

**ANNAMALAI UNIVERSITY**



**FACULTY OF ENGINEERING AND TECHNOLOGY**

**B.E. COMPUTER SCIENCE AND ENGINEERING**  
**Curriculum – 2025**

**HAND BOOK**  
**2025**



**ANNAMALAI UNIVERSITY**  
**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 Intelligence 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, IChE, 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/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

The break-up of Continuous Assessment for the theory course titled Basic Engineering in the II semester that involves two disciplines requires evaluating the performance under the five Course Outcomes, with 3 for one discipline and two for the other, 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.

### 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](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](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 end semester 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:

$$\text{Percentage of marks} = (\text{OGPA (or) CGPA} - 0.25) \times 10$$

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

$C_i$  - Credit hours of a course  $\text{GP}_i$  - 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).**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.

**20.4 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 (3 <sup>rd</sup> and 4 <sup>th</sup> Digits)	Details	Code (5 <sup>th</sup> and 6 <sup>th</sup> 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	Mechanical Engg. (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 commence

7<sup>th</sup> digit represents the semester and 8<sup>th</sup> and 9<sup>th</sup> 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							-
<b>Total Credits</b>									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
<b>Total Credits</b>									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	
<b>Total Credits</b>									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	
<b>Total Credits</b>									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
<b>Total Credits</b>									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
<b>Total Credits</b>									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
<b>Total Credits</b>									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	S	40	60	100	6
				10	2				
<b>Total Credits</b>									12

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
<b>Total</b>	<b>172</b>

**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/ 25ETBS201	ENGINEERING PHYSICS	L	T	P/D	C
		3	0	0	3

(25ETBS101 for Group 'A' branches and 25ETBS201 for Group 'B' branches)

### Course Objectives :

At the end of the course the students would be exposed to fundamental knowledge in various engineering subjects and applications

- 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 (9 Lectures)

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 (8 Lectures)

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 (7 Lectures)

Introduction to solid Materials – Crystal structure – Geometry of lattice unit cell – Bravai’s lattice – crystal systems –Crystal structures of Materials –(Co - ordination number, Atomic radius, packing factor and packing density) – Types of crystal Lattice (Simple Cubic, Body Centered Cubic, Face CenteredCubic and Hexagonal Closed Packed) Miller Indices and their calculations – Finding Miller indices of crystal planes.

### Unit - IV. Quantum Mechanics (8 Lectures)

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 (8 Lectures)

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, 2<sup>nd</sup> 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., 7<sup>th</sup> 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.

**Reference Books :**

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 :**

- 1 To understand the ray of light to undergo the phenomenon of interference, diffraction and gain knowledge on the construction of different types of interferometers.
- 2 To understand the principle and various application of Laser.
- 3 To explain the fundamental terms in crystallography and its properties.
- 4 To evaluate the quantum mechanical concept of wave functions.
- 5 To Compare the different energy resources and their availability.

Mapping of Course Outcomes with Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11
CO1	2	2	2	-	3	2	-	-	-	-	1
CO2	3	2	-	-	2	1	1	-	-	-	-
CO3	3	1	1	-	-	1	-	-	-	-	-
CO4	2	1	2	2	1	1	-	-	-	-	-
CO5	3	2	-	-	1	2	1	-	-	1	1

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

**Course Objectives :**

The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

- 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 1: Basic Calculus**

Curvature, Evolutes, and Involutives; 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 2: Single-variable Calculus (Differentiation)**

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

**Unit 3: 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 4: 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 5: 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) - Applications: 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, 36th Edition, 2010

**Reference Books :**

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, 9th Edition, Pearson publishers, Reprint, 2002.
3. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11<sup>th</sup> 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, students will learn

1. To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions Solve improper integrals using Beta and Gamma functions.
2. The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
3. The tool of power series for learning advanced Engineering Mathematics.
4. To deal with functions of several variables that are essential in most branches of engineering.
5. To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

Mapping of Course Outcomes with Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	2	-	-	-	-	-	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-
CO3	3	3	3	2	-	-	-	-	-	-	-
CO4	3	3	3	2	-	-	-	-	-	-	-
CO5	3	3	3	2	-	-	-	-	-	-	-

25ETHS103	Technical English	L	T	P	C
		2	0	0	2

### 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**

- 1.1 Use of phrases and clauses in sentences.  
1.2 Sentence Structures and Transformation of Sentences.  
1.3 Importance of proper punctuation.  
1.4 Creating coherence and Techniques for writing precisely.  
1.5 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**

- 1.1 Dialogue Writing and conversation in the work place  
1.2 Report Writing – Preparing agenda, Minutes of meeting and a Circular  
1.3 Mechanics of Presentation  
1.4 Public speaking and Interview Skills  
1.5 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-Lyons and Ben Heasley, 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 Communication Principles and Practice, Oxford University Press, New Delhi, 2014.

**Course Outcomes :**

At the end of this course work, 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.

Mapping of Course Outcomes with Program Outcomes -											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	2	-	2	-	-	-	-	3	-	3
CO2	-	2	-	2	2	-	-	-	3	-	3
CO3	-	-	3	-	-	2	2	-	3	-	3
CO4	-	-	2	-	2	2	2	-	3	-	3
CO5	-	-	3	2	-	-	-	2	3	-	3

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

**அலகு மொழி மற்றும் இலக்கியம்:**

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:**

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

**அலகு III: நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:**

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

**அலகு IV: தமிழர்களின் திணைக் கோட்பாடுகள்:**

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, கையெழுத்துப்படிசுள் - தமிழ்ப் புத்தகங்களின் அச்ச 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 & Jainism 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).
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 the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of TamilStudies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of TamilStudies.)
9. 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)
10. Studies in the History of India with Special Reference to TamilNadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by Department of Archaeology & TamilNaduText Book and Educational Services Corporation, TamilNadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book.

<b>25ETES105</b>	<b>BASIC ELECTRICAL AND ELECTRONICS ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P/D</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

### 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. R.Muthusubramanian, S.Salivahanan, Basic Electrical and Electronics Engineering, McGraw Hill Education, 2024.
2. A K Theraja & B L Theraja, Fundamentals of Electrical Engineering and Electronics, S Chand Publishing, 2022.

**Refernce Books :**

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 :**

By the end of this course, students will be able to:

1. Analyze and solve electrical circuit problems.
2. Understand the construction, operation, and applications of various electrical machines and select appropriate machines for practical applications.
3. Interpret and use electrical measuring instruments for the accurate measurement of electrical parameters in both AC and DC circuits.
4. Design and analyze analog electronic circuits and apply them in real-world scenarios.
5. Apply digital electronics concepts to design and implement simple combinational and sequential circuits such as adders, flip-flops, and multiplexers.

Mapping of Course Outcomes with Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	3	2	2	-	-	-	2	-	-	-	3
<b>CO2</b>	3	2	2	-	-	-	2	-	-	-	3
<b>CO3</b>	3	2	2	-	-	-	2	-	-	-	3
<b>CO4</b>	3	2	2	-	-	-	2	-	-	-	3
<b>CO5</b>	3	2	2	-	-	-	2	-	-	-	3

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

**Course Objectives :**

The main objectives of the course for the students is

- 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.

**Reference Books:**

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, Serope Kalpakjian. (2009). Manufacturing Processes for Engineering Materials (English), 5<sup>th</sup> Edition, Pearson India.

**Course Outcomes :**

Upon completion of this course, the students will be able to

1. Understand the functions of Water tube and Fire tube Boilers and Turbines
2. Know the functions of Internal Combustion Engines and Electric Vehicles
3. Acquire the fundamental knowledge on the various conventional machining operations and the metal forming operations
4. Understand the fundamentals of Metal Molding and various Metal Joining techniques
5. Understand the concept of CNC machining and Additive Manufacturing process.

