
3. Hadley Wickham, “R for Data Science”, O’Reilly, First Edition, 2016.

Course Outcomes:

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

1. Explain statistical data analysis concepts and R programming techniques for exploring, visualizing, and interpreting univariate and multivariate datasets.
2. Apply statistical inference and Bayesian methods using R to perform hypothesis testing and estimate data-driven conclusions.
3. Analyze datasets using predictive modeling techniques to evaluate relationships, trends, and classification performance for decision making.
4. Evaluate data quality, predictive models, and analytical methods to obtain reliable and reproducible insights from diverse datasets.
5. Develop end-to-end data analysis solutions using R by integrating data preprocessing, statistical modeling, predictive analytics, and result communication.

CO–PO/PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	2	–	–	–	–	–	–	2	–	–
CO2	2	3	–	2	2	–	–	–	–	–	–	2	1	–
CO3	2	3	2	2	2	–	–	–	–	–	–	1	3	–
CO4	2	2	–	3	2	–	–	–	–	–	–	2	2	–
CO5	2	2	3	–	3	–	–	–	–	1	–	2	2	2

25CSHS603	BUSINESS MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

1. To understand the core principles of Business Management.
2. To familiarize the methods of planning
3. To impart knowledge on Decision making and organizing in business.
4. To teach the necessity of motivation
5. To expose the ideas of change and control in business.

UNIT – I INTRODUCTION TO BUSINESS MANAGEMENT

Meaning and definition of business management- Features of business management- Nature of business management- Management as an Art- Management as a Science-Management as a Profession; Luther Gulicks POSDCORB Concept-Significance of Management, Process of Management-Levels of Management-Functional areas of management- Social Responsibility of Business-Management and Administration- 14 Principles of Management by Henry Feyol.

UNIT – II PLANNING

Meaning and definition of planning- Features and Importance of planning- Types and Process of planning- Elements of planning-Mission- Objectives, Strategies, Policies, Procedures, Rules, Programmes, Budget-Planning at different levels- Corporate Plan, Business unit Plan, Departmental Plans.

UNIT – III DECISION MAKING

Meaning and Definition of Decision Making, Importance and Types of Decision-Making, Decision-Making Process, Effective Decision Making, Techniques of Decision Making. Organizing: Meaning and Definition of organizing, Significance of organizing, Steps in the process of organizing, Authority and Responsibility relationship, Centralization and Decentralization, Merits and Demerits.

UNIT – IV MOTIVATION

Meaning and Definition of Motivation, Need of Motivation, Types of Motivation-Positive Motivation and Negative Motivation, Financial and Non-financial Incentives, Need Hierarchy Theory of Motivation, Theory 'X' and Theory 'Y' of Motivation. Leadership: Meaning and Definition of Leadership, Features of Leadership, Functions of a Leader, Qualities of a Successful Leader, Leadership styles.

UNIT – V CONTROLLING

Meaning and Definition of Controlling-Features and Importance of Controlling, Process of Controlling-Effective Control System-Techniques of Controlling, Traditional and Modern. Management of Change- Meaning and Definition of Management of Change- Need for change-Types of Change-Process of planned change, Resistance to change.

Text Books:

1. Kootz, O'Donnell, and Weighrich, " Essential of Management", Mcgraw-Hill. 10th edition,2015.
2. Stoner, Freeman, Gilbert Jr.: Management, Pearson Education.
3. Principles & Practice of Management, L.M. Prasad.
4. The Process of Management - Concept, Behaviour and Practice, Newman, Warren and Summer.

References:

1. Business Organizational Management, Singh and Chhabra.
2. Modern business and Organization, Sherlekar and Sherlekar.

Course Outcomes:

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

1. Explain business management principles, managerial functions, and organizational practices for effective administration in business environments.
2. Apply planning, organizing, and decision-making techniques to support effective business operations and resource management.
3. Analyze managerial challenges by evaluating organizational structures, leadership approaches, motivation strategies, and decision-making processes.
4. Evaluate management control systems and change management practices to improve organizational effectiveness and business performance.
5. Develop business management strategies by integrating planning, organizing, leadership, motivation, decision-making, and control for organizational success.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	–	–	–	2	–	–	–	–	2	–	–	–
CO2	2	2	2	–	–	2	–	–	–	–	3	–	–	–
CO3	2	3	–	2	–	2	–	–	2	–	2	–	–	–
CO4	2	2	–	2	–	3	–	–	–	–	2	–	–	–
CO5	2	2	3	–	–	2	–	–	2	2	2	–	–	–

25CSCP607	**COMPILER DESIGN LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives:

- To make the students to understand the different stages of compiler.
- To impart programming skills needed to develop a compiler.
- To get more knowledge in using modern tools for designing a compiler.

LIST OF EXERCISES

1. Implementation of lexical analyzer
2. Implementation of lexical tool
3. Conversion of regular expression to NFA
4. Elimination of left recursion
5. Left factoring the given grammar
6. Computation of first and follow sets
7. Implementation of recursive descent parser
8. Implementation of shift reduce parsing algorithm
9. Implementation of intermediate code generator

Course Outcomes:

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

1. Explain compiler design principles and language processing techniques for

developing compiler components using modern compiler development tools.
2. Apply lexical analysis, parsing, and intermediate code generation techniques to implement, test, and debug compiler components.
3. Analyze compiler construction techniques to develop efficient language processing solutions for programming language implementation.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	2	–	–	–	–	–	1	2	3	–
CO2	2	3	2	–	3	–	–	–	–	–	–	3	3	1
CO3	2	3	2	2	2	–	–	–	–	–	2	2	2	1

25CSCP608	DATA ANALYSIS WITH R LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To learn the basic concepts of general and mathematical commands in R programming.
- To understand null hypothesis and alternative hypothesis significance testing for two means and more than two means.
- To implement the predictive analysis by various regression statistical methods.

LIST OF EXERCISES

1. Learning R-Basic Mathematical and General Commands.
2. Write a R program to perform the Matrix Operations such as Addition (+), Subtraction (-), Multiplication (%*%), Transpose (t), Inverse (solve()) and Diagonal of a Matrix (diag) using matrix, rbind and cbind commands.
   a) Input matrix is fixed.
   b) Get the input matrix from Keyboard)
3. Create a data frame called student data, explore the structure of the data and process it using
   a) data.frame
   b) read.table
4. a) Write a R program to compute Interquartile Range (IQR) for a given data.
   b) Write a R program to compute Interquartile Range (IQR) for Sepal Length of Iris data.
5. Write a R program to generate Frequency Distributions of MT Car's Carburettors and Air Quality's Temperatures from its Data Sets.
6. a) Write a R program to construct Univariate Normal Density and to predict whether a Person is Adult or not Based on Height
   b) Write a R program to construct Multivariate Normal Density and to predict whether a Person is Adult or not Based on Height and Weight

7. Write a R program to analyze the Linear and Nonlinear Relationship between two variables in the different data sets (Women Data and MTcars Data) Using Covariance, Pearson and Spearman Correlation coefficients.
8. Write a R program to Analyze the Linear an Nonlinear Relationship Between the Continuous Variables of Iris Data Using Multiple Correlation coefficients.
9. Write a R program to analyze Baye's Rule and to predict whether A person is male or Female.
10. Write a R program to find prediction of rainfall using sample mean and population with US Precipitation cities data.
11. Write a R program to test the hypothesis which proves the mileage is better for manual cars than cars with automatic transmission using two means from MTcars dataset and to test more than two means from women's workout dataset using ANOVA Test.
12. Write a R program to predict the mileage of car based on weight of car using Simple Linear Regression Model.
13. Write a R program to predict the mileage of car based on weight and horse power of the car of MTcars dataset using Multiple Linear Regression Model.
14. Write a R program to construct Simple Decision Tree and to classify motor vehicles into motorcycles, golf carts, or sedans.
15. Write a R program to classify observations as being positive or negative for diabetes using Random Forest Tree.
16. Write a R program to apply k-Nearest Neighbours (kNN) to classify iris flowers using Iris features such as sepal length, sepal width, petal width and petal length with decision boundary.

Course Outcomes:

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

1. Explain statistical analysis principles and R programming concepts for developing data-driven solutions using statistical and predictive techniques.
2. Apply R programming and statistical methods to implement, test, and evaluate predictive models for real-world data analysis applications.
3. Analyze statistical models and machine learning techniques to develop efficient predictive solutions for engineering and decision-making applications.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	2	–	–	–	–	–	1	2	2	1
CO2	2	3	3	2	3	–	–	–	–	–	–	3	3	2
CO3	2	3	2	2	2	–	–	–	–	–	2	2	2	2

25CSES701	RESEARCH METHODOLOGY	L	T	P	C
		3	0	0	2

Course Objectives:

- Gain the basic concepts of Univariate, Multivariate data and relationships between two variables.
- Learn Null hypothesis and Alternative hypothesis significance testing for two means and more than two means.
- Understand the different types of Bayesian methods and its independent samples t-test.
- Learn the predictive analysis by various regression statistical methods.
- Handle missing data gracefully using multiple imputation; Identify and manage problematic data points.

UNIT – I INTRODUCTION TO RESEARCH

Definition, importance and objectives of research. Types of research - Basic, applied, and experimental. Steps in the research process - Identification of problem, literature review, hypothesis formulation, data collection, analysis. Qualities of good research. Research ethics – Avoiding plagiarism and misconduct

UNIT – II LITERATURE REVIEW AND PROBLEM IDENTIFICATION

Importance of reviewing existing work. Finding research materials - Journals, patents, online libraries. Bibliometric analysis and citation indexing (SCI, Scopus, Web of Science) Identifying research gaps. Defining a research problem. Skeleton of research paper.

UNIT – III RESEARCH DESIGN AND DATA COLLECTION

Research design types: Exploratory, descriptive, experimental and case study. Primary data collection methods - Surveys, interviews, and experiments. Secondary data collection methods - Government reports, industry data, archival research. Sampling methods: Probability and non-probability. Tools used in engineering research (e.g., MATLAB, Excel, Python)

UNIT – IV DATA ANALYSIS AND INTERPRETATION

Fundamentals of data analysis - Data preprocessing, cleaning, visualization. Basic statistics - Mean, median, standard deviation, variance. Inferential statistics - Hypothesis testing, confidence intervals, p-values. Correlation and regression analysis. Introduction to data visualization - charts, graphs, heat maps and dash board

UNIT – V RESEARCH WRITING, INTELLECTUAL PROPERTY, PUBLICATION ETHICS

Writing a technical report or research paper. Referencing styles and citation tools. Publication process and peer review. Intellectual Property Rights - Patents and copyrights. Publication Ethics- Plagiarism, duplicate submission, authorship conflicts, peer review process, predatory journals.

Text Books:

1. C.R. Kothari and Gaurav Garg, 'Research Methodology: Methods and Techniques', 4th Edition, New Age International.
2. Ranjit Kumar, 'Research Methodology: A Step-by-Step Guide for Beginners', 5th Edition, SAGE Publications.
3. John W. Creswell and J. David Creswell, 'Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 5th Edn., SAGE Publications.

References:

1. Leedy, P.D., and Ormrod, J.E., 'Practical Research: Planning and Design', 11th Edition, Pearson.

2. Greenfield, T., and Greener, S., 'Research Methods for Postgraduates', 3rd Edition, Wiley.
3. Montgomery, D.C., 'Design and Analysis of Experiments', 9th Edition, Wiley.
4. Cohen, L., Manion, L., & Morrison, K., 'Research Methods in Education', 8th Edition, Routledge.
5. Deborah E. Bouchoux, 'Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets', 5th edition.

Course Outcomes:

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

1. Explain research methodologies, ethical practices, and scholarly communication principles for conducting systematic engineering research.
2. Apply research design, literature review, and data collection techniques to investigate engineering research problems.
3. Analyze research data using statistical methods and visualization techniques to derive valid and meaningful interpretations.
4. Evaluate research quality, publication practices, and intellectual property issues to ensure ethical and credible research outcomes.
5. Develop a research proposal and technical report by integrating literature review, research methodology, data analysis, and publication standards.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	–	–	2	–	–	3	–	2	–	–	–	–
CO2	2	3	2	2	2	–	–	–	–	–	–	1	–	–
CO3	2	3	–	3	2	–	–	–	–	2	–	2	1	–
CO4	2	2	–	2	–	2	–	3	–	2	–	–	–	–
CO5	2	2	3	–	2	–	–	2	2	3	–	1	1	–

25CSPC702	**DIGITAL IMAGE PROCESSING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce the basics of digital image processing and OpenCV tools.
- To explain image enhancement techniques in spatial and frequency domains.
- To teach image segmentation methods and their practical use with OpenCV.
- To provide an overview of image compression and multi-resolution analysis.
- To inculcate knowledge on morphological operations and real-time applications using OpenCV.

UNIT – I FUNDAMENTALS

Digital imaging: Introduction – Steps in image processing systems – Image acquisition – Image Sampling and Quantization – Pixel relationships – Linear and nonlinear operations. OpenCV : Installing and importing cv2 – Reading, writing and displaying images – Color spaces and conversions – Understanding image as Arrays. Learning tools: Introduction to

Jupyter Notebook and Google Colab – Setting up Environment – Benefits of Notebook-based Learning.

UNIT – II IMAGE ENHANCEMENT

Spatial domain – Gray Level transformations – Histogram Equalization and Stretching – Spatial filtering – Smoothing and sharpening – Frequency domain: DFT, FFT, DCT – Frequency domain filtering – Homomorphic filtering – Image Enhancement using OpenCV.

UNIT – III IMAGE SEGMENTATION

Detection of discontinuities – Edge operators – Edge Linking and Contour Detection – Thresholding– Region based segmentation – Morphological Watersheds – Motion segmentation using frame differencing – Segmentation techniques using OpenCV.

UNIT – IV MULTI RESOLUTION ANALYSIS AND COMPRESSION

Image pyramids – Multi resolution expansion – Wavelet Transforms – Image Compression: Fundamentals – Lossless and Lossy compression – JPEG compression – Image format conversions – Image compression techniques using OpenCV.

UNIT – V MORPHOLOGICAL PROCESSING AND CASE STUDIES

Morphological image processing – Preliminaries – Dilation and Erosion – Opening and Closing – The Hit-or-Miss transformation – Representation: Boundary descriptors – Regional descriptors – Principal Component-based shape description. Applications of Image Processing – Face Detection – Barcode/QR Code scanner – Road lane detection.

Text Books:

1. R.C. Gonzalez and Rafael. C. Woods, Richard E, “Digital image processing”, fourth edition, Pearson education, 2018.
2. Sandipan Dey, “Hands-On Image Processing with Python”, Packt Publishing, first edition, 2018.

References:

1. AL. Bovik, “The Essential Guide to Image processing”, second edition, Elsevier, 2009.
2. Anil K. Jain, “Fundamentals of Digital Image Processing”, PHI, 2006.
3. Sanjit K. Mitra, & Giovanni L. Sicuranza, “Non Linear Image Processing”, Elsevier, 2007.
4. Maria Petrou, Costas Petrou, “Image Processing: The Fundamentals”, Wiley, second edition, 2010.

Course Outcomes:

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

1. Explain digital image processing principles, image representation techniques, and OpenCV tools for engineering applications.
2. Apply image enhancement, filtering, and transformation techniques using OpenCV to improve digital image quality.
3. Analyze digital images using segmentation, feature extraction, and morphological processing techniques for object identification.
4. Evaluate image compression and multi-resolution analysis techniques to optimize image representation and processing performance.
5. Develop intelligent image processing applications by integrating enhancement, segmentation, compression, and feature analysis using OpenCV.
6.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	3	–	–	–	–	–	–	2	–	1
CO2	2	3	2	–	3	–	–	–	–	–	–	2	2	2
CO3	2	3	–	3	2	–	–	–	–	–	–	2	2	2
CO4	2	2	–	2	2	–	–	–	–	–	–	1	2	2
CO5	2	2	3	–	3	–	–	–	–	–	–	2	2	3

25CSPC703	INTERNET OF THINGS (IOT)	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the fundamentals of Internet of Things.
- To explore the features of M2M and System Management.
- To acquire knowledge about developing Internet of things.
- To explain the concepts of Raspberry pi with python and Arduino.
- To demonstrate and design a small low cost IoT system and to apply the concept of Internet of Things in the real world scenario.

UNIT – I INTRODUCTION TO IOT

Introduction to IoT–Definition, Characteristics, Physical design of IoT, Logical Design of IOT, functional blocks, communication models, Communication APIs, IOT Enabling Technologies, Sensors, Participatory Sensing, RFIDs and Wireless Sensor Networks.

UNIT – II M2M AND SYSTEM MANAGEMENT

Introduction-M2M, Difference between M2M and IoT, SDN and NFV for IoT, System Management– need for IOT systems Management, SNMP, NETCONF, YANG.

UNIT – III DEVELOPING INTERNET OF THINGS

IoT Design Methodology-Purpose & Requirements specification, process specification, domain model specification, information model specification, service specification, IoT level specifications, Functional view specification, Operational view specification, Device and component Integration, Application Development.

UNIT – IV RASPBERRY PI WITH PYTHON AND ARDUINO

Logical Design using Python- Python Data types and Data Structures - IoT Physical Devices & Endpoints – Building blocks of an IOT Device- Raspberry Pi-Board- Linux on Raspberry Pi -Raspberry Pi Interfaces-Programming RaspberryPi with Python-Other IoT Platforms-Arduino.

UNIT – V CASE STUDIES ILLUSTRATING IOT DESIGN

Home Automation, Environment, Agriculture, Health, Industry. Case Study: Smart City, Streetlights Control and Monitoring

Text Books:

1. Arshdeep Bahga and Vijay Madisetti, Internet of Things A Hand-on Approach, Universities press, 2015.
2. Dr. Ovidiu Vermesan and Dr. Peter Friess, Internet of Things: From research and innovation to market deployment, River Publishers 2014.

References:

1. Dieter Uckelmann et.al, “Architecting the Internet of Things”, Springer, 2011

2. Pethuru Raj and Anupama C.Raman, "The Internet of Things: Enabling Technologies and Use Cases", CRC Press.
3. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective" - CRC Press 2012.

Course Outcomes:

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

1. Explain the principles, architecture, communication models, and enabling technologies of Internet of Things for engineering applications.
2. Apply IoT design methodologies, communication protocols, and system management techniques to develop connected IoT solutions.
3. Analyze IoT hardware platforms, software components, and communication interfaces for efficient device integration and application development.
4. Evaluate IoT architectures and implementation strategies for selecting suitable solutions in diverse real-world application domains.
5. Design and develop cost-effective IoT systems using embedded platforms, sensors, and communication technologies to address real-world engineering problems.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	2	–	–	–	–	–	1	2	2	–
CO2	2	3	2	2	2	–	–	–	–	–	1	2	3	–
CO3	2	2	3	3	3	–	–	–	–	–	2	3	3	1
CO4	2	3	2	3	2	1	1	–	–	–	2	2	3	1
CO5	2	2	3	2	3	1	1	–	1	–	2	3	3	2

25CSCP707	DIGITAL IMAGEPROCESSING LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To illustrate the basic image processing concepts through actual processing of images using python.
- To analyze image enhancement and image segmentation techniques in spatial domain.
- To understand the concept to image compression and morphological processing of an image.

LIST OF EXERCISES

1. Perform negative and logarithmic transformations on an image.
2. Convert a color image to grayscale and simulate sampling and quantization of an image.
3. Extract and display a Region of Interest (ROI) from an image.
4. Display individual color components(R,G,B,Cr,CB,H,S,I) of a color image.
5. Implement histogram equalization to enhance contrast for a full image and part of grayscale image.

6. Apply Smoothening and Sharpening filters to an image in spatial domain for noise reduction.
7. Transform an image to frequency domain using FFT.
8. Perform edge detection using Sobel, Prewitt, and Canny operators.
9. Apply global and adaptive thresholding for segmentation.
10. Perform image segmentation using watershed algorithm.
11. Construct Gaussian and Laplacian pyramids of an image.
12. Implement wavelet decomposition and reconstruction using Haar wavelets.
13. Implement Huffman coding and decoding for a given image.
14. Compute PSNR and MSE between original and compressed images.
15. Perform dilation and erosion operations on a binary image.
16. Perform skeletonization and extract boundaries of objects.

Assignment: Apply morphological operations for fingerprint recognition.

Course Outcomes:

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

1. Explain digital image processing principles and image transformation techniques for developing image analysis applications using Python.
2. Apply image enhancement, segmentation, compression, and morphological processing techniques to implement, test, and evaluate image processing solutions.
3. Analyze digital image processing techniques to develop efficient and reliable solutions for real-world image analysis and recognition applications.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	-	3	-	-	-	-	-	1	2	2	2
CO2	2	3	3	2	3	-	-	-	-	-	-	2	3	2
CO3	2	3	2	3	2	-	-	-	-	-	2	2	2	2

25CSCP708	**INTERNET OF THINGS LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives:

- To make the students learn the basic features of Arduino and Raspberry Pi.
- To get more knowledge about the usage of various sensors in IOT.
- To impart knowledge about how to use IoT based products that can be used in various real time applications.

LIST OF EXERCISES

1. Write an Arduino Program to Blink an RGB LED in a sequence in Arduino (Digital Code).
2. Write an Arduino Program to Interface LED(RGB) with Arduino.
3. Write an Arduino Program to interface Touch sensor with Arduino.
4. Write a Program for Distance measurement using Arduino.

5. Write an Arduino Program to Identify moisture content in Agricultural Land.
6. Write a Program for Motion detection using Arduino.
7. Write a Program to Identify Room Temperature and humidity using Arduino.
8. Write a Program to implement Colour recognition using Arduino.
9. Write a Program to implement Fire Alarm Indicator using Arduino.
10. Write a Program to implement Sound detection using Arduino.
11. Write a Program to Interface Flex sensor with Arduino.
12. Write a Program to Interface Force pressure sensor with Arduino.
13. Write a Program to Interface LED(RGB) with Raspberry Pi.
14. Write a Program to Identify Room Temperature and humidity using Raspberry Pi.
15. Write a Program to interface PIR motion sensor with Raspberry Pi.
16. Write a Program to interface Sound sensor with Raspberry Pi.

Course Outcomes:

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

1. Explain Internet of Things principles, embedded platforms, and sensor interfacing techniques for developing IoT-based monitoring and automation applications.
2. Apply Arduino, Raspberry Pi, and sensor interfacing techniques to implement, test, and debug IoT solutions for real-world applications.
3. Analyze IoT system design and sensor integration techniques to develop efficient and reliable smart monitoring and automation solutions.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	-	2	-	-	-	-	-	1	3	2	1
CO2	2	3	3	-	3	-	-	-	-	-	-	3	2	2
CO3	2	2	3	2	2	-	-	-	-	-	2	3	2	1

25ETIT709	**INDUSTRIAL TRAINING/RURAL INTERNSHIP/ INNOVATION/ENTREPRENEURSHIP**	**L**	**TR**	**S**	**C**
		0	**1**	**2**	**4**

Note:*- Four weeks during the summer vacation before the end of sixth semester

Course Objectives:

- To expose the students to understand technical and professional skill requirements in IT industries.
- To impart professional skills for solving problems in industries.
- To train the students to design innovative solutions for a problem.
- To motivate the students to become an Entrepreneur.
- To develop communication and technical report writing skill.

The students will work for two periods per week guided by student counselor. They will be asked to present a seminar of not less than 15 minutes and not more than 30 minutes on any

technical topic of student's choice related to Computer Science and Engineering and to engage in discussion with audience. They will defend their presentation. A brief copy of their presentation also should be submitted. Evaluation will be done by the student counselor based on the technical presentation, the report and also on the interaction shown during the seminar.

The students will individually undertake a training program in reputed concerns in the field of Computer Science and Engineering during summer vacation (at the end of sixth semester) for a minimum stipulated period of four weeks. At the end of training the student has to submit the detailed report on the training undertaken within ten days from the commencement of the seventh semester. The student will be evaluated by a team of staff members nominated by the Head of the Department through a viva-voce examination.

Course Outcomes:

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

1. Explain contemporary computing technologies, industrial practices, and professional skills through technical presentations and industrial training experiences.
2. Apply technical knowledge and professional practices to analyze engineering problems encountered during seminars and industrial training.
3. Analyze industrial problems and emerging technologies to propose effective engineering solutions supported by technical evidence.
4. Evaluate engineering practices, industrial workflows, and technological solutions through technical discussions, presentations, and professional reporting.
5. Develop innovative technical solutions and professional reports by integrating industrial exposure, communication skills, and entrepreneurial perspectives.

CO - PO / PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	–	–	–	–	2	2	–	1	–	2	–	–	1
CO2	2	2	2	–	2	–	1	2	3	–	1	2	2	–
CO3	2	3	3	2	1	1	–	–	1	–	1	3	2	2
CO4	–	2	2	3	–	1	1	–	3	2	1	–	1	2
CO5	1	2	3	2	2	1	1	–	2	3	2	2	2	3

25CSPV803	PROJECT WORK AND VIVA VOCE	L	PR	S	C
		0	10	2	6

Course Objectives:

- To inculcate the ability of the student to solve specific problems right from its identification.
- To review literatures based on the problem statement.
- To label methodology for solving the problem.
- To solve problems using modern tools if required.

- To impart the students in preparing project reports and to defend their reports during evaluation

Course Outcomes:

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

1. Explain the identified engineering problem, relevant literature, and project objectives to establish a systematic approach for problem solving.
2. Apply engineering principles and research methodologies to formulate feasible solutions for the identified problem.
3. Analyze literature, problem requirements, and alternative approaches to select an appropriate methodology for project implementation.
4. Evaluate the effectiveness of proposed methodologies and modern engineering tools to justify the selected project solution.
5. Develop a comprehensive project proposal and technical report with effective presentation and defense of the proposed engineering solution.

