ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

B.E. COMPUTER SCIENCE AND ENGINEERING
(Artificial Intelligence and Machine Learning)
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, IIChE, IEEE, SAE, ASHRAE, CSI and IWS

5.1 B.E (Honours) Degree

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

5.2 B.E Degree with Minor Engineering

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

6. Assignment of Credits for Courses

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

7. Duration of the Programme

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

8. Registration for Courses

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

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

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

8.1 Slow Learners

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

8.2 Advanced Learners

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

14.3 SC / ST Cell

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

15. Class Committee

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

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

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

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

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

- Teachers of the individual courses.
- A seminar coordinator (for seventh semester only) shall be appointed by the Head of the Department

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

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

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

The third meeting will be held after all the assessments but before the University 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:

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

Where OGPA (or) CGPA = $\frac{\Sigma Ci\ GPi}{\Sigma C_i}$

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

The first two digits relate to the year from which the Regulations commence
7th digit represents the semester and 8th and 9th digits represent the serial number of courses.

ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

B.E (Four Year) Degree Program

Choice Based Credit System (CBCS)

REGULATIONS 2025

CURRICULUM FOR GROUP 'A' BRANCHES

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

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

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

SEMESTER III									
Course Code	**Category**	**Course**	**L**	**T**	**P/D**	**CA**	**FE**	**Total**	**Credits**
25AIBS301	BS-V	Mathematics – III	3	-	-	25	75	100	3
25AIES302	ES-V	Fundamentals of Digital Computers	3	-	-	25	75	100	3
25AIPC303	PC-I	Data Structures and Algorithms	3	-	-	25	75	100	3
25AIPC304	PC-II	Python Programming	3	-	-	25	75	100	3
25AIPC305	PC-III	Computer Organisation and Architecture	3	-	-	25	75	100	3
25AIPC306	PC-IV	Principles of Artificial Intelligence	3	-	-	25	75	100	3
25AIPE307	PE-I		3	-	-	25	75	100	3
25AICP308	PCP-I	Data Structures and Algorithms Lab	-	-	3	40	60	100	1.5
25AICP309	PCP-II	Artificial Intelligence Lab	-	-	3	40	60	100	1.5
								Total Credits	24

SEMESTER IV									
Course Code	**Category**	**Course**	**L**	**T**	**P/D**	**CA**	**FE**	**Total**	**Credits**
25AIBS401	BS-VI	Discrete Mathematics	3	-	-	25	75	100	3
25AIES402	ES-VI	Object Oriented Programming	3	-	-	25	75	100	3
25AIPC403	PC-V	Operating Systems	3	-	-	25	75	100	3
25AIPC404	PC-VI	Database Management Systems	3	-	-	25	75	100	3
25AIPC405	PC-VII	Fundamentals of Machine Learning	3	-	-	25	75	100	3
25AIPC406	PC-VIII	Neural and Fuzzy Computing in AI	3	-	-	25	75	100	3
25AIPE407	PE-II		3	-	-	25	75	100	3
25AICP408	PCP-III	Operating System and Database Management Systems Lab	-	-	3	40	60	100	1.5
25AICP409	PCP-IV	Machine Learning Lab	-	-	3	40	60	100	1.5
								Total Credits	24

SEMESTER V									
Course Code	**Category**	**Course**	**L**	**T**	**P/D**	**CA**	**FE**	**Total**	**Credits**
25AIPC501	PC-IX	Image and Speech Processing	3	-	-	25	75	100	3
25AIPC502	PC-X	Computer Networks	3	-	-	25	75	100	3
25AIPC503	PC-XI	Deep Learning for Visual Computing	3	-	-	25	75	100	3
25AIPC504	PC-XII	Internet of Things	3	-	-	25	75	100	3
25AIPE505	PE-III		3	-	-	25	75	100	3
25AIOE506	OE-I		3	-	-	25	75	100	3
25AICP507	PCP-V	Deep Learning Tools Lab	-	-	3	40	60	100	1.5
25AICP508	PCP-VI	Internet of Things Lab	-	-	3	40	60	100	1.5
25ETIT509	IT-I	Industrial Training / Rural Internship/Innovation / Entrepreneurship	Four weeks during the summer vacation at the end of IV Semester				100	100	4
								Total Credits	25

SEMESTER VI									
Course Code	**Category**	**Course**	**L**	**T**	**P/D**	**CA**	**FE**	**Total**	**Credits**
25AIPC601	PC-XIII	Recommender Systems	3	-	-	25	75	100	3
25AIPC602	PC-XIV	Data Analytics with R	3	-	-	25	75	100	3
25AIHS603	HS-V	Business Management	3	-	-	25	75	100	3
25AIPE604	PE-IV		3	-	-	25	75	100	3
25AIPE605	PE-V		3	-	-	25	75	100	3
25AIOE606	OE-II		3	-	-	25	75	100	3
25AICP607	PCP-VII	Recommender Systems Lab	-	-	3	40	60	100	1.5
25AICP608	PCP-VIII	Data Analytics with R Lab	-	-	3	40	60	100	1.5
								Total Credits	21

SEMESTER VII									
Course Code	**Category**	**Course**	**L**	**T**	**P/D**	**CA**	**FE**	**Total**	**Credits**
25AIES701	ES-VII	Research Methodology	3	-	-	25	75	100	2
25AIPC702	PC-XV	Evolutionary Optimization Algorithms	3	-	-	25	75	100	3
25AIPC703	PC-XVI	AI in Cyber Security	3	-	-	25	75	100	3
25AIPE704	PE-VI		3	-	-	25	75	100	3
25AIPE705	PE-VII		3	-	-	25	75	100	3
25AIOE706	OE-III		3	-	-	25	75	100	3
25AICP707	PCP-IX	Evolutionary Optimization Algorithms Lab	-	-	3	40	60	100	1.5
25AICP708	PCP-X	AI in Cyber Security Lab	-	-	3	40	60	100	1.5
25ETIT709	IT-II	Industrial Training / Rural Internship/Innovation / Entrepreneurship	Four weeks during the summer vacation at the end of IV Semester				100	100	4
								Total Credits	24

SEMESTER VIII									
Course Code	**Category**	**Course**	**L**	**T**	**P/D**	**CA**	**FE**	**Total**	**Credits**
25AIOE801	OE-IV		3	-	-	25	75	100	3
25AIOE802	OE-V		3	-	-	25	75	100	3
25AIPV803	PV-I	Project Work and Viva Voce	-	PR 10	S 2	40	60	100	6
								Total Credits	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
Total	**172**

Total Credits: 172

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

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

PE - PROFESSIONAL ELECTIVES

1. Advanced Java Programming
2. Web Application Framework
3. Open Source Programming
4. Java Full Stack Development
5. NoSQL Databases
6. Data Mining
7. Mobile Computing
8. Mobile App Development
9. 5G and Wireless Communication
10. Computer Vision

11. Emotional Analytics in AI
12. Block Chain Technology
13. Predictive Analysis and Time Series
14. Reinforcement Learning
15. Robotics and AI
16. Social and Ethical Issues in AI
17. Affective Computing
18. Cognitive Science
19. Edge Computing
20. Quantum Computing
21. Generative Artificial Intelligence

OE - OPEN ELECTIVES

1. Game Theory
2. Large Language Models
3. AI tools for Engineering
4. Android Development
5. Industrial Internet of Things
6. Block Chain Fundamentals
7. Basics of Robotics
8. Agile Methodologies
9. Autonomous Drones
10. Entrepreneurship Innovation and Startup
11. Big Data Analytics[Naan Mudhalvan]
12. Machine Learning with Application to Objects Recognition[Naan Mudhalvan]
13. Full Stack [Naan Mudhalvan]
14. Augmented and Virtual Reality [Naan Mudhalvan]
15. Cloud Essentials [Naan Mudhalvan]

HONOURS ELECTIVE COURSES

1.	25AIHESCN	Computational Neuroscience
2.	25AIHESCN	Robot Learning and Sensorimotor Control
3.	25AIHESCN	Human Computer Interaction (or) Enterprise Deep learning
4.	25AIHESCN	Stochastic Process and Queuing Theory
5.	25AIHESCN	CNN for Visual Recognition
6.	25AIHESCN	Machine Learning for Predictive Data Analysis

MINOR ENGINEERING ELECTIVE COURSES

1	25AIMISCN	Principles of Artificial Intelligence
2	25AIMISCN	Fundamentals of Machine Learning
3	25AIMISCN	Deep Learning for Visual Computing
4	25AIMISCN	Mobile App Development
5	25AIMISCN	Internet of Things
6	25AIMISCN	Robotics and AI

ONE CREDIT COURSES

1.	Data Science Lab
2.	Data Visualization Lab
3.	Mobile Application Development Lab
4.	Cloud Computing Lab
5.	Professional Communication

VALUE ADDED COURSES

1	Generative AI
2	IoT for Industrial 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, 2nd Edition, 1997.
2. John Twidell & Tony Weir, " Renewable Energy Resources", Taylor & Francis, 2005.

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

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

Unit 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, 11th Reprint, 2010.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

Course Outcomes :

At the end of this course, 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-Lyonsand Ben Heasly, Cambridge University Press. 2006.
5. Communication Skills, Sanjay Kumar and Pushp Lata, Oxford University Press. 2011.
6. Exercises in Spoken English, Parts. I-III, CIEFL, Hyderabad. Oxford University Press.
7. Raman Meenakshi and Shama, Sangeetha –Technical 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 I: 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 திருவள்ளுவர் 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, ஒயிலாட்டம், 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.

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அலகு V: இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் – தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

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

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

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

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

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

Text-Cum-Reference Books :

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல்
2. மற்றும் கல்வியியல் பணிகள் கழகம்).
3. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
4. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
- 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) (Publish ed 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.

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

Course Objectives:

- Understand the fundamental principles of electrical circuits and their analysis
- Explore the construction, working principles, and applications of various electrical machines
- Gain knowledge of electrical measurement techniques and instrumentation used in

the measurement of electrical parameters
- Develop an understanding of analog electronics and their applications
- To teach the basics of digital electronics.

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

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

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

UNIT IV: ANALOG ELECTRONICS
Characteristics: PN junction diode, Zener diode, BJT- Applications: Rectifier, Voltage regulator, Operational amplifier

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

Text Books ;

1. 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.

Reference 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**
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

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), 5th 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**

		L	T	P/D	C
25ETBP107/ 25ETBP207	**Physics Laboratory**	**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.	**Air-Wedge;** To determine the thickness(diameter) of a thin wire by forming interference fringes.
2.	**Newtons rings;** To find the radius of curvature of the given plano convex lens by the Newton's rings.
3.	**Dispersive power of the prism;** To find the dispersive power of the material of the prism using spectrometer.
4.	**Spectrometer Grating;** To determine the wavelength of the prominent spectral lines of the Mercury(Hg) spectrum using grating.

5.	**Laser Grating;** To determine the wavelength of a given laser source by using diffraction grating method
6.	**Youngs Modulus - Non-Uniform bending;** To find the Young's modulus of the material of a uniform bar (metre scale) by non-uniform bending.
7.	**Youngs Modulus -Uniform bending;** To determine the Youngs modulus of the beam (metre scale) by uniform bending
8.	**Simple Pendulum;**To determine the time period of a simple pendulum for different lengths.
9.	**Torsion Pendulum;** To determine (i) Moment of inertia of a disc and (ii) Rigidity modulus of a wire by torsional pendulum.
10.	**Compound Pendulum;** To determine the value of acceleration due to gravity(g) using compound pendulum
11.	**Acoustic diffraction grating;** To determine the ultrasonic velocity in liquid by acoustical grating method.
12.	**Co-efficient of Viscosity by Stokes method;** To verify stokes law and hence to determine the co-efficient of viscosity of a highly viscous liquid.
13.	**Youngs double slit experiment;** To determine the nature of the light by observing interference patterns using double slit.

Course Outcomes:

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**
CO1	3	2	2	-	-	3	2	1	-	-	-
CO2	3	3	-	-	-	3	1	1	-	-	-
CO3	3	2	2	-	-	3	1	1	-	-	1
CO4	3	2	2	-	-	3	1	1	-	-	1
CO5	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**
CO1	3	2	2	2	2	2	1	1	2	1	3
CO2	2	3	2	3	2	3	1	2	2	2	2
CO3	3	3	3	3	2	3	1	2	2	2	3
CO4	2	2	3	2	3	2	1	3	2	2	2
CO5	3	3	3	3	3	3	1	2	2	2	3

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

Course Objectives :

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

[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	-	-	-	-	-	-

		L	T	P	C
25ETBS201/ 25ETBS101	Chemistry	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_2-O_2 fuel cell and Solid oxide fuel cell).

Unit – IV : Polymers, Nano Materials and Phase rule

Polymers – Polymerization – Types (Addition, condensation and copolym0.erization) – 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, 36th 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, 9th Edition, Pearson publishers, Reprint,2002.
3. Erwin kreyszig, Advanced Engineering Mathematics,9th Edition, John WileySons,2006.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi,11th Reprint, 2010.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

Course Outcomes:

At the end of this course, 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**
CO1	3	3	3	2	2	-	-	-	-	-	**1**
CO2	3	3	3	2	2	-	-	-	-	-	1
CO3	3	3	3	2	2	-	-	-	-	-	1
CO4	3	3	3	2	2	-	-	-	-	-	**1**
CO5	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 EXISTENC- 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 / References :

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

Course Outcomes :

At the end of 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 பானைத் தொழில்நுட்பம்: 3

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

அலகு II: வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: 3

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

அலகு III: உற்பத்தித் தொழில் நுட்பம்: 3

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

அலகு IV: வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: 3

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

அலகு V: அறிவியல் தமிழ் மற்றும் கணித்தமிழ்: 3

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

TOTAL : 15 PERIODS

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

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

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

Unit IV: Agriculture and Irrigation Technology: Dam, Tank, ponds, Sluice, Significance of 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) பொருநை – 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 theTamils (Dr.S.V.Subatamanian,Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
7. The Contributions of theTamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
8. Keeladi - 'Sangam City Civilizationon the bank so friver Vaigai'(Jointly Published by: Department of Archaeology &Tamil Nadu Text Book and Educational Service Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

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

Course Objectives:

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

UNIT I: INTRODUCTION TO CIVIL ENGINEERING

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

UNIT II: CONSTRUCTION MATERIALS

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

UNIT III MASONRY, ROOF AND FLOOR

Definitions and terms used in masonry – Brick masonry - Characteristics requirements of good masonry – Bonds in brick work – Header, Stretcher, English, Flemish – Stone masonry - Characteristics requirements of stone masonry – Walls – Types of walls – Concrete block walls – Types of building blocks.

Types of roofs – Flat, Sloped and Curved – Types of Roof coverings – Aluminum and iron sheets – Drainage in roofs – Floors - Types of floors and finishes – Finishing materials and types - Advantages and Disadvantages

UNIT IV BUILDING CONSTRUCTION

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

UNIT V SPECIAL STRUCTURES IN CIVIL ENGINEERING

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

Text Books :

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

References 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 erosionand desertification - Role of an individual in conservation of natural resources.- Equitable use of resources for sustainable lifestyles.