Mapping of Course Outcomes with Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	-	-	1	-	-	-	-	-	1
CO2	3	2	-	1	-	-	-	-	1	-	-
CO3	2	2	-	1	-	1	1	-	-	1	1
CO4	2	2	1	-	1	-	-	-	1	-	-
CO5	3	3	2	1	2	1	1	-	-	1	1

25ETBP107/ 25ETBP207	Physics Laboratory	L	T	P/D	C
		0	0	3	1.5

(25ETBP107 for Group 'A' branches and 25ETBP207 for Group 'A' branches)

**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.

S.No	LIST OF EXPERIMENTS
1.	<b>Air-Wedge;</b> To determine the thickness(diameter) of a thin wire by forming interference fringes.
2.	<b>Newtons rings;</b> To find the radius of curvature of the given plano convex lens by the Newton's rings.
3.	<b>Dispersive power of the prism;</b> To find the dispersive power of the material of the prism using spectrometer.
4.	<b>Spectrometer Grating;</b> To determine the wavelength of the prominent spectral lines of the Mercury(Hg) spectrum using grating.
5.	<b>Laser Grating;</b> To determine the wavelength of a given laser source by using diffraction grating method
6.	<b>Youngs Modulus - Non-Uniform bending;</b> To find the Young's modulus of the material of a uniform bar (metre scale) by non-uniform bending.
7.	<b>Youngs Modulus -Uniform bending;</b> To determine the Youngs modulus of the beam (metre scale) by uniform bending
8.	<b>Simple Pendulum;</b> To determine the time period of a simple pendulum for different lengths.
9.	<b>Torsion Pendulum;</b> To determine (i) Moment of inertia of a disc and (ii) Rigidity modulus of a wire by torsional pendulum.

10.	<b>Compound Pendulum;</b> To determine the value of acceleration due to gravity(g) using compound pendulum
11.	<b>Acoustic diffraction grating;</b> To determine the ultrasonic velocity in liquid by acoustical grating method.
12.	<b>Co-efficient of Viscosity by Stokes method;</b> To verify stokes law and hence to determine the co-efficient of viscosity of a highly viscous liquid.
13.	<b>Youngs double slit experiment;</b> To determine the nature of the light by observing interference patterns using double slit.

**Course Outcomes:**

1. Demonstrate an understanding of optical interference and diffraction by accurately conducting experiments such as Air Wedge, Newton's Rings, and diffraction grating methods.
2. Apply spectrometry techniques to analyze the spectral properties of light and determine physical constants like wavelength and dispersive power.
3. Evaluate mechanical properties of materials, such as Young's modulus and rigidity modulus, through bending and torsional experiments.
4. Measure and analyze pendulum motion to determine gravitational acceleration and understand the dynamics of simple, compound, and torsion pendulums.
5. Investigate fluid and wave behavior by experimentally determining viscosity and ultrasonic velocity using Stokes' method and acoustic diffraction techniques.

Mapping of Course Outcomes with Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	3	2	2	-	-	3	2	1	-	-	-
<b>CO2</b>	3	3	-	-	-	3	1	1	-	-	-
<b>CO3</b>	3	2	2	-	-	3	1	1	-	-	1
<b>CO4</b>	3	2	2	-	-	3	1	1	-	-	1
<b>CO5</b>	3	2	2	-	-	3	1	1	-	-	1

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.

**Laboratory Activities:**

The student has to empathize, define, ideate, prototype and test for five real world design thinking projects in his/her branch of study and submit a report.

**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.

**Reference Books :**

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, Revised Edition,2013.

**Course Outcomes:**

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

1. Explain the principles, mind set and five step process of design thinking, compare it with traditional problem-solving approaches.
2. Apply empathy-driven research methods to understand user behaviors, needs and pain points.
3. Analyze and synthesize user data to frame meaningful problem statements and design challenges.
4. Generate and evaluate creative solutions using divergent and convergent thinking, including lateral thinking techniques.
5. Develop and iteratively redefine prototypes based on user feedback to test and validate design solutions.

Mapping of Course Outcomes with Program Outcome											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	3	2	2	2	2	2	1	1	2	1	3
<b>CO2</b>	2	3	2	3	2	3	1	2	2	2	2
<b>CO3</b>	3	3	3	3	2	3	1	2	2	2	3
<b>CO4</b>	2	2	3	2	3	2	1	3	2	2	2
<b>CO5</b>	3	3	3	3	3	3	1	2	2	2	3

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

**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.

[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given].

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. Analyze program requirements and develop programs using conditional and looping statements.
2. Write programs for handling arrays and strings.
3. Create C programs with user defined functions and recursive function calls.
4. Utilize pointers and structures for dynamic memory allocation in C programming.
5. Develop C programs for handling files.

Mapping of Course Outcomes with Program Outcome											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	1	-	2	-	-	-	-	-	-
CO2	2	1	1	-	2	-	-	-	-	-	-
CO3	2	1	1	-	2	-	-	-	-	-	-
CO4	1	1	1	-	2	-	-	-	-	-	-
CO5	1	1	1	-	2	-	-	-	-	-	-

25ETBS201/ 25ETBS101	Chemistry	L	T	P	C
		3	0	0	3

(25ETBS201 for Group 'A' branches and 25ETBS101 for Group 'B' branches)

### 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<sub>2</sub>-O<sub>2</sub> fuel cell and Solid oxide fuel cell).

**Unit – IV : Polymers, Nano Materials and Phase rule**

Polymers – Polymerization – Types (Addition, condensation and copolymerization) – Mechanism of 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 the course the student will be able to

1. Develop innovative methods in soft water production for industrial uses and about adsorption analysis.
2. Describe the concept of electrochemistry and its applications; corrosion and its controlling methods.
3. Understand the properties of fuels and applications of energy storage devices.

4. Synthesize various polymers and understand about nano materials and Phase rule.
5. Gain knowledge on Refractories, Lubricants, Explosives and understand the concepts of certain spectroscopical techniques.

Mapping of Course Outcomes with Program Outcome											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	2	-	-	-	-	-	-	-
CO2	1	2	-	2	1	-	-	-	-	-	-
CO3	3	-	3	-	-	-	-	-	-	-	-
CO4	3	2	-	-	1	-	-	-	-	-	-
CO5	1	2	3	2	-	-	-	-	-	-	-

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, 36<sup>th</sup> Edition, 2010

**Reference Books :**

1. Reena Garg, Engineering Mathematics, Khanna Book Publishing Company, 2022
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9<sup>th</sup> Edition, Pearson publishers, Reprint, 2002.
3. Erwin kreyszig, Advanced Engineering Mathematics, 9<sup>th</sup> Edition, John WileySons, 2006.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11<sup>th</sup> 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, students will able to

1. The essential tool of matrices and linear algebra in a comprehensive manner.
2. Solve First order and Second order linear differential equations with constant coefficients
3. Apply effective mathematical tools for the solutions of vector calculus.
4. Construct analytic functions and analyze conformal mappings.
5. Acquaint the techniques in the theory of the complex integrals.

Mapping of Course Outcomes with Program Outcome											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	3	3	3	2	2	-	-	-	-	-	<b>1</b>
<b>CO2</b>	3	3	3	2	2	-	-	-	-	-	1
<b>CO3</b>	3	3	3	2	2	-	-	-	-	-	1
<b>CO4</b>	3	3	3	2	2	-	-	-	-	-	<b>1</b>
<b>CO5</b>	3	3	3	2	2	-	-	-	-	-	1

25ETHS203	UNIVERSAL HUMAN VALUES	L	T	P/D	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 b. 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 / Reference Books :

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. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
6. Small is Beautiful - E. F. Schumacher.
7. Slow is Beautiful - Cecile Andrews.
8. Economy of Permanence - JCKumarappa.
9. Bharat Mein Angreji Raj - Pandit Sunderlal.
10. Rediscovering India - by Dharampal.
11. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi.
12. India Wins Freedom - Maulana Abdul Kalam Azad.
13. Vivekananda - Romain Rolland (English).
14. Gandhi - Romain Rolland (English).

### Course Outcomes:

At the end of the course, students will demonstrate the ability to

1. Demonstrate increased awareness of themselves and their surroundings, including family, society, and nature.
2. Act more responsibly in life and address problems with sustainable solutions, keeping human relationships and the well-being of nature in mind.
3. Exhibit enhanced critical thinking and reflective abilities.
4. Show greater sensitivity and commitment toward the values they have understood, such as human values, human relationships, and the role of the individual in society.
5. Apply the concepts learned to their own lives in day-to-day situations, initiating positive changes in their personal and social behavior.

Mapping of Course Outcomes with Program Outcome											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	3	2	-	-	-	-	-
CO2	-	-	2	2	2	2	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	-	-	-
CO4	-	-	-	-	2	-	-	-	-	-	-
CO5	-	-	-	2	2	-	-	-	-	-	-

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

**அலகு I: நெசவு மற்றும் பாணைத் தொழில்நுட்பம்:** 3  
சங்க காலத்தில் நெசவுத் தொழில் - பாணைத் 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 குழுவித் 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 Kumizhi Thoompu 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) பொருளை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
4. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
5. Social Life of the Tamils The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
6. Historical Heritage of the Tamils (Dr.S.V.Subatamanian,Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
7. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
8. Keeladi - 'Sangam City Civilization on 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.