CO - PO / PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	–	2	–	–	–	–	1	–	1	2	–	–
CO2	3	3	3	–	2	–	–	–	–	–	–	2	3	2
CO3	2	3	2	3	2	–	–	–	–	–	–	2	3	2
CO4	2	2	3	3	3	–	–	–	–	–	–	2	3	2
CO5	2	1	2	2	2	–	–	–	3	2	2	1	2	2

PE - PROFESSIONAL ELECTIVES

25CSPESCN	ADVANCED JAVA PROGRAMMING	L	T	P	C
		3	0	0	3

Course Objectives:

- To demonstrate the uses of Applets and AWT concepts in Java.
- To learn the concepts of Network and Database programming.
- To familiarize students with Swing and Beans concepts.
- To build applications in Distributed Environment.
- To impart the knowledge of Spring and Hibernate frameworks.

UNIT – I APPLETS AND ABSTRACT WINDOW TOOLKIT (AWT)

Applets: Introduction to Java Programming– Working with Java– Java Applet– Drawing Shapes and Text– Images– Variables and Methods. Abstract Window Toolkit: Abstract Window Toolkit (AWT) – AWT Classes– Window Fundamentals– Working with Frame Windows– Introduction to Graphics– AWT Controls.

UNIT – II NETWORK AND DATABASE PROGRAMMING

Network Programming: Basic Network and Web Concepts– Streams– Output Streams Input Streams– Filter Streams– Sockets for Clients– Socket Basics– Using Sockets Socket Exceptions– Sockets for Servers– Broadcasting– Multicasting. Database Programming: Introduction to JDBC– Connection Troubles– Basic Database Access JDBC Support Classes– Database Servlet– Advanced JDBC.

UNIT – III SWING AND BEANS

Swing: Introduction– Features– MVC Connection– Components and Containers– Swing Packages– Event Handling– Exploring Swing– Swing Menus. Java Beans: Advantages– Introspection– Persistence– Customizers– Java Beans API.

UNIT – IV APPLICATIONS IN DISTRIBUTED ENVIRONMENT

Streams– Core Classes– Viewing a File– Layering Streams– Sockets Server Sockets– Customizing Socket Behavior – Designing the Remote Interface– Building Data Objects– Accounting for Partial Failure Serialization– RMI Registry– Naming Services– Security Policies– RMI, CORBA and RMI/IIOP.

UNIT – V SPRING FRAMEWORK AND HIBERNATE FRAMEWORK

Spring Framework: Introduction to Spring– Scope and Lifecycle of Bean Inversion of Control– Dependency Injection– Spring MVC– Building Spring Web Apps– Creating Controllers and Views– Request Params and Request Mapping– Form tags and Data Binding. Hibernate Framework: Introduction to Hibernate– Hibernate CURD Features– Advanced Mappings– Hibernate Query Languages and Transactions. Spring Hibernate Integrations: Hibernate DAO Implementation using Spring Framework.

Text Books:

1. Elizabeth Sugar Boese, “An Introduction to Programming with Java Applets”, Jones and Bartlett Publishers, 3rd Edition, 2010.
2. Herbert Schildt, “Java: The Complete Reference”, McGraw-Hill Publishers, 11th Edition, 2019.
3. William Grosso.“Java RMI”, O’Reilly Media Publication, 1st Edition, 2002.
4. Elliotte Rusty Harold, “JAVA Network Programming”, O’Reilly Media Publication, 4th Edition, 2013.

References:

1. D.T. Editorial Services “Java 8 Programming Black Book”, Wiley, 2015.

2. Santosh Kumar K, "Spring and Hibernate", Mc.Graw Hill Education, 2nd Edition, 2013.
3. George Reese, "Database Programming with JDBC and Java", O'Reilly Media Publication, 2nd Edition, 2000.

Course Outcomes:

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

1. Explain the principles of advanced Java programming for developing graphical, networked and enterprise applications.
2. Apply Java programming techniques and frameworks to implement GUI, database, network and distributed computing applications.
3. Analyze the design and interaction of Java components, enterprise frameworks and distributed services for efficient software solutions.
4. Evaluate suitable Java technologies, frameworks and architectural approaches for developing scalable enterprise applications.
5. Develop enterprise-level Java applications by integrating GUI components, networking, databases, distributed technologies and Spring–Hibernate frameworks.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	–	–	–	2	–	–	–	–	–	–	2	1	–
CO2	2	2	3	–	3	–	–	–	–	–	–	3	2	–
CO3	–	3	2	2	2	–	–	–	–	–	–	2	2	–
CO4	–	2	3	2	2	–	–	–	–	–	–	2	2	–
CO5	–	–	3	2	3	–	–	–	–	–	–	3	2	2

25CSPESCN	WEB APPLICATION FRAMEWORK	L	T	P	C
		3	0	0	3

Course Objectives

- Understand the architecture and components of modern web applications.
- To gain proficiency in developing web-based solutions using modern frameworks.
- To apply MVC architecture and RESTful APIs in real-world applications.
- Integrate databases, session handling, and authentication in web frameworks.
- To explore deployment techniques and performance optimization in web applications.

UNIT – I INTRODUCTION TO WEB FRAMEWORKS

Overview of Web Development - Introduction to Web Application Frameworks (WAF) - Client-server architecture and HTTP protocol - Introduction to MVC pattern - Setting up development environment.

UNIT – II FRONT-END AND SERVER-SIDE FRAMEWORKS

HTML5, CSS3, JavaScript essentials - Introduction to front-end frameworks (e.g., Bootstrap, React basics) - Introduction to server-side frameworks (Flask/Django/Express) - Routing, templating, and middleware integration.

UNIT – III WORKING WITH DATABASES AND ORM

Database connectivity and CRUD operations - Introduction to ORM (Object Relational Mapping) - Models, migrations, and schema definition - Connecting SQL/NoSQL databases with frameworks.

UNIT – IV SESSION HANDLING, AUTHENTICATION, AND RESTFUL APIS

State management and session handling - Authentication and Authorization (JWT, OAuth) - Building RESTful APIs - AJAX, JSON handling, and third-party API integration.

UNIT – V DEPLOYMENT, TESTING AND PERFORMANCE OPTIMIZATION

Deployment using Gunicorn, Nginx, Heroku, etc. - Environment variables and configuration - Unit testing and debugging techniques - Performance optimization and security practices.

Text Books:

1. Miguel Grinberg, Flask Web Development: Developing Web Applications with Python, O'Reilly Media, 2nd Edition, 2018.
2. Eric Matthes, Python Crash Course: A Hands-On, Project-Based Introduction to Programming, No Starch Press, 2nd Edition, 2019.

References:

1. Brad Dayley, Brendan Dayley, and Caleb Dayley, Node.js, MongoDB and Angular Web Development, Addison-Wesley Professional, 2nd Edition, 2018.
2. Ethan Brown, Web Development with Node and Express, O'Reilly Media, 2nd Edition, 2019.
3. MDN Web Docs – https://developer.mozilla.org/.
4. Django Documentation – https://docs.djangoproject.com/.

Course Outcomes:

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

1. Explain the architecture, components and development workflow of modern web application frameworks for scalable web solutions.
2. Apply web frameworks to implement interactive web applications using MVC architecture, databases and RESTful services.
3. Analyze web application requirements to integrate data management, authentication and API-based communication effectively.
4. Evaluate web framework technologies, deployment strategies and security practices for reliable and high-performance web applications.
5. Develop secure and scalable web applications by integrating front-end technologies, server-side frameworks, databases and deployment platforms.

CO–PO/PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	–	–	–	2	–	–	–	–	–	–	2	1	–
CO2	2	2	3	–	3	–	–	–	–	–	–	3	2	–
CO3	–	3	2	2	2	–	–	–	–	–	–	2	2	–
CO4	–	2	3	2	2	–	–	–	–	–	–	2	2	–
CO5	–	–	3	2	3	–	–	–	–	–	–	3	2	2

25CSPESCN	OPEN SOURCE PROGRAMMING	L	T	P	C
		3	0	0	3

Course Objectives:

- To study the context and operation of free and open source software (FOSS) communities and associated software projects.
- To understand the Linux core functionality and security mechanisms.
- To Learn the open source database MySQL basics.
- To know about the open source script language for Web development.
- To study the open source programming language develop for text manipulation.

UNIT – I INTRODUCTION TO OPEN SOURCE

Notion of Community-Guidelines for effectively working with FOSS community--, Benefits of Community based Software Development -Requirements for being open, free software, open source software –Four degrees of freedom - FOSS Licensing Models - FOSS Licenses – GPL- AGPL- LGPL - FDL - Implications – FOSS examples.

UNIT – II LINUX

Linux Installation and Hardware Configuration – Boot Process-The Linux Loader (LILO) - The Grand Unified Bootloader (GRUB) - Dual-Booting Linux and other Operating System - Boot-Time Kernel Options- X Windows System Configuration-System Administration – Backup and Restore Procedures- Strategies for keeping a Secure Server.

UNIT – III OPEN SOURCE DATABASE

Introduction to MySQL-Setting up account-Starting, terminating and writing your own SQL programs-Database-Table and views-Queries-Clauses-Conditions- Filtering & Pattern Matching-Join-Aggregate functions- Stored Procedures and Functions - MySQL and Web

UNIT – IV PHP

Introduction– Variables types in PHP– Understanding data types– Loose typing Testing variable– Changing variables data type– Type casting– Operators and expressions– Operator types– Decisions and loops Strings- Arrays– Functions- Getting information on files– Opening and closing files– Reading and writing to files.

UNIT – V PERL

Perl backgrounder-Perl overview-Perl parsing rules-Variables and Data-Statements and Control structures-Subroutines, Packages and Modules – Error Handling-Working with Files- Introduction to Modern Perl tools.

Text Books:

1. Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, “Linux in Nutshell”, Sixth Edition, OReilly Media, 2009.
2. Matt Doyle, Beginning PHP 5.3, Wiley Publishing,2013.
3. Tom Christiansen, brian d foy, Larry Wall, Jon Orwant, “Programming Perl”, 4th Edition, OReilly Media, 2012.

References:

1. Steve Suehring, “MySQL Bible”, John Wiley, 2002.
2. Philosophy of GNU URL: http://www.gnu.org/philosophy/.
3. Linux Administration URL: http://www.tldp.org/LDP/lame/LAME/linux-admin-made-easy/.
4. Perl Programming book at http://www.perl.org/books/beginning-perl/.

Course Outcomes:

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

1. Explain the principles, licensing models and development practices of free and open-source software for collaborative software development.
2. Apply open-source platforms, databases and scripting languages to implement secure software and web-based applications.
3. Analyze open-source tools and programming techniques to develop efficient database-driven and file-processing solutions.
4. Evaluate suitable open-source technologies, security mechanisms and development environments for diverse computing applications.
5. Develop integrated software solutions using Linux, MySQL and open-source scripting languages for real-world applications.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	–	–	–	2	–	–	–	–	–	–	2	1	–
CO2	2	2	3	–	3	–	–	–	–	–	–	3	2	–
CO3	–	3	2	2	2	–	–	–	–	–	–	2	2	–
CO4	–	2	3	2	2	–	–	–	–	–	–	2	2	–
CO5	–	–	3	2	3	–	–	–	–	–	–	3	2	2

25CSPESCN	**JAVA FULL STACK DEVELOPMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To design web pages using HTML & 08S elements.
- To make use of JavaScript for writing programs to perform client-side validation on web applications and utilize Type Script to develop web applications.
- To practice MySQL database and queries.
- To impart knowledge on java servlet to develop dynamic web pages.
- To understand the Java Server Pages for developing web applications

UNIT – I INTRODUCTION AND FRONT-END DEVELOPMENT

Introduction to Full Stack Development: Definition of Full Stack Web Development Introduction to Web Application Development- Front-End Technologies- Back-End Technologies- Introduction to Back-End Development with Java- Introduction to Model View Controller (MVC)- Introduction to Web Services- Communication Between Front End and Back-End. HTML: Introduction, Basic HTML Elements- Table Elements- Form Elements– Embedded Elements– HTML5 Security– Best Practices– Capstone Project. CSS: Getting Started with CSS3– Selectors– Cascading Order– Typography Box Model– Transformations– Transitions– Animations– Responsive Web Design Security– Capstone Projects.

UNIT – II SCRIPTING LANGUAGES

JavaScript: Getting Started with JavaScript– Setting-up the Environment– Identifiers Data Types– Operators– Statements and Expressions– Loops-– Functions– Classes Event Handling– Objects– Iterables – Asynchronous Programming– Modular Programming– Security– Best Practices– Capstone Project. Type Script: Getting Started with Type Script– Type Script Basics– Function– Interface– Class– Modules and Namespaces– Generics– Capstone Project.

UNIT – III DATABASE

MySQL: Introduction to MySQL– Using SQL to Manage Data– Data Types– Stored Programs– Query Optimization– MySQL Programming. JDBC– JDBC Driver– JDBC Interface– Using JDBC with Java Applications.

UNIT – IV BACK-END DEVELOPMENT USING JAVA SERVLETS AND EJB

Java Servlets: Usage– Servlet Life Cycle– Servlets for World Wide Web– Coding Http Servlet – Servlet Configuration– Servlet Context– Servlet Event Listeners. Enterprise Java Bean: Introduction to Enterprise- Enterprise Bean Architecture- EJB Container– Benefits of Enterprise Bean– Types of Enterprise Bean– Accessing Enterprise Beans– Packaging Enterprise Beans– Java Message Service.

UNIT – V BACK-END DEVELOPMENT USING JAVA SERVER PAGES

Java Server Pages: JSP Specification– JSP Life Cycle– JSP Syntax and Semantics Comments– JSP Document– JSP Elements– JSP GUI Example– JSP and Servlet Exceptions– Web Application Exception Handling. Case Study: Building a Complete Web Application.

Text Books:

1. Mayur Ramgir, “Full Stack Java Development with Spring MVC, Hibernate, jQuery, and Bootstrap”, Wiley India Pvt. Ltd., 2020.
2. Jon Duckett, “HTML & CSS: Design and Build Websites”, Wiley, 2011.
3. Colin J Ihrig, Adam Bretz, “Full Stack JavaScript Development with MEAN”, SitePoint Pty. Ltd., 2014.
4. Aristeidis Bampakos, Pablo Deeleman, “Learning Angular: A No-nonsense Beginner's Guide to Building Web Applications with Angular 10 and TypeScript”, 3rd Edition, Packt Publishing Ltd., 2020.
5. Paul DuBios, “MySQL”, 4th Edition, Developers Library book, Pearson Education Inc., 2009.
6. Jayson Falkner, Kevin Jones, “Servlets and Java Server Pages- The J2EETM Technology Web Tier” Pearson Education Inc., 2004.

References:

1. https://infyspringboard.onwingspan.com/en/app/toc/lex_17739732834840810000_sh ared/overview (HTML5).
2. https://infyspringboard.onwingspan.com/en/app/toc/lex_18109698366332810000_sh ared/overview (Javascript).
3. https://infyspringboard.onwingspan.com/en/app/toc/lex_9436233116512678000_shar ed/overview (Typescript).
4. Mark Matthews, Jim Cole, Joseph D. Gradecki, “MySQL and Java Developer’s Guide”, 4th Edition, Developers Library book, Wiley Publishing Inc., 2003.

Course Outcomes:

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

1. Explain the principles, architecture, and technologies of Java Full Stack Development for building secure and scalable web applications.
2. Apply front-end, scripting, database, and Java server-side technologies to develop interactive and database-driven web applications.
3. Analyze full-stack application components to select appropriate frameworks, communication mechanisms, and database solutions for engineering applications.
4. Evaluate the performance, security, and maintainability of full-stack web applications using established development practices.
5. Design and develop an end-to-end Java Full Stack web application by integrating front-end, database, and back-end technologies to address real-world problems.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	2	–	–	–	–	–	–	2	1	–
CO2	2	2	3	–	3	–	–	–	–	–	–	3	2	–
CO3	2	3	2	–	2	–	–	–	–	–	–	2	2	1
CO4	–	2	2	2	2	–	–	–	–	–	2	2	1	–
CO5	2	2	3	–	3	–	–	–	–	–	1	3	2	–

25CSPESCN	**NOSQL DATABASES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To describe various NoSQL databases and compare them with relational databases
- To familarise data models.
- To explain the features of document database.
- To introduce the concepts of key- value databases.
- To impart knowledge on column and graph databases.

UNIT – I INTRODUCTION TO NOSQL

Overview and History of NoSQL Databases - Definition of the Four Types of NoSQL Database - The Value of Relational Databases - Getting at Persistent Data – Concurrency – Integration - Impedance Mismatch - Application and Integration Databases - Attack of the Clusters - The Emergence of NoSQL - Comparison of relational databases to new NoSQL stores – MongoDB – Cassandra – HBASE - Neo4j.

UNIT – II DATA MODELS

RDBMS approach - Challenges NoSQL approach - Key-Value and Document Data Models– Column Family Stores - Aggregate-Oriented Databases -Replication and sharding - MapReduce on databases - Distribution Models - Single Server –Sharding - Master-Slave Replication - Peer-to-Peer Replication - Combining Sharding and Replication.

UNIT – III DOCUMENT DATABASE

NoSQL Document databases using MongoDB -Introduction to Document Databases - Features Consistency - Transactions, Availability - Query Features – Scaling - Document

Databases Terminology - Event Logging - Content Management Systems - Blogging Platforms - Web Analytics or Real-Time Analytics - E-Commerce Applications - Designing for Document Databases - Complex Transactions Spanning Different Operations - Queries against Varying Aggregate Structure.

UNIT – IV KEY VALUE DATABASE

NoSQL Key/Value databases using Riak -Introduction to Key-Value Databases -Key- Value Store Features Key value Databases Terminology -Storing Session Information - User Profiles – Preferences - Shopping Cart Data -Relationships among Data - Multioperation Transactions - Query by Data - Operations by Sets -Designing Key value Databases.

UNIT – V COLUMN AND GRAPH DATABASE

Introduction to Column Family Database - Features Column Family Database Terminology - Event Logging - Content Management Systems - Blogging Platforms – Counters - Expiring Usage -Designing for Column Family Databases - Introduction to Graph Databases - Features Consistency – Transactions – Availability - Query Features – Scaling -Graph Database Terminology -Designing for Graph Databases -Connected Data – Routing – Dispatch - Location-Based Services.

Text Books:

1. Dan Sullivan, “NoSQL for Mere Mortals”, Addison – Wesley, Pearson Education, 2015.
2. Pramod J. Sadalage and Martin Fowler, “NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence “, Addison - Wesley, 2012.

References:

1. Luc Perkins, Eric Redmond and Jim R. Wilson, “Seven Database in Seven Weeks : A Guide to Modern Databases and the NoSQL Movement”, The Pragmatic Bookshelf, 2 ndEdition,2012.
2. Aaron Ploetz, Devram Kandhare, Sudarshan Kadambi and Xun (Brian) Wu “Seven NoSQL Databases in a Week: Get up and running with the fundamentals and functionalities of seven of the most popular NoSQL databases”,packt Publishing, 2018.
3. Gaurav Vaish, “Getting Started with NoSql”,Packt Publishing, 2013.
4. Adam Flower,”NoSQL for Dummies”, John Wiley & Sons Inc, 2015.

Course Outcomes:

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

1. Explain the principles, architectures, and data models of NoSQL databases for scalable and distributed data management.
2. Apply appropriate NoSQL database models and distribution techniques to develop efficient data storage solutions for diverse applications.
3. Analyze application requirements to select suitable document, key-value, column-family, or graph databases for engineering solutions.
4. Evaluate the performance, scalability, consistency, and availability of NoSQL database systems in distributed computing environments.
5. Design scalable NoSQL database solutions by integrating appropriate data models, replication strategies, and database technologies for real-world applications.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	1	–	–	–	–	–	–	2	2	–
CO2	2	2	3	–	2	–	–	–	–	–	–	2	3	–
CO3	2	3	2	–	2	–	–	–	–	–	–	2	2	1
CO4	–	2	2	3	2	–	–	–	–	–	1	1	2	–
CO5	2	2	3	–	2	–	–	–	–	–	1	2	3	–

25CSPESCN	DATA MINING	L	T	P	C
		3	0	0	3

Course Objectives

- To enable the student to understand the data warehousing component and Multidimensional data model.
- To explain the concepts of Data warehousing Architecture and Implementation
- To describe the methodologies used for data preprocessing
- To teach various techniques used in classification and clustering.
- To expose the concepts of advanced data mining.

UNIT – I **DATA WAREHOUSING AND OLAP**

Evolution of Decision Support Systems - Data warehousing Components – Building a Data warehouse - Data Warehouse and DBMS - Data marts – Metadata - Multidimensional data model - OLAP Vs OLTP - OLAP operations - Data cubes - Schemas for Multidimensional Database: Stars, Snowflakes and Fact constellations.

UNIT – II **DATA WAREHOUSE IMPLEMENTATION**

Types of OLAP servers- 3 – Tier data warehouse architecture - distributed and virtual data warehouses - Data warehouse implementation - tuning and testing of data warehouse - Data Staging (ETL) Design and Development - data warehouse visualization - Data Warehouse Deployment – Maintenance – Growth - Business Intelligence Overview - Data Warehousing and Business Intelligence Trends - Business Applications - tools- SAS.

UNIT – III **DATA MINING**

Data mining - KDD versus data mining - Stages of the Data Mining Process - task primitives -Data Mining Techniques - Data mining knowledge representation – Data mining query languages - Integration of a Data Mining System with a Data Warehouse – Issues-Data preprocessing – Data cleaning - Data transformation - Feature selection - Dimensionality reduction - Discretization and generating concept hierarchies - Mining frequent patterns – association - correlation.

UNIT – IV **PATTERN MINING**

Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Clustering techniques – Partitioning methods - k-means- Hierarchical Methods – distance based agglomerative and divisible

clustering - Density-Based Methods – expectation maximization - Grid Based Methods – Model-Based Clustering Methods – Constraint – Based Cluster Analysis – Outlier Analysis.

UNIT – V DATA MINING TRENDS

Statistics and Data Analysis – EDA – Small and Big Data – Logistic Regression Model - Ordinary Regression Model - Mining complex data objects – Spatial databases – Temporal databases – Multimedia databases – Time series and sequence data – Text mining – Web mining – Applications in Data mining.

Text Books:

1. Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers, third edition,2011.
2. Alex Berson and Stephen J. Smith, “Data Warehousing, Data Mining & OLAP”, Tata McGraw Hill Edition, Tenth Reprint,2007.

References:

1. G. K. Gupta, “Introduction to Data Min Data Mining with Case Studies”, Prentice Hall of India, Easter Economy Edition,2006.
2. Ian.H.Witten, Eibe Frank and Mark.A.Hall, “Data Mining: Practical Machine Learning Tools and Techniques”, Third edition, (Then Morgan Kufmann series in Data Management systems),2011.
3. Bruce Ratner, “Statistical and Machine learning –Learning Data Mining, techniques for better Predictive Modeling and Analysis to Big Data”, CRC Press, Second Edition,2011.
4. Mehmed kantardzic, “Data mining concepts, models, methods, and algorithms”, Wiley- Interscience, IEEE Press, 2nd Edition,2003.
5. Ian Witten, Eibe Frank, “Data Mining: Practical Machine Learning Tools and Techniques”, Morgan Kaufmann, third edition,2011.
6. George M Marakas, “Modern Data Warehousing, Mining and Visualization”, Prentice Hall, Second Edition,2003.

Course Outcomes:

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

1. Explain the principles of data warehousing, OLAP, and data mining for knowledge discovery and decision support applications.
2. Apply data preprocessing, warehousing, and mining techniques to extract meaningful patterns from structured and large-scale datasets.
3. Analyze datasets using classification, clustering, and association mining techniques to support intelligent decision-making.
4. Evaluate appropriate data mining models, warehouse architectures, and analytical techniques for diverse business and engineering applications.
5. Design data mining solutions by integrating data warehousing, preprocessing, pattern discovery, and advanced analytics for real-world applications.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	1	–	–	–	–	–	–	2	2	–
CO2	2	2	2	–	3	–	–	–	–	–	–	2	3	–
CO3	2	3	2	2	2	–	–	–	–	–	–	2	2	–
CO4	–	2	2	3	2	–	–	–	–	–	1	1	2	1
CO5	2	2	3	–	2	–	–	–	–	–	1	2	3	–

25CSPESCN	MOBILE COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the concepts of mobile communication and architecture of mobile devices.
- To analyze the GSM, GPRS and UMTS network technologies and protocols.
- To educate the students about the mobile IP and transport layer issues in mobile networks.
- To expose the learners to ad hoc and sensor networks and their applications.
- To provide knowledge on recent trends in mobile platforms, operating systems and applications.

UNIT – I INTRODUCTION TO MOBILE COMPUTING

Mobile Computing Architecture – Mobile Devices – Wireless Communications – Cellular Networks – GSM, GPRS – Services and Architecture – Mobility Management – SMS – MMS – Wireless LANs – IEEE 802.11 Standards – Mobile IP – Wireless Access Protocol.

UNIT – II MOBILE NETWORKS AND TRANSPORT LAYER

Mobile IP – Dynamic Host Configuration Protocol – Mobile Transport Layer – TCP over Wireless – Indirect TCP – Snooping TCP – Mobile TCP – Fast Retransmit / Fast Recovery – Transmission/Timeout Freezing – Selective Retransmission – Transaction Oriented TCP.

UNIT – III WIRELESS NETWORKS AND ROUTING

Ad Hoc Wireless Networks – Introduction – Issues – MAC Protocols – Routing Protocols – Destination Sequenced Distance Vector – Dynamic Source Routing – Wireless Sensor Networks – Architecture – Data Dissemination – Data Gathering – MAC Protocols for Sensor Networks.

UNIT – IV MOBILE PLATFORMS AND APPLICATIONS

Mobile Device Operating Systems – Android – iOS – Mobile App Development Environments – App Development: Native, Web and Hybrid Apps – App Store and Play Store Deployment – Mobile UI Design – Context-aware and Location-based Services.

UNIT – V SECURITY AND FUTURE DIRECTIONS

Mobile Security Issues – Authentication – Encryption – VPN – Cloud Support for Mobile Computing – Mobile Cloud Architecture – IoT and Mobile Integration – Edge Computing – Future Trends and Research Directions.

Text Books:

1. Jochen Schiller, Mobile Communications, Pearson Education, 2nd Edition, 2012.

2. Asoke K Talukder, Roopa R Yavagal, Mobile Computing – Technology, Applications and Service Creation, Tata McGraw Hill, 2010.