UNIT II: ECOSYSTEMS

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

UNIT III: BIODIVERSITY AND ITS CONSERVATION

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

UNIT IV : ENVIRONMENTAL POLLUTION

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

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

UNIT V: HUMAN POPULATION AND THE ENVIRONMENT

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

FIELD WORK

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

Text Books :

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

References Books :

1. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
2. Clark R.S., Marine Pollution, Clanderson Press Oxford.
3. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001,
4. Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
5. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
6. Down to Earth, Centre for Science and Environment.
7. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev.,
8. Environment &Security.StockholmEnv.Institute Oxford Univ. Press. 473p.
9. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural
10. History Society, Bombay.
11. Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment.
12. Cambridge Univ. press 1140p.
13. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. HimalayaPub. House, Delhi 284 p.
14. Mckinney, M.L. & School, R.M. 1996. Environmental Science systems & Solutions,Web enhanced edition. 639p.
15. Mhaskar A.K., Matter Hazardous, Techno-Science Publication
16. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co.
17. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
18. Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. 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, Compliancesand Standards, Vol I and II, Enviro Media.
22. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication.
23. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia,USA 499p.

Course Outcomes:

At the end 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. SolderingPractice-Componentsdevicesandcircuits-usinggeneralpurposePCB
12. Corridor Wiring
13. Test the operation and control circuit for LED Flourescent Lamp(18W)
14. Study of various categories of Fuses and Insulators
15. Study and test the operation of Automatic Iron Box
16. Testing the buck/boost functions of the domestic stabilizer

Course Outcomes:

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

UNIT I: INTRODUCTION TO ENGINEERING DRAWING

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

UNIT II: ORTHOGRAPHIC PROJECTIONS

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

UNIT III: PROJECTIONS OF REGULAR SOLIDS

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

UNIT IV: SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS

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

UNIT V: ISOMETRIC PROJECTIONS

Isometric projections: Projections of simple solids. Conversion of pictorial view of simple objects

into orthographic projections (only elevation and plan)

OVERVIEW OF COMPUTER GRAPHICS COVERING

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

CUSTOMIZATION & CAD DRAWING

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

ANNOTATIONS, LAYERING & OTHER FUNCTIONS

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

Text/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

(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

VISION AND MISSION OF THE INSTITUTE

VISION

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

MISSION

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

VISION AND MISSION OF THE DEPARTMENT

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. COMPUTER SCIENCE AND ENGINEERING

(Artificial Intelligence and Machine Learning)
PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEOs	PEO Statements
PEO1	To prepare graduates with potential to get employed in the right role and/or become entrepreneurs to contribute to the society.
PEO2	To provide the graduates with the requisite knowledge to pursue higher education and carry out research in the field of Computer Science and Engineering.
PEO3	To equip the graduates with the skills required to stay motivated and adapt to the dynamically changing world so as to remain successful in their career.
PEO4	To train the graduates to communicate effectively, work collaboratively.

B.E COMPUTER SCIENCE & ENGINEERING
(Artificial Intelligence and Machine Learning)
PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSOs	Programme Specific Outcome
PSO1	Acquire the ability to understand basic sciences, humanity sciences, basic engineering sciences and fundamental core courses in Machine Learning, Deep Learning and Artificial Intelligence in terms of real world problems to meet the challenges of the future.
PSO2	Learn specialized courses in Machine Learning, Deep Learning and Artificial Intelligence to develop intelligent systems for solving problems from inter-disciplinary domains and for applying typical practices and approaches to deliver quality products intended for business and industry requirements.
PSO3	Apply innovative tools and techniques to solve problems in the areas related to Machine learning, Deep Learning, and Artificial Intelligence essential for employing current techniques to model real world problems in software development and to create pioneering career paths for pursuing higher studies, research and to be an entrepreneur.

B.E.COMPUTER SCIENCE & ENGINEERING
(Artificial Intelligence and Machine Learning)

After the successful completion of the B.E.COMPUTER SCIENCE & ENGINEERING (**Artificial Intelligence and Machine Learning**) degree programme the students will be able to

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

Sl. No.	Program Outcomes
PO1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
PO3	**Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO8	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO9	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO10	**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO11	**Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

B.E.COMPUTER SCIENCE & ENGINEERING
(Artificial Intelligence and Machine Learning)
CONSISTENCY OF PEOS WITH MISSION OF THE DEPARTMENT

PEO Statements	Mission Statements			
	M1	M2	M3	M4
PEO 1 - To prepare graduates with potential to get employed in the right role and/or become entrepreneurs to contribute to the society.	2	3	2	3
PEO 2 - 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	2	3	2
PEO 3 - To equip the graduates with the skills required to stay motivated and adapt to the dynamically changing world so as to remain successful in their career.	2	3	2	3
PEO 4 - To train the graduates to communicate effectively, work collaboratively.	3	3	2	3

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

25AIBS301	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 play an 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",6th edition, (Vol I & II) S. Chand & Co Ltd. New Delhi, 2006.
2. Venkataraman M K, "Engineering Mathematics", The National Publishing Co., Chennai,2003.

References:

1. Ramana B V., Higher Engineering Mathematics.,2007, Tata McGraw Hill Pub.
2. Veerarajan, T., Engineering Mathematics, 3rd edition, 2005, Tata McGraw 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.

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 discreate 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	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	3	3	-
CO4	3	3	3	3	-	-	-	-	-	-	-	3	3	-
CO5	3	3	3	3	-	-	-	-	-	-	-	3	3	-

25AIES302	**FUNDAMENTALS OF DIGITAL COMPUTERS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To familiarize with Digital signals, Logic operations, Boolean algebra, number systems, codes and digital ICs with TTL and CMOS logic,
- To describe the simplification of logic functions using K-map and Quine–McCluskey (Q-M) method, and also design logic circuits such as Multiplexer, De-multiplexer/Decoders, Adders, Subtractors, Digital Comparators, and Parity Checkers/Generators.
- To demonstrate operations of flip-flops including clocked SR, J-K, T and D types, shift registers, and synchronous/asynchronous counters.
- To educate the concepts of ADC and DAC converters.
- 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. Albert Paul Malvino and Leach, Donald P, "Digital Principles and Applications", 4th Edition, TAT MCGrow Hill(TMH), 2000.
2. Albert Paul Malvino, and, Donald P Leach, "Digital Computer Fundamentals", 3rd Edition, TAT MCGrow Hill(TMH), 1995.
3. Bartee, Thomas C, "Digital Computer Fundamentals", 6th Edition, TAT MCGrow Hill(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	-	-	-	-	-	-	-	2	-	-

25AIPC303	**DATA STRUCTURES AND ALGORITHMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce fundamental concepts of linear and non-linear data structures.
- To develop problem-solving abilities using data structures and algorithm design.

- To provide knowledge of advanced data structures such as AVL Trees, Heaps, Hashing and Graphs.
- To analyze and compare various searching, sorting, and traversal algorithms.
- To apply appropriate data structures for solving real-world computational problems.

UNIT – I Introduction to Data Structures and Algorithm Analysis

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

UNIT – II Linear Data Structures - Stacks, Queues, and their applications

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

UNIT – III Linked Lists

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

UNIT – IV Trees and Heaps

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

UNIT – V Graphs, Hashing and Sorting Algorithms

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

Text Books:

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

References:

1. R S Salaria , “Data Structures”, Khanna Publishing House,5th edition, 2017.
2. Yashwant Kanetkar, “Data Structures through C”, BPB Publications, 2nd edition, 2009.
3. RB Patel, “Expert Data Structures with C++”, Khanna Publications, 2nd 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	3	-
CO2	2	2	2	-	-	-	-	-	-	-	-	2	3	-
CO3	2	2	2	-	-	-	-	-	-	-	-	2	3	-
CO4	1	1	2	-	-	-	-	-	-	-	-	2	3	-
CO5	2	2	2	-	-	-	-	-	-	-	-	2	3	-

25AIPC304	PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

Course Objectives:

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

UNIT – I Introduction to Python Programming

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

UNIT – II Conditional and Looping Statements

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

UNIT – III Functions, Lists, Tuples, Sets and Dictionaries

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

UNIT – IV Standard Python Packages (NumPy, Pandas and Matplotlib)

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

UNIT – V Python Packages for GUI and Database Programming (Tkinter, and Oracledb)

Tkinter: Introduction - First (real) example - TK concepts - Basic widgets - More widgets - Grid geometry manager - Event loop – Menus - Windows and dialogs - Organizing complex interfaces -

Fonts, colors, images – Canvas – Text – Treeview - Styles and themes.
Oracledb: Introduction to the Python driver for Oracle database - Initializing python-oracledb - Connecting to Oracle database - Executing SQL - Executing PL/SQL - Managing transactions.

Text Books:

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

References:

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

Course Outcomes:

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

1. 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	-	-	-	-	-	-	-	-	-	1	-
CO4	-	-	-	3	-	-	-	-	-	-	1	-	3	3
CO5	-	-	-	3	2	-	-	-	-	-	1	-	3	3

25AIPC305	**COMPUTER ORGANIZATION AND ARCHITECTURE**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

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

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

UNIT – I Introduction

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

UNIT – II Fundamental Concepts

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

UNIT – III Memory

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

UNIT – IV I/O Devices

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

UNIT – V Parallel Processing

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

Text Books:

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

References:

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

Course Outcomes:

1. At the end of this course, the students will be able to
2. Understand the functional Units of a computer, bus organizations and addressing modes.
3. Compare and Contrast the Hardwired control and Micro programmed control.
4. Analyze RAM, ROM, Cache memory and virtual memory concepts.
5. Identify the various I/O interfaces that are communicated with computers.
6. 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	2	-
CO2	1	1	1	2	1	-	-	-	-	-	-	3	2	-
CO3	1	1	1	2	1	-	-	-	-	-	-	3	2	
CO4	1	1	2	2	2	-	-	-	-	-	-	3	2	-
CO5	1	1	2	2	2	-	-	-	-	-	-	3	2	-

25AIPC306	**PRINCIPLES OF ARTIFICIAL INTELLIGENCE**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce the fundamental concepts, definitions, and goals of artificial intelligence and intelligent agents.
- To enable students to apply classical and heuristic search strategies, including adversarial search for problem-solving and game-playing.
- To develop the ability to represent knowledge formally using propositional and first-order logic and perform reasoning using inference techniques.
- To familiarize students with planning methods, uncertainty reasoning using probability, and machine learning concepts such as supervised learning and decision trees.
- To educate practical AI applications in natural language processing, expert systems, and ethical considerations in real-world domains.

UNIT – I Introduction to Artificial Intelligence

Introduction: Definitions of AI – Acting humanly vs. thinking humanly – Thinking rationally vs. acting rationally. Intelligent Agents: Agents and Environments – Nature of Environments – Structure of Agents. Problem-Solving Agents: Formulating Problems – Example Problems. Uninformed Search Strategies: Breadth-First Search – Depth-First Search – Iterative Deepening Search. Constraint Satisfaction Problems (CSP): Overview – Example Problems.

UNIT – II Informed Search and Adversarial Search

Heuristic Search Strategies: Greedy Best-First Search – A* Search – Heuristic Functions. Local Search Algorithms: Hill Climbing – simple and steepest ascent. Adversarial Search: Game Playing – Minimax Algorithm – Alpha-Beta Pruning.

UNIT – III Knowledge and Reasoning

Knowledge-Based Agents: The Wumpus World. Logic: Propositional Logic – Syntax and Semantics – Inference – Resolution – Forward and Backward Chaining. First-Order Logic – Syntax and Semantics –Inference in First-Order Logic – Unification – Resolution – Forward and Backward Chaining in FOL.

UNIT – IV Planning and Uncertainty

Classical Planning: STRIPS Representation – Planning Graphs – Partial-Order Planning. Planning and Acting in the Real World: Hierarchical Planning – Time and Resources. Reasoning Under Uncertainty: Probability Basics – Bayes' Rule. Probabilistic Reasoning: Inference in Bayesian Networks. Basic Learning Concepts: Learning from Observations – Supervised Learning – Decision Trees – Cross-Validation.

UNIT – V Natural Language Processing, Expert Systems, and AI Applications

Natural Language Processing: Text Preprocessing – Syntactic Analysis – Semantic Analysis. Expert Systems: Knowledge Acquisition – Inference Engines – Applications. AI Ethics: Privacy – Fairness – Bias – Autonomous Systems – Societal Impact. AI Applications: Healthcare – Finance – Transportation – Education.

Text Books:

1. **Stuart Russell and Peter Norvig**, *Artificial Intelligence: A Modern Approach*, **4th Edition**, Pearson Education, 2020.
2. **Elaine Rich, Kevin Knight, and Shivashankar B. Nair**, *Artificial Intelligence*, **4th Revised Edition**, MedTech Science Press, 2024.
3. **Nils J. Nilsson**, *Artificial Intelligence: A New Synthesis*, **Paperback Reprint Edition**, Morgan Kaufmann, 2011.

References:

1. **George F. Luger**, *Artificial Intelligence: Structures and Strategies for Complex Problem Solving*, **6th Edition**, Pearson Education, 2009.
2. **Kevin P. Murphy**, *Machine Learning: A Probabilistic Perspective*, **1st Edition**, MIT Press, 2012.
3. **Patrick H. Winston**, *Artificial Intelligence*, **3rd Edition**, Addison Wesley, 1992.
4. **Peter Jackson**, *Introduction to Expert Systems*, **3rd Edition**, Addison-Wesley, 1998.

Course Outcomes:

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

1. Identify key concepts of artificial intelligence, intelligent agents, and problem-solving paradigms.
2. Implement uninformed and informed search algorithms, including game-playing strategies.
3. Investigate knowledge using propositional logic, first-order logic to perform logical reasoning using resolution and inference mechanisms.
4. Design classical planning solutions, apply probabilistic reasoning and supervised learning techniques to real-world problems.
5. 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

25AICP308	DATA STRUCTURES AND ALGORITHMS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

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

LIST OF EXERCISES

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

Course Outcomes:

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

1. 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.

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

25AICP309	ARTIFICIAL INTELLIGENCE LABORATORY	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To enable students to implement classical and heuristic search algorithms for example BFS, DFS, and A* for solving complex problem-solving scenarios.
- To develop the ability to design and implement intelligent agents using logic-based reasoning, constraint satisfaction techniques, and game-playing strategies.
- To provide practical exposure to reasoning under uncertainty, planning with STRIPS, and applying AI techniques in natural language processing and expert systems.

LIST OF EXERCISES

1. Breadth-First Search (BFS) and Depth-First Search (DFS)
2. Constraint satisfaction
3. A* algorithm
4. i) Implement Minimax Algorithm
   ii) Enhance with Alpha-Beta Pruning
5. Implement a simple forward chaining mechanism to derive new facts from given rules.
6. Use resolution with **PyDatalog** to answer queries:
   i) Implement unification to match queries with facts and rules using **PyDatalog**.
7. STRIPS-style Planner: Simulate simple classical planning using STRIPS-style actions.
8. Calculate conditional probabilities using the Naïve Bayes theorem.
9. Implement following NLP operations: tokenization, stemming using NLTK.
10. Build a simple rule-based expert system for medical diagnosis.