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 Hourr (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

**Reference Books :**

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 :**

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

1. Describe the role of civil engineering in society and recognize the different functions in civil engineering.
2. Identify common construction materials and explain their properties, applications, and advantages/disadvantages for various construction projects.
3. Recognize different construction methods and practices used in buildings
4. Explain different steps involved in construction of buildings and practice and also to assess the environmental impacts and eco-friendly practices to minimize negative effects.
5. Understand the different structures and their purposes in the field civil engineering.

Mapping of Course Outcomes with Program Outcome											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	3	1	1	1	1	1
CO2	3	-	-	-	1	3	2	1	1	1	1
CO3	3	-	-	-	-	3	-	-	-	-	-
CO4	3	-	-	-	-	3	-	-	-	2	1
CO5	3	-	-	-	-	2	-	-	-	-	1

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

### **Reference Books :**

1. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
2. Clark R.S., Marine Pollution, Clarendon 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. Ltd. 345p.
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,

Compliances and 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 students can able to

1. Understand the importance of environment.
2. Analyze the importance of environment in engineering.
3. Apply their own ideas and demonstrate advanced technologies that will be useful to protect environment.
4. Employ awareness among the society about environmental problems and natural disasters.
5. Practice according to the present and future environmental issues.

Mapping of Course Outcomes with Program Outcome											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-
CO4	3	-	2	-	2	2	-	-	-	-	-
CO5	3	-	2	-	-	2	-	-	-	-	-

25ETSP207/ 25ETSP107	CHEMISTRY LABORATORY	L	T	P/D	C
		0	0	3	1.5

(25ETSP207 for Group 'A' branches and 25ETSP107 for Group 'B' branches)

### 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 the course the students will be able to

1. Determine the physical properties like surface tension and viscosity.
2. Determine rate of reactions and saponification of oil.
3. Calculate the quantity of adsorbate adsorbed by charcoal.
4. Determine the impurity from Pharmaceutical products and hardness of water.
5. Determine exact concentration of acid and bases present in the industrial wastes.

Mapping of Course Outcomes with Program Outcome											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	-	1	-	-	-	-	-	-	-
CO2	2	1	1	-	-	1	-	-	-	-	-
CO3	3	2	1	1	-	-	-	-	-	-	-
CO4	3	-	1	-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-

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 work, 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.

Mapping of Course Outcomes with Program Outcome											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	3	2		-	-	2	-	2	-	3
CO2	-	3	2	2	-	-	-	-	3	-	3
CO3	-	-	2	-	-	2	-	-	3	-	3
CO4	-	2	-	-	-	-	-	2	3	-	3
CO5	-	-	3	-	-	-	2	-	3	2	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. Soldering Practice-Components devices and circuits-using general purpose PCB
12. Corridor Wiring
13. Test the operation and control circuit for LED Fluorescent 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 the course, the students will be able to

1. Familiarize with the electrical safety measures.
2. Identify the different types of electrical wiring.
3. Know the necessity of Earthing.
4. Gain knowledge on the different types of lighting circuits.
5. Understand the methods for measuring electrical variables.

Mapping of Course Outcomes with Program Outcome											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	2	-	-	2	2	-	-	3
CO2	3	-	-	2	-	-	2	2	-	-	3
CO3	3	-	-	2	-	-	2	2	-	-	3
CO4	3	-	-	2	-	-	2	2	-	-	3
CO5	3	-	-	2	-	-	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 through 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/Reference 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.
5. (Corresponding set of) CAD Software Theory and User Manuals.

**Course Outcomes:**

At the end of this course work, 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.

Mapping of Course Outcomes with Program Outcome											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO9	PO9	PO10	PO11
CO1	-	-	2	-	2	-	-	-	2	-	2
CO2	3	3	3	2	2	-	-	2	2	-	2
CO3	2	-	2	-	-	-	-	-	-	-	-
CO4	3	2	2	2	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	3	-	3

**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
<b>PEO1</b>	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.
<b>PEO2</b>	To provide the graduates with the requisite knowledge to pursue higher education and carry out research in the field of Computer Science and Engineering.
<b>PEO3</b>	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.
<b>PEO4</b>	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	<b>Engineering Knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	<b>Problem Analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
PO3	<b>Design/Development of Solutions:</b> 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	<b>Conduct Investigations of Complex Problems:</b> 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	<b>Modern Tool Usage:</b> 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	<b>The Engineer and Society:</b> 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	<b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO8	<b>Individual and Team Work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

<b>PO9</b>	<b>Communication:</b> 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.
<b>PO10</b>	<b>Project Management and Finance:</b> 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.
<b>PO11</b>	<b>Life-long Learning:</b> 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
<b>PSO1</b>	Ability to investigate challenging problems in various domains and exhibit programming skills to build automation solutions
<b>PSO2</b>	Ability to apply the algorithms and computational techniques to construct robust and resilient computer systems and applications.
<b>PSO3</b>	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 (CSE) - CONSISTENCY OF PEOS WITH MISSION OF THE DEPARTMENT

PEO'S	Mission Statements			
	M1	M2	M3	M4
<b>PEO1:</b> To equip the graduates with fundamental concepts and impart problem solving skills that will help them to pursue careers in Computer Science and Engineering.	3	2	2	3
<b>PEO2:</b> To provide the graduates with the requisite knowledge to pursue higher education and carry out research in the field of Computer Science and Engineering.	2	3	3	2

<b>PEO3:</b> 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.	3	3	2	3
<b>PEO4:</b> 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.	3	3	3	2

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

### B.E. (CSE) MAPPING OF PEOs WITH POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>PEO1</b>	3	2	3	2	3	1	1	2	2	1	2
<b>PEO2</b>	3	2	3	2	2	-	-	-	1	-	2
<b>PEO3</b>	2	2	2	1	3	1	1	2	2	-	3
<b>PEO4</b>	2	1	2	1	2	1	2	2	3	2	1

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

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 by eliminating 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", 6<sup>th</sup> edition, (Vol I & II) S. Chand & Co Ltd. New Delhi, 2006.
2. Ventakaraman 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, 3<sup>rd</sup> 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. Acquire basic understanding of the most common partial differential equations.
2. Understand the concepts of Fourier series.
3. Ability to solve boundary value problems.
4. Able to investigate signals problems using Fourier transform.
5. Familiarize Z - transform that play Important roles in many discrete engineering 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	3	3	3	-	-	-	-	-	-	-	3	-	-
CO2	3	3	3	3	-	-	-	-	-	-	-	2	2	-
CO3	3	3	3	3	-	-	-	-	-	-	-	2	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	3	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	3	-	-

<b>25CSES302</b>	<b>FUNDAMENTALS OF DIGITAL COMPUTERS</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
					<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### 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 and also 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 clocked SR, J-K, T and D-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. Acquire knowledge on Digital signals, Logic operations, Boolean algebra, number systems, codes and TTL / CMOS logic based digital ICs,
2. Apply the K-map & Q-M method to simplify logic and evaluate the design of logic circuits including Multiplexer, De-multiplexer/Decoders, Adders, Subtractor, digital comparator and parity checker/generator,
3. Demonstrate the operations of flip-flops including clocked SR, J-K, T and D-type, shift registers and Synchronous /Asynchronous counters.
4. Compare and contrast the design of weighted resistor & R-2R Ladder DAC and ADC such as successive approximation ADC, counting ADC and dual slope ADC.

5. Analyze the classification and characteristics of memories and to explain the design of PLD, CPLDS & FPGA.

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

<b>25CSPC303</b>	<b>DATA STRUCTURES AND ALGORITHMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### 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, "Data Structures", Khanna Publishing House, 5<sup>th</sup> edition, 2017.
2. Yashwant Kanetkar, "Data Structures through C", BPB Publications, 2<sup>nd</sup> edition, 2009.
3. RB Patel, "Expert Data Structures with C++", Khanna Publications, 2<sup>nd</sup> edition, 2012.

#### Course Outcomes:

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

1. Understand basic data structures, recursion, and analyze algorithm complexities.
2. Apply stack, queue, and linked list operations in solving real-world problems.
3. Implement advanced data structures like BST, AVL trees, and Heaps.
4. Analyze and apply graph traversal techniques and hashing.
5. Compare and implement efficient sorting algorithms for large datasets.

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	-	-	-	-	-	-	-	-	2	-	-
CO2	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	2	-	-

<b>25CSPC304</b>	<b>OBJECT ORIENTED PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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	-

<b>25CSPC305</b>	<b>COMPUTER ORGANIZATION AND ARCHITECTURE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

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

#### **Course Outcomes:**

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

1. Understand the functional Units of a computer, bus organizations and addressing modes.

2. Compare and Contrast the Hardwired control and Micro programmed control.
3. Analyze RAM, ROM, Cache memory and virtual memory concepts.
4. Identify the various I/O interfaces that are communicated with computers.
5. Recognize the concept of parallel processing and Pipelining on Computers.