References:

1. Raj Kamal, Mobile Computing, Oxford University Press, 2nd Edition, 2012.
2. Rappael C. Wong, Mobile Computing, McGraw-Hill Education, 2015.

Course Outcomes:

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

1. Explain the principles, architectures, protocols, and technologies underlying mobile computing and wireless communication systems.
2. Apply mobile networking protocols, transport mechanisms, and wireless communication techniques to support reliable mobile computing applications.
3. Analyze mobile networking, routing, and security mechanisms to address challenges in wireless and mobile computing environments.
4. Evaluate mobile platforms, application architectures, and emerging mobile computing technologies for diverse engineering applications.
5. Design secure and scalable mobile computing solutions by integrating wireless networks, mobile platforms, cloud services, and IoT technologies.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	2	–	–	–	–	–	–	2	1	1
CO2	2	2	2	–	3	–	–	–	–	–	–	2	2	1
CO3	2	3	2	2	2	–	–	–	–	–	–	1	2	2
CO4	–	2	2	2	2	–	–	–	–	–	2	2	2	–
CO5	2	2	3	–	3	–	–	–	–	–	1	2	1	1

25CSPESCN	**MOBILE APPLICATION DEVELOPMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To demonstrate their understanding of the fundamentals of Android operating systems.
- To demonstrate their skills of using Android software development tools.
- To demonstrate their ability to develop software with reasonable complexity on mobile platform.

UNIT – I INTRODUCTION TO ANDROID OPERATING SYSTEM:

Introduction to Android Operating System: Android SDK Features, Developing for Android, Best practices in Android programming, Android Development Tools. Android application components - Android Manifest file, Externalizing resources, The Android Application Lifecycle, A Closer Look at Android Activities.

UNIT – II ANDROID USER INTERFACE

Introducing Layouts, User Interface (UI) Components - Editable and Non-Editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers. Event Handling - Handling clicks or changes of various UI components. Introducing Fragments, Multi-screen Activities.

UNIT – III INTENTS AND BROADCASTS

Introducing Intents: Using Intents to Launch Activities. Using Intent to dial a number or to send SMS. Broadcast Receivers - Creating Intent Filters and Broadcast Receivers: Using Intent Filters to Service Implicit Intents. Finding and using Intents received within an Activity. Customizing the Action Bar, Using the Action Bar for application navigation. Notifications - Creating and Displaying notifications, Displaying Toasts.

UNIT – IV PERSISTENT STORAGE

Files - Reading data from files, listing contents of a directory, Creating and Saving Shared Preferences, Retrieving Shared Preferences. Database -Introducing Android Databases, Introducing SQLite, Content Values and Cursors, Working with SQLite Databases. Registering Content Providers, using content Providers (insert, delete, retrieve and update).

UNIT – V ADVANCED TOPICS:

Alarms -Using Alarms. Using Internet Resources - Connecting to internet resource, using download manager. Location Based Services -Using Location-Based Services, Using the Emulator with Location-Based Services. Introduction to Flutter, Dart introduction, Data Types and Variables, String interpolation, Operators, Control Flow Statements, Functions, Classes, Read and write with Dart IO: Setup, Read and write with Dart IO: Final code.

Text Books:

1. Reto Meier, “Professional Android 4 Application Development”, Wiley India, (Wrox), 2012.
2. Delvi Dawn Griffiths, David Griffiths “Head First Android Development”, O’Reilly Media, Inc., 2015.
3. Dieter Meiller, “Modern App Development with Dart and Flutter 2”, Walter de Gruyter GmbH, Berlin/Boston, 2021.

References:

1. Wei-Meng Lee, “Beginning Android 4 Application Development”, Wiley India (Wrox), 2013.
2. David Wolber, Hal Abelson, Ellen Spertus & Liz Looney, “App Inventor–Create your own Android Apps”, O’Reilly, 2011.

Course Outcomes:

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

1. Explain the architecture, components, and development environment of Android mobile application development.
2. Apply Android user interface components, event handling, and application services to develop interactive mobile applications.
3. Analyze Android application components, communication mechanisms, and data management techniques to build reliable mobile solutions.
4. Evaluate mobile application architectures, storage mechanisms, and platform services for secure and efficient application development.
5. Design and develop cross-platform mobile applications by integrating Android, Flutter, databases, internet services, and location-based technologies.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	2	–	–	–	–	–	–	2	1	–
CO2	2	2	3	–	3	–	–	–	–	–	–	3	2	–
CO3	2	3	2	2	2	–	–	–	–	–	–	2	2	1
CO4	–	2	2	3	2	–	–	–	–	–	1	2	1	1
CO5	2	2	3	–	3	–	–	–	–	–	1	3	2	–

25CSPESCN	5G AND WIRELESS COMMUNICATION	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the evolution, vision, and requirements driving 5G wireless technologies.
- To explore the enabling technologies such as IoT, SDN, NFV, and cognitive radio that support 5G networks.
- To analyze the radio access, architecture, and design aspects of 5G including small cells, cloud-RAN, and spectrum usage.
- To examine the 5G Core Network architecture and key concepts like network slicing, session management, and interworking.
- To evaluate the security, QoS, charging mechanisms, and emerging trends in 5G networks.

UNIT – I Introduction and 5G Vision

Introduction - Evolution of LTE Technology to Beyond 4G - 5G Roadmap - 10 Pillars of 5G - Internet of Things and Context-Awareness - Networking Reconfiguration and Virtualisation Support – Mobility - Quality of Service Control - Emerging Approach for Resource Over-Provisioning.

UNIT – II Enabling Technologies for 5G

The Mobile Cloud - Mobile Cloud Enablers - Network Coding - Cognitive Radio for 5G Wireless Networks - Spectrum Optimisation using Cognitive Radio - Relevant Spectrum Optimisation Literature in 5G - Cognitive Radio and Carrier Aggregation - Energy-Efficient Cognitive Radio Technology - Key Requirements and Challenges for 5G Cognitive Terminals.

UNIT – III 5G Radio Access and Network Architecture

Small Cells - Capacity Limits and Achievable Gains with Densification - Mobile Data Demand - Demand vs Capacity - Small-Cell Challenges - Cooperative Diversity and Relaying Strategies - PHY Layer Impact on MAC Protocol Analysis - SON in UMTS and LTE - Evolution towards Small-Cell Dominant HetNets.

UNIT – IV 5G Core Network Architecture and Concepts

The 5G System Architecture - Network Slicing - Policy control and charging - PDU Session Management and QoS - Interworking with EPC - Mobility Management.

UNIT – V Security, QoS and Future Directions

Network functions and services - Security in 5G - Quality of Service - Selected call flows - Architecture extensions and vertical industries.

Text Books:

1. Jonathan Rodriguez, Fundamentals of 5G Mobile Networks. Germany: Wiley, 2015.
2. Rommer, Stefan, Hedman, Peter, Olsson, Magnus, Frid, Lars, Sultana, Shabnam, Mulligan, Catherine, "5G Core Networks: Powering Digitalization", Elsevier Science, 2019.

References:

1. Afif Osseiran et al., 5G Mobile and Wireless Communications Technology, Cambridge University Press.
2. David Tse and Pramod Viswanath, Fundamentals of Wireless Communication, Cambridge University Press.
3. Alexander M. Wyglinski et al., Cognitive Radio Networks, Elsevier.

Course Outcomes:

At end of this course work, students will be able to

1. Explain the principles, architecture, and enabling technologies of 5G wireless communication for modern mobile networking applications.
2. Apply 5G radio access technologies, spectrum optimization methods, and network architecture concepts to solve wireless communication problems.
3. Analyze 5G core network functions, mobility management, network slicing, and quality of service for efficient communication systems.
4. Evaluate security mechanisms, resource management strategies, and service delivery models in 5G networks for diverse application scenarios.
5. Design 5G-enabled wireless communication solutions by integrating emerging technologies to address real-world networking requirements.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	1	–	–	–	–	–	–	2	–	–
CO2	2	3	2	–	2	–	–	–	–	–	–	3	1	–
CO3	2	3	–	2	2	–	–	–	–	–	–	2	2	–
CO4	2	2	–	3	1	–	–	–	–	–	–	1	3	–
CO5	–	2	3	2	3	–	–	–	–	–	–	2	2	2

25CSPESCN	**CRYPTOGRAPHY AND NETWORK SECURITY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce the basic concepts of Computer security and Cryptography.
- To impart knowledge about Symmetric key algorithms and AES.
- To provide basic knowledge of Asymmetric key algorithms and Digital signatures.
- To familiarize the basic properties and concepts of Digital certificates and public key Infrastructure (PKI)

- To explain about Firewalls, Virtual private networks, Secure Socket Layer, Transport Layer Security, Secure Electronic Transaction and E-mail security.

UNIT – I INTRODUCTION

Need for security - Principles of Security - Types of Attacks - Plain text and Cipher Text - Substitution techniques - Caesar Cipher - Mono alphabetic Cipher - Polygram - Polyalphabetic Substitution - Playfair - Hill Cipher - Transposition techniques - Encryption and Decryption - Symmetric and Asymmetric Key Cryptography - Steganography - KeyRange and Key Size -Possible Types of Attacks.

UNIT – II CRYPTOGRAPHY ALGORITHMS

Algorithms types and modes - OYverview of Symmetric key Cryptography - Data Encryption Standard (DES) - International Data Encryption Algorithm (IDEA) - RC4 - RC5 - Blowfish - Advanced Encryption Standard (AES).

UNIT – III ASYMMETRIC KEY CRYPTOGRAPHY

Brief history of Asymmetric Key Cryptography - Overview of Asymmetric Key Cryptography - RSA algorithm - Symmetric and Asymmetric key cryptography together - Digital Signatures -Knapsack Algorithm - Some other algorithms (Elliptic curve Cryptography - ElGamal - problems with the public key exchange).

UNIT – IV PRIMARY KEY MANAGEMENT

Digital Certificates-Private Key Management - The PKIX Model - Public Key Cryptography Standards (PKCS) - XML - PKI and Security - Hash functions - Key Predistribution - Blom's Scheme - Diffie-Hellman Key Predistribution - Kerberos - Diffie-Hellman Key Exchange - The Station-to-station Protocol.

UNIT – V TCP/IP AND FIREWALLS

Introduction to TCP/IP - Firewalls - IP Security - Virtual Private Networks (VPN) - Intrusion -Internet Security Protocols: Basic concepts - Secure Socket Layer (SSL) - Transport Layer Security (TLS) - Secure Hyper Text Transfer Protocol (SHTTP) - Time Stamping Protocol (TSP) - Secure Electronic Transaction (SET) - SSL Vs SET - 3D Secure Protocol - Electronic Money - E-mail Security - Wireless Application Protocol (WAP) Security - Security in GSM - Security in 3G.

Text Books:

1. William Stallings, "Cryptography and Network Security", Pearson Education, 8th Edition, 2024.
2. Jonathan Katz, Yehuda Lindell, "Introduction to Modern Cryptography", A Chapman & Hall Book, CRC Press, 3rd edition, 2025.
3. Atul Kahate "Cryptography and Network Security", Tata McGrawHill, 4th Edition, 2013.
4. Charlie Kauffman, Radia Perlman, Mike Spciner, "Network Security", Pearson Education, 2nd Edition, 2012.

References:

1. Craig Bauer, "Practical Mathematical Cryptography & Secret History: The Story of Cryptology", CRC Press, 1st edition, August 2024.
2. V.K. Jain, "Cryptography & Network Security", Khanna Publishing House, 1st edition, 2013.

Course Outcomes:

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

1. Explain the principles of cryptography, security mechanisms, and network security m concepts for protecting information and communication systems.
2. Apply cryptographic algorithms and key management techniques to secure data transmission and authentication in computer networks.
3. Analyze symmetric and asymmetric cryptographic solutions, digital signatures, and public key infrastructure to address security requirements.
4. Evaluate network security protocols, authentication mechanisms, and firewall technologies for secure communication in distributed environments.
5. Design secure communication solutions by integrating cryptographic techniques, key management, and network security protocols for real-world applications.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	1	–	–	–	–	–	–	2	–	–
CO2	2	3	2	–	2	–	–	–	–	–	–	3	1	–
CO3	2	3	–	2	2	–	–	–	–	–	–	2	2	–
CO4	2	2	–	3	2	–	–	–	–	–	–	2	2	–
CO5	–	2	3	2	3	–	–	–	–	–	–	2	2	2

25CSPESCN	NLP WITH DEEP LEARNING	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the concepts of deep learning for natural language processing (NLP).
- To study and analyse the word vector representations.
- To develop the Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN) model for NLP applications.
- To develop the Long Short-Term Memory Networks (LSTM) for NLP applications.
- To understand NLP applications such as Neural Machine Translation (NMT) and Chatbot.

UNIT – I INTRODUCTION

Introduction to Natural Language Processing (NLP) and Deep Learning (DL)–NLP libraries Getting started with NLP- Introduction to deep learning– Types of Neural Networks– Multi Layer Perceptron– Stochastic Gradient Descent– Backpropagation- Deep Learning Libraries– Traditional approach to NLP– Deep learning approach to NLP.

UNIT – II WORD VECTOR REPRESENTATIONS

Word2vec- Learning Word Embeddings– classical approach to learning word representation– Word2vec– a neural network based approach to learning word representation– The skip gram algorithm– The Continuous Bag-of-Words algorithm– Advanced Word2vec– Original skip-gram algorithm– Comparing skip-gram with CBOW– GloVe– Global Vectors representation– Document Classification with Word2vec.

UNIT – III CNN AND RNN FOR NLP

Sentence Classification with Convolutional Neural Networks (CNN)– Introduction Understanding CNN– Using CNN for sentence classification- Recurrent neural networks (RNN)– Understanding RNN– Backpropagation Through Time (BPTT)– Applications of RNNs– generating text with RNNs– Evaluating text results output from the RNN Perplexity– measuring the quality of text result

UNIT – IV LSTM FOR NLP

Long Short-Term Memory Networks (LSTM)– Understanding LSTM–vanishing gradient problem– Other variants of LSTMs– Applications of LSTM– Generating text– Data Implementing an LSTM– Applications of LSTM– Image Caption Generation– Machine learning pipeline for image caption generation– Extracting features with CNNs Implementation with VGG16– Learning word embeddings- Preparing captions for feeding into LSTMs– Generating data for LSTMs– Defining LSTM- Evaluating results.

UNIT – V NMT AND CHATBOT

Sequence-to-Sequence Learning– Neural Machine Translation (NMT)– Types of Machine translation– Understanding neural machine translation– Preparing data for NMT system-training the NMT– Inference with NMT– The BLEU score– Improving NMTs Developing a Chatbot– Introduction to Chatbot– Conversational Bot– Chatbot: Automatic Text Generation- Training a Chatbot– Evaluating Chatbots– Turing test.

Text Books:

1. Thushan Ganegedara, Natural language Processing with TensorFlow, Second edition,PACKT Publishing, 2022.
2. Karan Jain, Palash Goyal Sumit Pandey, Deep learning for Natural Language Processing: Creating Neural Networks with Python, Apress, 2018.

References:

1. Stephan Raaijmakers, Deep Learning for Natural Language Processing, Manning Publication Co. 2022.
2. Yoav Goldberg, Neural Network Methods in NLP, Morgan & Claypool Publishers, Springer series 2022.
3. Uday Lamath, John Liu, Jimmy Whitaker, Deep Learning for NLP and Speech Recognition, Springer Nature Switzerland AG, 2022.
4. Ian Goodfellow, Yoshua Bengio and Aaron Courville. Deep learning, The MIT Press, 2016.

Course Outcomes:

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

1. Explain deep learning principles and natural language processing techniques for developing intelligent language processing systems.
2. Apply word embedding models and deep learning architectures to solve natural language processing tasks.
3. Analyze deep neural network models for language representation, sequence modeling, and performance evaluation in NLP applications.
4. Evaluate deep learning approaches for natural language processing applications based on translation quality, text generation, and conversational intelligence.
5. Design intelligent natural language processing solutions by integrating deep learning models for real-world language understanding and generation tasks.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	1	–	–	–	–	–	–	2	–	–
CO2	2	3	2	–	2	–	–	–	–	–	–	3	1	–
CO3	2	3	–	2	2	–	–	–	–	–	–	2	2	–
CO4	2	2	–	3	2	–	–	–	–	–	–	1	3	–
CO5	–	2	3	2	3	–	–	–	–	–	–	2	2	2

25CSPESCN	BLOCK CHAIN TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the foundational concepts and components of blockchain technology.
- To analyze the architecture and working of consensus mechanisms.
- To educate students on smart contracts and decentralized applications.
- To explore the security and privacy aspects of blockchain systems.
- To provide insight into blockchain platforms and their use in various domains.

UNIT – I INTRODUCTION TO BLOCKCHAIN

Overview of Blockchain – Characteristics – Structure – Block – Transactions – Distributed Ledger – Types of Blockchain – Public, Private, Consortium – Advantages and Limitations – Use Cases.

UNIT – II CONSENSUS AND CRYPTOGRAPHY

Consensus Mechanisms – Proof of Work – Proof of Stake – Delegated Proof of Stake – Byzantine Fault Tolerance – Cryptographic Hash Functions – Merkle Trees – Digital Signatures – Public and Private Keys.

UNIT – III SMART CONTRACTS AND DAPPS

Introduction to Smart Contracts – Ethereum Architecture – Solidity Programming Basics – Writing, Deploying and Testing Smart Contracts – Decentralized Applications – Frontend Integration.

UNIT – IV BLOCKCHAIN PLATFORMS AND FRAMEWORKS

Ethereum – Hyperledger Fabric – Quorum – Multichain – Blockchain-as-a-Service – Development Tools – Truffle, Ganache, MetaMask – Wallets and Transactions – Gas and Fees.

UNIT – V SECURITY, PRIVACY AND APPLICATIONS

Security Issues – 51% Attack – Sybil Attack – Privacy Mechanisms – Zero Knowledge Proofs – Blockchain in Supply Chain, Healthcare, Banking, Voting – Emerging Trends – Scalability – Interoperability.

Text Books:

1. Imran Bashir, Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications, Packt Publishing, 3rd Edition.

2. Narayanan et al., Bitcoin and Cryptocurrency Technologies, Princeton University Press, 2016.

References:

1. Andreas M. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies, O'Reilly Media, 2015.
2. Joseph Bonneau et al., SoK: Research Perspectives and Challenges for Bitcoin and Cryptocurrencies, IEEE Symposium on Security and Privacy, 2015.

Course Outcomes:

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

1. Explain the principles of blockchain technology and decentralized computing for secure and transparent distributed systems.
2. Apply blockchain platforms, consensus mechanisms, and smart contract techniques to implement decentralized computing solutions.
3. Analyze blockchain architectures and decentralized applications to address security, scalability, and engineering challenges.
4. Evaluate blockchain frameworks, security mechanisms, and privacy models for selecting appropriate solutions in distributed environments.
5. Design blockchain-based applications by integrating smart contracts, decentralized platforms, and security mechanisms for real-world engineering applications.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	1	–	–	–	–	–	–	2	–	–
CO2	2	3	2	–	2	–	–	–	–	–	–	3	1	–
CO3	2	3	–	2	2	–	–	–	–	–	–	2	2	–
CO4	2	2	–	3	2	–	–	–	–	–	–	1	3	–
CO5	–	2	3	2	3	–	–	–	–	–	–	2	2	2

25CSPESCN	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives:

- To acquire the basics of Hadoopv2 configuration and administration.
- To understand concepts of Map Reduce design patterns namely summarization, filtering, data organization, join, output and Meta patterns.
- To develop Map Reduce applications.
- To solve data warehouse problems using Hive.
- To transfer data using Pig, HBase, Mahout and Sqoop between Hadoop and relational databases.

UNIT – I INTRODUCTION

Data science process – roles, stages in data science project – State of the practice in analytics – Role of data scientists – Key roles for successful analytic project – Main phases of life cycle – Working with data from files – Exploring data – Managing data – Cleaning and sampling for modeling and validation – Challenges of conventional systems – Web data – Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting – Modern data analytic tools. Introduction to Big Data Platform – Big Data and its importance, Five V's for Big data, Big data analytics, Big data applications.

UNIT – II HADOOPV2 CONFIGURATION AND ADMINISTRATION

Hadoop v2 : Introduction - Setting up Hadoop v2 in local machine - Writing a Word Count MapReduce application - Adding a combiner step to the Word Count MapReduce program - Setting up HDFS - Setting up Hadoop YARN in a distributed cluster environment using Hadoop v2 - Setting up Hadoop ecosystem - HDFS command-line file operations - Running the Word Count program in a distributed cluster environment - Using Hadoop YARN on Cloud Environments - Hadoop Configurations, Unit Tests, and Other APIs.

UNIT – III DEVELOPING COMPLEX MAPREDUCE APPLICATIONS

Introduction - Hadoop data types - Custom Hadoop Writable data type - Hadoop key type - Emitting data from a Mapper - Hadoop InputFormat- Adding support for new input data formats - Formatting the results of MapReduce computations – Hadoop OutputFormats - Writing multiple outputs - Intermediate data partitioning - Secondary sorting – sorting Reduce input values - Using Hadoop with legacy applications – Hadoop streaming - Adding dependencies between MapReduce jobs - Hadoop counters to report custom metrics.

UNIT – IV ANALYTICS AND APPLICATIONS USING MAPREDUCE

Analytics : Introduction - Simple analytics using MapReduce - Performing GROUP BY - Calculating frequency distributions and sorting - Plotting the results using gnuplot - Calculating histograms - Calculating Scatter plots - Parsing a complex dataset with Hadoop - Joining two datasets Applications : Content-based recommendations - Classification using the naïve Bayes - Assigning advertisements to keywords - Data preprocessing and De-duplicating data using Hadoop streaming and Python.

UNIT – V HADOOP ECOSYSTEM – APACHE HIVE

Creating databases and tables using Hive CLI Simple SQL-style data querying using Apache Hive -Creating and populating Hive tables and views using Hive query results-Utilizing different storage formats in Hive - storing table data using ORC files-Using Hive built-in functions-Hive batch mode - using a query file -Performing a join with Hive -Creating partitioned Hive tables -Writing Hive User-defined Functions (UDF) -Hadoop Ecosystem II – Pig, HBase, Mahout, and Sqoop

Text Books:

1. Thilina Gunarathne, "HadoopMapReducev2 Cookbook", Second Edition, Packt Publishing Ltd., 2015.
2. Donald Miner and Adam Shook, "MapReduce Design Pattern", O'Reilly Media Inc.,First Edition, 2012.

References:

1. Garry Turkington, "Hadoop Beginner's Guide", Packt Publishing Ltd.,First Edition, 2013.
2. Tom White, "Hadoop: The Definitive Guide", O'Reilly Media Inc.,Fourth Edition,2015.
3. Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich, "Professional Hadoop® Solutions", Wrox, First Edition,2013.

4. Srinath Perera, "Instant MapReduce Patterns – Hadoop Essentials How-to", Packt Publishing Ltd., First Edition,2013.
5. Kevin Schmidt and Christopher Phillips, "Programming Elastic MapReduce", O'Reilly Media Inc., First Edition, 2013.

Course Outcomes:

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

1. Explain the principles, architecture, and ecosystem of big data analytics for scalable data processing and engineering applications.
2. Apply Hadoop technologies and MapReduce programming techniques to develop efficient distributed data processing solutions.
3. Analyze large-scale datasets using MapReduce analytics and Hadoop ecosystem tools to derive meaningful insights for real-world applications.
4. Evaluate appropriate big data frameworks, storage mechanisms, and analytical techniques for scalable, reliable, and efficient data-driven solutions.
5. Design end-to-end big data analytics solutions by integrating Hadoop ecosystem components for complex computational problem solving.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	1	–	–	–	–	–	–	2	1	–
CO2	2	2	3	–	3	–	–	–	–	–	–	2	2	–
CO3	2	3	–	2	2	–	–	–	–	–	–	2	2	–
CO4	2	3	–	3	2	–	–	–	–	–	1	1	2	–
CO5	2	2	3	2	3	–	–	–	–	–	–	2	2	2

25CSPESCN	**WEB ANALYTICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand the growing connectivity and complexity in the world ranging from small groups to World Wide Web.
- To gain a practical understanding of common monitoring or analysis tasks and techniques used in web analytics
- To evaluate different types of software tools, techniques, and reports that are relevant to web analytics
- To make informed decisions on how to analyze and interpret web channel data and understand the difficulties and issues involved.

UNIT – I INTRODUCTION

Web Analytics 2.0: State of the Analytics Union - State of the Industry - Web Analytics 2.0. Clickstream analysis : Eight Critical Web Metrics - Bounce Rate - Exit Rate - Conversion Rate – Engagement - Web Metrics Demystified - Strategically-aligned Tactics. Practical solution : Web Analytics Primer - Web Analytics Report – Foundational Analytical Strategies - Everyday Clickstream Analyses - Perspectives on Key Web Analytics Challenges.

UNIT – II MEASURING SUCCESS AND LEVERAGING QUALITATIVE DATA

Measuring success: Five examples of actionable outcome - conversion rates - macro and micro conversions - Quantifying Economic Value - measuring success for a non ecommerce website - Measuring B2B Websites. Leveraging qualitative data: lab usability - usability alternative – surveys - web enabled emerging user research options. Testing and experimentation: A Primer on Testing Options: A/B and MVT, Actionable Testing Ideas, Controlled Experiments, Creating and Nurturing a Testing Culture.

UNIT – III INFORMATION RETRIEVAL

Search engines: Search challenge – History of search engines – Architecture and components – Crawling – Indexing. Link analysis: Web graph – link-based ranking – page rank - hypertext induced topic search – Link-based analysis. Recommendation and diversification for the web: Pruning information – Recommendation systems – Result diversification. Advertising in search.

UNIT – IV COMPETITIVE INTELLIGENCE ANALYSIS AND EMERGING ANALYTICS

Competitive Intelligence analysis: CI data sources, types and secrets - website traffic analysis - search and keyword analysis - segmentation analysis. Emerging analytics: measuring the new social web - Analysing offline customer experiences – Analysing mobile customer experiences - measuring the success of blogs - quantifying the impact of twitter - Analyzing Performance of Videos.