Course Outcomes:

1. At the end of this course, the students will be able to
2. Understand and apply basic and heuristic search techniques, including BFS, DFS, A, Minimax, and Alpha-Beta pruning game-playing algorithms.
3. Develop foundational AI systems using knowledge representation, logical reasoning (forward chaining, resolution), and planning under certainty and uncertainty.
4. Implement basic Natural Language Processing (NLP) tasks and design simple expert systems for real-world problem domains for medical diagnosis.

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

25AIBS401	DISCRETE MATHEMATICS	L	T	P	C
		3	0	0	3

Course Objectives:

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

UNIT – I Mathematical Logic

Propositions–Connectives–Tautologyandcontradiction–Equivalenceofprepositions–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–Specialsimplegraphs–Matrixrepresentationofgraphs–Pathcyclesand 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. VenkataramanMK,“DiscreteMathematics”,TheNationalPublishingCompany, 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	-	-

25AIPC402	**OBJECT ORIENTED PROGRAMMING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

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

UNIT – I Introduction

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

UNIT – II Member Functions and Overloading

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

UNIT – III Inheritance

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

UNIT – IV OOP in Java

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

UNIT – V Threads

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

Text Books:

1. Robert Lafore, "Object -Oriented Programming in C++", Sams Publication, 4th edition, 2002.
2. Balaguruswamy. E, "Programming with Java", Tat McGraw- Hill Publication, 5th edition, 2014.

References:

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

Course Outcomes:

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

1. Understand the basic concepts of Object-oriented programming, data hiding, class and object concepts.
2. Apply the concept of argument passing through function, operator overloading, function overloading, constructor and destructor function.
3. Construct C++ program using inheritance concepts and virtual function.
4. Develop Java applications using constructors, method access specifiers, Packages and Interfaces.
5. Build Java applications using multithreading and exception handling concepts.

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	-	-	-	-	-	-	-	-	-	-	3	3	-
CO2	2	2	1	-	-	-	-	-	-	-	-	3	3	-
CO3	2	2	2	1	-	-	-	-	-	-	-	3	3	
CO4	2	2	2	2	-	-	-	-	-	-	-	3	3	-
CO5	2	2	3	3	-	-	-	-	-	-	-	3	3	-

25AIPC403	**OPERATING SYSTEM**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To explain the basic concepts of operating system and perform Case study on UNIX and WINDOWS Operating System.
- To introduce the concepts of process, Threads and process scheduling.
- To teach the concepts of Critical Section, semaphores, IPC and deadlocks.
- To describe memory management techniques.

- To provide an overview of I/O hardware, I/O software, file managements and directories management.

UNIT – I INTRODUCTION

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

UNIT – II PROCESSES

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

UNIT – III PROCESS SYNCHRONIZATION

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

UNIT – IV MEMORY MANAGEMENT

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

UNIT – V FILE MANAGEMENT

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

Text Books:

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

References:

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

Course Outcomes:

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

1. Understand functional architecture of operating systems and file systems.

2. Analyze various algorithms for CPU Scheduling.
3. Implement programs on multi-threading libraries for an OS.
4. Explore application programs using system calls.
5. 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	-

25AIPC404	**DATABASE MANAGEMENT SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

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

UNIT – I INTRODUCTION TO DATABASE SYSTEMS

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

UNIT – II RELATIONAL MODEL

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

UNIT – III RELATIONAL DATABASE DESIGN

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

UNIT – IV TRANSACTIONS AND RECOVERY

Transaction Processing – Concepts and States – Need for Concurrency Control and Recovery– ACID Properties – Implementation of Atomicity and Durability – Schedules and Serializability – Concurrency Control Techniques: Lock-Based Protocols, Timestamp-Based protocols – Deadlock Handling – Recovery Techniques: Log Based Recovery, Shadow Paging, ARIES Recovery Algorithm.

UNIT – V QUERY PROCESSING AND ADVANCED CONCEPTS

Query Processing Overview – Estimation of Query Processing Cost – Query Processing and Optimization – File Structures : Heap, Sorted, Hashed – Indexing: Single-level, Multi-level, B-Trees

and B+ trees – Sorting and Joins – Introduction to Spatial and Temporal Databases, OO Databases, Distributed Databases, NoSQL.

Text Books:

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

References:

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

Course Outcomes:

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

1. Design ER and EER diagrams and map them to relational schemas.
2. Develop and execute complex SQL queries for data retrieval and manipulation.
3. Apply normalization techniques to design efficient relational schemas.
4. Describe concurrency issues and recovery mechanisms.
5. Analyze query processing cost and describe database storage structures and indexing techniques.

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	–	–	–	–	–	–	–	–	–	1	2	–
CO2	2	2	3	–	–	–	–	–	–	–	–	3	2	–
CO3	2	2	3	–	–	–	–	–	–	–	–	2	3	–
CO4	2	3	2	–	–	–	–	–	–	–	–	1	3	–
CO5	2	2	–	–	–	–	–	–	–	–	–	1	2	–

25AIPC405	**FUNDAMENTALS OF MACHINE LEARNING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce fundamentals of machine learning, regression and normal densities.
- To provide in-depth knowledge about the classification algorithms used in machine learning.
- To understand the clustering algorithms and methods of reducing the dimension of feature vectors.
- To familiarize the different deep learning architectures
- To understand the methods of combining evidence from two or more machine learning techniques.

UNIT – I Linear and Logistic Regression and Normal Distribution

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

UNIT – II Classification Algorithms

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

UNIT – III Component Analysis and Clustering Algorithms

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

UNIT – IV Deep Learning Architectures and Applications

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

UNIT – V Combining Multiple Learners

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

Text Books:

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

References:

1. Ethem Alpaydin, Introduction to Machine Learning, 3rd 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, NewYork, 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	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

25AIPC406	NEURAL AND FUZZY COMPUTING IN AI	L	T	P	C
		3	0	0	3

Course Objectives:

- To provide learning concepts of neural networks in the engineering perspective.
- To offer various design concepts of neural network architectures.
- To teach the application of neural networks in solving AI problems.
- To define fuzzy sets and relations.
- To utilize fuzzy systems to solve real world problems.

UNIT – I Introduction to Neural Networks and Learning Methods

Models of a Neuron – Neural Networks Viewed as Directed Graphs – Feedback – Network Architectures – Knowledge Representation – Artificial Intelligence and Neural Networks – Error-Correction Learning – Memory-Based Learning – Hebbian Learning – Competitive Learning – Boltzmann Learning.

UNIT – II Supervised Learning Networks

Perceptron – Perceptron Convergence Theorem – Adaline – Madaline - Back Propagation Algorithm – XOR Problem – Regularization Networks – Generalized Radial-Basis Function Networks - Optimal Hyperplane for Linearly Separable Patterns - Optimal Hyperplane for Non-separable Patterns – Support Vector Machine for Pattern Recognition – XOR Problem- Support Vector Machines for Nonlinear Regression.

UNIT – III Associative and Unsupervised Learning Networks

Associative Memory Networks – Auto Associative Memory Networks– Hetero Associative Memory Networks – Hopfield Networks - Self-Organizing Maps – Properties of Feature Maps - Learning Vector Quantization.

UNIT – IV Fuzzy Systems

Utility of Fuzzy Systems – Limitations of Fuzzy Systems – Uncertainty and Information – Fuzzy Sets and Membership – Classical Sets – Fuzzy Sets – Crisp Relations – Fuzzy Relations- Tolerance and Equivalence Relations – Fuzzy Tolerance and Equivalence Relations – Value Assignments.

UNIT – V Fuzzification and Defuzzification

Features of the Membership Function – Fuzzification – Defuzzification to Crisp Sets – λ-Cuts for Fuzzy Relations – Defuzzification to Scalars – Logic and Fuzzy Systems.

Text Books:

1. Simon Haykin, "Neural Networks – A Comprehensive Foundation", 2nd edition, Pearson Prentice Hall, 2005.
2. S. N. Sivanandam and S. N .Deepa, "Principles of Soft Computing", 2nd Edition, Wiley India Pvt Ltd, 2011.
3. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", 3rd Edition, John Wiley & Sons Ltd, 2010.

References:

1. Raul Rojas, "Neural Networks: A Systematic Introduction", Springer Science & Business Media, 2013.
2. Alianna J. Maren, Craig T. Harston, Robert M. Pap, "Handbook of Neural Computing Applications", Academic Press, 2014.
3. Robert Fuller, "Introduction to Neuro-Fuzzy Systems", Springer Science & BusinessMedia, 2013.
4. James J. Buckley, Esfandiar Eslami, "An Introduction to Fuzzy Logic and Fuzzy Sets", Springer Science & Business Media, 2013.

Course Outcomes:

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

1. Understand several learning methods in neural networks.
2. Know various categories of neural networks and their architectures.
3. Apply neural networks in solving AI problems.
4. Compare fuzzy systems with classical systems and apply fuzzy systems in various application areas.
5. Use fuzzy systems to interpret a natural 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	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	1	-	1	-	-	-	-	-	-	-	-	1	-	-
CO3	1	1	2	2	-	-	-	-	-	-	-	1	1	2
CO4	1	-	-	-	-	-	-	-	-	-	-	1	1	-
CO5	1	1	2	2	1	-	-	-	-	-	-	1	1	2

25AICP408	**OPERATING SYSTEMS AND DATABASE MANAGEMENT SYSTEMS LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives:

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

LIST OF EXERCISES

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

Course Outcomes:

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

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

25AICP409	**MACHINE LEARNING LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives:

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

LIST OF EXERCISES

1. Linear and logistic regression with error estimation
2. Implementation of univariate and multivariate Gaussian densities
3. Dimensionality reduction using principal component analysis (PCA)

4. Clustering using
   i. k-means
   ii. Gaussian mixture modeling (GMM)
5. Classification using
   i. Back propagation neural network (BPNN)
   ii. 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 usingPython.
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

25AIPC501	**IMAGE AND SPEECH PROCESSING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand the foundation of image processing systems and perception.
- To analyze the improvement of image appearances using pixel level operations.
- To describe the processing of working with image compression and separating image regions.
- To understand the fundamentals of signals and speech production,
- To expose the frequency analysis and solve the real time problems of speech processing.

UNIT – I Digital Image Processing

Image categories – Steps in Digital Image Processing – Components of an Image Processing system. Digital image fundamentals: Elements of visual perception – Electromagnetic spectrum – Image sensing and acquisition – Image Sampling and Quantization – Basic relationship between Pixels.

UNIT – II Image Enhancement in Spatial Domain

Basic Gray Level transformations – Histogram Processing – Enhancement using Arithmetic and Logic operations – Spatial filtering – Smoothing spatial filters – Sharpening spatial filters – Combining spatial enhancement methods.

UNIT – III Color Image Processing and Segmentation

Color fundamentals – Color models – Pseudo color image processing. Image Segmentation: Detection of Discontinuities – Edge Linking and Boundary Detection – Use of motion in Segmentation. Basis of wavelet transforms – Lossless and Lossy Compression techniques.

UNIT – IV Fundamentals of Digital Speech Processing

Discrete-time signals and systems – Sampling speech signals - Transform representation of signals and systems. Speech production mechanism – Acoustic phonetics. Time-Domain models for Speech Processing: Time-Dependent processing of speech – Short-Time Energy and Average Magnitude – Short-Time Average Zero-Crossing Rate – Speech Vs. Silence Discrimination – Pitch Period Estimation – Short-Time Autocorrelation Function.

UNIT – V Short-Time Fourier Analysis

Fourier Transform of speech signal - Linear Predictive Coding of speech: Linear Predictive Analysis – Computation of Gain – Durbin's Recursive solution. Man-Machine communication: Voice-Response systems – Speaker Recognition systems – Speech Recognition systems.

Text Books:

1. R.C. Gonzalez and Rafael. C. Woods, Richard E, Digital image processing, Fourth edition, Pearson education, 2018.
2. L. R. Rabiner and R.W. Schafer, Digital processing of speech signals, Prentice Hall publications, 1978.
3. L. R. Rabiner and R.W. Schafer, Digital processing of speech signals, Paperback, Pearson Education, First edition, 2003.

References:

1. Lizhe Tan Jean Jiang, "Digital Signal Processing: Fundamentals and Applications", Third edition, Academic Press, 9th November 2018.
2. D.O'Shaughnessy, "Speech Communications - Human and machine", Second edition, University press (India), 2001.
3. L. Rabiner and B.H. Juang, "Fundamentals of speech recognition", Pearson education, 2003.
4. A.K. Jain," Fundamentals of Digital Image Processing", Prentice-Hall of India, New Delhi, 2001.
5. Anil K. Jain, "Fundamentals of Digital Image Processing", Pearson Publications, 2015.

Course Outcomes:

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

1. Understand the fundamentals of image processing and relationship between pixels.
2. Implement image enhancement techniques on real time images.
3. Utilize image compression and segmentation techniques in Image applications.
4. Discuss the fundamentals of speech and processing of speech signals in time domain.
5. Solve the real time problems in speech including Speech Recognition and Speaker Verification systems.

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

25AIPC502	**COMPUTER NETWORKS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

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

UNIT – I Data Communication Components

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

UNIT – II Data Link Layer and Medium Access Sub Layer

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

UNIT – III Network Layer

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

UNIT – IV Transport Layer

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

UNIT – V Application Layer

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

Text Books:

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

Edition, Morgan Kaufmann, 2021.

References:

1. Nader F. Mir, "Computer and Communication Networks", 3rd Edition, Wiley, 2021.
2. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", 5th Edition, Morgan Kaufmann Publishers Inc., 2012.
3. William Stallings, "Data and Computer Communications", 10th Edition, Pearson Education, 2013.
4. Nader F. Mir, "Computer and Communication Networks", 2nd Edition, Prentice Hall, 2014.
5. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill Publisher, 2011.
6. James F. Kurose, Keith W. Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", 6th Edition, Pearson Education, 2013.

Course Outcomes:

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

1. Understand the functions of layering and protocols.
2. Explain the devices, protocols, and standards used to design a network.
3. Construct and implement the concept of switching and routing.
4. Apply appropriate protocols and techniques related to the transport layer in order to maintain consistent flow of information.
5. Demonstrate the functions of electronic mail, HTTP, DNS and SNMP.

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO3	3	1	3	2	-	-	-	-	-	-	-	1	-	-
CO4	3	1	3	2	-	-	-	-	-	-	-	1	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	1	-	-

25AIPC503	**DEEP LEARNING FOR VISUAL COMPUTING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To educate students on the mathematical and machine learning basics of deep learning for Visual Computing.
- To understand the knowledge about deep learning.
- To familiarize students with various deep learning Visual Computing tools namely Python, TensorFlow, Scala, PyTorch, etc.
- To prepare the test environment for deep learning of Visual Computing.
- To teach geometric and radiometric visual computing.

UNIT – I Applied Math and Machine Learning Basics

Linear algebra - Probability and Information theory - Numerical computation - Machine Learning basics - Modern Practical Deep Networks - Deep Feedforward Networks - Regularization for Deep

Learning - Optimization for training Deep Models - Convolutional Networks - Sequence Modeling: Recurrent and Recursive Nets - Practical Methodology - Applications.

UNIT – II Deep Learning Research

Linear Factor Models - Autoencoders - Representation Learning - Structured Probabilistic Models for Deep Learning - Monte Carlo methods - Confronting the partition function - Approximate inference - Deep Generative Models.