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	1	1	1	-	-	-	-	-	-	-	-	3	-	-
CO3	1	1	1	-	-	-	-	-	-	-	-	3	-	-
CO4	1	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	1	-	-	-	-	-	-	-	-	-	-	3	-	-

<b>25CSPC306</b>	<b>DATABASE MANAGEMENT SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### 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. Raghuram 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

<b>25CSCP308</b>	<b>DATA STRUCTURES AND ALGORITHMS LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

**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. Develop C++ programs for implementing fundamental data structures like stacks, queues, and linked lists.
2. Apply searching, sorting, and traversal algorithms through programming.
3. Demonstrate the ability to implement advanced data structures like Trees, Heaps, and Graphs.

<b>Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes</b>														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2		-	-	-	-	-	-	-	-	-	-
CO2	1	2	2	2	-	-	-	-	-	-	-	2	-	-
CO3	1	2	2	-	-	-	-	-	2	-	2	2	-	-

<b>25CSCP309</b>	<b>OBJECT ORIENTED PROGRAMMING LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

**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 tests 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:**

1. Design algorithms to implement data abstraction, encapsulation, data hiding, Inheritance, dynamic programming using C++.
2. Apply the concepts of interfaces, multithreads and exceptions to develop programs in Java SDK environment.
3. Demonstrate an ability to listen and answer the viva questions related to programming skills needed for solving real-world problems in Computer Science and Engineering.

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	2	-	-	-	-	-	-	-	-	-	-
CO2	2	2	3	1	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	2	-	-	-	-

<b>25CSBS401</b>	<b>DISCRETE MATHEMATICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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. Acquire the basic concepts in Mathematical Logic and theory of inferences.
2. Understand the concepts of Set theory, Relations and equivalence classes with matrix representation.
3. Implement Lattice theory and Boolean, Algebra in circuit design.
4. Design coding and encoding group codes.
5. Understand the basic concepts of Graph theory, Eulerian and Hamiltonian graphs.

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

<b>25CSES402</b>	<b>PYTHON PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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/](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. Understand the data types, operators, input/output and assignment statements used in Python programming.
2. Explain the usage of various conditional and looping statements in Python.
3. Build Python programs using functions, lists, tuples, sets and dictionaries.
4. Develop a Python program using the functions in Numpy, Pandas and Matplotlib packages.
5. Construct an application for solving real-life problems using TKinter and Oracledb packages.

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

<b>25CSPC403</b>	<b>OPERATING SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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, Dining 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:**

- Understand functional architecture of operating systems and file systems.
- Analyze various algorithms for CPU Scheduling
- Implement programs on multi-threading libraries for an OS.
- Explore application programs using system calls.
- Solve synchronization 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	2	1	-	-	-	-	-	-	-	-	-	2	3	-
CO2	2	3	-	1	-	-	-	-	-	-	-	2	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	2	3	2
CO4	1	1	1	-	-	-	-	-	-	-	-	2	3	2
CO5	2	2	2	-	-	-	-	-	-	-	-	2	3	-

<b>25CSPC404</b>	<b>DESIGN AND ANALYSIS OF ALGORITHMS</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
					<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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. Analyze the complexity of algorithms based on asymptotic analysis and justify the correctness of algorithms.
2. Develop algorithms using different design paradigms including divide-and- conquer, dynamic programming, greedy and backtracking algorithms.

3. Design algorithms using graphs and trees for engineering problems.
4. Compare and contrast tractable and un-tractable problems.
5. Describe and solve advanced algorithms on computational complexity theory.

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

<b>25CSPC405</b>	<b>COMPUTER GRAPHICS AND MULTIMEDIA</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
					<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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. Understand and capable of using OpenGL functions to create interactive Computer graphics structures.
2. Design and apply OpenGL functions to two dimensional graphics, transformations and clipping algorithms.
3. Design and apply OpenGL functions to three dimensional graphics, transformation and apply color models to graph systems.
4. Analyze and apply design strategies to multimedia systems and multimedia databases.
5. Understand different types of multimedia file formats and design basic 3D Scenes using Blender.

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

<b>25CSPC406</b>	<b>MICROPROCESSOR AND MICROCONTROLLER</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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 and 16 bit controller.
- To analyze the role of 8051 microcontroller 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, 2<sup>nd</sup> 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. Douglas V. Hall, “Microprocessors and Interfacing, Programming and Hardware”, TMH, 2012.
2. Ramesh S. Gaonkar, “Microprocessor Architecture Programming and Applications with 8085”, Penram International Publishing, 4<sup>th</sup> 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. Acquire the basic knowledge on the architecture of 8086 microprocessor including Addressing modes, Instructionset. Assembly language programming, Stacks,Macros, Interrupts and interrupt service routines.
2. Develop the programming skills on 8086 and comprehend the other microprocessors such as 80186, 80286, 80386, 80486 and Pentium processors
3. Design and develop the Traffic Light control, LED display, LCD display, Keyboard display interface and Alarm Controller through memory and I/O interfacing.
4. Derive programming knowledge on 8031/ 8051 microcontroller covering Special Function Registers, I/O Pins Ports and Circuits and also acquire familiarity on 16 bit Microcontroller.
5. Implement Programs for 8051 Timer, ADC, DAC, Stepper Motor and for Waveform generation.

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

<b>25CSCP408</b>	<b>OPERATING SYSTEM AND DATABASE MANAGEMENT SYSTEM LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

**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. Implement scheduling, management and synchronization techniques of OS.
2. Create databases and execute queries using basic and advanced SQL constructs.
3. Demonstrate an ability to listen and answer the viva questions related to programming skills needed for solving real-world problems in computer science and engineering.

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	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	1	-	-	-	-	-	-	-	-	2	-	-
CO3	2	2	2	1	-	-	-	-	-	-	-	2	-	-

<b>25CSCP409</b>	<b>COMPUTER GRAPHICS AND MULTIMEDIA LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

**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, Scaling
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. Implement 2D and 3D shape drawing algorithms, transformations and its applications.
2. Develop applications on image, sound and video using editing tools such as GIMP, Audacity, Windows Movie Maker, Swish, Flash, etc.
3. Demonstrate an ability to listen and answer the viva questions related to programming skills needed for solving real-world problems in Computer Science and Engineering.

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	2	1	-	1	-	-	-	-	-	-	3	3	-
CO2	1	1	3	1	3	-	-	-	-	-	1	3	3	2
CO3	2	2	-	-	-	-	-	-	2	-	2	3	3	2

SS25CSPC501	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 NFA – Finite Automaton with  $\epsilon$ - moves – Regular Languages- Regular Expression – Equivalence of NFA and DFA – Equivalence of NFA's with and without  $\epsilon$ -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 CFL problems 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, 3rd edition, 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”, Narosa Publishers, 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. Construct NFA, DFA and Minimal DFA.
2. Derive a grammar without useless symbols and obtain CNF and GNF.
3. Construct pushdown automata for a given context free grammar and language.
4. Design a Turing Machine for a given recursively enumerable language.
5. Acquire the Knowledge on decidable and undecidable 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	2	2	-	-	-	-	-	-	-	-	3	-	-
CO2	2	1	1	-	-	-	-	-	-	-	-	2	2	-
CO3	3	1	3	1	-	-	-	-	-	-	-	3	3	-
CO4	3	2	3	1	-	-	-	-	-	-	-	3	3	-
CO5	2	2	-	-	-	-	-	-	-	-	-	2	-	-

<b>25CSPC502</b>	<b>COMPUTER NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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”, 6<sup>th</sup> Edition, McGraw Hill, 2021.
2. William Stallings, “Data and Computer Communications”, 11<sup>th</sup> Edition, Pearson, 2022.
3. James F. Kurose & Keith W. Ross, “Computer Networking: A Top-Down Approach”, 8<sup>th</sup> Edition, Pearson, 2021.
4. Larry L. Peterson & Bruce S. Davie, “Computer Networks: A Systems Approach”, 6<sup>th</sup> Edition, Morgan Kaufmann, 2021.