UNIT – V GOOGLE ANALYTICS

Google Analytics contribution - Creating implementation plan - Working of Google analytics: Data collection and processing – Reports – Tracking code. Tracking visitor clicks, Outbound links, Non html files - Google analytics accounts and profiles: Google analytics accounts -Creating a Google Analytics Account - Profiles.

Text Books:

1. Avinash Kaushik, “Web Analytics 2.0: The Art of Online Accountability”, John Wiley & Sons, 2009.
2. Stefano Ceri, Alessandro Bozzon, Marco Brambilla, Emanuele Della Valle, PieroFraternali, Silvia Quarteroni, ”Web Information retrieval”, Springer,2013.

References:

1. Justin Cutroni, “Google Analytics”, O’Reilly, 2010.
2. Hansen, Derek, Ben Sheiderman, Marc Smith ,”Analyzing Social Media Networks with NodeXL: Insights from a Connected World”, Morgan Kaufmann, 2011.
3. Wasserman. S, Faust. K, “Social network analysis: Methods and applications”, New York: Cambridge University Press,1994.
4. Monge. P. R, Contractor. N. S, “Theories of communication networks”, New York: Oxford University Press,2003.

Course Outcomes:

At the end of this course, the students will be able

1. Explain the principles, metrics, and analytical frameworks of web analytics for measuring website performance and user behavior.
2. Apply web analytics techniques and information retrieval methods to measure, monitor, and improve web-based applications.
3. Analyze web data, search behavior, and competitive intelligence to derive actionable insights for decision making.

4. Evaluate web analytics tools, experimentation strategies, and performance reports to optimize digital business outcomes.
5. Design comprehensive web analytics solutions by integrating measurement frameworks, search analytics, and Google Analytics for real-world applications.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	2	–	–	–	–	–	–	2	1	–
CO2	2	2	2	2	3	–	–	–	–	–	–	2	2	–
CO3	2	3	–	2	2	–	–	–	–	–	–	2	2	–
CO4	2	2	2	3	2	–	–	–	–	–	1	1	2	–
CO5	2	2	3	2	3	–	–	–	–	–	–	2	2	2

25CSPESCN	ANDROID SECURITY	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the Android operating system architecture and security model.
- To educate students on application sandboxing and permission mechanisms.
- To analyze Android threats, vulnerabilities, and exploit techniques.
- To expose learners to mobile malware, forensics, and secure coding practices.
- To provide practical skills in assessing and enhancing Android application security.

UNIT – I INTRODUCTION TO ANDROID SECURITY

Overview of Android Architecture – Linux Kernel – Android Runtime – Application Framework – System Services – Android Security Model – Security Features – App Signing – UID Assignments.

UNIT – II PERMISSIONS AND APPLICATION ISOLATION

Android App Components – Application Sandbox – Permissions and Enforcement – Dangerous vs Normal Permissions – Permission Groups – Role of SELinux – Secure IPC Mechanisms – Intent Filters and Risks.

UNIT – III THREATS, VULNERABILITIES AND EXPLOITS

Common Vulnerabilities – Insecure Data Storage – Insecure Communication – Component Exposure – Exploiting Intents and Activities – Case Studies – Reverse Engineering APKs – Exploit Development Tools.

UNIT – IV MALWARE ANALYSIS AND FORENSICS

Mobile Malware – Static and Dynamic Analysis – Obfuscation Techniques – Mobile Device Forensics – Log Analysis – Data Recovery – Memory Dump Analysis – Tools: MobSF, Frida, Drozer, Wireshark.

UNIT – V SECURE APP DEVELOPMENT AND BEST PRACTICES

Security Best Practices for Developers – Input Validation – Secure Storage – HTTPS and Certificate Pinning – Secure APIs – Testing and Debugging for Security – OWASP Mobile Top 10 – Play Store Security Policies.

Text Books:

1. Abhishek Dubey, Android Security Internals: An In-Depth Guide to Android's Security Architecture, No Starch Press, 2014.
2. Nikolay Elenkov, Android Security: Attacks and Defenses, McGraw-Hill Education, 2014.

References:

1. Keith Makan, Android Malware and Analysis, Packt Publishing, 2014.
2. OWASP Mobile Security Testing Guide – https://owasp.org/www-project-mobile-security-testing-guide/

Course Outcomes:

At the end of this course, the students will be able

1. Explain Android security architecture, application isolation, and protection mechanisms for securing mobile computing environments.
2. Apply Android security mechanisms and assessment techniques to implement secure application communication and access control.
3. Analyze Android applications to identify vulnerabilities, exploit vectors, and malware behaviors using security analysis techniques.
4. Evaluate Android application security using forensic methods, security tools, and secure development best practices.
5. Design secure Android applications by integrating security controls, defensive coding practices, and risk mitigation strategies for real-world mobile systems.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	2	–	–	–	–	–	–	2	1	–
CO2	2	2	3	–	3	–	–	–	–	–	–	2	2	–
CO3	2	3	–	3	2	–	–	–	–	–	–	2	2	–
CO4	2	2	–	3	3	–	–	–	–	–	1	1	2	–
CO5	2	2	3	2	3	–	–	–	–	–	–	2	2	2

25CSPESCN	ENGINEERING ETHICS	L	T	P	C
		3	0	0	3

Course Objectives:

- To provide basic knowledge about engineering Ethics, Variety of moral issues and Moral dilemmas, Professional Ideals and Virtues.
- To familiarize about Engineers as responsible Experimenters, Research Ethics, Codes of Ethics, Industrial Standards,
- To educate the Safety and Risk, Risk Benefit Analysis,
- To teach about the Collegiality and Loyalty, Collective Bargaining, Confidentiality, to teach about the Collegiality and Loyalty, Collective Bargaining, Confidentiality,
- To impart knowledge about MNC's, Business, Environmental, Computer Ethics, Honesty, Moral Leadership, sample Code of Conduct.

UNIT – I INTRODUCTION

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.

UNIT – II CHALLENGES

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study.

UNIT – III RISK ANALYSIS

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal.

UNIT – IV LOYALTY

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT – V BUSINESS ETHICS

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers –Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct.

Text Books:

1. Govindarajan M, Natarajan S and Senthilkumar V S, "Professional Ethics and Human values", PHI Learning, New Delhi,2013.
2. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York,2005.

References:

1. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Thompson Learning, 2000.
2. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999. John R Boatright, "Ethics and the Conduct of Business", Pearson Education,2003
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, 2001.
4. David Ermann and Michele S Shauf, s "Computers, Ethics and Society", Oxford University Press,2003.

Course Outcomes:

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

1. Explain ethical principles, professional responsibilities, and moral frameworks applicable to engineering practice and decision making.
2. Apply engineering codes of ethics, legal standards, and professional responsibilities to address ethical issues in engineering practice.
3. Analyze ethical dilemmas, safety risks, and professional conflicts using systematic ethical reasoning and risk assessment approaches.
4. Evaluate engineering decisions by considering ethical, legal, environmental, social, and professional responsibilities in diverse organizational contexts.
5. Develop ethical solutions and professional practices that promote integrity, leadership, sustainability, and responsible engineering in real-world applications.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	–	–	–	2	–	3	–	–	–	–	–	–
CO2	2	2	1	–	–	2	–	3	–	–	–	–	–	–
CO3	1	3	–	2	–	3	1	2	–	–	–	–	–	–
CO4	1	2	2	2	–	3	2	3	–	–	1	–	–	–
CO5	1	2	2	–	–	2	2	3	2	2	1	–	–	–

25CSPESCN	SOFT COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives:

- Understand the fundamental concepts and need for soft computing as an alternative to conventional computing.
- Explore the principles of fuzzy logic, neural networks, and genetic algorithms.
- Learn how to apply soft computing techniques for solving complex, real-world problems.
- Develop hybrid systems by integrating fuzzy logic, neural networks, and genetic algorithms.
- Encourage critical thinking and practical implementation of soft computing techniques in various domains such as optimization, control systems, and data analysis.

UNIT – I INTRODUCTION TO SOFT COMPUTING

Definition and Need of Soft Computing - Soft Computing vs Hard Computing - Components of Soft Computing - Applications of Soft Computing.

UNIT – II FUZZY LOGIC SYSTEMS

Fuzzy Sets and Fuzzy Relations - Fuzzy Membership Functions - Fuzzy Rule-Based System – Fuzzy Inference System and Defuzzification Techniques.

UNIT – III ARTIFICIAL NEURAL NETWORKS

Biological Neurons and Artificial Neurons - Learning Rules: Hebbian, Perceptron, Delta Rule Feedforward and Feedback Networks -Backpropagation Algorithm and Applications

UNIT – IV GENETIC ALGORITHMS

Basics of Genetic Algorithms - Selection, Crossover and Mutation - Fitness Functions and Genetic Programming - Applications of Genetic Algorithms in Optimization

UNIT – V HYBRID SYSTEMS AND APPLICATIONS

Integration of Fuzzy Logic, Neural Networks and Genetic Algorithms - Neuro-Fuzzy Systems GA-Based Neural Network Training - Case Studies and Real-World Applications.

Text Books:

1. S. N. Sivanandam and S. N. Deepa, 'Principles of Soft Computing', Wiley India.
2. J.S.R. Jang, C.T. Sun and E. Mizutani, 'Neuro-Fuzzy and Soft Computing', Pearson Education.

References:

1. David E. Goldberg, 'Genetic Algorithms in Search, Optimization and Machine Learning', Pearson Education.
2. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', Wiley.
3. Simon Haykin, 'Neural Networks and Learning Machines', Pearson Education.
4. Rajasekaran and G.A. Vijayalakshmi Pai, 'Neural Networks, Fuzzy Logic and Genetic Algorithms', PHI Learning.

Course Outcomes:

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

1. Explain the principles of soft computing techniques for intelligent problem solving and engineering applications.
2. Apply soft computing models to develop computational solutions for complex engineering problems.
3. Analyze the performance and suitability of fuzzy systems, neural networks, genetic algorithms, and hybrid approaches for diverse applications.
4. Evaluate soft computing techniques to select efficient intelligent solutions for optimization, control, and data-driven engineering problems.
5. Design intelligent hybrid soft computing systems by integrating fuzzy logic, neural networks, and genetic algorithms for real-world applications.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	1	–	–	–	–	–	–	2	1	–
CO2	2	2	3	–	3	–	–	–	–	–	–	2	2	–
CO3	2	3	–	2	2	–	–	–	–	–	–	2	2	–
CO4	2	3	–	3	2	–	–	–	–	–	1	1	2	–
CO5	2	2	3	2	3	–	–	–	–	–	–	2	2	2

25CSPESCN	SOFTWARE ENGINEERING AND DEVOPS	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the phases of development of a Software Project.
- To understand the major considerations for enterprise integration and deployment concepts of Requirements engineering and Analysis Modeling.
- To learn Fundamental concepts of DevOps
- To learn about Management Tools

UNIT – I SOFTWARE PROCESS

The Software process– A Generic Process Model– Perspective Process Models– Specialized Process Models– The Unified Process–Personal and team process models–Agile Development–Extreme Programming (XP) – Requirements Engineering–Requirements Analysis–Establishing the Groundwork– Eliciting Requirements– Developing Use Cases– Negotiating Requirements– Validating Requirements–Requirements Analysis–Scenario–Based Modeling.

UNIT – II DESIGN CONCEPTS

Design concepts–The Design Process–Design Concepts–The Design Model– Architectural Design–Assessing Alternative Architectural Designs– Architectural Mapping Using Data Flow–Component–level design–Designing Class–Based Components–Conducting Component–Level Design–User Interface design–User Interface Analysis and Design–Interface Analysis–Pattern based Design– WebApp design–WebApp Design Quality–WebApp Interface design.

UNIT – III QUALITY MANAGEMENT

Quality Management– Software Quality– The Software Quality Dilemma– Achieving Software Quality– Review techniques–Cost Impact of Software Defects–Defect Amplification and Removal–Review Metrics and Their Use-Informal Reviews–Formal Technical Reviews–Software Quality Assurance- Test Strategies for Conventional Software-Test Strategies for Object–Oriented Software-SQA Tasks, Goals, and Metrics–Statistical Software Quality Assurance-A Strategic Approach to Software Testing–System Testing–The Art of Debugging..

UNIT – IV DEVOPS ASSESSMENT

Fundamental concepts of Agile and DevOps-DevOps assessment, Maturity levels and DevOps implementation.

UNIT – V MANAGEMENT TOOLS

Tools to orchestrate, ALM, SCM, code quality, deployment ,infrastructure management, cloud security, Technology stacks- micro soft, database.Atlassian tool stack ,phabricator ,Jenkins, puppet ,IBM bluemix, pivotal cloud foundary(PCF),AWS, openshift,HP fortify.

Text Books:

1. Roger S. Pressman, “Software Engineering – A Practitioner’s Approach”, Seventh Edition, McGraw Hill International Edition, 2010.
2. Ian Sommerville, “Software Engineering”, 9th Edition, Pearson Education Asia, 2011.
3. Wiley, Deepak Gaikwad, Viral Thakkar Learn DevOps concepts and Methodology.

References:

1. Kelkar S.A., “Software Engineering”, Prentice Hall of India Pvt Ltd, 2007.
2. Stephen R.Schach, “Software Engineering”, Tata McGraw–Hill Publishing Company Limited, 2007.
3. Nasib Singh Gill, “Software Engineering”, Khanna Publishing House.
4. K.K. Aggarwal & Yogesh Singh, “Software Engineering”, New Age International.

Course Outcomes:

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

1. Explain software engineering principles, software processes, and DevOps concepts for systematic software development and deployment.
2. Apply software engineering methodologies, design practices, and DevOps workflows to develop reliable software solutions.
3. Analyze software requirements, architectural designs, quality assurance processes, and DevOps practices to improve software quality.
4. Evaluate software development methodologies, testing strategies, and DevOps tools for efficient software lifecycle management.

5. Design integrated software systems by incorporating software engineering principles, quality practices, and DevOps technologies for real-world applications.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	1	–	–	–	–	–	–	2	1	–
CO2	2	2	3	–	3	–	–	–	–	–	–	2	2	–
CO3	2	3	–	2	2	–	–	–	–	–	–	2	2	–
CO4	2	3	–	3	2	–	–	–	–	–	1	1	2	–
CO5	2	2	3	2	3	–	–	–	–	–	–	2	2	2

25CSPESCN	EDGE COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the fundamental concepts and architecture of Edge Computing.
- To explore the relationship between Edge, Fog, and Cloud Computing paradigms.
- To understand the deployment models and challenges in Edge environments.
- To develop knowledge in edge-enabled applications, services, and security mechanisms.
- To analyze real-time case studies and frameworks involving Edge Computing platforms.

UNIT – I INTRODUCTION TO EDGE COMPUTING

Definition, Evolution, and Characteristics – Edge vs Fog vs Cloud – Use cases – Applications in IoT, Smart Cities, Healthcare, and Autonomous Systems – Key Benefits and Limitations.

UNIT – II EDGE ARCHITECTURE AND AI INTEGRATION

Architectural Overview – Edge Devices, Gateways, Nodes – Edge Data Centers – Virtualization, Containers, Orchestration Tools (Kubernetes, Docker) – Network requirements.

UNIT – III DATA MANAGEMENT AND REAL-TIME ANALYTICS

Public, Private, Hybrid Edge Deployments – Micro services for Edge – Industrial Frameworks: AWS Greengrass, Microsoft Azure IoT Edge, Open Horizon – Real-world implementation issues.

UNIT – IV EDGE SECURITY AND FEDERATED LEARNING

Edge Data Collection and Aggregation – Stream Processing – Edge AI/ML – Decision Making – Data Security and Privacy at the Edge – Resource Management Challenges.

UNIT – V FRAMEWORKS AND EDGE APPLICATIONS

Security Challenges – Identity and Access Management – Threat Models – Trust Management – Block chain for Edge – Emerging Trends: 6G, Federated Learning, Edge Intelligence.

Text Books:

1. Mahadev Satyanarayanan, "Edge Computing: Vision and Challenges", IEEE Internet of Things Journal, 2017.
2. Perry Lea, "Edge Computing: A Primer", O'Reilly Media, 2020.

References:

1. Flavio Bonomi et al., "Fog Computing and Its Role in the Internet of Things", MCC Workshop, ACM, 2012.
2. K. Suresh and S. Rajalakshmi, "Foundations of Edge Computing: A Practical Guide", Wiley, 2021.
3. Tao Zhang, "Edge Computing for IoT Applications", Springer, 2021.

Course Outcomes:

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

1. Explain the principles of Edge Computing architectures, deployment models, and enabling technologies for distributed computing applications.
2. Apply Edge Computing frameworks and virtualization technologies to implement efficient real-time data processing solutions.
3. Analyze Edge Computing architectures and resource management strategies to address performance, scalability, and deployment challenges.
4. Evaluate Edge Computing solutions by assessing security, privacy, and reliability requirements for intelligent distributed systems.
5. Design Edge-enabled intelligent applications by integrating Edge AI, emerging technologies, and secure computing frameworks for real-world engineering problems.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	2	–	–	–	–	–	–	2	1	–
CO2	2	3	2	–	3	–	–	–	–	–	–	2	2	2
CO3	2	3	3	2	2	–	–	–	–	–	–	–	3	2
CO4	2	3	–	2	2	–	–	–	–	–	1	–	3	2
CO5	2	2	3	2	3	–	–	–	–	–	1	–	2	3

25CSPESCN	**QUANTUM COMPUTING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To know the background of classical computing and quantum computing and to learn the fundamental concepts behind quantum computation.
- To study the details of quantum mechanics and the relation to Computer Science.
- To gain knowledge about the basic hardware and mathematical models of quantum computation.
- To learn the basics of quantum information and the theory behind it.
- To learn the fundamental concepts of quantum machine learning.

UNIT – I FUNDAMENTAL CONCEPTS

Global Perspectives – Quantum Bits – Quantum Computation – Quantum Algorithms – Experimental Quantum Information Processing – Quantum Information.

UNIT – II QUANTUM MECHANICS AND AN OVERVIEW OF COMPUTATIONAL MODELS

Quantum Mechanics: Linear Algebra – Postulates of Quantum Mechanics – Application: Superdense Coding – Density Operator – The Shmidt Decomposition and Purifications – EPR and the Bell Inequality – Computational Models: Turing Machines – Circuits – Analysis of Computational Problems.

UNIT – III QUANTUM COMPUTATION

Quantum Circuits: Quantum Algorithms – Universal Quantum Gates – Quantum Circuit Model of Computation – Simulation – Quantum Fourier Transform and Applications – Quantum Search Algorithms – Quantum Computers.

UNIT – IV QUANTUM INFORMATION AND THEORY

Quantum Noise and Quantum Operations: Classical Noise and Markov processes – Quantum Operations – Examples – Applications – Distance Measures for Quantum Information – Quantum Error Correction – Entropy- Data Compression - Quantum Cryptography.

UNIT – V QUANTUM MACHINE LEARNING

Quantum Machine Learning: The basics of machine learning - training a model - Quantum Classical models- Quantum Support Vector Machine - Quantum Neural Network - Quantum Generative Adversarial Networks.

Text Books:

1. Michael A. Nielsen, Issac L. Chuang, “Quantum Computation and Quantum Information”, Tenth Edition, Cambridge University Press, 2010.
2. Elias F. Combarro, Samuel Gonzalez-Castillo, “A Practical Guide to Quantum Machine Learning and Quantum Optimization”, Packt Publishing Ltd, 2023.

References:

1. Scott Aaronson, “Quantum Computing Since Democritus”, Cambridge University Press, 2013.
2. Osvaldo Simeone, “An Introduction to Quantum Machine Learning for Engineers”, Foundations and Trends® in Signal Processing, 2022.

Course Outcomes:

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

1. Explain the principles of quantum computing, quantum mechanics, and computational models underpinning quantum information processing.
2. Apply quantum computing concepts and computational models to formulate solutions for quantum information processing problems.
3. Analyze quantum algorithms, quantum circuits, and information-theoretic techniques to evaluate computational efficiency and reliability.
4. Evaluate quantum computing approaches by assessing quantum information, error correction, cryptographic mechanisms, and machine learning models.
5. Design quantum-enabled intelligent solutions by integrating quantum algorithms, quantum information processing, and quantum machine learning techniques for emerging applications.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	2	–	–	–	–	–	–	2	–	1
CO2	2	3	2	–	3	–	–	–	–	–	–	2	2	2
CO3	2	3	3	2	2	–	–	–	–	–	–	–	3	2
CO4	2	3	–	2	2	–	–	–	–	–	1	–	3	2
CO5	2	2	3	2	3	–	–	–	–	–	1	–	2	3

25CSPESCN	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the core concepts of Cloud, Parallel and Distributed Computing.
- To familiarize about Virtualization and Cloud Computing Architecture.
- To impart the basic knowledge of Concurrent Computing and High-Throughput Computing.
- To explain the importance of ANEKA Platform and Data-Intensive Computing.
- To analyze the recent developments in Cloud Computing

UNIT – I INTRODUCTION

Cloud computing at a glance - Historical developments - Building cloud computing environments - Principles of Parallel and Distributed Computing: Parallel vs. distributed computing - Elements of parallel computing - Elements of distributed computing - Technologies for distributed computing.

UNIT – II VIRTUALIZATION AND CLOUD COMPUTING ARCHITECTURE

Introduction - Characteristics of virtualized environments - Taxonomy of virtualization techniques - Virtualization and cloud computing - Pros and cons of virtualization – Cloud Computing Architecture: The cloud reference model - Types of clouds - Economics of the cloud - Open challenges.

UNIT – III CONCURRENT COMPUTING AND HIGH-THROUGHPUT COMPUTING

Concurrent Computing: Introducing parallelism for single-machine computation - Programming applications with threads - Multithreading with Aneka - Programming applications with Aneka threads - High-Throughput Computing: Task computing - Task-based application models - Aneka task-based programming.

UNIT – IV ANEKA PLATFORM AND DATA-INTENSIVE COMPUTING

Aneka: Framework overview - Anatomy of the Aneka container - Building Aneka clouds - Cloud programming and management - Data-Intensive Computing: What is data-intensive computing? - Technologies for data-intensive computing – Aneka Map Reduce programming.

UNIT – V INDUSTRIAL PLATFORMS AND NEW DEVELOPMENTS

Cloud Platforms in Industry: Amazon web services - Google AppEngine - Microsoft Azure - Cloud Applications: Scientific applications - Business and consumer applications - Advanced topics in Cloud Computing: Energy efficiency in clouds - Market-based management of clouds - Federated clouds/InterCloud - Third-party cloud services.

Text Books:

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "Mastering Cloud Computing", Tata McGraw Hill, 2013.
2. A. Srinivasan and J. Suresh, "Cloud Computing: A Practical Approach for learning and implementation", 1st Edition, Pearson, 2014.

References:

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. John W. Rittinghouse and James F. Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
3. Danielle Ruest, Nelson Ruest, "Virtualization: A Beginner's Guide", McGraw-Hill Osborne Media, 2009.

Course Outcomes:

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

1. Explain the principles of cloud computing, virtualization, and distributed computing for scalable computing environments.
2. Apply cloud computing architectures, virtualization technologies, and concurrent computing techniques to implement distributed computing solutions.
3. Analyze cloud platforms, programming models, and data-intensive computing frameworks to address performance and scalability requirements.
4. Evaluate cloud computing infrastructures by assessing resource management, virtualization strategies, and emerging cloud technologies for engineering applications.
5. Design cloud-based computing solutions by integrating virtualization, distributed computing, and industrial cloud platforms for real-world applications.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	2	–	–	–	–	–	–	2	1	–
CO2	2	3	2	–	3	–	–	–	–	–	–	2	2	2
CO3	2	3	3	2	2	–	–	–	–	–	–	–	3	2
CO4	2	3	–	2	2	–	–	–	–	–	1	–	3	2
CO5	2	2	3	2	3	–	–	–	–	–	1	–	2	3

OE – OPEN ELECTIVES

25CSOESCN	SOCIAL NETWORK ANALYSIS	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the concept of semantic web and related applications.
- To teach knowledge representation using ontology.
- To explain about communities in social network.
- To impart the knowledge of human behaviour in social web and related communities.
- To develop the skills required to visualize social networks.

UNIT – I INTRODUCTION

Development of Semantic Web - Emergence of the Social Web – Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis – Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities – Web-based networks – Applications of Social Network Analysis.

UNIT – II KNOWLEDGE REPRESENTATION

Ontology-based knowledge Representation –Resource Description Framework – Web Ontology Language - Modeling and aggregating social network data: State-of- the-art in network data representation - Ontological representation of social individuals – Ontological representation of social relationships - Aggregating and reasoning with social network data – Advanced representations.

UNIT – III EVOLUTION

Extracting evolution of Web Community from a Series of Web Archive – Detecting communities in social networks – Evaluating communities – Methods for community detection and mining – Applications of community mining algorithms – Tools for detecting communities social network infrastructures and communities – Decentralized online social networks.

UNIT – IV DATA MANAGEMENT

Understanding and predicting human behavior for social communities – User data management - Inference and Distribution – Enabling new human experiences– Reality mining – Context – Awareness - Privacy in online social networks – Trust models based on subjective logic – Trust network analysis – Trust transitivity analysis – Combining trust and reputation – Trust derivation based on trust comparisons – Attack spectrum and countermeasures.

UNIT – V GRAPH THEORY

Graph theory – Centrality – Clustering – Node - Edge Diagrams – Matrix representation – Visualizing online social networks, Visualizing social networks with matrix - based representations – Matrix and Node-Link Diagrams – Hybrid representations – Applications – Cover networks– Community welfare- Collaboration networks– Co Citation networks.

Text Books:

1. Borko Furht, “Handbook of Social Network Technologies and Applications”, Springer, 1st edition, 2010.
2. Peter Mika, “Social Networks and the Semantic Web, Springer, 1st edition,2007.

References:

1. Guandong Xu, Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and applications”, Springer, 1st edition, 2011.
2. Dion Goh and Schubert Foo, “Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively”, IGI Global Snippet,2008.

3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet,2009.
4. John G Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web", Springer,2009.