UNIT – III Fundamentals of Image Based Visual Computing

Data - Visualization - Discretization - Representation - Noise - Techniques - Interpolation-Geometric Intersections Convolution - Linear systems - Linear filters - Implementation details - Spectral analysis - Discrete Fourier Transform - Polar Notation - Periodicity of frequency domain - Aliasing - Extension for 2D Interpretation - Duality - Feature detection - Edge detection - Feature detection - Other non-linear filters.

UNIT – IV Geometric Visual Computing

Geometric Transformations - Homogeneous coordinates - Linear Transformations - Euclidean and Affine Transformations - Concatenation of Transformations - Coordinate systems - Properties of concatenation - Projective Transformation - Degrees of freedom - Non-Linear Transformations. The Pinhole Camera - The Model - Considerations in the practical camera - Epipolar geometry - Background - Correspondences in Multi-View geometry - Fundamental matrix - Essential matrix - Rectification - Applying Epipolar geometry.

UNIT – V Radiometric Visual Computing

Light - Radiometry - Photometry and color - Color reproduction - Modeling additive color mixtures - Color management - Modeling Subtractive Color Mixture - Limitations - Photometric processing - Histogram processing - Image composition - Photometric stereo visual content synthesis - The Diverse Domain - Modeling - Processing – Rendering - Application - Interactive Graphics pipeline - Geometric Transformation of Vertices - Clipping and Vertex Interpolation of Attributes - Rasterization and Pixel Interpolation of Attributes - Realism and Performance - Illumination - Shading - Shadows - Texture mapping - Bump Mapping - Environment mapping - Transparency - Accumulation buffer - Back Face Culling - Visibility Culling - Graphics programming - Development of Graphics Processing Unit - Development of Graphics APIs and libraries - The Modern GPU and CUDA.

Text Books:

1. Aditi Majumder, M. Gopi, “Introduction to Visual Computing: Core Concepts in Computer Vision, Graphics, and Image Processing”, CRC Press, First Edition, 2018.
2. Ian Good fellow, Yoshua Bengio and Aaron Courville, “Deep Learning”, MIT Press, First Edition, 2016.

References:

1. Jon Krohn, Beyleveld Grant and Bassens Aglaé, “Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence”, Addison-wesley, First Edition, 2019.
2. Hyatt Saleh, “Applied Deep Learning with PyTorch, Packt”, First Edition, 2019.
3. Pradeep Pujari, Md. and Rezaul Karim, Mohit Sewak, “Practical Convolutional Neural Networks”, Packt Publishing, First Edition, February2018.
4. Ragav Venkatesan and Baoxin Li, “Convolutional Neural Networks in Visual Computing(Data-Enabled Engineering)”, CRC Press, First Edition, September 2017.

Course Outcomes:

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

1. Understand Deep learning for Visual Computing and able to setup development environment.
2. Implement image classification and learning.
3. Investigate object detection and implement convolutional neural network autoencoding.

4. Understand Geometric visual computing.
5. Familiarize students with radiometric visual computing.

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

25AIPC504	**INTERNET OF THINGS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce the fundamentals of Internet of Things.
- To expose 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, Mark Harrison, Florian Michahelles, "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, 2017.
3. Honbo Zhou,"The Internet of Things in the Cloud: A Middleware Perspective",CRC Press 2013.

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

25AICP507	**DEEP LEARNING TOOLS LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives:

- To practice creating and manipulating tensors using TensorFlow.
- To familiarize students with Applied Deep Learning using PyTorch and Character-Level RNN.
- To implement applications for Artificial Intelligence in the Scala programming language.

LIST OF EXERCISES

19. Introduction to Tensor Flow.
20. Learning about Features and Outliers.
21. Working with Training Sets and Test Sets.
22. Scala program to demonstrate example of collection list and for loop.
23. Appending and merging Lists using scala.
24. Scala List class and pattern matching.
25. L2 Regularization and Correlated Features.
26. Classifying Names with a Character-Level RNN.
27. Generating Shakespeare with a Character-Level RNN.

Course Outcomes:

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

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

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

25AICP508	**INTERNET OF THINGS LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives:

- To understand the the basic features of Arduino and Raspberry Pi.
- To explore 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 a Program to Blink an RGB LED in a sequence in Arduino.
2. Write a Program to Interface LED(RGB) with Arduino.
3. Write a 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	-	-	-	-	-	-	-	-	2
CO2	2	2	-	-	1	-	-	-	-	-	-	-	-	2
CO3	2	2	-	-	1	-	-	-	-	-	1	-	-	2

25AIPC601	**RECOMMENDER SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To educate students understand the significance of recommender systems and the principles of neighbourhood-based collaborative filtering.
- To acquire the knowledge of content-based recommender systems and Knowledge based recommendations.
- To expose the importance of designing the hybrid recommender systems.
- To familiarize on recommender system, and various attacks on collaborative recommender systems.
- To build the online consumer decision making for the next-generation web recommendations in the ubiquitous environments.

UNIT – I Introduction to Recommender Systems & Collaborative Recommendation

Introduction to Recommender Systems: Goals of Recommender Systems – Basic Models of Recommender Systems – Domain Specific Challenges in Recommender Systems – Advanced topics and applications. Collaborative recommendation: User-based nearest neighbor recommendation – Item-based nearest neighbor recommendation - About ratings - Further model-based and pre-processing based approaches - Recent practical approaches and systems.

UNIT – II Content-Based and Knowledge-Based Recommendation

Content-based recommendation: Content representation and content similarity - Similarity- based retrieval - Other text classification methods. Knowledge-based recommendation: Introduction - Knowledge representation and reasoning - Interacting with constraint-based recommenders - Interacting with case-based recommenders - Example applications.

UNIT – III Hybrid Recommendation Approaches and Explanations

Hybrid recommendation approaches: Opportunities for hybridization – Monolithic hybridization design - Parallelized hybridization design - Pipelined hybridization design. Explanations in recommender systems: Introduction - Explanations in constraint-based recommenders - Explanations in case-based recommenders - Explanations in collaborative filtering recommenders.

UNIT – IV Evaluation of Recommender Systems and Security Attacks on Collaborative Filtering

Evaluating recommender systems: Introduction - General properties of evaluation research - Popular evaluation designs - Evaluation on historical datasets – Alternate evaluation designs. Case study: Personalized game recommendations on the mobile Internet: Application and personalization overview - Algorithms and ratings – Evaluation. Attacks on collaborative recommender systems: A first example - Attack dimensions - Attack types - Evaluation of effectiveness and counter measures – Counter measures - Privacy aspects – distributed collaborative filtering.

UNIT – V Online Consumer Decision Making and Recommendations in Ubiquitous Environments

Online consumer decision making: Introduction - Context effects - Primacy/recency effects - Further effects - Personality and social psychology. Recommender systems and the next-generation web: Trust-aware recommender systems - Folksonomies and more - Ontological filtering - Extracting semantics from the web. Recommendations in ubiquitous environments: Introduction - Context-aware recommendation - Application domains.

Text Books:

1. Charu C. Agarwal, "Recommender Systems: The Textbook", Springer, 2016.
2. Dietmar Jannach, Markus Zanker, Alexander FelFernig, Gerhard Friedrich, "Recommender Systems: An Introduction", Cambridge University Press, First Edition, 2011.

References:

1. Manouselis N., Drachsler H., Verbert K., Duval E., "Recommender Systems For Learning", Springer, First Edition, 2013.
2. Ricci F., Rokach L., Shapira D., Kantor B.P., "Recommender Systems Handbook", Springer, First Edition, 2011.
3. Gerald Kembellec, Ghislaine Chartron, Imad Saleh, "Recommender Systems (Information Systems, Web and Pervasive Computing)", First Edition, ISTE Ltd, 2014.
4. Kim Falk, "Practical Recommender Systems", First Edition, Manning Publications, 2019.

Course Outcomes:

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

1. Understand the concept of recommender systems along with neighborhood-based collaborative systems.
2. Illustrate the knowledge of content based recommender systems and Knowledge based recommendation.
3. Acquire the importance of designing the hybrid recommender systems.
4. Evaluate the recommender system, and various attacks on collaborative recommender systems.
5. Develop the online consumer decision making for the next-generation web recommendations in ubiquitous environments.

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

25AIPC602	DATA ANALYTICS WITH R	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the basic concepts of Univariate, Multivariate data and relationships between two variables.
- To acquire Null hypothesis and Alternative hypothesis significance testing for two means and more than two means.
- To understand the different types of Bayesian methods and its independent samples t-test.
- To analyze the predictive analysis by various regression statistical methods.
- To investigate 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. Acquire the knowledge about the data and its relationship by applying various statistical methods.
2. Develop 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. Implement 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	-	-
CO2	2	2	1	-	2	-	-	-	-	-	2	3	-	-
CO3	1	-	1	-	2	-	-	-	-	-	-	3	-	-
CO4	3	2	2	2	-	1	-	-	-	-	-	3	-	-
CO5	2	2	1	2	1	-	-	-	-	-	1	3	-	-

25AIHS603	**BUSINESS MANAGEMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

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

UNIT – I Introduction to Business Management

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

UNIT – II Planning

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

UNIT – III Decision Making

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

UNIT – IV Motivation

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

UNIT – V Controlling

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

Text Books:

1. Harold Kootnz, HeinzWeihrich and Mark V Cannice, "Essentials of Management", Eleventh Edition, McGraw Hill Education, 2020.
2. Stoner, Freeman and Gilbert, "Management", Sixth Edition, Pearson, 2018.

References:

1. L M Prasad, "Principles and practice of Management", Tenth Edition, Educational Publishers, 2020.
2. Newman, Summer and Warren, " The Process of Management", Fourth Edition, Prentice Hall, 2015.

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

25AICP607	RECOMMENDER SYSTEMS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To understand the foundational concepts and types of recommender systems.
- To gain hands-on experience implementing collaborative and content-based recommenders.
- To apply matrix factorization and deep learning techniques for recommendation tasks.

LIST OF EXERCISES

1. Introduction to Recommender Systems
2. Popularity-Based Recommendation
3. User-Based Collaborative Filtering (UBCF)
4. Item-Based Collaborative Filtering (IBCF)
5. Matrix Factorization (SVD)
6. Content-Based Filtering
7. Hybrid Recommender Systems
8. Implicit Feedback Recommendation
9. Deep Learning for Recommender Systems
10. Evaluation and Metrics

Course Outcomes:

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

1. Describe the key principles and algorithms used in recommender systems.
2. Implement user-based, item-based, and content-based recommendation models using Python.
3. Utilize matrix factorization and deep learning models for personalized recommendations.

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

25AICP608	DATA ANALYTICS WITH R LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To introduce 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. Write an R program to compute Interquartile Range (IQR) for
   a) User data. b) Sepal Length of Iris data.
5. Write an R program to generate Frequency Distributions of MT Car's Carburettors and Air Quality's Temperatures from its Data Sets.
6. a) Write an R program to construct Univariate Normal Density and to predict whether a person is adult or not based on height.
   b) Write an R program to construct Multivariate Normal Density and to predict whether a person is adult or not based on height and weight
7. Write an 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 an R program to analyze the Linear and Nonlinear Relationship between the Continuous Variables of Iris Data Using Multiple Correlation coefficients.
9. Write an R program to analyze Baye's Rule and to predict whether A person is male or Female.
10. Write an R program to find prediction of rainfall using sample mean and population with US Precipitation cities data.
11. Write an 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 an R program to predict the mileage of car based on weight of car using Simple Linear Regression Model.
13. Write an 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 an R program to construct Simple Decision Tree and to classify motor vehicles into motorcycles, golf carts, or sedans.
15. Write an R program to classify observations as being positive or negative for diabetes using Random Forest Tree.
16. Write an 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	-	1	-	-	-	-	-	-	-	3
CO2	2	2	1	2	1	-	-	-	-	-	2	-	-	3
CO3	3	2	2	2	-	1	-	-	-	-	-	-	-	3

25AIES701	RESEARCH METHODOLOGY	L	T	P	C
		3	0	0	2

Course Objectives:

- To introduce the fundamentals of research and its importance in engineering and technology.
- To develop the ability to review existing literature and identify research gaps and problems.
- To educate the students to design and conduct research, including data collection and sampling techniques.
- To enable students to analyze data statistically and interpret research findings effectively.
- To train students in research documentation, technical writing, and understanding intellectual property rights and publication ethics.

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 pre-processing, 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”, Fourth Edition, New Age International, 2019.
2. Ranjit Kumar, “Research Methodology: A Step-by-Step Guide for Beginners”, Fifth Edition, SAGE Publications, 2019.
3. John W. Creswell and J. David Creswell, “Research Design: Qualitative, Quantitative, and Mixed Methods Approaches”, Fifth Edition., SAGE Publications, 2018.

References:

1. Leedy, P.D., and Ormrod, J.E., “Practical Research: Planning and Design”, Eleventh Edition, Pearson, 2016.
2. Greenfield, T., and Greener, S., “Research Methods for Postgraduates”, Third Edition, Wiley, 2016.

3. Montgomery, D.C., "Design and Analysis of Experiments", Ninth Edition, Wiley, 2017.
4. Cohen, L., Manion, L., & Morrison, K., "Research Methods in Education", Eighth Edition, Routledge, 2017.
5. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets", Fifth edition, 2017.

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

25AIPC702	EVOLUTIONARY OPTIMIZATION ALGORITHMS	L	T	P	C
		3	0	0	3

Course Objectives:

- Understand the fundamentals of optimization and evolutionary algorithm paradigms.
- Design and implement Genetic Algorithms for solving optimization problems.
- Apply PSO and understand swarm-based techniques for optimization.
- Analyze and apply various evolutionary algorithms in practical scenarios.
- Utilize evolutionary tools for application development and understand ethical considerations.

UNIT – I Introduction to Optimization and Evolutionary Algorithms

Basic concepts of optimization: Types, constraints, objective functions - Introduction to evolutionary algorithms (EAs) - Differences between deterministic and stochastic methods - Nature-inspired algorithms overview.

UNIT – II Genetic Algorithms

Working principles of Genetic Algorithms (GA) - Selection, crossover, mutation techniques - Fitness evaluation and scaling - Applications of GA in engineering and real-world problems.

UNIT – III Swarm Intelligence and Particle Swarm Optimization

Swarm Intelligence concepts - Particle Swarm Optimization (PSO): Algorithm, variants, parameters - Comparison with other metaheuristics - Case studies using PSO.

UNIT – IV Evolutionary Algorithms

Ant Colony Optimization (ACO), Differential Evolution (DE) - Simulated Annealing, Artificial Bee Colony (ABC) - Comparison of performance metrics among EAs - Hybrid algorithms and memetic algorithms.

UNIT – V Constrained Optimization

Penalty function approaches - Ranking candidate solutions - Pareto optimality - Goals of multi-objective optimization- Non-Pareto based evolutionary algorithms- Pareto-based evolutionary algorithms- Multi-objective biogeography-based optimization.

Text Books:

1. Aboul Ella Hassanien, Eid Emary,"Swarm Intelligence Principles, Advances, and Applications", CRC press, 2020.
2. Kalyanmoy Deb, Erick goodman, "Evolutionary Multi Criterion Optimization", Springer, 2019.