#### **References:**

1. Nader F. Mir, “Computer and Communication Networks”, 3<sup>rd</sup> Edition, Wiley, 2021.
2. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, 5<sup>th</sup> Edition, Morgan Kaufmann Publishers Inc., 2012.
3. William Stallings, “Data and Computer Communications”, 10<sup>th</sup> Edition, Pearson Education, 2013.
4. Nader F. Mir, “Computer and Communication Networks”, 2<sup>nd</sup> 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”, 6<sup>th</sup> 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	-	-

<b>25CSPC503</b>	<b>SOFTWARE ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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

<b>25CSPC504</b>	<b>MACHINE LEARNING</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
					<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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, New York, 2018.

**References:**

1. Ethem Alpaydin, Introduction to Machine Learning, 3<sup>rd</sup> Edition, 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. Understand the basic concepts of machine learning, regression and normal densities.
2. Implement different classification algorithms used in machine learning.
3. Implement clustering and component analysis techniques.
4. Design and implement deep learning architectures for solving real life problems.
5. Combine the evidence from two or more models/methods for designing a system.

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

<b>25CSCP507</b>	<b>COMPUTER NETWORKS LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

**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. To apply network administration commands and demonstrate their use in different network scenarios.
2. Implement the Socket programming for Client Server Architecture, Analyze the Packet Contents of different Protocols and Implementation of the routing Protocols.
3. Demonstrate an ability to listen and answer the viva questions related to programming skills needed for solving real-world problems in Computer science and Engineering.

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	3	3	3	-	-	-	-	-	-	-	-	1
CO2	3	3	2	2	3	-	-	-	-	-	-	-	-	1
CO3	2	2	-	-	-	-	-	-	-	2	2	-	-	1

<b>25CSCP508</b>	<b>MACHINE LEARNING LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

#### 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. Implement Gaussian densities, regression and principal component analysis algorithms.
2. Design and implement the classification and clustering algorithms using Python.
3. Design and implement methods for solving real life problems using convolutional neural network and recurrent neural network.

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	1	3	-	-	-	-	-	1	3	2	2
CO2	3	3	2	2	3	-	-	-	-	-	2	3	2	2
CO3	3	3	3	3	3	-	-	-	-	-	2	3	2	2

<b>25CSPC601</b>	<b>COMPILER DESIGN</b>										<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
											<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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, 2<sup>nd</sup> 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. Loudon, “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. Illustrate the different phases of compiler.
2. Explain the process of lexical analysis.
3. Understand the need of parser and compare the principle of top down and bottom- up parser.
4. Construct syntax trees and able to explain storage organization
5. Develop algorithms for generating intermediate code and target code.

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	-	-	-	-	-	-	-	3	3	-
CO3	2	2	-	3	-	-	-	-	-	-	-	3	3	-
CO4	1	1	2	-	1	-	-	-	-	-	-	-	1	2
CO5	1	1	1	-	1	-	-	-	-	-	-	2	2	2

<b>25CSPC602</b>	<b>DATA ANALYSIS WITH R</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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. Get the knowledge about the data and its relationship by applying various statistical methods.
2. Acquire the knowledge on probability and different testing hypothesis testing methods.
3. Analyze different Bayesian methods to test the sample taken independently.
4. Apply the predictive analysis by various regression statistical methods.

5. Apply various statistical methods for analysis of the real-world data using R language.

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

<b>25CSHS603</b>	<b>BUSINESS MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### 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 Fayol.

### 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. 10<sup>th</sup> 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. Define the principles of Business Management.
2. Identify planning methods and procedures.
3. Implement effective Decision making in Business management.
4. Visualize the role of a leader.
5. Infer the need for exercising good control.

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

<b>25CSCP607</b>	<b>COMPILER DESIGN LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

#### 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. Apply the programming knowledge skill to design and develop a compiler.
2. Understand and implement lexical analyzer, syntax analyser, code optimizer and code generator.
3. Demonstrate an ability to listen and answer the viva questions related to programming skills needed for solving real-world problems in Computer Science and Engineering.

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
<b>CO1</b>	2	2	-	-	-	-	-	-	-	-	-	3	3	1
<b>CO2</b>	2	2	3	3	-	-	-	-	-	-	-	3	3	1
<b>CO3</b>	2	2	-	-	-	-	-	-	2	-	2	3	3	1

<b>25CSCP608</b>	<b>DATA ANALYSIS WITH R LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

**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 and 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. Understand the basic concepts of general and mathematical commands in R programming.
2. Design and implement the hypothesis testing (t-test & ANOVA test) for two means and more than two means.
3. Design and implement the predictive analysis by various regression statistical methods (Simple and Multiple Linear Regression Models)

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	2	2	2	-	-	-	-	-	-	-	3	2	2
CO2	2	2	1	2	1	-	-	-	-	-	2	3	2	2
CO3	3	2	2	2	-	-	-	-	-	-	-	3	2	2

<b>25CSES701</b>	<b>RESEARCH METHODOLOGY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>2</b>

**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', 5<sup>th</sup> edition.

**Course Outcomes:**

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

1. Understand the purpose and process of research in engineering and apply basic research principles.
2. Identify relevant literature and formulate a research problem based on gaps and existing studies.
3. Design appropriate research methodologies and collect data using suitable tools and techniques.
4. Apply basic statistical methods to analyze and interpret research data meaningfully.
5. Prepare research reports, write technical papers, and understand the ethical and legal aspects of research publication and intellectual property.

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

<b>25CSPC702</b>	<b>DIGITAL IMAGE PROCESSING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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. Understand the fundamentals of digital image processing and use OpenCV for basic operations.
2. Implement image enhancement techniques in both spatial and frequency domains using OpenCV.
3. Analyze and evaluate various image segmentation techniques with practical applications.
4. Utilize wavelet transforms and image compression techniques in real time image applications.
5. Develop real-time image processing solutions using morphological operations.

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

<b>25CSPC703</b>	<b>INTERNET OF THINGS (IOT)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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

<b>25CSCP707</b>	<b>DIGITAL IMAGEPROCESSING LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

### 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 Smoothing 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. Develop program for real time images and can be able to process using python.
2. Solve the image processing problems based on image enhancement and image segmentation techniques in spatial domain.
3. Implement image compression techniques and morphological operations on an image.

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	2	3	-	-	-	-	-	-	3	2	3
CO2	3	-	2	2	3	-	-	-	-	-	-	3	2	3
CO3	3	-	2	2	3	-	-	-	-	-	-	3	2	3

<b>25CSCP708</b>	<b>INTERNET OF THINGS LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

### 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. Understand the basic concepts of Arduino and Raspberry pi programming.
2. Understand the working principle of various sensors.
3. Demonstrate an ability to identify the various programming skills required for solving the Real-World 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	2	2	-	-	1	-	-	-	-	-	-	3	-	-
CO2	2	2	-	-	1	-	-	-	-	-	-	3	-	-
CO3	2	2	-	-	1	-	-	-	1	-	1	3	1	2

**PROFESSIONAL ELECTIVES**

<b>25CSPESC</b>	<b>ADVANCED JAVA PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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 CRUD 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. Elliott 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:**

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

1. Understand the importance of Applets and Abstract Window Toolkit (AWT).
2. Work with Database and Network based application development.
3. Design Graphical User Interface using Swing and Beans.
4. Build and deploy distributed applications using RMI and CORBA.
5. Recognize the capabilities of Java framework to facilitate solving industrial applications using Spring and Hibernate framework

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

<b>25CSPESC</b>	<b>WEB APPLICATION FRAMEWORK</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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. Understand the concepts and structure of modern web application frameworks.
2. Develop web applications using MVC architecture and standard components.
3. Implement CRUD operations, ORM, and database integration within frameworks.
4. Build secure and RESTful applications with session management and authentication.
5. Deploy, test, and optimize performance in a web application environment.

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

<b>25CSPESCEN</b>	<b>OPEN SOURCE PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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. Identify information about Free and Open Source Software projects from software releases and from sites on the internet.
2. Understand the fundamentals of Linux operating system.
3. Understand database basic concepts and database administration tasks.
4. Recognize the concept of PHP programming to develop web applications.
5. Develop scripts for text processing and to implement modular code using subroutines and packages.

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

<b>25CSPESC</b>	<b>N</b>	<b>AVA</b>	<b>ULL</b>	<b>STACK</b>	<b>DEVELOPMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
						<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objectives:**

- To design web pages using HTML & CSS elements.
- To make use of JavaScript for writing programs to perform client-side validation on web applications and utilize TypeScript 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\\_shared/overview](https://infyspringboard.onwingspan.com/en/app/toc/lex_17739732834840810000_shared/overview) (HTML5).
2. [https://infyspringboard.onwingspan.com/en/app/toc/lex\\_18109698366332810000\\_shared/overview](https://infyspringboard.onwingspan.com/en/app/toc/lex_18109698366332810000_shared/overview) (Javascript).
3. [https://infyspringboard.onwingspan.com/en/app/toc/lex\\_9436233116512678000\\_shared/overview](https://infyspringboard.onwingspan.com/en/app/toc/lex_9436233116512678000_shared/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. Build web pages using HTML & CSS elements.
2. Apply JavaScript to embed programming interface for web pages to perform client side validations and Develop applications using Typescript.