Course Outcomes:

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

1. Explain the principles of social network analysis, semantic web technologies, and knowledge representation for analyzing interconnected systems.
2. Apply social network models, ontology-based techniques, and community detection methods to analyze social network data.
3. Analyze the evolution, structure, and behavior of social networks using graph-based models and analytical techniques.
4. Evaluate social network solutions by assessing trust, privacy, security, and data management issues in online communities.
5. Design visualization models and analytical solutions for social network applications using graph-theoretic and semantic web techniques.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	2	–	–	–	–	–	–	2	–	1
CO2	2	3	2	–	3	–	–	–	–	–	–	2	2	2
CO3	2	3	3	2	2	–	–	–	–	–	–	–	2	3
CO4	2	3	–	2	2	–	–	1	–	–	1	–	2	2
CO5	2	2	3	2	3	–	–	–	–	–	1	–	2	3

25CSOESCN	**INDUSTRIAL IOT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand the fundamentals of Industrial Internet of Things
- To learn about the basics of IIOT protocols
- To learn about the sensors, actuators and Interfacing
- To learn about IIoT Network Standards
- To apply the concept of Data analytics in II0T

UNIT – I INTRODUCTION TO IIOT AND INDUSTRY 4.0

Introduction to IIoT- IoT vs IIoT- Components of IIoT- Sensing- Network- Data Analytics- Industry 4.0 pillars and reference architecture- Use cases in smart manufacturing- healthcare- agriculture.

UNIT – II IIOT ARCHITECTURE AND PROTOCOLS

IIoT layered architecture- Physical to Application layer- Fog, Edge- Cloud Computing- Communication Protocols- MQTT- CoAP- OPC-UA- HTTP- AMQP- SCADA systems and their role in IIoT.

UNIT – III SENSORS, ACTUATORS AND INTERFACING

Types of sensors and actuators- Data acquisition systems (DAS)- Interfacing with Arduino- Raspberry Pi- Wireless sensor networks (WSN) in industries.

UNIT – IV IIOT NETWORKING AND COMMUNICATION

Network standards- Modbus- CAN- Profibus- Ethernet/IP- Zigbee- LoRaWAN- 5G- NB-IoT- Network architecture and topologies- Time-Sensitive Networking (TSN)- Fieldbus-Industrial Ethernet.

UNIT – V DATA ANALYTICS AND ML IN IIOT

Role of data analytics in IIoT- Data collection- preprocessing- storage- ML models for fault prediction and optimization-Tools: Apache Spark- Hadoop- Python- Power BI.

Text Books:

1. Industry 4.0: The Industrial Internet of Things;Alasdair Gilchrist (Apress), 2017
2. Introduction to Industrial Internet of Things and Industry 4.0 by Sandeep Misra, Chandana Roy, Anandarup Mukherjee

References:

1. Industrial Internet of Things: Cyber manufacturing Systems: Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer), 2017
2. Hands-On Industrial Internet of Things: Create a powerful Industrial IoT by Giacomo Veneri, Antonio Capasso, Packt, 2018
3. Industrial Internet of Things: Technologies, Design, and Applications by Jha, Tariq, Joshi, Solanki (Routledge)

Course Outcomes:

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

1. Explain the principles of Industrial Internet of Things architectures, Industry 4.0 technologies, and communication frameworks for industrial automation.
2. Apply IIoT protocols, sensors, actuators, and networking technologies to implement industrial monitoring and control solutions.
3. Analyze IIoT architectures, communication networks, and device integration strategies to address industrial connectivity and performance challenges.
4. Evaluate IIoT systems by assessing communication protocols, network standards, and data analytics techniques for reliable industrial applications.
5. Design intelligent IIoT solutions by integrating industrial devices, cloud-edge platforms, and machine learning techniques for real-world industrial environments.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	2	–	–	–	–	–	–	2	1	–
CO2	2	3	2	–	3	–	–	–	–	–	–	2	2	2
CO3	2	3	3	2	2	–	–	–	–	–	–	–	3	2
CO4	2	3	–	2	2	–	–	–	–	–	1	–	3	2
CO5	2	2	3	2	3	–	–	–	–	–	1	–	2	3

25CSOESCN	**ROBOTIC PROCESS AUTOMATION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand the basic concepts of Robotic Process Automation.
- To expose to the key RPA design and development strategies and methodologies.
- To learn the fundamental RPA logic and structure.
- To explore the Exception Handling, Debugging and Logging operations in RPA.
- To learn to deploy and maintain the software bot.

UNIT – I INTRODUCTION TO ROBOTIC PROCESS AUTOMATION

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.

UNIT – II AUTOMATION PROCESS ACTIVITIES

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events

UNIT – III APP INTEGRATION, RECORDING AND SCRAPING

App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Process Mining.

UNIT – IV EXCEPTION HANDLING AND CODE MANAGEMENT

Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crash dumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine.

UNIT – V DEPLOYMENT AND MAINTENANCE

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Publishing and managing updates. RPA Vendors - Open Source RPA, Future of RPA

Text Books:

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packt Publishing, 2018.
2. Tom Taulli , “The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems”, Apress publications, 2020.

References:

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston, Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018.
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018.
3. A Gerardus Blokdyk, “Robotic Process Automation Rpa A Complete Guide “, 2020.

Course Outcomes:

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

1. Explain the principles, architecture, tools, and workflow concepts of Robotic Process Automation for business process automation.
2. Apply RPA design methodologies, workflow activities, and automation techniques to implement software bots for business applications.
3. Analyze RPA workflows, application integration, and exception management strategies to improve automation reliability and operational efficiency.
4. Evaluate RPA deployment, debugging, maintenance, and orchestration approaches for scalable and secure enterprise automation solutions.
5. Develop end-to-end Robotic Process Automation solutions by integrating workflow design, data processing, exception handling, and deployment for real-world applications.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	–	–	–	2	–	–	–	–	–	–	2	–	–
CO2	2	2	–	–	3	–	–	–	–	–	–	2	2	–
CO3	2	3	–	2	2	–	–	–	–	–	–	2	2	–
CO4	2	2	–	3	2	–	–	–	–	–	1	1	2	–
CO5	1	2	3	2	3	–	–	–	–	–	2	2	3	2

25CSOESCN	ANDROID DEVELOPMENT	L	T	P	C
		3	0	0	3

Course Objectives:

- Understand Android platform and application components
- Design user interfaces for mobile applications
- Implement data storage and content access mechanisms
- Integrate multimedia, sensors, and web services
- Develop, test and deploy complete Android applications

UNIT – I INTRODUCTION TO ANDROID

Overview of Android platform and architecture - Installing Android Studio and setting up environment - Android application components and lifecycle - Creating a simple Android application.

UNIT – II USER INTERFACE DESIGN

Layouts and Views - UI controls (TextView, EditText, Button, etc.) - Event handling and listeners - Menus, Dialogs, and Toasts.

UNIT – III DATA STORAGE AND CONTENT PROVIDERS

Shared Preferences and Internal Storage - SQLite database integration - Using Content Providers to access shared data - Permissions and data security.

UNIT – IV MULTIMEDIA AND CONNECTIVITY

Playing audio and video in Android - Using camera and sensors - Accessing internet and web services - Networking with HTTP and JSON parsing.

UNIT – V ADVANCED ANDROID CONCEPTS

Location-based services and Google Maps integration - Working with background tasks and Services - Firebase integration (Authentication, Realtime Database) - Publishing apps to Google Play Store.

Text Books:

1. Bill Phillips, Chris Stewart, Kristin Marsicano, 'Android Programming: The Big Nerd Ranch Guide', 4th Edition, Big Nerd Ranch Guides, 2019.
2. B.M. Harwani, 'Android Programming Unleashed', Pearson Education, 2013.

References:

1. Reto Meier, Ian Lake, 'Professional Android', 4th Edition, Wrox, 2018.
2. Joseph Annuzzi Jr., Lauren Darcey, Shane Conder, 'Advanced Android Application Development', 4th Edition, Addison-Wesley, 2015.

Course Outcomes:

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

1. Explain Android application architecture, components, lifecycle, and development environment for mobile application development.
2. Apply Android development techniques to implement interactive mobile applications with user interfaces, data management, and connectivity features.
3. Analyze Android application requirements to select appropriate components, storage mechanisms, multimedia services, and networking solutions.
4. Evaluate Android application design, security, performance, and deployment strategies for reliable and efficient mobile computing solutions.
5. Develop complete Android applications by integrating user interfaces, databases, web services, device features, and cloud services for real-world applications.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	–	–	–	2	–	–	–	–	–	–	2	–	–
CO2	2	2	–	–	3	–	–	–	–	–	–	2	2	–
CO3	2	3	–	2	2	–	–	–	–	–	–	2	2	–
CO4	2	2	–	3	2	–	–	–	–	–	1	1	2	–
CO5	1	2	3	2	3	–	–	–	–	–	2	2	3	2

25CSOESCN	**ROBOTICS AND ITS APPLICATIONS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- Understand and discuss the fundamental elementary concepts of Robotics.
- Provide insight into different types of robots.
- Explain intelligent modules for robotic motion control.
- Educate on various path planning techniques.
- Visualize the working of innovative robotic devices

UNIT – I INTRODUCTION TO ROBOTICS

Introduction to Robotics and Automation, laws of robot, brief history of robotics, basic components of robot, robot specifications, classification of robots, human system and robotics, safety measures in robotics, social impact, Robotics market and the future prospects, advantages and disadvantages of robots.

UNIT – II ROBOT ANATOMY AND MOTION ANALYSIS

Anatomy of a Robot, Robot configurations: polar, cylindrical, Cartesian, and jointed arm configurations, Robot links and joints, Degrees of freedom: types of movements, vertical, radial and rotational traverse, roll, pitch and yaw, Wok volume/envelope, Robot kinematics: Introduction to direct and inverse kinematics, transformations and rotation matrix.

UNIT – III ROBOT DRIVES AND END EFFECTORS

Robot drive systems: Hydraulic, Pneumatic and Electric drive systems, classification of end effectors, mechanical grippers, vacuum grippers, magnetic grippers, adhesive gripper, gripper force analysis and gripper design, 1 DoF, 2 DoF, multiple degrees of freedom robot hand, tools as end effectors, Robot control types: limited sequence control, point-to-point control, playback with continuous path control, and intelligent control.

UNIT – IV PATH PLANNING:

Definition-Joint space technique, Use of P-degree polynomial-Cubic,polynomial- Cartesian space technique, parametric descriptions, straight line and circular paths, position and orientation planning.

UNIT – V ROBOTICS APPLICATIONS

Material Handling: pick and place, palletizing and depalletizing, machining loading and unloading, welding & assembly, Medical, agricultural and space applications, unmanned vehicles: ground, Ariel and underwater applications, robotic for computer integrated manufacturing. Types of robots: Manipulator, Legged robot, wheeled robot, aerial robots, Industrial robots, Humanoids, Robots, Autonomous robots, and Swarm robots

Text Books:

1. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education, 2009.
2. Mikell P. Groover et. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, Special Edition, (2012).
3. Ganesh S Hegde, “A textbook on Industrial Robotics”, University science press, 3rd edition, 2017

References:

1. Richard D Klafter, Thomas A Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd., 2006.
2. Fu K S, Gonzalez R C, Lee C.S.G, "Robotics: Control, Sensing, Vision and Intelligence", McGraw Hill, 1987. https://www.robots.com/applications.

Course Outcomes:

At the end of this course, the student will be able to

1. Explain the principles, architecture, kinematics, and operational characteristics of robotic systems for engineering applications.
2. Apply robot kinematics, motion analysis, drive systems, and end effectors to solve robotic control and automation problems.
3. Analyze robotic configurations, motion planning techniques, and control strategies to improve robotic system performance.
4. Evaluate robot path planning, control mechanisms, and application-specific solutions for efficient and safe industrial automation.
5. Develop robotic solutions by integrating robot mechanisms, motion planning, control strategies, and intelligent automation for real-world applications.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	–	–	–	2	–	–	–	–	–	–	2	–	–
CO2	2	2	–	–	3	–	–	–	–	–	–	2	2	–
CO3	2	3	–	2	2	–	–	–	–	–	–	2	2	–
CO4	2	2	–	3	2	–	–	–	–	–	1	1	2	–
CO5	1	2	3	2	3	–	–	–	–	–	2	2	3	2

25CSOESCN	E-COMMERCE AND DIGITAL MARKETING	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the fundamental concepts of e-commerce.
- To explore digital marketing strategies and tools.
- To develop skills for creating and managing online business operations.
- To analyze the use of technology in modern marketing practices.
- To evaluate the performance and effectiveness of digital marketing campaigns

UNIT – I INTRODUCTION TO E-COMMERCE

Definition, scope and types of e-commerce- Business models in e-commerce-Benefits and limitations of e-commerce- E-commerce infrastructure and technologies.

UNIT – II E-COMMERCE APPLICATIONS AND PAYMENT SYSTEMS

Applications of e-commerce in different sectors - Online payment systems and gateways - Security and encryption in e-commerce - Legal and ethical issues in e-commerce

UNIT – III INTRODUCTION TO DIGITAL MARKETING

Definition and importance of digital marketing - Traditional marketing vs. digital marketing Types of digital marketing: SEO, SEM, SMM, Content Marketing -Overview of digital marketing tools and platforms

UNIT – IV DIGITAL MARKETING STRATEGIES AND ANALYTICS

Developing a digital marketing strategy - Campaign creation and execution - Google Ads, Facebook Ads, email marketing - Web analytics and performance metrics

UNIT – V TRENDS AND FUTURE OF DIGITAL MARKETING

Mobile marketing and video marketing- Influencer and affiliate marketing - Automation and AI in digital marketing - Emerging trends and future scope

Text Books:

1. Kenneth C. Laudon, Carol Traver, 'E-commerce 2021: Business, Technology, Society', Pearson.
2. Seema Gupta, 'Digital Marketing', McGraw Hill Education.

References:

1. Dave Chaffey, Fiona Ellis-Chadwick, 'Digital Marketing', Pearson Education.
2. Vandana Ahuja, 'Digital Marketing', Oxford University Press.
3. Philip Kotler et al., 'Marketing 5.0: Technology for Humanity', Wiley.
4. Bharat Bhaskar, 'Electronic Commerce: Framework, Technologies and Applications', McGraw Hill.

Course Outcomes:

At the End of course, Students will be able to

1. Explain the principles, technologies, business models, and marketing concepts underlying e-commerce and digital marketing ecosystems.
2. Apply e-commerce technologies, digital marketing tools, and online payment systems to support effective business operations and customer engagement.
3. Analyze e-commerce platforms, digital marketing strategies, and web analytics to improve organizational performance and decision-making.
4. Evaluate digital marketing campaigns, e-commerce security, legal compliance, and emerging technologies for sustainable online business practices.
5. Develop integrated e-commerce and digital marketing solutions by incorporating business models, online promotion, analytics, and emerging technologies for real-world applications.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	–	–	–	2	–	–	–	–	–	–	2	–	–
CO2	2	2	–	–	3	–	–	–	–	–	–	2	2	–
CO3	2	3	–	2	2	–	–	–	–	–	–	2	2	–
CO4	2	2	–	3	2	–	–	–	–	–	1	1	2	–
CO5	1	2	3	2	3	–	–	–	–	–	2	2	3	2

25CSOESCN	PRIVACY AND SECURITY IN INTERNET OF THINGS	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand privacy and security challenges in IoT environments.
- To explore cryptographic techniques and access control for IoT.
- To identify threats, vulnerabilities, and risk assessment methods.
- To analyze security frameworks and standards for IoT applications.
- To evaluate real-time case studies and regulatory implications in IoT.

UNIT – I INTRODUCTION TO IOT AND SECURITY LANDSCAPE

Overview of IoT – architecture, characteristics, and applications - IoT ecosystem and stakeholders - Security challenges in IoT compared to traditional systems - Key attack surfaces in IoT devices and network.

UNIT – II CRYPTOGRAPHY AND SECURE COMMUNICATION IN IOT

Overview of cryptographic principles - Lightweight cryptography for IoT - Authentication protocols and secure key management - Data encryption and end-to-end security models

UNIT – III PRIVACY THREADS AND DATA PROTECTION

Privacy issues in IoT data collection and processing - Anonymization and pseudonymization techniques - Access control and identity management - User consent, profiling, and surveillance concerns

UNIT – IV SECURITY FRAMEWORKS, STANDARDS AND RISK MANAGEMENT

IoT security standards: ISO, NIST, IETF, ETSI - Security lifecycle and threat modeling in IoT - Intrusion detection and prevention systems for IoT - Security risk assessment and mitigation strategies

UNIT – V CASE STUDIES AND LEGAL ASPECTS

Case studies on IoT security breaches and lessons learned - Regulatory frameworks: GDPR, HIPAA, and local laws - Ethical and societal implications of IoT security -Future trends and secure design principles

Text Books:

1. Fei Hu, 'Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations', CRC Press.
2. Rajeev Piyare, 'Internet of Things: Security and Privacy Issues', Springer

References:

1. Francis daCosta, 'Rethinking the Internet of Things: A Scalable Approach to Connecting Everything', Apress.
2. Brian Russell & Drew Van Duren, 'Practical Internet of Things Security', Packt Publishing.
3. Hossain, M. Shamim, et al., 'Security and Privacy in Internet of Things (IoT): Models, Algorithms, and Implementations', Springer.
4. Sudip Misra, et al., 'Security Challenges and Approaches in Internet of Things', Springer.

Course Outcomes:

At the End of course, Students will be able to

1. Explain the principles of privacy, security, and risk management for protecting IoT systems and data across diverse application environments.
2. Apply cryptographic techniques, authentication mechanisms, and access control strategies to secure IoT communication and information exchange.
3. Analyze IoT security threats, privacy vulnerabilities, and regulatory requirements to assess risks in real-world IoT deployments.
4. Evaluate IoT security frameworks, standards, and mitigation strategies for ensuring trustworthy, resilient, and privacy-preserving IoT applications.
5. Design secure IoT solutions by integrating privacy-by-design principles, security mechanisms, and regulatory compliance for real-world engineering applications.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	1	–	–	–	–	–	–	2	1	–
CO2	2	2	3	–	3	–	–	–	–	–	–	2	3	–
CO3	2	3	–	2	1	–	–	–	–	–	–	2	2	–
CO4	2	2	2	2	2	–	–	1	–	–	–	2	2	–
CO5	1	2	3	–	2	–	–	1	–	–	1	2	3	–

25CSOESCN	GENERATIVE ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the core principles and motivation behind generative models.
- To explore architectures such as VAEs, GANs, and Transformers used for data synthesis.
- To acquire the knowledge of various generative models for image generation, style transfer and text generation.
- To understand the application of prompt engineering and transformer-based LLMs.
- To implement and evaluate generative models using real-world datasets and APIs.

UNIT – I AN INTRODUCTION TO GENERATIVE AI

Definition, Motivation & Applications, Why Use Generative Models- Use Cases & Advantages, Discriminative vs Generative Models, Taxonomy of Generative Models,

Probability and Data Distributions, Evaluation Metrics for Generative Models, Challenges (Mode Collapse, Overfitting, Instability) & Ethics in Generative AI

UNIT – II FUNDAMENTALS OF GENERATIVE MODELS

Autoencoders: Regularized & Variational Autoencoders, Stochastic Encoders & Decoders, Autoregressive Models: Fully Visible sigmoid Belief Network (FVSBN), Neural Autoregressive Density Estimation (NADE), Masked Autoencoder for Distribution Estimation (MADE)

UNIT – III GENERATIVE ADVERSARIAL NETWORKS (GANS)

GAN Architecture: Generator and Discriminator Networks, Loss Functions (Minimax) and Training Challenges, Vanilla GANs, Deep Convolutional GANs (DCGANs), Progressive GANs, Applications: Image Generation, Style Transfer, Image-to-Image Translation (Pix2Pix), Super-Resolution, and Data Augmentation.

UNIT – IV TRANSFORMERS AND PROMPT ENGINEERING

Self-Attention, Transformer Basics, Transformers, BERT, Large Language Models, Masked Language Modeling (MLM), Next Sentence Prediction (NSP), Generative Pretrained Transformers (GPT), Task-specific GPT Fine-tuning, Prompt Engineering, Hugging Face pretrained Transformers, Hugging Face APIs.

UNIT – V LANGUAGE MODELS AND APPLICATIONS

OpenAI GPT-3, 3.5, 4, OpenAI APIs, Working with the OpenAI Playground, Content Filtering, Text Generation and Transformation, Text Classification and Categorization, Building GPT-powered Question Answering Applications and Chatbots, Mini Projects using Large Language Models.

Text Books:

1. David Foster, Generative Deep Learning, 2nd Edition, O'Reilly Media, 2023
2. Joseph Babcock, Raghav Bali, Generative AI with Python and TensorFlow 2, Packt Publishing Ltd., UK, 2021.

References:

1. Denis Rothman, Transformers for Natural Language Processing, 2nd Edition, Packt Publishing, 2023
2. Sabit Ekin, Prompt Engineering for Chat GPT: A Quick Guide to Techniques, Tips, and Best Practices, DOI: 10.36227/techrxiv. 22683919.v2, 2023
3. Chris Fregly, Antje Barth, Shelbee Eigenbrode, Generative AI on AWS: Building Context-Aware Multimodal Reasoning Applications, O'Reilly, 2023
4. Auffarth, B., Generative AI with LangChain: Build Large Language Model (LLM) Apps with Python, ChatGPT, and Other LLMs, Packt Publishing, 2023

Course Outcomes:

At the end osf the course, the students will be able to

1. Explain the principles, architectures, evaluation methods, and ethical considerations of generative artificial intelligence for intelligent data generation.
2. Apply generative AI models and transformer-based frameworks to develop solutions for image, text, and multimodal generation tasks.
3. Analyze the performance, limitations, and suitability of generative models for diverse real-world artificial intelligence applications.
4. Evaluate prompt engineering techniques, large language models, and generative AI frameworks to optimize application performance and reliability.
5. Design generative AI applications by integrating foundation models, APIs, and prompt engineering techniques for real-world intelligent systems.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	1	–	–	1	–	–	–	2	1	–
CO2	2	2	3	–	3	–	–	–	–	–	–	2	3	–
CO3	2	3	–	2	1	–	–	–	–	–	–	2	2	–
CO4	2	2	2	2	2	–	–	1	–	–	–	2	2	–
CO5	1	2	3	–	2	–	–	–	–	–	1	2	3	–

25CSOESCN	DATA ANALYSIS USING OPEN SOURCE TOOLS	L	T	P	C
		3	0	0	3

Course Objectives:

- To acquire knowledge on handling data with one and two variables.
- To develop skills to perform time series and multivariate analysis
- To explain the tests and methods in classical statistics for data analysis
- To impart knowledge on clustering techniques
- To provide an understanding on reporting and dashboards

UNIT – I SINGLE AND TWO VARIABLES

A Single Variable: Shape and Distribution - Dot and Jitter Plots - Histograms and Kernel Density Estimates - Histograms - Kernel Density Estimates - Optional: Optimal Bandwidth Selection - The Cumulative Distribution Function - Optional: Comparing Distributions with Probability Plots and QQ Plots Rank-Order Plots and Lift Charts - Only When Appropriate: Summary Statistics and Box Plots - Summary StatisticsBox-and-Whisker Plots - Tool: NumPy.Two Variables: Establishing Relationships - Scatter Plots - Conquering Noise: Smoothing Splines - LOESS -Examples - Residuals - Logarithmic Plots - Linear Regression - Graphical Analysis and Presentation -Tool: matplotlib - Using matplotlib Interactively - Case Study: LOESS with matplotlib - Managing Properties The matplotlib Object Model and Architecture.

UNIT – II TIME SERIES ANALYSIS AND MULTIVARIATE ANALYSIS

Time As a Variable: Time-Series Analysis - Examples - The Task - Requirements and the Real World - Smoothing - Running Averages - Exponential Smoothing - The Correlation Function Examples - Implementation Issues - Filters and Convolutions - scipy.signal. More Than Two Variables: Graphical Multivariate Analysis - False-Color Plots - Multiplots - The Scatter-Plot Matrix - The Co-Plot - Variations - Composition Problems - Changes in Composition - Multidimensional Composition: Tree and Mosaic Plots - Novel Plot Types - Glyphs - Parallel Coordinate Plots - Interactive Explorations - Querying and Zooming - Linking and Brushing - Grand Tours and Projection Pursuits - Tools for Multivariate Graphics - R Experimental Tools - Python Chaco Library. A Data Analysis Session - Tool: gnuplot

UNIT – III CLASSICAL STATISTICS

What You Really Need to Know About Classical Statistics - Genesis - Statistics Defined - Statistics Explained Example: Formal Tests Versus Graphical Methods - Controlled Experiments Versus Observational Studies -Design of Experiments - Perspective - Bayesian Statistics - The Frequentist Interpretation of Probability The Bayesian Interpretation of Probability - Bayesian Data Analysis: A Worked Example - Bayesian Inference: Summary and Discussion - Tool: R

UNIT – IV CLUSTERING

Finding Clusters - What Constitutes a Cluster? - A Different Point of View - Distance and Similarity Measures - Common Distance and Similarity Measures - Numerical data - Categorical data - String data Special-purpose metrics - Clustering Methods - Center Seekers - Tree Builders - Neighborhood Growers Pre- and Postprocessing - Scale Normalization - Cluster Properties and Evaluation - A Special Case: Market Basket Analysis - A Word of Warning - Tools: Pycluster and the C Clustering Library

UNIT – V REPORTING, BUSINESS INTELLIGENCE, AND DASHBOARDS

Business Intelligence - Reporting - Corporate Metrics and Dashboards - Recommendations for a Metrics Program - Data Quality Issues - Data Availability - Data Consistency - Tools: Berkeley DB and SQLite.

Text Books:

1. Philipp K. Janert, "Data Analysis with Open Source Tools", O'Reilly Media Inc., First Edition, 2010, ISBN: 978-0596802356.

References:

1. Jeffrey Strickland, "Data Analytics using Open Source Tools", lulu.com, 2016, ISBN: 978-1365270413
2. Florrent Buisson, "Behavioral Data Analysis with R and Python", O'Reilly Media Inc., 2021, ISBN: 9781492061373.
3. Wes Mckinney, "Python for Data Analysis", O'Reilly Media Inc., Third Edition, 2022.
4. Chantal D. Larose, Daniel T. Larose, Shaukat Ali Shahee, "Fundamentals of Data Science using Python and R", Wiley, 2024, ISBN: 9789363860759.