References:

1. Sivanandam, S.N., and Deepa, S.N, "Introduction to Genetic Algorithms", Springer, 2013.
2. Kalyanmoy Deb, "Optimization for Engineering Design: Algorithms and Examples", Prentice Hall, 2014.
3. Slim Bechikh, Ritupama Datta, "Recent Advances in Evolutionary Multi objective Optimization Algorithms", Springer, 2017.Publications, 2015.

Course Outcomes:

At the end of course the students will be able to

1. Expose the core principles of optimization and evolutionary computation techniques.
2. Develop and apply Genetic Algorithms to address complex optimization tasks.
3. Apply Particle Swarm Optimization and interpret the dynamics of swarm intelligence methods.
4. Investigate evolutionary strategies for solving real-world optimization problems.
5. Practice evolutionary computation tools in application development with awareness of ethical practices.

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

25AIPC703	**AI IN CYBER SECURITY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To apply core knowledge of AI concepts and tools.
- To analyze a problem, identify and detect cyber security threats with AI.
- To identify network anomaly and Authentication abuse Prevention

- To investigate the frauds Detection with GANs.
- To expose AI arsenal and to prevent authentication abuse.

UNIT – I AI Core Concepts and Tools

Applying AI in cyber security: Evolution in AI-Types of machine learning-algorithm training and optimization-Know Python's libraries. Python for AI and cyber security-Python libraries for cyber security-enter Anaconda-playing with Jupyter notebooks-Installing DL libraries.

UNIT – II Detecting cyber security threats with AI

Detecting email cyber security threats with AI: Detecting spam with perceptrons-spam detection with SVM-Phishing detection with logistic regression and decision trees-spam detection with Naïve Bayes-NLP to the rescue. Malware threat detection: Malware analysis at a glance-telling different malware families apart-Decision tree malware detectors-detecting metamorphic malware with HMM-advanced malware detection with deep learning.

UNIT – III Network anomaly detection with AI and authentication abuse prevention

Network anomaly detection techniques-classifying network attacks-detecting botnet topology- ML algorithms for botnet detection. Securing user authentication: Authentication abuse prevention-account reputation scoring-user authentication with keystroke recognition- biometric authentication with facial recognition.

UNIT – IV Fraud prevention and GANs

Fraud detection algorithms-predictive analytics for credit card fraud detection-IBM Watson cloud solution-importing sample data in the cloud-evaluating quality of our predictions. GANS in a nutshell-GAN Python tools and libraries-network attack via model substitution- IDS evasion via GAN-facial recognition attacks with GAN.

UNIT – V Evaluating and testing AI Arsenal

Best practices of feature engineering-evaluating a detector's performance with ROC-split data to training and test sets-using cross validation for algorithms. Assessing AI arsenal: Evading ML detectors-challenging ML anomaly detection-testing for data and model quality-ensuring security and reliability.

Text Books:

1. Alessandro Parisi, Hands on Artificial Intelligence for Cyber security, Packt Publishing Ltd., 2019.
2. Jack Caravelli and Nigel Jones, Cyber security-Threats and responses for government and business, Praeger security international, First Edition, 2019.

References:

1. Brij B. Gupta, Michael Sheng, Machine learning for computers and cyber security, CRC Press, First Edition, 2019.
2. Clarence Chio, David freeman, Machine Learning and Security, O'Reilly, First Edition ,2018.
3. Soma Halder and Sinan Ozademir, Machine Learning for Cybersecurity, Packt publishing, 2018.
4. Ted Coombs, Artificial Intelligence and Cybersecurity for dummies, IBM Limitec Edition, John Wiley & Sons, 2018.

Course Outcomes:

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

1. Understand the basic concepts of AI and the necessary tools for cyber security.
2. Detect cyber security threats in AI.
3. Understand the fundamentals of Network anomaly detection with AI and authentication abuse prevention.
4. Demonstrate working knowledge fraud prevention with cloud AI solutions.

5. Develop algorithms and to test AI arsenal.

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

25AICP707	**EVOLUTIONARY OPTIMIZATION ALGORITHMS LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives:

- To understand and classify the fundamental concepts and types of optimization problems.
- To apply Genetic Algorithms and implement Particle Swarm Optimization, and other evolutionary techniques to solve real-world problems.
- To analyze and evaluate the performance of optimization algorithms using appropriate simulation tools

LIST OF EXERCISES

1. **Introduction to Optimization Problems**
   Implement basic mathematical optimization problems using Python/MATLAB.
2. **Genetic Algorithm – One Variable Optimization**
   Design and implement a GA to optimize a single-variable objective function.
3. **Genetic Algorithm – Multi-Variable Optimization**
   Extend the GA for optimization of multi-variable continuous functions.
4. **Genetic Algorithm – Parameter Tuning**
   Study the effects of mutation and crossover rates on GA performance.
5. **Binary Coded Genetic Algorithm**
   Implement binary-coded GA for discrete optimization problems.
6. **Particle Swarm Optimization (PSO)**
   Develop and test PSO on benchmark optimization functions.
7. **Comparison of GA and PSO**
   Compare GA and PSO performance metrics on a common problem.
8. **Ant Colony Optimization (ACO)**
   Implement ACO for solving path optimization problems (e.g., TSP).
9. **Differential Evolution Algorithm (DE)**
   Apply DE algorithm to solve engineering design problems.
10. **Hybrid Evolutionary Algorithm**
    Design a hybrid EA by combining GA with local search methods.
11. **Real-World Optimization Case Study**
    Solve a practical optimization problem using any evolutionary algorithm

Course Outcomes:

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

1. Identify and differentiate between SPAM and HAM emails.
2. Evaluate and determine the strength of passwords.

3. Authenticate user rights and classify different types of malware threats.

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

25AICP708	**AI IN CYBER SECURITY LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives:

- To educate how to Identify spam and SMS using AI and ML Algorithms.
- To practice how to Authenticate keystroke dynamics using GAN.
- To identify strong Password using Ml Algorithms

LIST OF EXERCISES

1. Email spam classification using NLP
2. Phishing detection using Decision Tree
3. Malware Classification Using Decision Tree and Random Forest
4. MI Algorithm for Botnet Detection Using Gaussian
5. Keystroke Dynamics for user Authentication using AI
6. Keystroke Dynamics for user Authentication using GAN
7. Face Recognition for Access Control
8. URL Classification using AI to Identify Malicious URL
9. Detect Strong and weak Password
10. Spam SMS Detection using MI

Course Outcomes:

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

1. To identify SPAM and HAM Email.
2. To Detect whether password is strong or not.
3. To authenticate rights and classify the malware threats.

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

PROFESSIONAL ELECTIVES

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

Course Objectives:

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

UNIT – I Applets and Abstract Window Toolkit (AWT)

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

UNIT – II Network and Database Programming

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

UNIT – III Swing and Beans

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

UNIT – IV Applications in Distributed Environment

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

UNIT – V Spring Framework and Hibernate Framework

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

Text Books:

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

References:

1. D.T. Editorial Services “Java 8 Programming Black Book”, Wiley, 2015.
2. Santosh Kumar K, “Spring and Hibernate”, Mc.Graw Hill Education, 2nd Edition, 2013.

3. George Reese, "Database Programming with JDBC and Java", O'Reilly Media Publication, 2nd Edition, 2000.

Course Outcomes:

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

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

25AIPESCN	**WEB APPLICATION FRAMEWORK**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives

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

UNIT – I Introduction to Web Frameworks

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

UNIT – II Front-end and Server-side Frameworks

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

UNIT – III Working with Databases and ORM

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

UNIT – IV Session Handling, Authentication, and RESTful APIs

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

UNIT – V Deployment, Testing and Performance Optimization

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

Text Books:

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

References:

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

Course Outcomes:

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

1. 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														
COs	**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

25AIPESCN	**OPEN SOURCE PROGRAMMING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

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

UNIT – I Introduction to Open Source

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

UNIT – II LINUX

Linux Installation and Hardware Configuration – Boot Process-The Linux Loader (LILO) - The Grand Unified Bootloader (GRUB) - Dual-Booting Linux and other Operating System - Boot-Time

Kernel Options- X Windows System Configuration-System Administration – Backup and Restore Procedures- Strategies for keeping a Secure Server.

UNIT – III Open Source Database

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

UNIT – IV PHP

Introduction– Variables types in PHP– Understanding data types– Loose typing Testing variable– Changing variables data type– Type casting– Operators and expressions– Operator types– Decisions and loops Strings- Arrays– Functions- Getting information on files– Opening and closing files– Reading and writing to files.

UNIT – V PERL

Perl backgrounder-Perl overview-Perl parsing rules-Variables and Data-Statements and Control structures-Subroutines, Packages and Modules – Error Handling-Working with Files- Introduction to Modern Perl tools.

Text Books:

1. Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, “Linux in a Nutshell”, Sixth
2. Edition, OReilly Media, 2009.
3. Matt Doyle, Beginning PHP 5.3, Wiley Publishing,2013.
4. Tom Christiansen, brian d foy, Larry Wall, Jon Orwant, “Programming Perl”, 4th Edition,
5. 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

25AIPESCN	JAVA FULL STACK DEVELOPMENT	L	T	P	C
		3	0	0	3

Course Objectives:

- To design web pages using HTML & 08S elements.
- To make use of JavaScript for writing programs to perform client-side validation on web applications and utilize Type Script to develop web applications.
- To practice MySQL database and queries.
- To impart knowledge on java servlet to develop dynamic web pages.
- To understand the Java Server Pages for developing web applications

UNIT – I Introduction and Front-End Development

Introduction to Full Stack Development: Definition of Full Stack Web Development Introduction to Web Application Development- Front-End Technologies- Back-End Technologies- Introduction to Back-End Development with Java- Introduction to Model View Controller (MVC)- Introduction to Web Services- Communication Between Front End and Back-End. HTML: Introduction, Basic HTML Elements- Table Elements- Form Elements– Embedded Elements– HTML5 Security– Best Practices– Capstone Project. CSS: Getting Started with CSS3– Selectors– Cascading Order– Typography Box Model– Transformations– Transitions– Animations– Responsive Web Design Security– Capstone Projects.

UNIT – II Scripting Languages

JavaScript: Getting Started with JavaScript– Setting-up the Environment– Identifiers Data Types– Operators– Statements and Expressions– Loops-– Functions– Classes Event Handling– Objects– Iterables – Asynchronous Programming– Modular Programming– Security– Best Practices– Capstone Project. Type Script: Getting Started with Type Script– Type Script Basics– Function– Interface– Class– Modules and Namespaces– Generics– Capstone Project.

UNIT – III Database

MySQL: Introduction to MySQL– Using SQL to Manage Data– Data Types– Stored Programs– Query Optimization– MySQL Programming. JDBC– JDBC Driver– JDBC Interface– Using JDBC with Java Applications.

UNIT – IV Back-End Development using Java Servlets and EJB

Java Servlets: Usage– Servlet Life Cycle– Servlets for World Wide Web– Coding Http Servlet – Servlet Configuration– Servlet Context– Servlet Event Listeners. Enterprise Java Bean: Introduction to Enterprise- Enterprise Bean Architecture- EJB Container– Benefits of Enterprise Bean– Types of Enterprise Bean– Accessing Enterprise Beans– Packaging Enterprise Beans– Java Message Service.

UNIT – V Back-End Development using Java Server Pages

Java Server Pages: JSP Specification– JSP Life Cycle– JSP Syntax and Semantics Comments– JSP Document– JSP Elements– JSP GUI Example– JSP and Servlet Exceptions– Web Application Exception Handling. Case Study: Building a Complete Web Application.

Text Books:

1. Mayur Ramgir, “Full Stack Java Development with Spring MVC, Hibernate, jQuery, and Bootstrap”, Wiley India Pvt. Ltd., 2020.
2. Jon Duckett, “HTML & CSS: Design and Build Websites”, Wiley, 2011.
3. Colin J Ihrig, Adam Bretz, “Full Stack JavaScript Development with MEAN”, SitePoint Pty. Ltd., 2014.
4. Aristeidis Bampakos, Pablo Deeleman, “Learning Angular: A No-nonsense Beginner's Guide to Building Web Applications with Angular 10 and TypeScript”, 3rd Edition, Packt Publishing Ltd., 2020.
5. Paul DuBios, “MySQL”, 4th Edition, Developers Library book, Pearson Education Inc., 2009.

6. Jayson Falkner, Kevin Jones, "Servlets and Java Server Pages- The J2EETM Technology Web Tier" Pearson Education Inc., 2004.

References:

1. https://infyspringboard.onwingspan.com/en/app/toc/lex_17739732834840810000_shared/overview (HTML5).
2. https://infyspringboard.onwingspan.com/en/app/toc/lex_18109698366332810000_shared/overview (Javascript).
3. 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	-	-

25AIPESCN	**NoSQL DATABASES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To describe various NoSQL databases and compare them with relational databases
- To familarise data models.
- To explain the features of document database.
- To introduce the concepts of key- value databases.
- To impart knowledge on column and graph databases.

UNIT – I Introduction to NoSQL

Overview and History of NoSQL Databases - Definition of the Four Types of NoSQL Database - The Value of Relational Databases - Getting at Persistent Data – Concurrency – Integration - Impedance Mismatch - Application and Integration Databases - Attack of the Clusters - The Emergence of NoSQL - Comparison of relational databases to new NoSQL stores – MongoDB – Cassandra – HBASE - Neo4j.

UNIT – II Data Models

RDBMS approach - Challenges NoSQL approach - Key-Value and Document Data Models–Column Family Stores - Aggregate-Oriented Databases -Replication and sharding -MapReduce on databases - Distribution Models - Single Server –Sharding - Master-Slave Replication - Peer-to-Peer Replication - Combining Sharding and Replication.

UNIT – III Document Database

NoSQL Document databases using MongoDB -Introduction to Document Databases - Features Consistency - Transactions, Availability - Query Features – Scaling - Document Databases Terminology - Event Logging - Content Management Systems - Blogging Platforms - Web Analytics or Real-Time Analytics - E-Commerce Applications - Designing for Document Databases - Complex Transactions Spanning Different Operations - Queries against Varying Aggregate Structure.

UNIT – IV Key Value Database

NoSQL Key/Value databases using Riak -Introduction to Key-Value Databases -Key- Value Store Features Key value Databases Terminology -Storing Session Information - User Profiles – Preferences - Shopping Cart Data -Relationships among Data - Multioperation Transactions - Query by Data - Operations by Sets -Designing Key value Databases.

UNIT – V Column and Graph Database

Introduction to Column Family Database - Features Column Family Database Terminology - Event Logging - Content Management Systems - Blogging Platforms – Counters - Expiring Usage - Designing for Column Family Databases - Introduction to Graph Databases - Features Consistency – Transactions – Availability - Query Features – Scaling -Graph Database Terminology -Designing for Graph Databases -Connected Data – Routing – Dispatch - Location-Based Services.

Text Books:

1. Dan Sullivan, “NoSQL for Mere Mortals”, Addison – Wesley, Pearson Education, 2015.
2. Pramod J. Sadalage and Martin Fowler, “NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence “, Addison - Wesley, 2012.