3. Work with MySQL database using queries.
4. Develop a dynamic content for the Webpage using Java servlet and java bean.
5. Utilize Java Server Pages to design dynamic and responsive web pages

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	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	3	-	-	-	-	-	-	-	-	2	-	-
CO3	3	-	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	3	2	2	-	-	-	-	-	-	2	-	-
CO5	2	-	3	3	2	-	-	-	-	-	-	2	-	-

<b>25CSPESC N</b>	<b>NOSQL DATABASES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### Course Objectives:

- To describe various NoSQL databases and compare them with relational databases
- To familiarise 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, 2nd Edition, 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. Compare NOSQL databases with each other and Relational database Systems.
2. Explain the concepts of Replication, distribution, sharding, and resilience in a NOSQL database.
3. Demonstrate the knowledge of Document Databases.
4. Describe the features of Key- Value databases.
5. Analyze the features of Column and Graph Databases.

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	1	-	-	1	-	-	-	-	-	-	-	3	-
CO2	2	1	-	-	1	-	-	-	-	-	-	-	3	-
CO3	2	1	-	-	1	-	-	-	-	-	-	-	3	-
CO4	2	1		-	1	-	-	-	-	-	-	--	3	-
CO5	1	1	-	-	1	-	-	-	-	-	-	-	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, 2<sup>nd</sup> 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. Understand the functionality of the various data mining and data warehousing component.
2. Develop the Data warehousing Architecture and Implement.
3. Classify the methodologies used for analysis of data
4. Compare various techniques which enhance the data modeling.
5. Analyze developing areas such as web mining, text mining and ethical aspects of data mining.

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	-	1	1	1	-	-	-	-	-	-	-	2	-
CO3	1	-	2	1	2	-	-	-	-	-	-	-	2	-
CO4	1	-	-	2	2	-	-	-	-	-	-	-	2	-
CO5	1	-	-	-	2	-	-	-	-	-	-	-	2	-

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 architecture, components, and standards of mobile communication and

- computing.
- Analyze mobile transport protocols and routing strategies in mobile networks.
  - Evaluate the functioning and design of ad hoc and sensor networks.
  - Develop and deploy applications on various mobile platforms with awareness of design constraints.
  - Identify and apply mobile security solutions and emerging trends in mobile computing and IoT integration.

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

<b>25CSPESC N</b>	<b>MOBILE APP DEVELOPMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### 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

<b>25CSPE SCN</b>	<b>5G AND WIRELESS COMMUNICATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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. Describe the key drivers, use cases, and global vision behind the development of 5G systems.
2. Demonstrate knowledge of core enabling technologies like SDN, NFV, IoT, and mobile cloud that make up 5G ecosystems.
3. Design and analyze the radio access technologies and network infrastructure for efficient 5G deployment.
4. Apply concepts of 5G core architecture including service-based design, network slicing, and interworking with existing systems.
5. Critically assess security frameworks, QoS mechanisms, and anticipate future developments in 5G 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	3	3	2	3	2	-	-	-	-	-	-	1	1	3
CO2	3	3	3	2	2	-	-	-	-	-	-	1	1	2
CO3	3	3	2	2	2	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	2	-	-	-	-	-	-	3	2	2
CO5	3	2	3	3	2	-	-	-	-	-	-	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 - Overview 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, 8<sup>th</sup> Edition, 2024.
2. Jonathan Katz, Yehuda Lindell, "Introduction to Modern Cryptography", A Chapman & Hall Book, CRC Press, 3<sup>rd</sup> edition, 2025.
3. Atul Kahate "Cryptography and Network Security", Tata McGrawHill, 4<sup>th</sup> Edition, 2013.
4. Charlie Kauffman, Radia Perlman, Mike Spciner, "Network Security", Pearson Education, 2<sup>nd</sup> Edition, 2012.

**References:**

1. Craig Bauer, “Practical Mathematical Cryptography & Secret History: The Story of Cryptology”, CRC Press, 1<sup>st</sup> edition, August 2024.
2. V.K. Jain, “Cryptography & Network Security”, Khanna Publishing House, 1<sup>st</sup> edition, 2013.

**Course Outcomes:**

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

1. Acquire the basic concepts in Computer security and Cryptography.
2. Understand the concepts of Symmetric key algorithms and AES.
3. Analyze RSA algorithms, ECC algorithms and Digital signatures.
4. Implement Key management using public key cryptography.
5. Understand the basic concepts of Firewalls, SET, SSL and E-mail security.

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

<b>25CSPESC</b>	<b>NLP WITH DEEP LEARNING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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. Understand the basics of NLP, Deep learning techniques, NLP libraries and Deep learning libraries.
2. Identify the word vector representations suitable for a given NLP application.
3. Build CNN model and RNN model for NLP applications such as sentence classification and text generation respectively.
4. Develop an LSTM model for NLP applications and implementing with VGG16.

5. Understand the NLP applications such as NMT and Chatbot.

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

<b>25CSPESCN</b>	<b>BLOCK CHAIN TECHNOLOGY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### 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, 2020.
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:**

1. Understand the foundational concepts and applications of blockchain technology.
2. Analyze consensus mechanisms and cryptographic methods in blockchain systems.
3. Design and implement smart contracts and decentralized applications.
4. Evaluate different blockchain platforms and their development tools.
5. Assess security and privacy aspects of blockchain and explore real-world applications.

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

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.
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	-	-	-	-	-	-	-	-	-

<b>25CSPESCN</b>	<b>WEB ANALYTICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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, Piero Fraternali, 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. Recognize the role of web analytics within the digital marketing landscape.
2. Measure the success rate and testing options.
3. Use the search engines for retrieving the information.
4. Understand the intelligence analysis and emerging analytics.
5. Analyze Google analytics contribution and study the working of Google analytics, accounts and profiles.

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

25CSPESCNCN	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:**

1. Understand the Android OS architecture and its built-in security mechanisms.
2. Analyze application permissions, sandboxing and secure inter-process communication.
3. Identify and exploit vulnerabilities in Android applications.

4. Perform mobile malware analysis and forensics to detect security breaches.
5. Apply secure coding practices to develop robust and secure Android applications.

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

<b>25CSPESC</b>	<b>ENGINEERING ETHICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### 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. Understand the basic concepts of engineering Ethics.
2. Analyze the importance of codes in engineering practice.
3. Comprehend the Risk analysis in Ethics.
4. Describe about Collegiality and Loyalty
5. Acquire knowledge on Business Ethics.

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

<b>25CSPESCN</b>	<b>SOFT COMPUTING</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
					<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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. Understand the fundamentals and need for soft computing techniques
2. Apply fuzzy logic concepts to model uncertain and imprecise systems
3. Implement neural network models and learning algorithms
4. Design and apply genetic algorithms for optimization problems
5. Integrate fuzzy, neural, and genetic techniques in hybrid systems
6. Analyze real-world applications of soft computing methods fields.

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

<b>25CSPESC</b>	<b>SOFTWARE ENGINEERING AND DEVOPS</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
					<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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. Comprehend the basic elements of Software Project Models.
2. Visualize the significance of the different kind of Software Testing methods.
3. Ability to analyze the strategies in Software Designing
4. Develop framework of Agile and DevOps
5. Knowledge about ALM, SCM.

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	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	2	-	-	-	-	-	-	-	-	-	2	3
CO4	1	2	2	-	2	-	-	-	-	-	-	-	1	2
CO5	1	1	-	-	2	-	-	-	-	-	-	-	1	3

<b>25CSPESCEN</b>	<b>EDGE COMPUTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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.
4. H. Cao, M. Ma, "Security and Privacy in Edge Computing: A Survey", Future Generation Computer Systems, Elsevier, 2020.

**Course Outcomes:**

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

1. Describe the fundamentals and architecture of Edge Computing and differentiate it from traditional computing paradigms.
2. Apply knowledge of Edge system components and deployment strategies for various real-time applications.
3. Analyze and design Edge-based solutions using open-source frameworks and virtualization tools.
4. Demonstrate skills in handling Edge data analytics, AI models, and real-time decision-making.
5. Evaluate security and privacy issues in Edge environments and explore emerging trends and technologies.