Course Outcomes:

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

1. Explain the principles of statistical data analysis, visualization, and open-source analytical tools for effective data-driven decision making.
2. Apply open-source tools and statistical techniques to preprocess, analyze, visualize, and interpret structured datasets for engineering applications.
3. Analyze multivariate data, time-series patterns, and clustering results to discover meaningful insights from complex datasets.
4. Evaluate statistical methods, clustering techniques, visualization approaches, and reporting strategies for reliable business intelligence and decision support.
5. Develop data analytics solutions by integrating open-source tools, statistical models, visualization techniques, and dashboards for real-world data analysis applications.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	2	–	–	–	–	–	–	2	1	–
CO2	2	2	3	–	3	–	–	–	–	–	–	2	3	–
CO3	2	3	–	2	2	–	–	–	–	–	–	2	2	–
CO4	2	2	2	2	1	–	–	–	–	–	1	2	1	–
CO5	1	2	3	–	2	–	–	–	–	–	1	2	2	2

25CSOESCN	ENTREPRENEURSHIP, INNOVATION AND STARTUP	L	T	P	C
		3	0	0	3

Course Objectives:

- To develop entrepreneurial mindset and skills.
- To understand innovation processes and types.
- To equip students with tools for developing business models and startups.
- To introduce government and private startup support systems.
- To encourage ethical and sustainable entrepreneurship.

UNIT – I INTRODUCTION TO ENTREPRENEURSHIP

Definition, Evolution, and Importance of Entrepreneurship- Characteristics and Types of Entrepreneurs- Entrepreneurial Mindset and Motivation- Role of Entrepreneurship in Economic Development- Myths and Realities of Entrepreneurship.

UNIT – II INNOVATION AND CREATIVITY

Meaning and Concept of Innovation- Design Thinking for Innovation- Innovation Life Cycle- Incremental Vs Radical Innovation-Inbound and Outbound Ideation-Open and Other Innovative Ideation Methods.

UNIT – III BUSINESS MODEL AND PLAN DEVELOPMENT

Business Planning and Fund Raising: Identifying, assessing and validation of the idea- Identifying the target segment and market share- creating an effective B-Plan- Market research, Financial, Market and Technical feasibility- Fund raising and valuation-Idea pitching.

UNIT – IV LEGAL AND FINANCIAL ASPECTS

Legal aspects: Permits, Registrations and compliances- Intellectual Property Rights- Contracts. Financial aspects- Working capital management- Financial management and long-term investments- Capital structure and taxation- Brake even analysis.

UNIT – V CONTEMPORARY ISSUES

Legal forms of entrepreneurial organizations- Debt, Equity, Angle and Venture Capital markets for Start-ups, Growth and Development stages- new venture finance- Initial Public Offer (IPO) Governmental initiatives to encourage startups - Business Incubations and its benefits-Protection of Intellectual Property.

Text Books:

1. Drucker, P. F. , Innovation and entrepreneurship: Practice and principles (Rev. ed.). Harper Business, 2006.
2. Khanka, S. S., Entrepreneurial development. S. Chand Publishing, 2007.

References:

1. Blank, S., & Dorf, B, The startup owner's manual: The step-by-step guide for building a great company. K&S Ranch Press.,2012
2. Aulet, B. , Disciplined entrepreneurship: 24 steps to a successful startup. Wiley,2013.

Course Outcomes:

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

1. Explain the principles of entrepreneurship, innovation, and startup ecosystems for creating sustainable business opportunities.
2. Apply entrepreneurial tools and innovation methodologies to identify, validate, and develop viable business opportunities.
3. Analyze business models, market feasibility, financial requirements, and legal considerations for successful startup development.
4. Evaluate funding strategies, government support systems, intellectual property, and ethical practices for sustainable entrepreneurial ventures.
5. Develop comprehensive startup business plans by integrating innovation, financial planning, legal compliance, and entrepreneurial strategies for real-world ventures.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	–	–	–	–	–	1	–	–	2	1	–	–
CO2	2	2	3	–	1	–	–	–	–	–	2	1	2	–
CO3	2	3	2	2	–	–	–	–	–	–	3	1	2	–
CO4	1	2	–	–	–	–	–	2	–	–	3	–	1	–
CO5	1	2	3	–	1	–	–	1	–	1	3	1	2	–

HONORS ELECTIVES

25CSHESCN	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the basics of software project management.
- To facilitate assessment analysis of projects.
- To illustrate about project scheduling.
- To enable the students to learn about managing software project contracts.
- To expose about organizational behavior.

UNIT – I PROJECT DEFINITION

Project Definition – Contract Management – Activities Covered By Software Project Management – Overview of Project Planning – Stepwise Project Planning.

UNIT – II STRATEGIC ASSESSMENT

Strategic Assessment – Technical Assessment – Cost Benefit Analysis – Cash Flow Forecasting – Cost Benefit Evaluation Techniques – Risk Evaluation.

UNIT – III PROJECT SCHEDULING

Objectives – Project Schedule-Sequencing and Scheduling Activities – Network Planning Models – Forward Pass – Backward Pass – Activity Float – Shortening Project Duration – Activity on Arrow Networks – Risk Management – Nature Of Risk – Types Of Risk – Managing Risk – Hazard Identification – Hazard Analysis – Risk Planning And Control.

UNIT – IV CONTRACT MANAGEMENT

Creating Framework – Collecting The Data – Visualizing Progress – Cost Monitoring – Earned Value-Prioritizing Monitoring – Getting Project Back To Target – Change Control – Managing Contracts – Introduction – Types Of Contract – Stages In Contract Placement – Typical Terms Of A Contract – Contract Management – Acceptance.

UNIT – V ORGANISATIONAL BEHAVIOUR

Introduction – Understanding Behaviour – Organizational Behaviour: A Background – Selecting The Right Person For The Job – Instruction In The Best Methods – Motivation – The Oldman – Hackman Job Characteristics Model – Working In Groups – Becoming A Team –Decision Making – Leadership – Organizational Structures – Stress –Health And Safety – Case Studies.

Text Books:

1. Bob Hughes, Mike Cotterell, Rajib Mall “Software Project Management”, Fifth Edition, Tata McGraw Hill, 2011.
2. Gopalaswamy Ramesh, “Managing Global Software Projects”, Tata McGraw Hill, New Delhi, 2006.

References:

1. Pankaj Jalote, “Software Project Management in Practice”, Pearson Education, reprinted 2009.
2. Walker Royce, “Software Project Management”, Pearson Education, 2002.
3. Kelkar SA, “Software Project Management”, PHI Learning, New Delhi, 2013.

Course Outcomes:

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

1. Explain the principles and practices of software project management for effective planning and execution of software projects.
2. Apply project assessment, estimation, scheduling, and monitoring techniques to manage software development activities.

3. Analyze project risks, resource requirements, contractual aspects, and organizational factors affecting software project success.
4. Evaluate project management strategies, control mechanisms, and leadership practices for improving software project performance.
5. Develop software project management plans by integrating scheduling, risk management, contract administration, and organizational practices for real-world projects.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	–	–	–	–	–	1	–	–	2	2	–	–
CO2	2	3	2	–	2	–	–	–	–	–	3	2	2	–
CO3	2	3	2	2	–	–	–	–	–	–	2	1	2	–
CO4	1	2	2	2	1	–	–	2	–	1	2	1	2	–
CO5	1	2	3	–	2	–	–	1	–	1	3	2	2	–

25CSHESCN	NANO COMPUTING	L	T	P	C
		3	1	0	4

Course Objectives:

- To introduce the fundamental concepts, technologies, and evolution of Nano Computing and its significance in modern computing systems.
- To analyze the impact of physical imperfections and defects on the performance and reliability of nano computing devices.
- To apply reliability evaluation techniques and tools to assess and improve nano device behavior under fault conditions.
- To explain the principles, hardware, and architectural challenges of quantum and QCA-based computing at the nanoscale.
- To demonstrate the design and implementation of QCA-based circuits and evaluate emerging paradigms like molecular and optical computing.

UNIT – I NANO COMPUTING FUNDAMENTALS

Introduction - History of Computing – Nano Computing - Quantum Computers - Nano Computing Technologies - Nano Information Processing - Prospects and Challenges - Physics of Nano Computing: Digital Signals and Gates - Silicon Nanoelectronics - Carbon Nanotube Electronics - CNTFETs – Nanolithography.

UNIT – II NANO COMPUTING WITH IMPERFECTIONS

Introduction – Nano Computing in the Presence of Defects and Faults – Defect Tolerance – Towards Quadrillion Transistor Logic Systems.

UNIT – III RELIABILITY OF NANO COMPUTING

Markov Random Fields – Reliability Evaluation Strategies – NANOLAB – NANOPRISM – Reliable Manufacturing and Behavior from Law of Large Numbers.

UNIT – IV NANO SCALE QUANTUM COMPUTING

Quantum Computers – Hardware Challenges – Fabrication, Test and Architecture – Quantum-dot Cellular Automata (QCA) – Computing with QCA – QCA Clocking – QCA Design Rules.

UNIT – V QCA DESIGNER AND QCA IMPLEMENTATION

Basic QCA Circuits using QCA Designer – QCA Implementation – Molecular Computing – Optimal Computing – Ultrafast Pulse Shaping – Tb/sec Data Speeds.

Text Books:

1. Sahni V. and Goswami D., Nano Computing, McGraw Hill Education Asia Ltd., 2008.

References:

1. Reza B. Far, Mobile Computing Principles, Cambridge University Press, 2005.
2. William C.Y. Lee, Mobile Communication Design Fundamentals, John Wiley, 2010.
3. William Stallings, Wireless Communications and Networks, Pearson Education, 2009.

Course Outcomes:

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

1. Explain the principles, technologies, and challenges of nano computing for emerging computing systems and applications.
2. Apply reliability assessment techniques and fault-tolerant approaches to improve the performance of nanoscale computing devices.
3. Analyze nanoscale computing architectures, device imperfections, and design constraints for reliable system development.
4. Evaluate quantum and QCA-based computing paradigms based on architectural features, reliability, and implementation challenges.
5. Design nanoscale computing solutions using QCA-based methodologies and emerging computing paradigms for advanced engineering applications.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	1	–	–	–	–	–	–	2	1	–
CO2	2	3	2	–	2	–	–	–	–	–	–	2	2	–
CO3	2	3	2	2	1	–	–	–	–	–	–	2	3	–
CO4	2	2	2	3	2	–	–	–	–	–	–	2	2	–
CO5	1	2	3	–	2	–	–	–	–	–	1	2	3	–

25CSHESCN	PRINCIPLES OF ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the fundamental concepts, definitions, and goals of artificial intelligence and intelligent agents.
- To enable students to apply classical and heuristic search strategies, including adversarial search for problem-solving and game-playing.
- To develop the ability to represent knowledge formally using propositional and first-order logic and perform reasoning using inference techniques.
- To familiarize students with planning methods, uncertainty reasoning using probability, and machine learning concepts such as supervised learning and decision trees.
- To educate practical AI applications in natural language processing, expert systems, and ethical considerations in real-world domains.

UNIT – I INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Introduction: Definitions of AI – Acting humanly vs. thinking humanly – Thinking rationally vs. acting rationally. Intelligent Agents: Agents and Environments – Nature of Environments – Structure of Agents. Problem-Solving Agents: Formulating Problems – Example Problems. Uninformed Search Strategies: Breadth-First Search – Depth-First Search – Iterative Deepening Search. Constraint Satisfaction Problems (CSP): Overview – Example Problems.

UNIT – II INFORMED SEARCH AND ADVERSARIAL SEARCH

Heuristic Search Strategies: Greedy Best-First Search – A* Search – Heuristic Functions. Local Search Algorithms: Hill Climbing – simple and steepest ascent. Adversarial Search: Game Playing – Minimax Algorithm – Alpha-Beta Pruning.

UNIT – III KNOWLEDGE AND REASONING

Knowledge-Based Agents: The Wumpus World. Logic: Propositional Logic – Syntax and Semantics – Inference – Resolution – Forward and Backward Chaining. First-Order Logic – Syntax and Semantics –Inference in First-Order Logic – Unification – Resolution – Forward and Backward Chaining in FOL.

UNIT – IV PLANNING AND UNCERTAINTY

Classical Planning: STRIPS Representation – Planning Graphs – Partial-Order Planning. Planning and Acting in the Real World: Hierarchical Planning – Time and Resources. Reasoning Under Uncertainty: Probability Basics – Bayes' Rule. Probabilistic Reasoning: Inference in Bayesian Networks. Basic Learning Concepts: Learning from Observations – Supervised Learning – Decision Trees – Cross-Validation.

UNIT – V NATURAL LANGUAGE PROCESSING, EXPERT SYSTEMS, AND AI APPLICATIONS

Natural Language Processing: Text Preprocessing – Syntactic Analysis – Semantic Analysis. Expert Systems: Knowledge Acquisition – Inference Engines – Applications. AI Ethics: Privacy – Fairness – Bias – Autonomous Systems – Societal Impact. AI Applications: Healthcare – Finance – Transportation – Education.

Text Books:

1. Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach,* 4th Edition, Pearson Education, 2020.
2. Elaine Rich, Kevin Knight, and Shivashankar B. Nair, *Artificial Intelligence,* 4th Revised Edition, MedTech Science Press, 2024.
3. Nils J. Nilsson, *Artificial Intelligence: A New Synthesis*, Paperback Reprint Edition, Morgan Kaufmann, 2011.

References:

1. George F. Luger, *Artificial Intelligence: Structures and Strategies for Complex Problem Solving,* 6th Edition, Pearson Education, 2009.
2. Kevin P. Murphy, *Machine Learning: A Probabilistic Perspective,* 1st Edition, MIT Press, 2012.
3. Patrick H. Winston**,** *Artificial Intelligence,* 3rd Edition**,** Addison Wesley, 1992.
4. Peter Jackson, *Introduction to Expert Systems*, 3rd Edition**,** Addison-Wesley, 1998.

Course Outcomes:

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

1. Explain the fundamental principles of artificial intelligence and intelligent agents for computational problem solving.
2. Apply appropriate search, reasoning, and learning techniques to develop efficient solutions for AI-based applications.
3. Analyze knowledge representation and inference approaches for designing intelligent decision-making systems.
4. Evaluate planning, uncertainty handling, and machine learning methods for real-world artificial intelligence applications.
5. Design intelligent systems by integrating AI techniques for addressing complex engineering and societal problems.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	–	–	–	–	–	–	–	2	1	–
CO2	3	3	2	1	2	–	–	–	–	–	–	3	2	–
CO3	3	3	2	2	–	–	–	–	–	–	–	2	3	1
CO4	2	3	2	3	2	–	1	–	–	–	–	2	2	1
CO5	2	3	3	2	3	1	1	–	–	–	–	3	3	2

25CSHESCN	**GRAPH THEORY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce the fundamentals of Graph theory.
- To impart knowledge about Trees and planer graph.
- To explain about Graph coloring and directed graph.
- To make the student to understand permutation and combination.
- To familiarize generating functions.

UNIT – I INTRODUCTION

Graphs – Introduction – Isomorphism – Sub Graphs – Walks, Paths, Circuits– Connectedness– Components – Euler Graphs – Hamiltonian paths and circuits –Trees– Properties of Trees– Distance and Centers in Tree – Rooted and Binary Trees.

UNIT – II TREES, CONNECTIVITY & PLANARITY

Spanning Trees – Fundamental Circuits – Spanning Trees in a Weighted Graph– Cut Sets– Properties of Cut Set – All Cut Sets – Fundamental Circuits and Cut Sets – Connectivity and Separability – Network Flows – 1-Isomorphism – 2- Isomorphism– Combinational and Geometric Graphs – Planer Graphs – Different Representation of a Planer Graph.

UNIT – III MATRICES, COLORING AND DIRECTED GRAPH

Chromatic Number – Chromatic Partitioning – Chromatic Polynomial – Matching–Covering – Four Color Problem – Directed Graphs – Types of Directed Graphs–Digraphs and Binary Relations – Directed Paths and Connectedness – Euler Graphs

UNIT – IV PERMUTATIONS & COMBINATIONS

Fundamental Principles of Counting - Permutations and Combinations - Binomial Theorem - Combinations with Repetition - Combinatorial Numbers - Principle of Inclusion and Exclusion - Derangements - Arrangements with Forbidden Positions.

UNIT – V GENERATING FUNCTIONS

Generating Functions - Partitions of Integers - Exponential Generating Function-Summation Operator - Recurrence Relations - First Order and Second Order –Non-Homogeneous Recurrence Relations - Method of Generating Functions.

Text Books:

1. Narsingh Deo, Graph theory, Prentice Hall India,2008.
2. Douglas B. West, Introduction to Graph Theory, Prentice Hall India Ltd., 2001.

References:

1. H.Cormen, C.E. Leiserson and R.L. Rivest,“ Introduction to Algorithms,” McGraw-Hill, 2007.
2. Baase, "Computer algorithms", Pearson India 2008.
3. Frank Harary, “Graph Theory”, Narosa Publishing House, 2001.

Course Outcomes:

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

1. Explain the fundamental concepts of graph theory and discrete structures for computational problem solving.
2. Apply graph theoretic techniques and combinatorial methods to solve engineering and computing problems.
3. Analyze graph properties, connectivity structures, and mathematical models for complex network applications.
4. Evaluate graph-based algorithms and discrete mathematical approaches for efficient solution development.
5. Design computational models using graph theory and combinatorial techniques for real-world applications.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	–	–	–	–	–	–	–	2	1	–
CO2	3	3	2	1	–	–	–	–	–	–	–	3	2	–
CO3	3	3	2	2	1	–	–	–	–	–	–	2	3	1
CO4	2	3	3	2	1	–	–	–	–	–	–	2	2	1
CO5	2	3	3	2	2	–	–	–	–	–	–	3	3	2

25CSHESCN	DEEP LEARNING	L	T	P	C
		3	0	0	3

Course Objectives:

- To present the mathematical, statistical and computational challenges of building neural networks.
- To study the concepts of deep learning.
- To introduce dimensionality reduction techniques.
- To examine the case studies of deep learning techniques.

UNIT – I INTRODUCTION

Introduction to machine learning- Linear models (SVMs and Perceptron, logistic regression) - Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates

UNIT – II CONCEPTS OF DEEP LEARNING

History of Deep Learning- a Probabilistic Theory of Deep Learning- Back propagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep vs Shallow Networks- Convolutional Networks- Generative Adversarial Networks (GAN), Semi supervised Learning

UNIT – III METRIC LEARNING

Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization

UNIT – IV OPTIMIZATION

Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization- Generalization in neural networks- Spatial Transformer Networks-Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level
RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience

UNIT – V ADVANCED TECHNIQUES

Imagenet- Detection-Audio WaveNet-Natural Language Processing Word2Vec - Joint Detection- Bio Informatics- Face Recognition- Scene Understanding- Gathering Image Captions

Text Books:

1. Cosma Rohilla Shalizi, “Advanced Data Analysis from an Elementary Point of View”, 2015.
2. Deng & Yu, “Deep Learning: Methods and Applications”, Now Publishers, 2013.

References:

1. Ian Good fellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MITPress, 2016.
2. Michael Nielsen, “Neural Networks and Deep Learning”, Determination Press, 2015.

Course Outcomes:

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

1. Explain the fundamental concepts of deep learning models and neural network architectures for computational problem solving.
2. Apply deep learning algorithms and optimization techniques to develop solutions for engineering applications.
3. Analyze deep learning architectures and dimensionality reduction methods for complex data-driven systems.

4. Evaluate deep learning models and performance metrics for real-world intelligent applications.
5. Design deep learning-based intelligent systems by integrating advanced neural network techniques for practical problem domains.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	–	–	–	–	–	–	–	2	1	–
CO2	3	3	2	1	2	–	–	–	–	–	–	3	2	–
CO3	3	3	2	2	2	–	–	–	–	–	–	2	3	1
CO4	2	3	2	3	2	–	1	–	–	–	–	2	2	1
CO5	2	3	3	2	3	1	1	–	–	–	–	3	3	2

25CSHESCN	OPERATIONAL RESEARCH	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the basic concepts and techniques of OR for decision making.
- To develop models for optimization techniques including transportation and assignment problems.
- To understand decision theory and game theory for decision making problems.
- To analyze complex decision situations using simulation and Queuing theory models.
- To apply OR techniques in real world problems from engineering and management.

UNIT – I INTRODUCTION TO OR AND LINEAR PROGRAMMING

Origin and development of OR- Applications and limitations- Formulation of LPP- Graphical and Simplex Methods - Duality and Sensitivity Analysis

UNIT – II TRANSPORTATION AND ASSIGNMENT PROBLEMS

Initial feasible solutions (NWCR, LCM, VAM)- Optimality test (MODI) - Unbalanced problems - Assignment model – Hungarian method - Travelling Salesman Problem

UNIT – III DECISION THEORY AND GAME THEORY

Decision-making under certainty, risk, and uncertainty - Decision trees - Two-person zero-sum games - Pure and mixed strategies - Saddle point, Dominance rule, and Graphical solution

UNIT – IV QUEUING THEORY AND INVENTORY CONTROL

Structure of Queuing systems - Poisson process - Models: (M/M/1), (M/M/C) - Inventory models: EOQ, ABC Analysis, Purchase vs. Manufacturing models

UNIT – V PROJECT MANAGEMENT AND SIMULATION

Project scheduling using CPM and PERT - Critical path and slack computation - Crashing of projects - Basics of simulation and Monte Carlo techniques

Text Books:

1. H.A. Taha, Operations Research: An Introduction, Pearson Education, 10th Edition, 2017.
2. KantiSwarup, P.K. Gupta, Man Mohan, Operations Research, Sultan Chand & Sons, 18th Edition, 2014.

References:

1. Frederick S. Hillier and Gerald J. Lieberman, Introduction to Operations Research, McGraw Hill, 10th Edition, 2015.
2. S.D. Sharma, Operations Research, KedarnathRamnath& Co., Latest Edition.
3. J.K. Sharma, Operations Research: Theory and Applications, Macmillan, 4th Edition.
4. Tulsian& Pandey, Quantitative Techniques, Pearson Education.

Course Outcomes:

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

1. Explain the principles of operations research models and optimization techniques for decision-making applications.
2. Apply mathematical optimization methods to formulate and solve engineering and management problems.
3. Analyze operational models involving allocation, scheduling, uncertainty, and resource optimization for effective decision support.
4. Evaluate alternative strategies using quantitative techniques for complex decision-making scenarios.
5. Develop optimization-based solutions using operations research methodologies for real-world engineering applications.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	–	–	–	–	–	–	–	2	1	–
CO2	3	3	2	1	2	–	–	–	–	–	–	3	2	–
CO3	3	3	2	2	1	–	–	–	–	–	–	2	3	1
CO4	2	3	2	3	2	–	1	–	–	–	–	2	2	1
CO5	2	3	3	2	3	1	1	–	–	–	–	3	3	2

25CSHESCN	**PARALLEL AND DISTRIBUTED ALGORITHMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce the basics of parallel computing, architecture and organization of parallel platforms and process-processor mapping techniques.
- To teach the techniques to decompose a computation for concurrent execution and to communicate between processes on various parallel architectures.
- To explain the Message-Passing and shared address space architectures and to prepare the students to write programs using Message Passing Interface topologies.
- To provide an understanding of the models for Message Passing systems and to illustrate the ring topology and shared memory model with suitable problems.
- To familiarize the students with different failures in distributed systems and to explain the fault-tolerant distributed systems.

UNIT – I INTRODUCTION TO PARALLEL COMPUTING

Scope of Parallel Computing –Parallel Programming Platforms –Implicit Parallelism– Limitations of Memory System Performance –Control Structure of Parallel platforms–

Communication Model of Parallel Platforms –Physical Organization of Parallel Platforms– Communication Costs in Parallel Machines – Impact of Process - Processor Mapping and Mapping Techniques.

UNIT – II PARALLEL ALGORITHM DESIGN

Preliminaries –Decomposition Techniques –Characteristics of Tasks and Interactions– Mapping Techniques for Load Balancing –Methods for Containing Interaction Overheads– Parallel Algorithm Models –Basic Communication Operations –One -to-All Broadcast and All-to-One Reduction –All to -All Broadcast and Reduction –All -Reduce and Prefix Sum Operations –Scatter and Gather –All - to-All Personalized Communication –Circular Shift – Improving the Speed of some Communication Operations.

UNIT – III PROGRAMMING USING MESSAGE PASSING AND SHARED ADDRESS SPACE

Principles of Message Passing Programming –Building Blocks –Send and Receive Operations –MPI –Message Passing Interface –Topologies and Embedding – Overlapping Communication with Computation –Collective Communication and Computation Operations –Groups and Communicators –POSIX thread API – OpenMP: a Standard for Directive based Parallel Programming –Applications of Parallel Programming -Matrix-Matrix Multiplication –Solving Systems of Equations– Sorting Networks –Bubble Sort Variations –Parallel Depth First Search.

UNIT – IV DISTRIBUTED COMPUTING PARADIGM

Paradigms for Distributed applications–Basic algorithms in Message passing Systems– Leader Election in Rings –Mutual Exclusion in Shared Memory.

UNIT – V FAULT TOLERANT DESIGN

Synchronous Systems with Crash Failures–Byzantine Failures–Impossibility in Asynchronous Systems -Formal Model for Simulation –Broadcast and Multicast– Specification of a Broadcast Service –Implementing a Broadcast Service –Multicast in Groups -Distributed Shared Memory–Linearizable–Sequentially Consistent Shared Memory –Algorithms.

Text Books:

1. Ananth Grama, Anshul Gupta, George Karypis and Vipin Kumar, Introduction to Parallel Computing, 2nd Edition, Pearson Education, 2009.
2. Haggit Attiya and Jennifer Welch, Distributed Computing–Fundamentals, Simulations and Advanced Topics, 2nd Edition, Wiley, 2012.