References:

1. Luc Perkins, Eric Redmond and Jim R. Wilson, “Seven Database in Seven Weeks : A Guide to Modern Databases and the NoSQL Movement”, The Pragmatic Bookshelf, 1st 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:

1. At the end of this course, the students will be able to
2. Compare NOSQL databases with each other and Relational database Systems.
3. Explain the concepts of Replication, distribution, sharding, and resilience in a NOSQL database.
4. Demonstrate the knowledge of Document Databases.
5. Describe the features of Key- Value databases.
6. 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	-	-	-	-	-	-	2	3	-
CO2	2	1	-	-	1	-	-	-	-	-	-	2	3	-
CO3	2	1	-	-	1	-	-	-	-	-	-	2	3	-
CO4	2	1		-	1	-	-	-	-	-	-	2	3	-
CO5	1	1	-	-	1	-	-	-	-	-	-	2	3	-

25AIPESCN	**DATA MINING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives

- To enable the student to understand the data warehousing component and Multidimensional data model.
- To explain the concepts of Data warehousing Architecture and Implementation
- To describe the methodologies used for data preprocessing
- To teach various techniques used in classification and clustering.
- To expose the concepts of advanced data mining.

UNIT – I Data Warehousing and OLAP

Evolution of Decision Support Systems - Data warehousing Components – Building a Data warehouse - Data Warehouse and DBMS - Data marts – Metadata - Multidimensional data model - OLAP Vs OLTP - OLAP operations - Data cubes - Schemas for Multidimensional Database: Stars, Snowflakes and Fact constellations.

UNIT – II Data Warehouse implementation

Types of OLAP servers- 3 – Tier data warehouse architecture - distributed and virtual data warehouses - Data warehouse implementation - tuning and testing of data warehouse - Data Staging (ETL) Design and Development - data warehouse visualization - Data Warehouse Deployment – Maintenance – Growth - Business Intelligence Overview - Data Warehousing and Business Intelligence Trends - Business Applications - tools- SAS.

UNIT – III Data Mining

Data mining - KDD versus data mining - Stages of the Data Mining Process - task primitives -Data Mining Techniques - Data mining knowledge representation – Data mining query languages - Integration of a Data Mining System with a Data Warehouse – Issues-Data preprocessing – Data cleaning - Data transformation - Feature selection - Dimensionality reduction - Discretization and generating concept hierarchies - Mining frequent patterns – association - correlation.

UNIT – IV Pattern Mining

Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Clustering techniques – Partitioning methods - k-means- Hierarchical Methods – distance based agglomerative and divisible clustering - Density-Based Methods –

expectation maximization - Grid Based Methods – Model-Based Clustering Methods – Constraint – Based Cluster Analysis – Outlier Analysis.

UNIT – V Data Mining Trends

Statistics and Data Analysis – EDA – Small and Big Data – Logistic Regression Model - Ordinary Regression Model - Mining complex data objects – Spatial databases – Temporal databases – Multimedia databases – Time series and sequence data – Text mining – Web mining – Applications in Data mining.

Text Books:

1. Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers, third edition,2011.
2. Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", Tata McGraw Hill Edition, Tenth Reprint,2007.

References:

1. G. K. Gupta, "Introduction to Data Min Data Mining with Case Studies", Prentice Hall of India, Easter Economy Edition,2006.
2. Ian.H.Witten, Eibe Frank and Mark.A.Hall, "Data Mining: Practical Machine Learning Tools and Techniques", Third edition, (Then Morgan Kufmann series in Data Management systems),2011.
3. Bruce Ratner, "Statistical and Machine learning –Learning Data Mining, techniques for better Predictive Modeling and Analysis to Big Data", CRC Press, Second Edition,2011.
4. Mehmed kantardzic, "Data mining concepts, models, methods, and algorithms", Wiley-Interscience, IEEE Press, 2nd Edition,2003.
5. Ian Witten, Eibe Frank, "Data Mining: Practical Machine Learning Tools and Techniques", Morgan Kaufmann, third edition,2011.
6. George M Marakas, "Modern Data Warehousing, Mining and Visualization", Prentice Hall, Second Edition,2003.

Course Outcomes:

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

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

25AIPESCN	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

6. Explain the architecture, components, and standards of mobile communication and computing.
7. Analyze mobile transport protocols and routing strategies in mobile networks.
8. Evaluate the functioning and design of ad hoc and sensor networks.
9. Develop and deploy applications on various mobile platforms with awareness of design constraints.
10. 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	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	3	2	-	2	-	-	-	-	-	-	-	1	-
CO3	2	3	3	2	2	-	-	-	-	-	-	-	2	-
CO4	-	2	3	-	3	-	-	-	-	-	-	-	2	-
CO5	-	2	2	2	3	-	-	-	-	-	-	-	2	-

25AIPESCN	**MOBILE APP DEVELOPMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To demonstrate their understanding of the fundamentals of Android operating systems.
- To develop their skills of using Android software development tools.
- To describe their ability to develop software with reasonable complexity on mobile platform.
- To train students to understand android SDK.
- To teach students to gain a basic understanding of Android application development.

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 the course, the students should be able to

1. 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.

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

25AIPESCN	**5G AND WIRELESS COMMUNICATION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand the evolution, vision, and requirements driving 5G wireless technologies.
- To explore the enabling technologies such as IoT, SDN, NFV, and cognitive radio that support 5G networks.
- To analyze the radio access, architecture, and design aspects of 5G including small cells, cloud-RAN, and spectrum usage.
- To examine the 5G Core Network architecture and key concepts like network slicing, session management, and interworking.
- To evaluate the security, QoS, charging mechanisms, and emerging trends in 5G networks.

UNIT – I Introduction and 5G Vision

Introduction - Evolution of LTE Technology to Beyond 4G - 5G Roadmap - 10 Pillars of 5G - Internet of Things and Context- Awareness - Networking Reconfiguration and Virtualisation Support – Mobility - Quality of Service Control - Emerging Approach for Resource Over-Provisioning.

UNIT – II Enabling Technologies for 5G

The Mobile Cloud - Mobile Cloud Enablers - Network Coding - Cognitive Radio for 5G Wireless Networks - Spectrum Optimisation using Cognitive Radio - Relevant Spectrum Optimisation Literature in 5G - Cognitive Radio and Carrier Aggregation - Energy- Efficient Cognitive Radio Technology - Key Requirements and Challenges for 5G Cognitive Terminals.

UNIT – III 5G Radio Access and Network Architecture

Small Cells - Capacity Limits and Achievable Gains with Densification - Mobile Data Demand - Demand vs Capacity - Small- Cell Challenges - Cooperative Diversity and Relaying Strategies - PHY Layer Impact on MAC Protocol Analysis - SON in UMTS and LTE - Evolution towards Small- Cell Dominant HetNets.

UNIT – IV 5G Core Network Architecture and Concepts

The 5G System Architecture - Network Slicing - Policy control and charging - PDU Session Management and QoS - Interworking with EPC - Mobility Management.

UNIT – V Security, QoS and Future Directions

Network functions and services - Security in 5G - Quality of Service - Selected call flows - Architecture extensions and vertical industries.

Text Books:

1. Jonathan Rodriguez, “Fundamentals of 5G Mobile Networks”, Wiley, First Edition, 2015.
2. Stefan Rommer, Peter Hedman, Magnus Olsson, Lars Frid, Shabnam Sultana, Catherine Mulligan, “5G Core Networks: Powering Digitalization”, Elsevier Science, First Edition, 2019.

References:

1. Afif Osseiran et al., “5G Mobile and Wireless Communications Technology”, Cambridge University Press, First Edition, 2016.
2. Alexander M. Wyglinski, Maziar Nekovee, Y. Thomas Hou, “Cognitive Radio Communications and Networks - Principles and Practice”, Elsevier, First Edition, 2010.
3. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge University Press, First Edition, 2005.

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

25AIPESCN	**COMPUTER VISION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand the fundamental concepts related to Image formation and processing.
- To learn feature detection, matching and detection.
- To become familiar with feature-based alignment and motion estimation.
- To develop skills on 3D reconstruction.
- To understand image-based rendering and recognition.

UNIT – I Introduction to image formation and processing

Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.

UNIT – II Feature detection, matching and segmentation

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.

UNIT – III Feature-based alignment and motion estimation

2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment – Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.

UNIT – IV 3D reconstruction

Shape from X - Active range finding - Surface representations - Point-based representations- Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos.

UNIT – V Image-based rendering and recognition

View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.

Text Books:

1. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer- Textsin Computer Science, Second Edition, 2022.
2. D. A. Forsyth, J. Ponce, “Computer Vision: A Modern Approach”, Pearson Education, Second Edition, 2015.

References:

1. Richard Hartley and Andrew Zisserman, "Multiple View Geometry in Computer Vision", Second Edition, Cambridge University Press, March 2004.
2. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006
3. E. R. Davies, "Computer and Machine Vision", Fourth Edition, Academic Press, 2012.

Course Outcomes:

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

1. Understand basic knowledge, theories and methods in image processing and computer vision.
2. Implement basic and some advanced image processing techniques in OpenCV.
3. Apply 2D feature-based based image alignment, segmentation and motion estimations.
4. Apply 3D image reconstruction techniques.
5. Design and develop innovative image processing and computer vision 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	1	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	2	1	1	2	-	-	-	-	-	2	-	3	-
CO3	2	1	1	2	2	-	-	-	-	-	1	-	3	-
CO4	3	2	2	2	-	1	-	-	-	-	1	-	3	-
CO5	2	2	1	2	1	-	-	-	-	-	1	-	3	-

25AIPESCN	**EMOTIONAL ANALYTICS IN AI**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce Emotional Intelligence and offer its relevance in AI.
- To provide techniques to detect, interpret and simulate emotions using AI.
- To teach machine learning and deep learning techniques to analyse emotional data.
- To integrate emotional analytics in real-time systems like chatbots, robots, and healthcare.
- To address ethical concerns related to emotion-aware AI systems.

UNIT – I Foundations of Emotional Intelligence and Affective Computing

Introduction - Emotional Intelligence (EI) - Historical Development and Importance of EI in AI systems - Emotional Quotient (EQ) - Intelligence Quotient (IQ) - Multiple Intelligences - The Emotional Brain - Amygdala Hijack - Basic Models of Emotions: Ekman's Six Basic Emotions, Plutchik's Wheel of Emotions - Emotional Data Types - Text, Speech, Facial Expressions, Physiological Signals.

UNIT – II Emotion Recognition Techniques and Tools

Modalities of Emotion Recognition: Facial Expression Analysis (FACS) - Speech Emotion Recognition (SER) - Textual Emotion Detection (NLP Techniques) - Physiological Signals (EEG, ECG, GSR) - Tools and Datasets: Affectnet, IEMOCAP, Emoreact, DEAP, SEMAINE - Emotion Annotation and Labelling Techniques - Introduction to Multimodal Emotion Analysis.

UNIT – III Components of Emotional Intelligence and its Applications

Components of EI : Self-awareness – Self- management – Social – awareness – Social – management – Motivation – Empathy - Applications of EI : Everyday Behaviour – Education – Workplace - Case Study Discussion with Role Plays.

UNIT – IV Machine Learning and Deep Learning for Emotional Analytics

Overview of Supervised and Unsupervised ML for Emotion Detection - Feature Engineering for Emotional Data - Deep Learning Models: CNNs for Facial Expressions, RNNs/LSTMs for Speech/Text - Transformers and Attention Mechanisms in Emotional NLP - BERT, Roberta - Multi-modal Fusion Techniques for Emotion Classification.

UNIT – V Applications of Emotional Analytics in Real-world Systems

Emotion-Aware Virtual Assistants and Chatbots - Emotion Sensing in Robotics and Autonomous Systems - Emotion-Driven Recommendation Systems - Affective E-Learning Platforms - Emotional Analytics in Healthcare and Mental Health Monitoring - Smart Environments and Wearable Emotion Sensors.

Text Books:

1. Daniel Goleman, "The Brain and Emotional Intelligence: New Insights", More Than Sound, 2011.
2. Gil Hasson, "Understanding Emotional Intelligence", Pearson, 2014,
3. Paul Ekman, "Emotions Revealed: Recognizing Faces and Feelings to Improve Communication and Emotional Life", Times Books, 2003.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.

References:

1. Neilson Kite and Frances Kay, "Understanding Emotional Intelligence", Kogan Page, 2011.
2. Rosalind W. Picard, "Affective Computing", MIT Press, 2000.
3. Jeanne Segal, "The Language of Emotional Intelligence: The Five Essential Tools for Building Powerful and Effective Relationships", Mc-Graw Hill, 2008.
4. Marvin Minsky, "The Emotion Machine, Commonsense Thinking, Artificial Intelligence, and the Future of the Human Mind" Simon and Schuster, 2007.

Course Outcomes:

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

1. Realize the importance of Emotional Intelligence.
2. Recognize emotions through various modalities.
3. Learn and employ different machine and deep learning models for classification of emotions.
4. Solve real world problems using Emotional Intelligence.
5. Understand the ethical, psychological and societal perspectives of Emotional Intelligence.

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

25AIPESCN	BLOCK CHAIN TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the foundational concepts and components of blockchain technology.
- To analyze the architecture and working of consensus mechanisms.
- To educate students on smart contracts and decentralized applications.
- To explore the security and privacy aspects of blockchain systems.
- To provide insight into blockchain platforms and their use in various domains.

UNIT – I Introduction to Blockchain

Overview of Blockchain – Characteristics – Structure – Block – Transactions – Distributed Ledger – Types of Blockchain – Public, Private, Consortium – Advantages and Limitations – Use Cases.

UNIT – II Consensus and Cryptography

Consensus Mechanisms – Proof of Work – Proof of Stake – Delegated Proof of Stake – Byzantine Fault Tolerance – Cryptographic Hash Functions – Merkle Trees – Digital Signatures – Public and Private Keys.

UNIT – III Smart Contracts and Dapps

Introduction to Smart Contracts – Ethereum Architecture – Solidity Programming Basics – Writing, Deploying and Testing Smart Contracts – Decentralized Applications – Frontend Integration.

UNIT – IV Blockchain Platforms and Frameworks

Ethereum – Hyperledger Fabric – Quorum – Multichain – Blockchain-as-a-Service – Development Tools – Truffle, Ganache, MetaMask – Wallets and Transactions – Gas and Fees.

UNIT – V Security, Privacy and Applications

Security Issues – 51% Attack – Sybil Attack – Privacy Mechanisms – Zero Knowledge Proofs – Blockchain in Supply Chain, Healthcare, Banking, Voting – Emerging Trends – Scalability – Interoperability.

Text Books:

1. Imran Bashir, "Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications", Packt Publishing, 3rd Edition, 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:

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

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

25AIPESCN	**PREDICTIVE ANALYTICS AND TIME SERIES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To know various predictive data analysis models.
- To provide distinctive knowledge on implementation of simple linear and logistic regression models.
- To know about dummy modelling and panel data model.
- To understand the basic statistical techniques required for forecasting.
- To understand the data mining and simulation concepts.

UNIT – I Simple and Multiple Regression Analysis

Predictive Analytics: Introduction - Applications in Predictive Analytics - Concept of Association. Simple Regression Analysis: Concept Fundamentals of Regression Analysis - Requirements in Regression Model Building - Model Diagnostics - Interpretation of Regression results for Management Decision. Multiple Regression Analysis: Concept - Significance of Multiple Regression Analysis - Structure of Model Estimation - Testing Rule of Multiple Regression Analysis - Concepts to Establish the Relatability of Estimated Models.