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	2	1	2	2	0	1	0	1	1	0	2	2	0
CO2	2	2	3	2	3	0	0	0	2	1	0	3	2	0
CO3	2	3	3	3	3	0	0	0	2	2	1	3	3	1
CO4	2	2	3	3	3	1	1	0	2	2	1	3	3	1
CO5	2	2	2	2	2	2	3	1	2	1	2	3	2	2

<b>25CSPESC N</b>	<b>QUANTUM COMPUTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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 Schmidt 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. Understand the basics of quantum computing
2. Understand the background of Quantum Mechanics.
3. Analyse the computation models and the circuits using quantum computation.
4. Understand the quantum operations, such as noise and error correction.
5. Understand the concepts of quantum machine learning.

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

<b>25CSPESC</b>	<b>CLOUD COMPUTING</b>										<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
											<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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”, 1<sup>st</sup> 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. Understand the basics of Cloud, Parallel and Distributed Computing.

2. Identify the architecture, infrastructure and delivery models of Cloud Computing.
3. Familiarize about Concurrent Computing and High-Throughput Computing.
4. Explain how Aneka's Framework allows integration with different cloud providers, enabling hybrid and multi-cloud deployments
5. Analyze the recent developments in Industry-specific cloud platforms.

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	2	2	2	-	-	-	-	-	-	-	3	2
CO2	3	2	3	2	3	-	-	-	-	-	-	2	3	2
CO3	2	3	3	3	3	-	-	-	-	-	-	2	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	3	3	3
CO5	2	3	2	3	3	-	-	-	-	-	-	3	3	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, 1<sup>st</sup> edition, 2010.
2. Peter Mika, “Social Networks and the Semantic Web, Springer, 1<sup>st</sup> edition,2007.

**References:**

1. Guandong Xu, Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and applications”, Springer, 1<sup>st</sup> 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

<b>25CSOESCN</b>	<b>INDUSTRIAL IOT</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
					<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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 IIoT

**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. Understand the architecture, components, and evolution of Industrial IoT and Industry
2. Analyze various IIoT communication protocols, computing models, and technologies.
3. Apply knowledge of sensors, actuators, and interfacing in industrial environments.
4. Evaluate different wired and wireless networking technologies for industrial communication.
5. Apply data analytics and ML principles for predictive maintenance and industrial optimization.

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

<b>25CSOESCN</b>	<b>ROBOTIC PROCESS AUTOMATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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 (Author), 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. Enunciate the key distinctions between RPA and existing automation techniques and platforms.
2. Use UiPath to design control flows and work flows for the target process
3. Implement recording, web scraping and process mining by automation
4. Use UiPath Studio to detect, and handle exceptions in automation processes
5. Implement and use Orchestrator for creation, monitoring, scheduling, and controlling of automated bots and processes.

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	2	-	-	-	-	-	-	-	-	-	2	-	-
CO3	1	2	2	-	2	2	-	-	-	-	-	-	2	-
CO4	2	1	-	-	3	-	-	-	-	-	-	1	-	-
CO5	-	-	2	2	2	-	1	-	-	-	-	-	-	-

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', 4<sup>th</sup> 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 Anuzzi Jr., Lauren Darcey, Shane Conder, 'Advanced Android Application Development', 4<sup>th</sup> Edition, Addison-Wesley, 2015.

**Course Outcomes:**

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

1. Explain Android architecture and create basic Android applications
2. Design user interfaces using layouts, views, and event handling
3. Implement data storage using Shared Preferences, SQLite, and Content Providers
4. Integrate multimedia, sensors, and network communication in Android apps
5. Develop apps with location services, Firebase, and background tasks
6. Prepare and publish Android applications to the Google Play Store

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

<b>25CSOESCN</b>	<b>ROBOTICS AND ITS APPLICATIONS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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, 3<sup>rd</sup> 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. Understand the significance, social impact and future prospects of robotics and automation in various engineering applications.
2. Identify and describe the components and anatomy of robotic system.
3. Know about various path planning techniques and analyze different motions of robotics system
4. Utilize the suitable drives and end-effectors for a given robotics application.

5. Apply robotics concept to automate the monotonous and hazardous tasks and categorize various types of robots based on the design and applications in real world scenarios.

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

25CSOESCN	<b>E-COMMERCE AND DIGITAL MARKETING</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
					<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### 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. Understand the concepts and models of e-commerce.
2. Identify the tools and techniques of digital marketing.
3. Apply digital marketing strategies for online business growth.
4. Evaluate e-commerce platforms and their business applications.
5. Design and assess digital marketing campaigns using analytics tools.

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

<b>25CSOESCN</b>	<b>PRIVACY AND SECURITY IN INTERNET OF THINGS</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
					<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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. Understand the architecture and unique security issues of IoT systems.
2. Apply cryptographic techniques and protocols for secure communication in IoT.
3. Identify and analyze privacy threats and data protection mechanisms in IoT.
4. Evaluate security frameworks, standards, and risk mitigation strategies.
5. Examine real-world case studies, legal, and ethical aspects of IoT privacy and security.

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

<b>25CSOESCN</b>	<b>GENERATIVE ARTIFICIAL INTELLIGENCE</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
					<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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 the course, the students will be able to

1. Understand the fundamental concepts and techniques of generative models (VAEs, GANs, Transformers).
2. Develop and implement generative models using various architectures and algorithms.
3. Analyze the performance of generative models using appropriate evaluation metrics on various datasets.
4. Apply generative AI techniques to solve real-world problems in different domains.
5. Use state-of-the-art tools and frameworks for developing and testing generative AI models.

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

<b>25CSOESCN</b>	<b>DATA ANALYSIS USING OPEN SOURCE TOOLS</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
					<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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 Statistics Box-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. Acquire knowledge to handle single and two variables during data analysis.
2. Familiarize the tools and techniques for time series and multivariate analysis.
3. Describe the tests and methods in classical statistics for data analysis.
4. Explain the methods for clustering.
5. Apply the tools used for reporting and dashboards in business applications.

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

<b>25CSOESCN</b>	<b>ENTREPRENEURSHIP, INNOVATION AND STARTUP</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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. Understand the foundations of entrepreneurship and types of entrepreneurs.
2. Apply creativity and innovation techniques to generate business ideas.
3. Develop a complete business model and viable business plan.
4. Identify funding sources and support systems for startups.
5. Understand legal, ethical, and strategic aspects of startups

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

**HONORS ELECTIVES**

<b>25CSHESCN</b>	<b>SOFTWARE PROJECT MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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. Understand the basic concepts and issues of software project management
2. Apply project assessment, cost benefit analysis, risk evaluation
3. Implement and schedule the software projects and create project plans
4. Develop framework for monitoring and managing projects
5. Manage people and groups by understanding behavior, providing leadership

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

<b>25CSHESCN</b>	<b>NANO COMPUTING</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
					<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**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. Introduce the evolution and key technologies of nano computing and assess its role in future computing systems.
2. Analyze how defects and imperfections impact the design and operation of nano computing architectures.
3. Apply appropriate reliability evaluation techniques using tools such as NANOLAB and NANOPRISM to ensure nano system robustness.
4. Explain the architectural and implementation challenges in quantum-dot and QCA-based computing systems.
5. Demonstrate the ability to design and evaluate QCA circuits and compare emerging molecular and optical computing technologies.

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	-	-
CO2	-	2	-	-	-	-	-	-	-	-	-	-	2	-
CO3	-	-	2	-	2	-	-	-	-	-	-	2	-	-
CO4	-	-	-	2	-	-	-	-	-	-	1	-	2	2
CO5	-	-	2	-	-	-	-	-	-	-	1	-	-	2

<b>25CSHESCN</b>	<b>PRINCIPLES OF ARTIFICIAL INTELLIGENCE</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
					<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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*, 4<sup>th</sup> Edition, Pearson Education, 2020.
2. Elaine Rich, Kevin Knight, and Shivashankar B. Nair, *Artificial Intelligence*, 4<sup>th</sup> 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*, 6<sup>th</sup> Edition, Pearson Education, 2009.

- Kevin P. Murphy, *Machine Learning: A Probabilistic Perspective*, 1<sup>st</sup> Edition, MIT Press, 2012.
- Patrick H. Winston, *Artificial Intelligence*, 3rd Edition, Addison Wesley, 1992.
- 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

- Identify key concepts of artificial intelligence, intelligent agents, and problem-solving paradigms.
- Implement uninformed and informed search algorithms, including game-playing strategies.
- Investigate knowledge using propositional logic, first-order logic to perform logical reasoning using resolution and inference mechanisms.
- Design classical planning solutions, apply probabilistic reasoning and supervised learning techniques to real-world problems.
- Analyze ethical challenges and evaluate the impact of AI applications in various sectors, for example healthcare, finance, and transportation.