References:

1. Michael Quinn, Parallel Computing - Theory and Practice, Second Edition, Tata McGraw Hill, 2002.
2. Norman Matloff, Parallel Computing for Data Science - With Examples in R, C++ and CUDA, Chapman and Hall/CRC, 2015.
3. Wan Fokkink, Distributed Algorithms: An Intuitive Approach, MIT Press, 2013.
4. M.L. Liu, Distributed Computing - Principles and Applications, 1st Edition, Pearson Education, 2011.

Course Outcomes:

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

1. Explain the principles of parallel and distributed computing models for efficient computational problem solving.
2. Apply parallel algorithm design techniques and communication models to develop scalable computational solutions.
3. Analyze parallel programming approaches and distributed system algorithms for performance-oriented applications.

4. Evaluate fault tolerance mechanisms and distributed computing strategies for reliable system development.
5. Design parallel and distributed solutions by integrating algorithmic techniques for complex engineering applications.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	–	–	–	–	–	–	–	2	1	–
CO2	3	3	2	1	2	–	–	–	–	–	–	3	2	–
CO3	3	3	2	2	2	–	–	–	–	–	–	2	3	1
CO4	2	3	2	3	2	1	–	–	–	–	–	2	2	1
CO5	2	3	3	2	3	1	1	–	–	–	–	3	3	2

25CSHESCN	DIGITAL WATERMARKING AND STEGANOGRAPHY	L	T	P	C
		3	0	0	3

Course Objectives:

- Understand basic concepts, history, and scope of information hiding techniques.
- Apply different steganographic techniques using spatial and frequency domains.
- Develop watermarking algorithms for image and multimedia protection.
- Evaluate the performance of watermarking and steganography under various attacks.
- Use tools for implementation and explore real-world applications and trends.

UNIT – I INTRODUCTION TO INFORMATION HIDING

Introduction to steganography and watermarking - Historical background and importance in security - Basic concepts: cover medium, payload, capacity, imperceptibility - Difference between steganography and watermarking

UNIT – II STEGANOGRAPHIC TECHNIQUES

Types of steganography: text, image, audio, and video - Spatial domain methods: LSB insertion, masking, filtering - Frequency domain methods: DCT, DWT-based steganography - Statistical steganography and distortion techniques

UNIT – III DIGITAL WATERMARKING FUNDAMENTALS

Watermarking requirements and applications - Classification: visible vs. invisible, robust vs. fragile - Watermarking using DCT, DWT, and SVD techniques - Watermark embedding and extraction algorithms

UNIT – IV ATTACKS, DETECTION AND PERFORMANCE EVALUATION

Common attacks: compression, cropping, filtering, noise - Steganalysis and watermark detection - Performance metrics: PSNR, SSIM, BER, robustness - Security issues and countermeasures

UNIT – V STEGANALYSIS

Overview of steganalysis - Statistical properties of images - Visual steganalytic system - IQM-based steganalytic system - Learning strategies - Frequency-domain steganalytic system.

Text Books:

1. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom – Digital Watermarking and Steganography, Morgan Kaufmann.
2. Frank Y. Shih – Digital Watermarking and Steganography: Fundamentals and Techniques, CRC Press.

References:

1. S. Katzenbeisser and F. Petitcolas – Information Hiding Techniques for Steganography and Digital Watermarking, Artech House.
2. Neil F. Johnson, Zoran Duric, Sushil Jajodia – Information Hiding: Steganography and Watermarking - Attacks and Countermeasures, Springer.
3. Borko Furht and Darko Kirovski – Multimedia Security Handbook, CRC Press.
4. Chwan-Hwa Wu and J. David Irwin – Introduction to Computer Networks and Cybersecurity, CRC Press.

Course Outcomes:

At the End of course, Students will be able to

1. Explain the principles of information hiding techniques for secure multimedia communication and protection.
2. Apply steganographic and watermarking methods to develop secure multimedia data protection solutions.
3. Analyze watermarking algorithms and information hiding techniques against security threats and attacks.
4. Evaluate the performance and robustness of multimedia security techniques using appropriate assessment measures.
5. Design secure information hiding systems by integrating watermarking and steganography approaches for real-world applications.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	–	–	–	–	–	–	–	2	1	–
CO2	3	3	2	1	2	–	–	–	–	–	–	3	2	–
CO3	3	3	2	2	2	–	–	–	–	–	–	2	3	1
CO4	2	3	2	3	2	1	–	–	–	–	–	2	2	1
CO5	2	3	3	2	3	1	1	–	–	–	–	3	3	2

MINOR ENGINEERING ELECTIVES

25CSMISCN	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the basic concepts of object-oriented programming approaches and its features.
- To prepare the students to write program solve mathematical and scientific problems using functions and overloading of functions
- To make the student to learn the advance features of inheritance and virtual function
- To impart knowledge on object-oriented programming concepts using java advanced features.
- To train the student to develop application program using multi-threading and multitasking concept.

UNIT – I INTRODUCTION

Traditional Versus Object Orientation Approach – Benefits and applications of OOP – Characteristics of Object-Oriented Programming Languages- C++ Programming Basics: Overview–C++ Data Types–Basics of object and class in C++ – Program structure– Member Functions and Member Variable – Techniques for Creating and Initializing Objects –Data Hiding – Namespace– Identifiers– Variables – Constants– Operators– Typecasting– Control structures– Loops and Decisions.

UNIT – II MEMBER FUNCTIONS AND OVERLOADING

Constructors and their types – Destructor – Access specifiers: Private Public and Protected members. C++ Functions: Simple functions- Arguments passed by value and by reference- Overloading of functions – Constructor Overloading-Inline functions - Passing and returning of objects- friend function - Friend Classes - Static Functions - Operator Overloading: Overloading Unary Operators- Overloading Binary Operators - Data Conversion: Conversions Between Objects and Basic Types -Conversions Between Objects of Different Classes.

UNIT – III INHERITANCE

Concept of Inheritance –Types of Inheritance: Single –Multiple – Multilevel – Hierarchical –Hybrid – Virtual Functions: Normal Member Functions Accessed with Pointers – Virtual Member Functions Accessed with Pointers – Abstract Classes and Pure Virtual Functions – Virtual Destructors –Virtual Base Classes – THIS Pointer.

UNIT – IV OOP IN JAVA

Characteristics of Java - The Java Environment -Java Source File -Structure – Compilation- Fundamental Programming Structures in Java -Defining classes in Java –constructors-method access specifiers - Packages - Interfaces -defining an Interface- implementing interface - differences between classes and interfaces and extending interfaces-packages.

UNIT – V THREADS

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups.

Text Books:

1. Robert Lafore, "Object -Oriented Programming in C++", Sams Publication, 4th edition, 2002.
2. Balaguruswamy. E, "Programming with Java", Tat McGraw- Hill Publication, 5th edition, 2014.

References:

1. Balaguruswamy. E, "Object Oriented Programming with C++", Tata McGraw- Hill Publication, 6th edition,2013.
2. R.S. Salaria, "Mastering Object-Oriented Programming with C++", Khanna Book Publishing, N. Delhi, 6th edition,2016.
3. D. Samantha, "Object Oriented Programming in C++ and Java", PHI, 1st edition, 2004.
4. Tanweer Alam, "Internet and Java Programming", Khanna Publishing House,1st edition,2012.

Course Outcomes:

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

1. Understand the basic concepts of Object-oriented programming, data hiding, class and object concepts.
2. Apply the concept of argument passing through function, operator overloading, function overloading, constructor and destructor function.
3. Construct C++ program using inheritance concepts and virtual function.
4. Develop Java applications using constructors, method access specifiers, Packages and Interfaces.
5. Build Java applications using multithreading and exception handling concepts.

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	-	-	-	-	-	-	-	-	-	-	3	2	-
CO2	2	2	1	-	-	-	-	-	-	-	-	3	2	-
CO3	2	2	2	1	-	-	-	-	-	-	-	3	2	
CO4	2	2	2	2	-	-	-	-	-	-	-	3	2	-
CO5	2	2	3	3	-	-	-	-	-	-	-	3	2	-

25CSMISCN	**DATABASE MANAGEMENT SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To explain the fundamentals of DBMS and ER Model.
- To provide a strong foundation in relational model and SQL.
- To develop knowledge for designing normalized relational schemas.
- To introduce transaction management and recovery mechanisms.
- To familiarize students with query processing and advanced databases.

UNIT – I INTRODUCTION TO DATABASE SYSTEMS

Purpose of Database Systems – File System Vs Database System – Data Models – Database Languages – Schemas and Instances – DBMS Architecture – Centralized and Client/Server Architecture – Database Applications– ER Models – Enhanced Entity Relationship Model.

UNIT – II RELATIONAL MODEL

Relational Model Concepts – Constraints – Keys – Dependencies – Relational Algebra : Fundamental Operations, Additional Operations – SQL– Data Definition – Data Manipulation and Retrieval Queries – Set operations – Aggregate Functions – Null values– Nested Queries – Derived Relations – Joins – Views– Cursors – Procedures – Functions – Triggers – Embedded and Dynamic SQL.

UNIT – III RELATIONAL DATABASE DESIGN

Features of good Relational Database Design – Decomposition using Functional Dependencies – Normal Forms - Normalization using Functional Dependencies – Normalization using Multi-valued Dependencies – Normalization using Join Dependencies – Domain-Key Normal form.

UNIT – IV TRANSACTIONS AND RECOVERY

Transaction Processing – Concepts and States – Need for Concurrency Control and Recovery– ACID Properties – Implementation of Atomicity and Durability – Schedules and Serializability – Concurrency Control Techniques: Lock-Based Protocols, Timestamp-Based protocols – Deadlock Handling – Recovery Techniques: Log Based Recovery, Shadow Paging, ARIES Recovery Algorithm.

UNIT – V QUERY PROCESSING AND ADVANCED CONCEPTS

Query Processing Overview – Estimation of Query Processing Cost – Query Processing and Optimization – File Structures : Heap, Sorted, Hashed – Indexing: Single-level, Multi-level, B-Trees and B+ trees – Sorting and Joins – Introduction to Spatial and Temporal Databases, OO Databases, Distributed Databases, NoSQL.

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, Tata McGraw Hill, 2020.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson/Addison – Wesley, 2017.

References:

1. C.J. Date, A. Kannan and S. Swamynathan, “An Introduction to Database Systems”, Pearson Education, Eighth Edition, 2006.
2. Raghu Ramakrishnan and Johannes Gehrke, “Database Management Systems”, Third Edition, McGraw Hill, 2014.
3. Andreas Meier, Michael Kaufmann, “SQL & NoSQL Databases: Models, Languages, Consistency Options and Architectures for Big Data Management”, 1st Edition 2019.

Course Outcomes:

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

1. Design ER and EER diagrams and map them to relational schemas.
2. Develop and execute complex SQL queries for data retrieval and manipulation.
3. Apply normalization techniques to design efficient relational schemas.
4. Describe concurrency issues and recovery mechanisms.
5. Analyze query processing cost and describe database storage structures and indexing techniques.

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	–	–	–	–	–	–	–	–	–	1	2	–
CO2	2	2	3	–	–	–	–	–	–	–	–	3	2	–
CO3	2	2	3	–	–	–	–	–	–	–	–	2	3	2
CO4	2	3	2	–	–	–	–	–	–	–	–	1	3	–
CO5	2	1	–	–	2	–	–	–	–	–	–	1	2	2

25CSMISCN	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

- To impart knowledge on the Software Process Models and Requirement analysis.
- To familiarize the concepts of Architectural Design, component level design, user interface design, pattern based design, web app design and web app interface design
- To disseminate the knowledge of Software Quality management , Review techniques and Software Quality Assurance
- To educate Software Configuration Management Repository with its metrics
- To illustrate the concept of Software Project estimation, Risk Management and Review engineering.

UNIT – I SOFTWARE PROCESS

The Software process- A Generic Process Model- Perspective Process Models-Specialized Process Models- The Unified Process-Personal and team process models-Agile Development-Extreme Programming (XP)- Requirements Engineering-Requirements Analysis-Establishing the Groundwork- Eliciting Requirements- Developing Use Cases-Negotiating Requirements- Validating Requirements-Requirements Analysis-Scenario-Based Modeling.

UNIT – II DESIGN CONCEPTS

Design concepts-The Design Process-Design Concepts-The Design Model- Architectural Design- Assessing Alternative Architectural Designs- Architectural Mapping Using Data Flow-Component- level design-Designing Class-Based Components-Conducting Component-Level Design-User Interface design-User Interface Analysis and Design-Interface Analysis-Pattern based Design- WebApp design-WebApp Design Quality-WebApp Interface design.

UNIT – III QUALITY MANAGEMENT

Quality Management- Software Quality- The Software Quality Dilemma- Achieving Software Quality- Review techniques-Cost Impact of Software Defects-Defect Amplification and Removal- Review Metrics and Their Use-Informal Reviews-Formal Technical Reviews-Software Quality Assurance- Test Strategies for Conventional Software-Test Strategies for Object-Oriented Software- SQA Tasks, Goals, and Metrics-Statistical Software Quality Assurance-A Strategic Approach to Software Testing-System Testing-The Art of Debugging

UNIT – IV SOFTWARE CONFIGURATION MANAGEMENT

Software Configuration Management-The SCM Repository-The SCM Process-Configuration Management for Web Apps-A Framework for Product Metrics-Metrics for the Requirements Model- Metrics for the Design Model- Project Management concepts- The management spectrum-People-The Product- The Process-Metrics in the Process and Project Domains

UNIT – V PROJECT ESTIMATION

Software Project Estimation-Decomposition Techniques-Empirical Estimation Models-The Make/Buy Decision-Project Scheduling-Defining a Task Set for the Software Project-Defining a Task Network-Reactive versus Proactive Risk Strategies-Risk Identification-Risk Projection-Risk Refinement-The RMMM Plan-Business Process Reengineering-Software Reengineering-Reverse Engineering-Restructuring-Forward Engineering-The SPI Process-The CMMI-The People CMM-SPI Return on Investment-SPI Trends.

Text Books:

1. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Seventh Edition, Mc Graw-Hill International Edition, 2010.
2. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.
3. Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI Learning Private Limited, 2009.

References:

1. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.
2. Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007.
3. Stephen R.Schach, "Software Engineering", Tata McGraw-Hill Publishing Company Limited, 2007.

Course Outcomes:

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

1. Understand the generic view of Software process models and practices in their appropriate models.
2. Describe the various Design concepts, Design Models that provide the structure of software product.
3. Infer the Software quality management approach for developing the quality products.
4. Determine the need for, and an ability to engage in, Software Configuration management.
5. Acquire the knowledge on Software Project estimation techniques and Software Reengineering.

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	2	-	-	-	-	-	-	-	-	-	2	2
CO4	1	1	2	-	2	-	-	-	-	-	-	-	2	2
CO5	2	1	-	-	2	-	-	-	-	-	-	-	1	3

25CSMISCN	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives:

- To impart knowledge on layered approach that makes design, implementation and operation of extensive networks possible.
- To teach the components required to build networks.
- To provide basic concepts related to network addressing and routing.
- To educate students on the concepts of end-to-end flow of information and congestion control.
- To familiarize with the concepts of electronic mail, HTTP, DNS and SNMP.

UNIT – I DATA COMMUNICATION COMPONENTS

Data Communications, Networks, Networks Types, Protocols Layering, TCP/IP Protocol Suite, OSI model, Performance, Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum, Transmission Media, Switching.

UNIT – II DATA LINK LAYER AND MEDIUM ACCESS SUB LAYER

Introduction of Data Link Layer, Link Layer Addressing, Error Detection and Error Correction - DLC Services, Data Link Layer Protocols, HDLC, PPP- Media Access Control, wired LANs - Ethernet, Wireless LANs:- Introduction, IEEE 802.11, Bluetooth - Connecting Devices.

UNIT – III NETWORK LAYER

Network Layer Services - Packet switching - Performance - IPV4 Addresses - Forwarding of IP Packets - Network Layer Protocols: IP, ICMP v4 - Unicast Routing Algorithms - Protocols - Multicasting Basics - IPV6 Addressing - IPV6 Protocol.

UNIT – IV TRANSPORT LAYER

Introduction - Transport Layer Protocols - Services - Port Numbers - User Datagram Protocol - Transmission Control Protocol - SCTP.

UNIT – V APPLICATION LAYER

WWW and HTTP - FTP - Email - Telnet - SSH - DNS - SNMP.

Text Books:

1. Behrouz A. Forouzan, “Data Communications and Networking”, 6th Edition, McGraw Hill, 2021.
2. William Stallings, “Data and Computer Communications”, 11th Edition, Pearson, 2022.
3. James F. Kurose & Keith W. Ross, “Computer Networking: A Top-Down Approach”, 8th Edition, Pearson, 2021.
4. Larry L. Peterson & Bruce S. Davie, “Computer Networks: A Systems Approach”, 6th Edition, Morgan Kaufmann, 2021.

References:

1. Nader F. Mir, “Computer and Communication Networks”, 3rd Edition, Wiley, 2021.
2. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, 5th Edition, Morgan Kaufmann Publishers Inc., 2012.

3. William Stallings, "Data and Computer Communications", 10th Edition, Pearson Education, 2013.
4. Nader F. Mir, "Computer and Communication Networks", 2nd Edition, Prentice Hall, 2014.
5. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill Publisher, 2011.
6. James F. Kurose, Keith W. Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", 6th Edition, Pearson Education, 2013.

Course Outcomes:

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

1. Understand the functions of layering and protocols.
2. Explain the devices, protocols, and standards used to design a network.
3. Construct and implement the concept of switching and routing.
4. Apply appropriate protocols and techniques related to the transport layer in order to maintain consistent flow of information.
5. Demonstrate the functions of electronic mail, HTTP, DNS and SNMP.

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO3	3	1	3	2	-	-	-	-	-	-	-	1	-	-
CO4	3	1	3	2	-	-	-	-	-	-	-	1	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	1	-	-

25CSMISCN	MOBILE APP DEVELOPMENT	L	T	P	C
		3	0	0	3

Course Objectives:

- To demonstrate their understanding of the fundamentals of Android operating systems.
- To demonstrate their skills of using Android software development tools.
- To demonstrate their ability to develop software with reasonable complexity on mobile platform.

UNIT – I INTRODUCTION TO ANDROID OPERATING SYSTEM:

Introduction to Android Operating System: Android SDK Features, Developing for Android, Best practices in Android programming, Android Development Tools. Android application components - Android Manifest file, Externalizing resources, The Android Application Lifecycle, A Closer Look at Android Activities.

UNIT – II ANDROID USER INTERFACE

Introducing Layouts, User Interface (UI) Components - Editable and Non-Editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers. Event

Handling - Handling clicks or changes of various UI components. Introducing Fragments, Multi-screen Activities.

UNIT – III INTENTS AND BROADCASTS

Introducing Intents: Using Intents to Launch Activities. Using Intent to dial a number or to send SMS. Broadcast Receivers - Creating Intent Filters and Broadcast Receivers: Using Intent Filters to Service Implicit Intents. Finding and using Intents received within an Activity. Customizing the Action Bar, Using the Action Bar for application navigation. Notifications - Creating and Displaying notifications, Displaying Toasts.

UNIT – IV PERSISTENT STORAGE

Files - Reading data from files, listing contents of a directory, Creating and Saving Shared Preferences, Retrieving Shared Preferences. Database -Introducing Android Databases, Introducing SQLite, Content Values and Cursors, Working with SQLite Databases. Registering Content Providers, using content Providers (insert, delete, retrieve and update).

UNIT – V ADVANCED TOPICS:

Alarms -Using Alarms. Using Internet Resources - Connecting to internet resource, using download manager. Location Based Services -Using Location-Based Services, Using the Emulator with Location-Based Services. Introduction to Flutter, Dart introduction, Data Types and Variables, String interpolation, Operators, Control Flow Statements, Functions, Classes, Read and write with Dart IO: Setup, Read and write with Dart IO: Final code.

Text Books:

1. Reto Meier, “Professional Android 4 Application Development”, Wiley India, (Wrox), 2012.
2. Delvi Dawn Griffiths, David Griffiths “Head First Android Development”, O’Reilly Media, Inc., 2015.
3. Dieter Meiller, “Modern App Development with Dart and Flutter 2”, Walter de Gruyter GmbH, Berlin/Boston, 2021.

References:

1. Wei-Meng Lee, “Beginning Android 4 Application Development”, Wiley India (Wrox), 2013.
2. David Wolber, Hal Abelson, Ellen Spertus & Liz Looney, “App Inventor–Create your own Android Apps”, O’Reilly, 2011.

Course Outcomes:

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

1. Interpret and analyze Android platform architectures and features to learn best practices in android programming.
2. Design the User Interface for mobile applications.
3. Apply Intents, Broadcast receivers and Internet services in Android App.
4. Develop database management system to retrieve and/or store data for mobile application.
5. Evaluate and select appropriate solutions to the mobile computing platform and Build Flutter applications for complex problems.

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	-	1	-	-	-	-	-	-	-	3	1
CO2	3	2	1	-	1	-	-	-	-	-	-	-	3	2
CO3	3	1	1	-	1	-	-	-	-	-	-	1	3	1
CO4	3	2	1	2	2	-	-	-	1	-	-	1	3	2
CO5	2	2	1	2	2	-	-	-	1	-	-	1	2	2

25CSMISCN	INTERNET OF THINGS (IOT)	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the fundamentals of Internet of Things.
- To explore the features of M2M and System Management.
- To acquire knowledge about developing Internet of things.
- To explain the concepts of Raspberry pi with python and Arduino.
- To demonstrate and design a small low cost IoT system and to apply the concept of Internet of Things in the real world scenario.

UNIT – I INTRODUCTION TO IOT

Introduction to IoT–Definition, Characteristics, Physical design of IoT, Logical Design of IOT, functional blocks, communication models, Communication APIs, IOT Enabling Technologies, Sensors, Participatory Sensing, RFIDs and Wireless Sensor Networks.

UNIT – II M2M AND SYSTEM MANAGEMENT

Introduction-M2M, Difference between M2M and IoT, SDN and NFV for IoT, System Management– need for IOT systems Management, SNMP, NETCONF, YANG.

UNIT – III DEVELOPING INTERNET OF THINGS

IoT Design Methodology-Purpose & Requirements specification, process specification, domain model specification, information model specification, service specification, IoT level specifications, Functional view specification, Operational view specification, Device and component Integration, Application Development.

UNIT – IV RASPBERRY PI WITH PYTHON AND ARDUINO

Logical Design using Python- Python Data types and Data Structures - IoT Physical Devices & Endpoints – Building blocks of an IOT Device- Raspberry Pi-Board- Linux on Raspberry Pi -Raspberry Pi Interfaces-Programming RaspberryPi with Python-Other IoT Platforms-Arduino.

UNIT – V CASE STUDIES ILLUSTRATING IOT DESIGN

Home Automation, Environment, Agriculture, Health, Industry. Case Study: Smart City, Streetlights Control and Monitoring

Text Books:

1. Arshdeep Bahga and Vijay Madisetti, Internet of Things A Hand-on Approach, Universities press, 2015.
2. Dr. Ovidiu Vermesan and Dr. Peter Friess, Internet of Things: From research and innovation to market deployment, River Publishers 2014.

References:

1. Dieter Uckelmann et.al, “Architecting the Internet of Things”, Springer, 2011

2. Pethuru Raj and Anupama C.Raman, "The Internet of Things: Enabling Technologies and Use Cases", CRC Press.
3. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective" - CRC Press 2012.

Course Outcomes:

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

1. Understand the fundamental concepts of Internet of Things and sensors.
2. Educate about M2M, SDN and IoT system management.
3. Describe about developing internet of things with various levels of specification and application development.
4. Demonstrate IoT device programming with Arduino and Raspberry Pi.
5. Illustrate applications of IoT in real time scenario.

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	1	-	-	2	1	-	-	-	-	-	1	1	2
CO5	2	1	2	1	2	1	-	-	-	-	1	-	-	2

25CSPMISCN	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives:

- To acquire the basics of Hadoopv2 configuration and administration.
- To understand concepts of Map Reduce design patterns namely summarization, filtering, data organization, join, output and Meta patterns.
- To develop Map Reduce applications.
- To solve data warehouse problems using Hive.
- To transfer data using Pig, HBase, Mahout and Sqoop between Hadoop and relational databases.

UNIT – I INTRODUCTION

Data science process – roles, stages in data science project – State of the practice in analytics – Role of data scientists – Key roles for successful analytic project – Main phases of life cycle – Working with data from files – Exploring data – Managing data – Cleaning and sampling for modeling and validation – Challenges of conventional systems – Web data – Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting – Modern data analytic tools. Introduction to Big Data Platform – Big Data and its importance, Five V's for Big data, Big data analytics, Big data applications.

UNIT – II HADOOPV2 CONFIGURATION AND ADMINISTRATION

Hadoop v2 : Introduction - Setting up Hadoop v2 in local machine - Writing a Word Count MapReduce application - Adding a combiner step to the Word Count MapReduce program - Setting up HDFS - Setting up Hadoop YARN in a distributed cluster environment using Hadoop v2 - Setting up Hadoop ecosystem - HDFS command-line file operations - Running

the Word Count program in a distributed cluster environment - Using Hadoop YARN on Cloud Environments - Hadoop Configurations, Unit Tests, and Other APIs.

UNIT – III DEVELOPING COMPLEX MAPREDUCE APPLICATIONS

Introduction - Hadoop data types - Custom Hadoop Writable data type - Hadoop key type - Emitting data from a Mapper - Hadoop InputFormat- Adding support for new input data formats - Formatting the results of MapReduce computations – Hadoop OutputFormats - Writing multiple outputs - Intermediate data partitioning - Secondary sorting – sorting Reduce input values - Using Hadoop with legacy applications – Hadoop streaming - Adding dependencies between MapReduce jobs - Hadoop counters to report custom metrics.

UNIT – IV ANALYTICS AND APPLICATIONS USING MAPREDUCE

Analytics : Introduction - Simple analytics using MapReduce - Performing GROUP BY - Calculating frequency distributions and sorting - Plotting the results using gnuplot - Calculating histograms - Calculating Scatter plots - Parsing a complex dataset with Hadoop - Joining two datasets Applications : Content-based recommendations - Classification using the naïve Bayes - Assigning advertisements to keywords - Data preprocessing and De-duplicating data using Hadoop streaming and Python.