UNIT – II Nonlinear Regression and Regression Modeling

Non-Linear Regression Analysis: Concept - Types of Non-linear Regression Models - Model Transformation - Difference between Linear and Non-linear Regression Models. Diagnostics of Regression Modeling: Model Diagnostics - Multicollinearity - Autocorrelation – Heteroscedasticity.

UNIT – III Dummy modelling and Panel Data Model

Dummy Modelling: Concept - Dummy Independent Modelling - Linear Probability Model - Logit Model - Probit Model. Panel Data Model: Concept - Panel Data Models - Fixed Effects Model - Random Effects Model - Forms of Panel Data Models - Applications to use Panel Data Models.

UNIT – IV Forecasting and Machine Learning

Time Series Forecasting: Concept - Forecasting Techniques - Measures of Forecast Error - Trend Analysis - Time Series Models - Auto Regressive Model - Applications of Time Series Models. Machine Learning: Concept - Predictive Analysis under Machine Learning - Model of Artificial Neural Networks (ANN) - Model of Random Forest - Model of Support Vector Machine - Assumptions under Machine Learning.

UNIT – V Data Mining and Simulation

Data Mining: Concept - Data Interpretation - Data Reduction - Classification and Clustering Techniques - Association Rule Mining - Cause and Effect Model. Simulation: Concept - Monte Carlo Simulation - Discriminant Event Simulation - Application Using Simulation.

Text Books:

1. James R Evans, "Business Analytics", Global Edition, Pearson Education, 3rd Edition, 2020.
2. U Dinesh Kumar, "Business Analytics: The Science of Data - Driven Decision Making", Wiley India Pvt. Ltd., New Delhi, 2nd Edition, 2017.

References:

3. Thomas W. Miller, "Modeling Techniques in Predictive Analytics with Python and R - A Guide to Data Science", Pearson Education, 2015.
4. Daniel T. Larose and Chantal D. Larose, "Data Mining and Predictive Analytics", John Wiley & Sons Inc., New Jersey, 2nd Edition, 2015.
5. Barry Keating, J. Holton Wilson, Shovan Chowdhury and John Galt Solutions Inc., "Forecasting and Predictive Analytics with ForecastX", McGraw Hill, 7th Edition, 2020.
6. Purba Halady Rao, "Business Analytics: An Application Focus", PHI Learning, New Delhi, 2013.

Course Outcomes:

After the completion of the course, the students will be able to

2. Analyze the suitability of Predictive Models for effective business decisions.
3. Acquire the skills on Linear and Logistic Regression.
4. Investigate the dummy modelling and panel data model.
5. Understand the basic statistical techniques required for forecasting.
6. Acquire knowledge about data mining and simulation 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	2	-	-	2	-	-	-	-	-	-	-	2	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	2	-	2	-	-	-	-	-	-	-	-	2	-
CO4	2	2	-	2	-	-	-	-	-	-	-	-	2	-
CO5	2	2	2	-	-	-	-	-	-	-	-	-	2	-

25AIPESCN	REINFORCEMENT LEARNING	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand various Components and Applications of Reinforcement Learning.
- To learn different policy exploration and strategies of Reinforcement Learning.
- To Study and examine diverse Model based and Model Free Prediction techniques.
- To acquire knowledge in different value-based Reinforcement Learning Algorithms.
- To learn and investigate various Policy based Reinforcement Learning Algorithms.

UNIT – I Introduction

Deep Reinforcement Learning, Suitability of RL, Components of Reinforcement Learning -Agent, Environment, Observations, Actions, Example-The Bandit Walk Environment, Agent-Environment interaction cycle, MDP (Markov Decision Process): The engine of the Environment-States, Actions, Transition Function, Reward Signal.

UNIT – II Planning, Exploitation and Exploration of Reinforcement Learning

Objective of a decision making agent-environment, Plan, Optimal policy, Comparison of Policies, Bellman Equation/State-Value Function, Action-Value Function, Action-Advantage Function, Optimality. Bandits- Single-state decision problem(Multi-Armed Bandit(MAB) problem), The cost of exploration, Approaches to solve MAB environments, Greedy Strategy, Random Strategy, Epsilon-Greedy Strategy, Decaying Epsilon-Greedy Strategy, Optimistic Initialization strategy, Strategic exploration, Softmax exploration strategy, Upper confidence bound (UCB) equation strategy, Thompson sampling strategy.

UNIT – III Model based and Model Free Reinforcement Learning

Monte Carlo Prediction (MC), First-Visit MC (FVMC), Every-Visit MC (EVMC), Temporal Difference Learning (TD), Learning to estimate from multiple steps, N-step TD learning, Forward-view TD(λ), Backward-view TD(λ), Generalized policy iteration(GPI), Monte Carlo control, SARSA: On-Policy TD control, Q-learning: Off-Policy TD control, Double Q-learning, SARSA(λ), Watkins's Q(λ). Dyna-Q, Trajectory sampling.

UNIT – IV Value Based Reinforcement Learning

Deep reinforcement learning agents with sequential feedback, evaluative feedback, sampled feedback, Function Approximation for Reinforcement Learning- high-dimensional state and action spaces, continuous state and action spaces, state-value function and action-value function with and without function approximation, Neural Fitted Q (NFQ), Deep Q-Network (DQN), Double Deep-Q Networks(DDQN), Dueling DDQN, Prioritized Experience Replay (PER).

UNIT – V Policy Based Reinforcement Learning

Policy Gradient and Actor-Critic Methods—REINFORCE Algorithm and Stochastic Policy Search, Vanilla Policy Gradient(VPG), Asynchronous Advantage Actor-Critic (A3C), Generalized Advantage Estimation (GAE), Advantage Actor-Critic(A2C), Deep Deterministic Policy Gradient (DDPG), Twin-Delayed DDPG (TD3), Soft Actor-Critic (SAC), Proximal Policy Optimization (PPO).

Text Book:

1. Miguel Morales,"Grokking Deep Reinforcement Learning", Manning Publications, 2020.

References:

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An Introduction", Second Edition, MIT Press, 2019.
2. Marco Wiering, Martijn van Otterlo(Ed), "Reinforcement Learning, State-of-the-Art, Adaptation, Learning, and Optimization book series", ALO, volume 12, Springer, 2012.
3. Keng, Wah Loon, Graesser, Laura, "Foundations of Deep Reinforcement Learning: Theory and Practice in Python", Addison Wesley Data & Analytics Series, 2020.
4. Francois Chollet, "Deep Learning with Python", Manning Publications, 2018.

Course Outcomes:

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

1. Practice and investigate various Components and Applications of Reinforcement Learning.
2. Make use of different policy exploration and strategies of Reinforcement Learning.
3. Apply diverse Model based and Model Free Prediction techniques.
4. Implement different value-based Reinforcement Learning Algorithms.
5. Demonstrate and visualize various Policy based Reinforcement Learning Algorithms

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

25AIPESCN	**ROBOTICS AND AI**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce students to the foundations of robotic systems and intelligent behaviour.
- To analyze AI techniques applicable in robotic perception, planning, and control.
- To understand reactive, deliberative, and learning-based robotic behaviours.
- To integrate computer vision and machine learning into autonomous robotic systems.
- To explore real-world applications of intelligent robotics in industries and services.

UNIT – I Introduction to Robotics and AI

Classification of Robots: Industrial, Mobile, Humanoid-Social Robots-Components of a Robotic System: Sensors, Actuators, Controllers-AI in Robotics: Symbolic AI vs. Sub-symbolic AI-Role of AI in Perception, Planning, and Decision-making-Case Studies: Self-driving Cars, Delivery Robots, Industrial Arms.

UNIT – II Reactive Behavior and Rule-Based AI

Braitenberg Vehicles and Behavioral Robotics-Finite State Machines (FSMs): Modeling, Transitions, State Diagrams-Rule-Based AI: Production Systems-IF-THEN Rules-Behavior Trees and Decision Trees-Subsumption Architecture and Layered Control-Rule-Based Systems and Expert Systems in Robotics-Designing Reactive Agents for Obstacle Avoidance and Navigation, Wall Following, Line Following.

UNIT – III Robotic Kinematics, Motion Planning and Learning

Degrees of Freedom (DOF)-Forward and Inverse Kinematics-Manipulator Kinematics and Denavit–Hartenberg Convention (overview)-Trajectory Generation and Interpolation, Path Planning Algorithms: A*, D*, RRT, PRM-Motion Control: PID Control, Feedforward and Feedback Control-Reinforcement Learning (RL): Basics, Q-learning, SARSA-Deep Reinforcement Learning (DQN, PPO) in navigation and control-Markov Decision Processes (MDPs) for robot decision-making.

UNIT – IV Computer Vision and Robotic Perception

Camera Models and Calibration-Image Processing: Color Models, Filtering, Edge Detection-Blob Detection-Object Recognition: Feature Detection (SIFT, ORB)-Template Matching-Deep Learning for Vision: CNNs, YOLO-SSD-Visual SLAM: Concepts and Approaches-Depth Estimation with Stereo Vision and RGB-D Cameras-Sensor Fusion for Perception (e.g., LIDAR + Camera)-Applications: Face Detection, Gesture Recognition, Autonomous Driving Vision.

UNIT – V Cognitive AI and Human-Robot Interaction

Natural Language Processing (NLP) in Robotics: Speech Recognition, Command Parsing-Probabilistic Robotics: Bayesian Filters, Kalman and Particle Filters-Fuzzy Logic Control: Membership Functions, Rule Base, Defuzzification-Ethics in Robotics: Bias, Safety, Privacy, Job Displacement-Human-Robot Interaction (HRI): Social Intelligence, Affective Computing-Cloud Robotics and Internet of Robotic Things (IoRT)- Autonomous Decision-Making: Planning under Uncertainty, Game Theory (intro).

Text Books:

1. Mordechai Ben-Ari, Francesco Mondada,"Elements of Robotics", Springer, 2018.
2. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson, 4th Edition.
3. Mikell P. Groover, Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, "Industrial Robotics, Technology programming and Applications", McGraw Hill, 2012.

References:

1. Peter Corke, Robotics, "Vision and Control", Springer, 2017.
2. Sebastian Thrun et al., "Probabilistic Robotics", MIT Press, 2005.
3. Richard D. Klafter et al., "Robotics Engineering", PHI, 2009.
4. Sutton & Barto, "Reinforcement Learning: An Introduction", MIT Press, 2018.

Course Outcomes:

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

1. Describe the architecture and components of intelligent robotic systems.
2. Design and implement behaviour-based models using AI techniques.
3. Apply machine learning and motion planning in robotic control.
4. Integrate vision and sensor data for real-time perception in robots.
5. Develop autonomous robots capable of decision-making and interaction

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

25AIPESCN	**SOCIAL AND ETHICAL ISSUES IN AI**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand key ethical theories, concepts, and frameworks relevant to the design and deployment of AI systems.
- To explore philosophical and practical issues associated with superintelligent agents, machine consciousness, and moral agency in AI.
- To analyze the social impacts of algorithmic bias, autonomous weapons, and workplace automation.
- To evaluate the ethical and legal dimensions of AI applications in areas such as self-driving

cars, expert systems, and decision-making agents.

- To examine the global risks and policy responses to emerging AI technologies and understand the responsibilities of AI engineers in building safe and beneficial systems.

UNIT – I **Foundations of AI Ethics and Moral Status of Machines**

Introduction to AI Ethics: Need for ethical reflection in AI development - Ethics in machine learning and domain-specific AI algorithms - Artificial General Intelligence (AGI): Definitions and debates - Moral status of machines and minds with exotic properties - Superintelligence and Singularity: Arguments, intelligence explosion, philosophical challenges - Constraints and post-singularity integration: Internal and external constraints, uploading and consciousness, personal identity.

UNIT – II **Superintelligent Agents, Algorithmic Bias, and Fairness**

Superintelligent Agents: Orthogonality thesis, instrumental convergence - Ethical implications of goal alignment in intelligent systems - Racist and Biased AI: Rise of algorithmic decision-making in policing, hiring, credit scoring - Contestable epistemic and normative assumptions, embodied values - Algorithmic accountability and public reason - Challenges in fairness, transparency, and interpretability of AI systems - Case studies: COMPAS recidivism algorithm, facial recognition bias.

UNIT – III **AI in Warfare, Automation, and Employment Ethics**

Autonomous Weapons and Killer Robots: Ethical debates on robot warriors, war crimes, and human oversight - International humanitarian law and autonomous systems - Children and robots in warfare: Ethical and psychological concerns - Workplace Automation: Future of work, employment polarization, wage impacts - Polanyi's Paradox and limitations of automation. Responsible AI design for workplace augmentation - Global and Indian perspectives on labor displacement and skilling.

UNIT – IV **Artificial Moral Agents, Self-Driving Cars, and Human-AI Collaboration**

Moral agency in AI: Definitions, moral norms, and the Moral Turing Test - Ethical theories: Consequentialism, Deontology, Virtue ethics - Computational models of morality: Evolutionary, associative learning, emotion-driven models - Ethics of autonomous vehicles: The trolley problem, crash avoidance strategies - Legal and ethical responsibility in AI actions - Human–robot collaboration: Shared decision-making, accountability, trust - Case studies: Tesla autopilot accidents, MIT Moral Machine project.

UNIT – V **Global AI Risks, Policy Frameworks, and Responsible AI**

AI as a global risk: Anthropomorphic bias, mind design space - Intelligence amplification: Capability vs motive, optimization risks - Friendly AI: Goals, technical and philosophical failure Regulation and Policy: UNESCO AI Ethics, EU AI Act, OECD principles - Indian policy landscape: NITI Aayog's National Strategy for AI, data protection laws - Explainable and Transparent AI: Need for accountability in decision-making - Role of engineers in developing socially responsible and safe AI.

Text Books:

1. Mark Coeckelbergh, "AI Ethics", 1st Edition, MIT Press, 2020.
2. Patrick Lin, Keith Abney, Ryan Jenkins, "Robot Ethics 2.0: From Autonomous Cars to Artificial Intelligence", 1st Edition, Oxford University Press, 2017.

References:

1. Nick Bostrom, "Superintelligence:Paths, Dangers, Strategies", 1st Edition, Oxford University Press, 2014.
2. Wendell Wallach, Colin Allen, "Moral Machines: Teaching Robots Right from Wrong", 1st Edition, Oxford University Press, 2008.
3. Virginia Dignum, "Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way", 1st Edition, Springer, 2019.
4. Shannon Vallor, "Technology and the Virtues: A Philosophical Guide to a Future Worth Wanting", 1st Edition, Oxford University Press, 2016.

Course Outcomes:

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

1. **Explain** fundamental ethical theories and apply them to assess moral dilemmas in AI technologies.
2. **Analyze** philosophical arguments related to AGI, superintelligence, and personal identity in machine consciousness.
3. **Evaluate** real-world cases involving algorithmic discrimination, autonomous warfare, and automation to recommend ethically informed solutions.
4. **Apply** legal and ethical frameworks to AI applications in self-driving cars and algorithmic decision-making systems.
5. **Propose** responsible AI development strategies considering global risks, policy regulations, and long-term societal impact.