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

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. Understand the fundamentals of graphs.
2. Acquire the knowledge about Trees and planer graph.
3. Apply graph coloring and use directed graph in discrete problems.
4. Solve problems in permutation and combination.
5. Implement the Generating function in solving recurrence relation.

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

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. Describe the challenges in Neural networks.
2. Explain the fundamental concepts of deep learning.
3. Train deep learning networks.
4. Apply the methods for optimization in deep learning.

5. Comprehend and develop applications using the concepts of deep learning.

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

<b>25CSHESCN</b>	<b>OPERATIONAL RESEARCH</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### 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, 10<sup>th</sup> Edition, 2017.

2. KantiSwarup, P.K. Gupta, Man Mohan, Operations Research, Sultan Chand & Sons, 18<sup>th</sup> 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, 4<sup>th</sup> Edition.
4. Tulsian& Pandey, Quantitative Techniques, Pearson Education.

**Course Outcomes:**

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

1. Formulate and solve linear programming problems using graphical and simplex methods.
2. Solve transportation and assignment problems using appropriate methods.
3. Apply decision theory and game theory to decision-making problems.
4. Analyze and interpret results of queuing and inventory models.
5. Apply project management techniques such as PERT and CPM for effective planning.

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

<b>25CSHESCN</b>	<b>PARALLEL AND DISTRIBUTED ALGORITHMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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, 2<sup>nd</sup> Edition, Pearson Education, 2009.
2. Haggit Attiya and Jennifer Welch, Distributed Computing–Fundamentals, Simulations and Advanced Topics, 2<sup>nd</sup> 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, 1<sup>st</sup> Edition, Pearson Education, 2011.

**Course Outcomes:**

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

1. Understand the communication models and costs in parallel platforms to build

- efficient mappings between processes and processors.
- Design algorithms to decompose problems for parallel execution using communication operations including broadcast & reduction and methods to speed up the communication between processes.
  - Develop Message Passing environment and solve problems including matrix-matrix multiplication, sorting and searching.
  - Implement suitable distributed algorithms to solve problems including Leader Election in ring topology and Mutual Exclusion in shared memory architectures.
  - Design and construct fault-tolerant systems to simulate communication between and failures of processors.

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

25CSHESCN	<b>DIGITAL WATERMARKING AND STEGANOGRAPHY</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
					<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### 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. Explore the fundamental concepts, history, and applications of information hiding techniques.
2. Implement spatial and frequency domain steganographic techniques to hide information in digital media.
3. Construct digital watermarking algorithms for protecting images and multimedia content.
4. Assess the robustness of watermarking and steganographic systems under various attacks.
5. Demonstrate the use of tools to implement information hiding methods and investigate real-world applications and emerging trends.

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

**MINOR ENGINEERING ELECTIVE COURSES**

<b>25CSMISCN</b>	<b>OBJECT ORIENTED PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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	-

<b>25CSMISCN</b>	<b>DATABASE MANAGEMENT SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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.

- Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", Third Edition, McGraw Hill, 2014.
- 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

- Design ER and EER diagrams and map them to relational schemas.
- Develop and execute complex SQL queries for data retrieval and manipulation.
- Apply normalization techniques to design efficient relational schemas.
- Describe concurrency issues and recovery mechanisms.
- 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

<b>25CSMISCN</b>	<b>COMPUTER NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### 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”, 6<sup>th</sup> Edition, McGraw Hill, 2021.
2. William Stallings, “Data and Computer Communications”, 11<sup>th</sup> Edition, Pearson, 2022.
3. James F. Kurose & Keith W. Ross, “Computer Networking: A Top-Down Approach”, 8<sup>th</sup> Edition, Pearson, 2021.
4. Larry L. Peterson & Bruce S. Davie, “Computer Networks: A Systems Approach”, 6<sup>th</sup> Edition, Morgan Kaufmann, 2021.

**References:**

1. Nader F. Mir, “Computer and Communication Networks”, 3<sup>rd</sup> Edition, Wiley, 2021.
2. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, 5<sup>th</sup> Edition, Morgan Kaufmann Publishers Inc., 2012.
3. William Stallings, “Data and Computer Communications”, 10<sup>th</sup> Edition, Pearson Education, 2013.
4. Nader F. Mir, “Computer and Communication Networks”, 2<sup>nd</sup> 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”, 6<sup>th</sup> 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	-	-

<b>25CSMISCN</b>	<b>MOBILE APP DEVELOPMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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

<b>25CSPMISCN</b>	<b>BIG DATA ANALYTICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### 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, 1<sup>st</sup> edition, 2010.
2. Peter Mika, “Social Networks and the Semantic Web, Springer, 1<sup>st</sup> edition,2007.

#### References:

1. Guandong Xu, Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and applications”, Springer, 1<sup>st</sup> 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**

<b>25CSOCCSCN</b>	<b>DEEP LEARNING LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**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. Create and manipulate tensors using Tensorflow tool and to understand tensor flow concepts.
2. Know supervised learning and working with features and labels.
3. Acquire knowledge on CNN, RNN.

<b>Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	-	-	2	-	2	-	-	-	-	-	-	2	2	-
<b>CO2</b>	-	3	3	1	3	1	-	-	-	-	2	2	2	-
<b>CO3</b>	2	2	-	-	-	-	-	-	-	2	2	2	2	-

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. Familiarize about cloud architecture, virtualization and parallel/distributed computing principles.
2. Design and deploy virtualized and concurrent applications using platforms like Aneka.
3. Develop and analyze real-world cloud applications using industrial platforms (AWS,Azure).

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	2	2	2	-	-	-	-	-	-	-	-	2	2
CO2	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO3	3	3	-	-	-	-	-	-	2	-	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. Discover the various elements in the interface to load and analyze data.
2. Design filters for data visualization.
3. Develop dashboard design for typical data analytics applications.

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	3	-	-	-	-	-	-	-	-	2	2	-
CO2	1	2	2	2	-	-	-	-	-	-	-	2	2	-
CO3	2	2	2	-	-	-	-	-	2	-	2	2	2	-

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. Analyze all the components and their properties of various Emulators for selecting suitable emulators.
2. Apply essential Android programming concepts for developing efficient mobile apps.
3. Develop Android applications related to various layouts.
4. Design flutter applications with rich user interactive interfaces.
5. Develop Android applications related to mobile related server-less database like SQLite.
6. Extend event handling to develop various mobile applications.

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

<b>25CSOCCSCN</b>	<b>PROFESSIONAL COMMUNICATIONS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>

**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. Make effective presentations.
2. Participate confidently in Group Discussions.
3. Attend job interviews and be successful in them.
4. Develop adequate Soft Skills required for the workplace .

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

### VALUE ADDED COURSES

<b>25ECSEVAC01</b>	<b>GENERATIVE AI</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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:**

- Understand the fundamental concepts and techniques of generative models (VAEs, GANs, Transformers).
- Develop and implement generative models using various architectures and algorithms.
- Analyze the performance of generative models using appropriate evaluation metrics on various datasets.
- Apply generative AI techniques to solve real-world problems in different domains.
- Use state-of-the-art tools and frameworks for developing and testing generative AI models.

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

<b>25ECSEVAC02</b>	<b>IOT FOR INDUSTRIAL AND HEALTHCARE APPLICATIONS</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
					<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objectives:**

- Define the basics concepts of IOT
- Understand IIOT and IOT analytics.
- Understand the IOT Security and IOT 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 Madiseti, 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:**

1. Understand the basic concepts and various IoT Layers and their relative importance.
2. Realize the importance of Data Analytics in IoT. Study various IoT platforms and Security and the concepts of Design Thinking.
3. Ability to apply big data analytics in Medical IoT devices
4. Ability to analyse mobility in location based IoT systems
5. Ability to evaluate the performance of IoT applications in healthcare.

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

<b>25ECSEVAC03</b>	<b>5G TECHNOLOGIES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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. To analyze the evolution of wireless networks.
2. To utilize the concepts of 5G networks.
3. To demonstrate the 5G architecture and protocols.
4. To understand the dynamic spectrum management.
5. To visualize the security aspects in 5G 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	3	3	2	3	2	-	-	-	-	-	-	1	1	3
CO2	3	3	3	2	2	-	-	-	-	-	-	1	1	2
CO3	3	3	2	2	2	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	2	-	-	-	-	-	-	3	2	2
CO5	3	2	3	3	2	-	-	-	-	-	-	2	2	2