UNIT – V HADOOP ECOSYSTEM – APACHE HIVE

Creating databases and tables using Hive CLI Simple SQL-style data querying using Apache Hive -Creating and populating Hive tables and views using Hive query results-Utilizing different storage formats in Hive - storing table data using ORC files-Using Hive built-in functions-Hive batch mode - using a query file -Performing a join with Hive -Creating partitioned Hive tables -Writing Hive User-defined Functions (UDF) -Hadoop Ecosystem II – Pig, HBase, Mahout, and Sqoop

Text Books:

1. Thilina Gunarathne, “HadoopMapReducev2 Cookbook”, Second Edition, Packt Publishing Ltd., 2015.
2. Donald Miner and Adam Shook, “MapReduce Design Pattern”, O’Reilly Media Inc.,First Edition, 2012.

References:

1. Garry Turkington, “Hadoop Beginner's Guide”, Packt Publishing Ltd.,First Edition, 2013.
2. Tom White, “Hadoop: The Definitive Guide”, O’Reilly Media Inc.,Fourth Edition,2015.
3. Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich, “Professional Hadoop® Solutions”, Wrox, First Edition,2013.
4. Srinath Perera, “Instant MapReduce Patterns – Hadoop Essentials How-to”, Packt Publishing Ltd., First Edition,2013.
5. Kevin Schmidt and Christopher Phillips, “Programming Elastic MapReduce”, O’Reilly Media Inc., First Edition, 2013.
6. https://data-flair.training/blogs/hadoop-mapreduce-tutorial/ - “Hadoop MapReduce Tutorial, A Complete Guide to Map Reduce”, Data flair Team · Published on November 23, 2016 · Updated on November 14, 2018.

Course Outcomes:

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

1. Configure and administer Hadoop v2, Hadoop YARN, and HDFS clusters and deploy clusters to cloud environments.
2. Design MapReduce patterns such as summarization patterns, filtering patterns, and data organization patterns.
3. Develop MapReduce patterns such as join patterns, metapatterns, output Patterns.
4. Solve large-scale analytics problems using MapReduce-based applications.

5. Tackle complex problems using Apache Hive, Pig, Hbase, Mahout and Sqoop to provide data warehousing capabilities.

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	2	1	-	2	-	-	-	-	-	-	-	-	-
CO3	1	-	1	-	2	-	-	-	-	-	-	-	2	-
CO4	3	2	2	2	-	1	-	-	-	-	-	-	2	-
CO5	2	2	1	2	1	-	-	-	-	-	-	-	-	-

25CSMISCN	SOCIAL NETWORK ANALYSIS	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the concept of semantic web and related applications.
- To teach knowledge representation using ontology.
- To explain about communities in social network.
- To impart the knowledge of human behaviour in social web and related communities.
- To develop the skills required to visualize social networks.

UNIT – I INTRODUCTION

Development of Semantic Web - Emergence of the Social Web – Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis – Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities – Web-based networks – Applications of Social Network Analysis.

UNIT – II KNOWLEDGE REPRESENTATION

Ontology-based knowledge Representation –Resource Description Framework – Web Ontology Language - Modeling and aggregating social network data: State-of- the-art in network data representation - Ontological representation of social individuals – Ontological representation of social relationships - Aggregating and reasoning with social network data – Advanced representations.

UNIT – III EVOLUTION

Extracting evolution of Web Community from a Series of Web Archive – Detecting communities in social networks – Evaluating communities – Methods for community detection and mining – Applications of community mining algorithms – Tools for detecting communities social network infrastructures and communities – Decentralized online social networks.

UNIT – IV DATA MANAGEMENT

Understanding and predicting human behavior for social communities – User data management - Inference and Distribution – Enabling new human experiences– Reality mining – Context – Awareness - Privacy in online social networks – Trust models based on subjective logic – Trust network analysis – Trust transitivity analysis – Combining trust and reputation – Trust derivation based on trust comparisons – Attack spectrum and countermeasures.

UNIT – V GRAPH THEORY

Graph theory – Centrality – Clustering – Node - Edge Diagrams – Matrix representation – Visualizing online social networks, Visualizing social networks with matrix - based representations – Matrix and Node-Link Diagrams – Hybrid representations – Applications – Cover networks– Community welfare- Collaboration networks– Co Citation networks.

Text Books:

1. Borko Furht, "Handbook of Social Network Technologies and Applications", Springer, 1st edition, 2010.
2. Peter Mika, "Social Networks and the Semantic Web, Springer, 1st edition,2007.

References:

1. Guandong Xu, Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", Springer, 1st edition, 2011.
2. Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet,2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet,2009.
4. John G Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web", Springer,2009.

Course Outcomes:

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

1. Understand the concept of semantic web and related applications.
2. Derive knowledge using ontology.
3. Identify communities in social network.
4. Analyze human behavior in social web and related Communities.
5. Develop the visualization diagrams for social networks.

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	-	-	-	-	-	-	-	-	-	-	-	2
CO2	2	2	3	-	-	-	-	-	-	-	-	-	-	2
CO3	2	2	-	-	1	-	-	-	-	-	-	-	2	2
CO4	1	1	2	-	1	-	-	-	-	-	-	-	-	2
CO5	1	1	1	-	1	-	-	-	-	-	-	-	2	2

ONE CREDIT COURSES

25CSOCCSCN	DEEP LEARNING LAB	L	T	P	C
		0	0	2	1

Course Objectives:

- To learn how to create and manipulate tensors using Tensorflow tool.
- To get to know Applied Deep Learning with PyTorch.
- To create and manipulate applications for artificial intelligence in the Scala programming language.
- To learn Character-Level RNN.

LIST OF EXERCISES

1. Introduction to Tensor Flow.
2. Learning about Features and Outliers.
3. Working with Training Sets and Test Sets.
4. Scala program to demonstrate example of collection list and for loop.
5. Appending and merging Lists using scala.
6. Scala List class and pattern matching.
7. L2 Regularization and Correlated Features.
8. Classifying Names with a Character-Level RNN.
9. Generating Shakespeare with a Character-Level RNN.

Course Outcomes:

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

1. Explain the fundamental concepts of deep learning frameworks and computational models for implementing intelligent applications.
2. Apply deep learning tools and programming techniques to construct models for data processing and neural network applications.
3. Analyze deep learning model behavior using training strategies, feature analysis, and performance evaluation techniques.
4. Evaluate deep learning implementations based on model accuracy, regularization methods, and application-specific requirements.
5. Develop intelligent applications using deep learning frameworks and programming environments for real-world computational problems.

CO–PO/PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	–	–	–	1	–	–	–	–	–	–	2	1	–
CO2	3	2	2	–	3	–	–	–	–	–	–	3	2	1
CO3	3	3	2	2	3	–	–	–	–	–	–	3	2	2
CO4	2	3	3	3	2	–	–	–	–	–	–	2	3	2
CO5	3	3	3	2	3	–	–	–	–	–	1	3	3	3

25CSOCCSCN	CLOUD COMPUTING LAB	L	T	P	C
		0	0	2	1

Course Objectives:

- To understand foundational concepts and architectures in cloud computing, virtualization and parallel/distributed systems.
- To implement and deploy scalable, concurrent and data-intensive applications using cloud platforms and tools like Aneka, AWS, Azure or GCP.

LIST OF EXERCISES

1. Study of cloud Computing Architectures and service models
2. Demonstrate Parallel vs Distributed computing with examples.
3. Create a Virtual Machine and explore Virtualization Features.
4. Explore Types of Clouds and Cloud Reference Architecture.
5. Develop a Multithreaded Application using Aneka Thread Programming.
6. Build and deploy a Task-Based Application using Aneka Task Programming.
7. Create an Aneka Private Cloud and Deploy Applications.
8. Perform MapReduce Programming using Aneka for a Data-Intensive Task
9. Launch and use AWS EC2 and S3 services.
10. Develop and deploy an application on Microsoft Azure/ Google App Engine.

Course Outcomes:

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

1. Explain the fundamental concepts, architectures, and service models of cloud computing for distributed application environments.
2. Apply cloud computing tools and platforms to implement virtualized, concurrent, and scalable computing solutions.
3. Analyze cloud-based application performance by evaluating virtualization, parallel processing, and data-intensive computing approaches.
4. Evaluate cloud deployment strategies and service platforms based on scalability, reliability, and application requirements.
5. Develop cloud-based applications using appropriate platforms and programming models for real-world computing problems.

CO–PO/PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	–	–	–	1	–	–	–	–	–	–	2	1	–
CO2	3	2	2	–	3	–	–	–	–	–	–	3	2	1
CO3	3	3	2	2	3	–	–	–	–	–	–	3	2	2
CO4	2	3	3	3	2	–	–	–	–	–	–	2	3	2
CO5	3	3	3	2	3	–	–	–	–	–	1	3	3	3

22CSOCSCN	DATA VISUALISATION LAB	L	T	P	C
		0	0	2	1

Course Objectives:

- To learn the interface in Tableau / MS-Excel for creating visualisations.
- To understand the methods for drawing charts and graphs.
- To learn the use of maps and tables in creating visualisation.
- To prepare dashboard design for data analytics applications.

LIST OF EXERCISES

1. Study of interface, screen and visual cues in Tableau / MS-Excel.
2. Connecting with various data sources
3. Working with measures and dimensions
4. Working with Colours
5. Working with Expressions, Functions, Date, Time
6. Drawing Charts and Graphs
7. Creating Maps
8. Working with Table Calculations
9. Sorting Data
10. Applying Filters
11. Dashboard design

Course Outcomes:

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

1. Explain the fundamental concepts and techniques of data visualization for representing analytical information effectively.
2. Apply visualization tools and techniques to create graphical representations from diverse data sources.
3. Analyze visual data representations using appropriate charts, tables, filters, and analytical methods.
4. Evaluate visualization outcomes based on clarity, accuracy, and suitability for data-driven decision making.
5. Develop interactive dashboards using visualization tools for real-world data analytics applications.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	–	–	–	1	–	–	–	–	–	–	2	1	–
CO2	3	2	2	–	3	–	–	–	–	–	–	3	2	1
CO3	3	3	2	2	3	–	–	–	–	–	–	3	2	2
CO4	2	3	3	3	2	–	–	–	–	–	–	2	3	2
CO5	3	3	3	2	3	–	–	–	–	–	1	3	3	3

25CSOCCSCN	MOBILE APPLICATION DEVELOPMENT LAB	L	T	P	C
		0	0	2	1

Course Objectives:

- To learn how to develop Applications for android environments.
- To learn how to develop user interface applications.
- To learn how to develop URL related applications.

LIST OF EXERCISES

1. Create an Android application that shows Hello + name of the user and run it on an emulator. (b) Create an application that takes the name from a text box and shows hello message along with the name entered in text box, when the user clicks the OK button.
2. Create a screen that has input boxes for Username, Password, Address, Gender (radio buttons for male and female), Age (numeric), Date of Birth (Date Picker), State (Spinner) and a Submit button. On clicking the submit button, print all the data below the Submit Button. Use (a) Linear Layout, (b) Relative Layout and (c) Grid Layout or Table Layout.
3. Develop an application that shows names as a list and on selecting a name it should show the details of the candidate on the next screen with a “Back” button. If the screen is rotated to landscape mode (width greater than height), then the screen should show list on left fragment and details on right fragment instead of second screen with back button. Use Fragment transactions and Rotation event listener.
4. Develop an application that uses a menu with 3 options for dialing a number, opening a website and to send an SMS. On selecting an option, the appropriate action should be invoked using intents.
5. Develop an application that inserts some notifications into Notification area and whenever a notification is inserted, it should show a toast with details of the notification.
6. Create an application that uses a text file to store usernames and passwords (tab separated fields and one record per line). When the user submits a login name and a password through a screen, the details should be verified with the text file data and if they match, show a dialog saying that login is successful. Otherwise, show the dialog with Login Failed message.
7. Create a user registration application that stores the user details in a database table.
8. Create a database and a user table where the details of login names and passwords are stored. Insert some names and passwords initially. Now the login details entered by the user should be verified with the database and an appropriate dialog should be shown to the user.
9. Create an application for Alarm clock with Snooze ability, i.e., if user don't off the alarm when it rings, then alarm should repeat for every 10 minutes until user turns it off.
10. Create an App to demonstrate Action Bar for application navigation.

Course Outcomes:

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

1. Explain the fundamental concepts and components involved in developing mobile applications for Android platforms.
2. Apply Android development tools and programming techniques to implement user interface based mobile applications.
3. Analyze mobile application functionality using data management, navigation, and connectivity mechanisms.

4. Evaluate Android applications based on usability, performance, security, and functional requirements.
5. Develop Android applications integrating interface design, data handling, and platform features for real-world mobile solutions.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	–	–	–	1	–	–	–	–	–	–	2	1	–
CO2	3	2	2	–	3	–	–	–	–	–	–	3	2	1
CO3	3	3	2	2	3	–	–	–	–	–	–	3	2	2
CO4	2	3	3	3	2	–	–	–	–	–	–	2	3	2
CO5	3	3	3	2	3	–	–	–	–	–	1	3	3	3

25CSOCCSCN	**PROFESSIONAL COMMUNICATIONS**	**L**	**T**	**P**	**C**
		0	**1**	**0**	**1**

Course Objectives:

- Enhance the Employability and Career Skills of students.
- Orient the students towards grooming as a professional.
- Make them Employable Graduates.
- Develop their confidence and help them attend interviews successfully.

UNIT – I

Introduction to Soft Skills - Hard skills & soft skills - employability and career Skills - Grooming as a professional with values - Time Management - General awareness of Current Affairs.

UNIT – II

Self-Introduction - organizing the material - Introducing oneself to the audience – introducing the topic - answering questions - individual presentation practice - presenting the visuals effectively - 5 minute presentations.

UNIT – III

Introduction to Group Discussion - Participating in group discussions – understanding group dynamics - brainstorming the topic - questioning and clarifying - GD strategies – activities to improve GD skills.

UNIT – IV

Interview etiquette - dress code - body language - attending job interviews - telephone/skype interview - one to one interview & panel interview – FAQs related to job interviews.

UNIT – V

Recognizing differences between groups and teams - managing time – managing stress - networking professionally - respecting social protocols - understanding career management -developing a long-term career plan - making career changes.

Recommended Software:

1. Globearena
2. Win English

References:

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015.
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015.
3. Interact English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016.
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.

Course Outcomes:

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

1. Explain the principles of professional communication and interpersonal skills required for workplace effectiveness.
2. Apply communication strategies to deliver effective presentations and professional interactions.
3. Analyze communication practices and behavioral skills for collaborative professional environments.
4. Evaluate personal communication effectiveness and career readiness for professional opportunities.
5. Develop professional communication skills and career strategies for successful workplace performance.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	–	–	–	–	–	2	2	–	2	–	2	–	–	1
CO2	–	–	–	–	–	–	1	2	3	–	1	–	–	2
CO3	–	2	–	–	–	2	1	2	2	–	2	–	–	2
CO4	–	2	–	–	–	2	2	–	2	–	2	–	–	1
CO5	–	–	1	–	–	1	1	–	2	2	3	–	–	2

VALUE ADDED COURSES

25ECSEVAC01	GENERATIVE AI	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the core principles and motivation behind generative models.
- To explore architectures such as VAEs, GANs, and Transformers used for data synthesis.
- To acquire the knowledge of various generative models for image generation, style transfer and text generation.
- To understand the application of prompt engineering and transformer-based LLMs.
- To implement and evaluate generative models using real-world datasets and APIs.

UNIT – I AN INTRODUCTION TO GENERATIVE AI

Definition, Motivation & Applications, Why Use Generative Models- Use Cases & Advantages, Discriminative vs Generative Models, Taxonomy of Generative Models, Probability and Data Distributions, Evaluation Metrics for Generative Models, Challenges (Mode Collapse, Overfitting, Instability) & Ethics in Generative AI

UNIT – II FUNDAMENTALS OF GENERATIVE MODELS

Autoencoders: Regularized & Variational Autoencoders, Stochastic Encoders & Decoders, Autoregressive Models: Fully Visible sigmoid Belief Network (FVSBN), Neural Autoregressive Density Estimation (NADE), Masked Autoencoder for Distribution Estimation (MADE)

UNIT – III GENERATIVE ADVERSARIAL NETWORKS (GANS)

GAN Architecture: Generator and Discriminator Networks, Loss Functions (Minimax) and Training Challenges, Vanilla GANs, Deep Convolutional GANs (DCGANs), Progressive GANs, Applications: Image Generation, Style Transfer, Image-to-Image Translation (Pix2Pix), Super-Resolution, and Data Augmentation.

UNIT – IV TRANSFORMERS AND PROMPT ENGINEERING

Self-Attention, Transformer Basics, Transformers, BERT, Large Language Models, Masked Language Modeling (MLM), Next Sentence Prediction (NSP), Generative Pretrained Transformers (GPT), Task-specific GPT Fine-tuning, Prompt Engineering, Hugging Face pretrained Transformers, Hugging Face APIs.

UNIT – V LANGUAGE MODELS AND APPLICATIONS

OpenAI GPT-3, 3.5, 4, OpenAI APIs, Working with the OpenAI Playground, Content Filtering, Text Generation and Transformation, Text Classification and Categorization, Building GPT-powered Question Answering Applications and Chatbots, Mini Projects using Large Language Models.

Text Books:

1. David Foster, Generative Deep Learning, 2nd Edition, O'Reilly Media, 2023
2. Joseph Babcock, Raghav Bali, Generative AI with Python and TensorFlow 2, Packt Publishing Ltd., UK, 2021.

References:

1. Denis Rothman, Transformers for Natural Language Processing, 2nd Edition, Packt Publishing, 2023
2. Sabit Ekin, Prompt Engineering for Chat GPT: A Quick Guide to Techniques, Tips, and Best Practices, DOI: 10.36227/techrxiv. 22683919.v2, 2023

3. Chris Fregly, Antje Barth, Shelbee Eigenbrode, Generative AI on AWS: Building Context-Aware Multimodal Reasoning Applications, O'Reilly, 2023
4. Auffarth, B., Generative AI with LangChain: Build Large Language Model (LLM) Apps with Python, ChatGPT, and Other LLMs, Packt Publishing, 2023

Course Outcomes:

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

1. Explain the principles, architectures, evaluation methods, and ethical considerations of generative AI for intelligent data generation and engineering applications.
2. Apply generative AI models, transformer architectures, prompt engineering techniques, and APIs to develop solutions for text and image generation tasks.
3. Analyze the performance, limitations, and suitability of generative models for diverse real-world applications using appropriate evaluation metrics.
4. Evaluate generative AI models and large language model solutions by assessing performance, reliability, ethical implications, and application-specific requirements.
5. Develop generative AI applications by integrating transformer-based large language models, prompt engineering, and modern AI frameworks for real-world problem solving.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	1	–	1	2	–	–	–	1	–	2	2
CO2	2	2	3	–	3	–	1	–	–	–	1	3	2	2
CO3	2	3	2	2	2	–	1	–	–	–	1	2	3	2
CO4	1	2	2	3	2	2	3	–	–	–	2	1	2	2
CO5	2	2	3	2	3	1	1	–	–	–	2	3	3	3

25ECSEVAC02	IOT FOR INDUSTRIAL AND HEALTHCARE APPLICATIONS	L	T	P	C
		3	0	0	3

Course Objectives:

- Define the basics concepts of IOT
- Understand IIOT and IIOT analytics.
- Understand the IOT Security and IIOT Applications
- To provide exposure to the routing protocols used in medical IoT devices.
- To comprehend on applications of IoT in the field of healthcare

UNIT – I INTRODUCTION TO IOT

Introduction to IoT – Physical design of IoT – Logical design of IoT – IoT enabling technologies – IoT levels and deployment templates – Cloud computing – Deployment models – Service models – Service management – Cloud security – Communication protocols – CoAP – MQTT.

UNIT – II INDUSTRIAL IOT

IIoT-Introduction, Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models, Industrial IoT- Layers: IIoT Sensing, IIoT Processing, IIoT

Communication, IIoT Networking.

IIOT ANALYTICS - Big Data Analytics and Software Defined Networks, Machine Learning and Data Science, Julia Programming, Data Management with Hadoop

UNIT – III IOT SECURITY And IIOT APPLICATIONS

IOT SECURITY - Industrial IoT: Security and Fog Computing - Cloud Computing in IIoT, Fog Computing in IIoT, Security in IIoT.

CASE STUDY : Industrial IOT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies: Milk Processing and Packaging Industries, Manufacturing Industries

UNIT – IV IOT IN HEALTHCARE

IoT in Healthcare – Challenges in current healthcare systems – IoT healthcare services – Big data in IoT – Architecture of apache flume and spark – Wireless Body Area Networks (WBAN) Routing Protocols – Medium access control – Issues of WBAN.

UNIT – V REAL TIME HEALTHCARE APPLICATIONS

Case Studies – Wearable sensor network for remote health monitoring – IoT based location aware smart healthcare framework – Analysis of recovery of mobility through inertial navigation techniques and virtual reality – Control and remote monitoring of muscle activity and simulation in the rehabilitation process.

Text Books:

1. Chandan K.Reddy, Charu C. Aggarwal, “Health Care data Analysis”, First edition, CRC, 2015.
2. Vikas Kumar, “Health Care Analysis Made Simple”, Packt Publishing, 2018.
3. Industry 4.0: The Industrial Internet of Things”, by Alasdair Gilchrist (Apress), 2017
4. “Industrial Internet of Things: Cybermanufacturing Systems”by Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer), 2017
5. Hands-On Industrial Internet of Things: Create a powerful Industrial IoT by Giacomo Veneri, Antonio Capasso, Packt, 2018.

References:

1. Valentina Emilia Balas and Souvik Pal, Healthcare Paradigms in the Internet of Things Ecosystem, Academic Press, 2021.
2. Arsheep Bahga and Vijay Madisetti, Internet of Things: A Hands-on Approach, Universities Press, 2015.
3. Rajkumar Buyya and Amir Vahid Dastjerdi, Internet of Things Principles and Paradigms, Elsevier Inc, 2016.

Course Outcomes:

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

1. Explain IoT principles, Industrial IoT architectures, healthcare IoT frameworks, communication protocols, and security concepts for connected intelligent systems.
2. Apply IoT technologies, cloud platforms, analytics, and communication protocols to develop Industrial IoT and healthcare monitoring solutions.
3. Analyze IoT architectures, networking, security mechanisms, and healthcare routing protocols to recommend efficient solutions for real-world applications.
4. Evaluate Industrial IoT and healthcare IoT systems by assessing analytics, security, communication performance, and application-specific requirements.

5. Develop secure IoT-based industrial and healthcare applications by integrating sensing, networking, cloud analytics, and intelligent monitoring techniques.

CO–PO/PSO Articulation Matrix														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	1	1	2	–	–	–	1	1	2	2
CO2	2	2	3	–	3	–	1	–	–	–	1	3	3	2
CO3	2	3	2	2	2	1	2	–	–	–	1	2	3	2
CO4	1	2	2	3	2	2	2	–	–	–	2	1	2	2
CO5	2	2	3	2	3	2	1	–	–	–	2	3	3	3

25ECSEVAC03	5G TECHNOLOGIES	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the evolution of wireless networks.
- To familiarize with the fundamentals of 5G networks.
- To investigate the processes associated with 5G architecture.
- To teach spectrum sharing and spectrum trading.
- To practice the security features in 5G networks.

UNIT – I EVOLUTION OF WIRELESS NETWORKS

Networks evolution: 2G, 3G, LTE, 4G, Evolution of radio access networks, Need for 5G, 4G versus 5G, Next Generation core (NG-core), visualized Evolved Packet core (vEPC).

UNIT – II 5G CONCEPTS AND CHALLENGES

Fundamentals of 5G technologies, Overview of 5G core network architecture, 5G new radio and cloud technologies, Radio Access Technologies (RATs), EPC for 5G.

UNIT – III NETWORK ARCHITECTURE AND THE PROCESSES

5G Architecture and Core, Network Slicing, Multi Access Edge Computing (MEC), Visualization of 5G Components, End-to-End System Architecture, Service Continuity, Relation to EPC and edge computing. 5G protocols: 5G NAS, NGAP, GTP-U, IPSec and GRE.

UNIT – IV DYNAMIC SPECTRUM MANAGEMENT AND MM-WAVES

Mobility management, Command and control, Spectrum sharing and Spectrum trading, Cognitive radio based on 5G, Millimeter waves.

UNIT – V SECURITY IN 5G NETWORKS

Security features in 5G networks, Network domain security, User domain security, Flow based QoS framework, Mitigating the threats in 5G.

Text Books:

1. Saro Velrajan, “An Introduction to 5G Wireless Networks: Technology, Concepts and Use cases”, First Edition, 2020.
2. Stephen Rommer, “5G Core networks: Powering Digitalization”, Academic Press, 2019.

References:

1. Amitabha Ghosh, Rapeepat Ratasuk, *“Essentials of 5G Technology”*, Cambridge University Press, 2020.

2. Jonathan Rodriguez, *"Fundamentals of 5G Mobile Networks"*, Wiley, 2015.

Course Outcomes:

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

1. Explain the principles, architecture, protocols, spectrum management, and security mechanisms of 5G networks for next-generation wireless communication.
2. Apply 5G technologies, network architecture, and spectrum management techniques to support efficient wireless communication applications.
3. Analyze 5G network architectures, protocols, edge computing, and radio access technologies to determine suitable solutions for communication requirements.
4. Evaluate 5G network performance, spectrum utilization, service continuity, and security mechanisms for reliable and secure wireless systems.
5. Develop 5G-enabled communication solutions by integrating network architecture, edge computing, spectrum management, and security features for emerging applications.

CO–PO/PSO Articulation Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	–	–	2	–	1	–	–	–	1	–	2	2
CO2	2	2	3	–	3	–	–	–	–	–	1	1	3	2
CO3	2	3	2	2	2	–	1	–	–	–	1	1	3	2
CO4	1	2	2	3	2	1	3	–	–	–	2	–	2	2
CO5	2	2	3	2	3	1	1	–	–	–	2	2	3	2