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

25AIPESCN	**AFFECTIVE COMPUTING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To provide understanding on the interdisciplinary nature of affective computing
- To teach how machines can recognize, interpret, and simulate human emotions
- To Design systems that can respond to affective inputs appropriately
- To educate the applications of AI
- To expose ethical, social, and practical implications

UNIT – I Fundamentals of Affective Computing

Definition and Scope – Historical Background and Key milestones - Affective computing Applications – Education, Healthcare, Gaming and Customer Service. Emotion Theory and Emotional Design: Emotion Psychology - Emotion Theory- Brain & Asymmetry - Emotional Design.

UNIT – II Emotions

Emotions in Voice - Emotional Recognition by speech signal - Speech in Affective Computing - Applications. Automatic Speech Analysis based Affect Recognition - Emotions in Text: Emotional Recognition using text. Emotions in Physiological Signals - Emotions via Skin Conductance - Emotions Via EEG.

UNIT – III Emotions in Facial Expressions

Introduction to Facial Expression Recognition - Facial Feature Extraction - Group Level Emotion - Applications of Facial Expression Recognition. Multimodal Emotion Recognition: Multimodal Affect Recognition - Multimodal Analysis - Empathy and Empathetic Agents, Development of

Artificial Empathy - Evoking Empathy - Empathy in Virtual and Robotic Agents, Empathy beyond Emotional States

UNIT – IV Experimental Design

Evaluation of Emphatic Response - Emotionally Intelligent Machines. Affect Elicitation - Experimental Methodology - Research and Development Tools.

UNIT – V Online and Adaptive Recognition of Emotions

Motivation, Challenges and Opportunities - Methods and Techniques. Ethical Issues: Ethics in Affective Computing - Ethical, legal and Social Implications of Affective Computing.

Text Books:

1. Rosalind W Picard, "Affective Computing", Reprint Edition, MIT Press, 2000
2. A Calvo, Sidney, Jonathan and Arvid Kappasr, "The Oxford Handbook of Affective Computing ", Second Edition, The Oxford University Press, 2015
3. Gyanendra K Verma, "Multimodal Affective Computing", First Edition, Bentham Science Publishers, 2023

References:

1. Claude Ghaoue, "The Encyclopedia of Human-Computer Interaction ", Second Edition, Hershey PA Publishers, 2006
2. Sharp, Rogers and Preece, "Interaction Design: Beyond Human-Computer Interaction " Fifth Edition, John Wiley & Sons, 2019
3. Michael Garron, "Emotional Intelligence", Pluto King Publishing, 2018

Course Outcomes:

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

1. Understand the basic concepts of affective computing and the theory of emotion
2. Develop techniques to recognize emotions in various forms
3. Acquire knowledge on multimodal emotion and affect recognition
4. Design emotionally intelligent machines
5. Visualize the ethical issues in affective computing

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

25AIPESCN	**COGNITIVE SCIENCE**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand the interdisciplinary nature of Cognitive Science and its philosophical, psychological, and neuroscientific foundations.

- To explore cognitive architectures and analyze the role of AI and deep learning in modeling cognition.
- To develop and apply probabilistic programming for modeling inference and decision-making.
- To implement generative and inference-based models of cognition, including reasoning mechanisms.
- To evaluate learning models of cognition and apply them to language understanding and processing.

UNIT – I Philosophy, Psychology and Neuro Science

Philosophy: Mental – Physical relation – From materialism to mental science – Logic and the Sciences of the mind – Psychology: Place of Psychology within Cognitive Science – Science of information processing –Cognitive Neuroscience – Perception – Decision – Learning and memory – Language understanding and processing – Interdisciplinary nature of Cognitive Science – Principal technology enablers of Cognitive Computing – Cognitive Computing resources-based learning.

UNIT – II Computational Intelligence

Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge based systems – Logical representation and reasoning – Logical decision making – Learning – Language – Vision. Cognitive computing systems and applications– Deep Learning models.

UNIT – III Probabilistic Programming Language

WebPPL Language – Syntax – Using JavaScript libraries – Manipulating probability types and distributions – Finding Inference – Exploring random computation – Coroutines: Functions that receive continuations – Enumeration, Visual analytics as an approach to cognitive computing – Visual analytics Sandbox: An implementation architecture.

UNIT – IV Inference Models of Cognition

Generative models – Conditioning – Causal and statistical dependence – Conditional dependence – Data analysis – Algorithms for Inference. Machine Reasoning Predicate Calculus Logical Reasoning (Deduction, Abduction, Induction) Drawing Inferences.

UNIT – V Learning Models of Cognition

Learning as Conditional Inference – Learning with a language of thought – Hierarchical models– Learning (Deep) Continuous functions – Mixture models. The Linguistic approach: The Importance of Language – The Nature of Language– Artificial Intelligence and Linguistics: Natural Language Processing.

Text Books:

1. José Luis Bermúde, “Cognitive Science: An Introduction to the Science of the Mind” Cambridge University Press, Third edition, 2020.
2. Vijay V Raghavan, Venkat Gudivada, Venu Govindaraju, C.R. Rao, “Cognitive Computing: Theory and Applications:” (Handbook of Statistics 35), Elsevier publications, 2016.

References:

1. Robert A. Wilson, Frank C. Keil, “The MIT Encyclopedia of the Cognitive Sciences”, The MIT Press, Bradford Books; Reprint edition September 1, 2001.
2. Jose Luis Bermúdez, “Cognitive Science – An Introduction to the Science of the Mind”, Cambridge University Press 2020.
3. Noah D. Goodman, Andreas Stuhlmuller, “The Design and Implementation of Probabilistic Programming Languages”, Electronic version of book, https://dippl.org/.
4. Noah D. Goodman, Joshua B. Tenenbaum, “The Prob Mods Contributors: Probabilistic

Models of Cognition", Second Edition, 2016, https://probmods.org/.

Course Outcomes:

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

1. Understand key concepts in philosophy, psychology, and neuroscience.
2. Analyze the architectures of cognition and the role of AI, learning, and perception systems.
3. Implement mathematical functions through Web PPL.
4. Develop applications using the cognitive inference model.
5. Develop learning models of cognition and demonstrate their application in natural language processing.

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

25AIPESCN	**EDGE COMPUTING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce the fundamental concepts and architecture of Edge Computing.
- To explore the relationship between Edge, Fog, and Cloud Computing paradigms.
- To understand the deployment models and challenges in Edge environments.
- To develop knowledge in edge-enabled applications, services, and security mechanisms.
- To analyze real-time case studies and frameworks involving Edge Computing platforms.

UNIT – I Introduction to Edge Computing

Definition, Evolution, and Characteristics – Edge vs Fog vs Cloud – Use cases – Applications in IoT, Smart Cities, Healthcare, and Autonomous Systems – Key Benefits and Limitations.

UNIT – II Edge Architecture and AI Integration

Architectural Overview – Edge Devices, Gateways, Nodes – Edge Data Centers – Virtualization, Containers, Orchestration Tools (Kubernetes, Docker) – Network requirements.

UNIT – III Data Management and Real-Time Analytics

Public, Private, Hybrid Edge Deployments – Micro services for Edge – Industrial Frameworks: AWS Greengrass, Microsoft Azure IoT Edge, Open Horizon – Real-world implementation issues.

UNIT – IV Edge Security and Federated Learning

Edge Data Collection and Aggregation – Stream Processing – Edge AI/ML – Decision Making – Data Security and Privacy at the Edge – Resource Management Challenges.

UNIT – V Frameworks and Edge Applications

Security Challenges – Identity and Access Management – Threat Models – Trust Management – Block chain for Edge – Emerging Trends: 6G, Federated Learning, Edge Intelligence.

Text Books:

1. Mahadev Satyanarayanan, "Edge Computing: Vision and Challenges", IEEE Internet of Things Journal, 2017.
2. Perry Lea, "Edge Computing: A Primer", O'Reilly Media, 2020.

References:

1. Flavio Bonomi et al., "Fog Computing and Its Role in the Internet of Things", MCC Workshop, ACM, 2012.
2. K. Suresh and S. Rajalakshmi, "Foundations of Edge Computing: A Practical Guide", Wiley,2021.
3. Tao Zhang, "Edge Computing for IoT Applications", Springer, 2021.
4. H. Cao, M. Ma, "Security and Privacy in Edge Computing: A Survey", Future Generation
5. 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	-	1	-	1	1	-	-	2	-
CO2	2	2	3	2	3	-	-	-	2	1	-	-	2	-
CO3	2	3	3	3	3	-	-	-	2	2	1	-	3	-
CO4	2	2	3	3	3	1	1	-	2	2	1	-	3	-
CO5	2	2	2	2	2	2	3	1	2	1	2	-	2	-

25AIPESCN	**QUANTUM COMPUTING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To know the background of classical computing and quantum computing and to learn the fundamental concepts behind quantum computation.
- To study the details of quantum mechanics and the relation to Computer Science.
- To gain knowledge about the basic hardware and mathematical models of quantum computation.

- To learn the basics of quantum information and the theory behind it.
- To learn the fundamental concepts of quantum machine learning.

UNIT – I Fundamental Concepts

Global Perspectives – Quantum Bits – Quantum Computation – Quantum Algorithms – Experimental Quantum Information Processing – Quantum Information.

UNIT – II Quantum Mechanics and an Overview of Computational Models

Quantum Mechanics: Linear Algebra – Postulates of Quantum Mechanics – Application: Superdense Coding – Density Operator – The Shmidt Decomposition and Purifications – EPR and the Bell Inequality – Computational Models: Turing Machines – Circuits – Analysis of Computational Problems.

UNIT – III Quantum Computation

Quantum Circuits: Quantum Algorithms – Universal Quantum Gates – Quantum Circuit Model of Computation – Simulation – Quantum Fourier Transform and Applications – Quantum Search Algorithms – Quantum Computers.

UNIT – IV Quantum Information and Theory

Quantum Noise and Quantum Operations: Classical Noise and Markov processes – Quantum Operations – Examples – Applications – Distance Measures for Quantum Information – Quantum Error Correction – Entropy- Data Compression - Quantum Cryptography.

UNIT – V Quantum Machine Learning

Quantum Machine Learning: The basics of machine learning - training a model - Quantum Classical models- Quantum Support Vector Machine - Quantum Neural Network - Quantum Generative Adversarial Networks.

Text Books:

1. Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information", Tenth Edition, Cambridge University Press, 2010.
2. Elias F. Combarro, Samuel Gonzalez-Castillo, "A Practical Guide to Quantum Machine Learning and Quantum Optimization", Packt Publishing Ltd, 2023.

References:

1. Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 2013.
2. Osvaldo Simeone, "An Introduction to Quantum Machine Learning for Engineers", Foundations and Trends® in Signal Processing, 2022.

Course Outcomes:

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

1. 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.

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

25AIPESCN	GENERATIVE ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the core principles and motivation behind generative models.
- To explore architectures such as VAEs, GANs, and Transformers used for data synthesis.
- To acquire the knowledge of various generative models for image generation, style transfer and text generation.
- To understand the application of prompt engineering and transformer-based LLMs.
- To implement and evaluate generative models using real-world datasets and APIs.

UNIT – I An Introduction to Generative AI

Definition, Motivation & Applications, Why Use Generative Models- Use Cases & Advantages, Discriminative vs Generative Models, Taxonomy of Generative Models, Probability and Data Distributions, Evaluation Metrics for Generative Models, Challenges (Mode Collapse, Overfitting, Instability) & Ethics in Generative AI.

UNIT – II Fundamentals of Generative Models

Autoencoders: Regularized & Variational Autoencoders, Stochastic Encoders & Decoders, Autoregressive Models: Fully Visible sigmoid Belief Network (FVSBN), Neural Autoregressive Density Estimation (NADE), Masked Autoencoder for Distribution Estimation (MADE).

UNIT – III Generative Adversarial Networks (GANs)

GAN Architecture: Generator and Discriminator Networks, Loss Functions (Minimax) and Training Challenges, Vanilla GANs, Deep Convolutional GANs (DCGANs), Progressive GANs, Applications: Image Generation, Style Transfer, Image-to-Image Translation (Pix2Pix), Super-Resolution, and Data Augmentation.

UNIT – IV Transformers and Prompt Engineering

Self-Attention, Transformer Basics, Transformers, BERT, Large Language Models, Masked Language Modeling (MLM), Next Sentence Prediction (NSP), Generative Pretrained Transformers (GPT), Task-specific GPT Fine-tuning, Prompt Engineering, Hugging Face pretrained Transformers, Hugging Face APIs.

UNIT – V Language Models and Applications

OpenAI GPT-3, 3.5, 4, OpenAI APIs, Working with the OpenAI Playground, Content Filtering, Text Generation and Transformation, Text Classification and Categorization, Building GPT-powered Question Answering Applications and Chatbots, Mini Projects using Large Language Models.

Text Books:

1. David Foster, “Generative Deep Learning”, O'Reilly Media, 2nd Edition, 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”, Packt Publishing, 2nd Edition, 2023
2. Sabit Ekin, “Prompt Engineering for Chat GPT: A Quick Guide to Techniques, Tips, and Best Practices”, DOI: 10.36227/techrxiv. 22683919.v2, 2023.
3. Chris Fregly, Antje Barth, Shelbee Eigenbrode, “Generative AI on AWS: Building Context-Aware Multimodal Reasoning Applications”, O’Reilly, 2023.
4. Auffarth, B., “Generative AI with LangChain: Build Large Language Model (LLM) Apps with Python, ChatGPT, and Other LLMs”, Packt Publishing, 2023.

Course Outcomes:

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

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

OPEN ELECTIVES

25AIOESCN	GAME THEORY	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand fundamental concepts of game theory
- To apply strategic form and Nash equilibrium concepts
- To analyze extensive form games and repeated interactions
- To solve Bayesian games involving incomplete information
- To evaluate cooperative game scenarios using various solution concepts

UNIT – I Introduction to Game Theory

Definition and scope of game theory - Classification of games: cooperative and non-cooperative, symmetric and asymmetric - Key concepts: players, strategies, payoffs, and equilibrium - Real-life applications of game theory

UNIT – II Strategic Form Games and Nash Equilibrium

Representation of games in strategic (normal) form - Dominant and dominated strategies - Pure and mixed strategy Nash equilibrium - Best response analysis and examples

UNIT – III Extensive Form Games

Representation of games in extensive form - Game trees and backward induction - Subgame perfect equilibrium - Repeated games and finitely/infinite repetitions

UNIT – IV Bayesian Games and Incomplete Information

Games with incomplete information - Bayesian Nash equilibrium - Harsanyi transformation- Applications of Bayesian games

UNIT – V Cooperative Game Theory

Coalitions and coalition formation - The Core, Shapley value, and bargaining - Stable sets and nucleolus - Applications in economics and computer science

Text Books:

1. Roger B. Myerson, 'Game Theory: Analysis of Conflict', Harvard University Press, 1997.
2. Martin J. Osborne, 'An Introduction to Game Theory', Oxford University Press, 2004.

References:

1. Drew Fudenberg and Jean Tirole, 'Game Theory', MIT Press, 1991.
2. Kevin Leyton-Brown and Yoav Shoham, 'Essentials of Game Theory', Morgan & Claypool Publishers, 2008.
3. Eric Rasmusen, 'Games and Information: An Introduction to Game Theory', Wiley-Blackwell, 2006.
4. 4. Ken Binmore, 'Game Theory: A Very Short Introduction', Oxford University Press, 2007.

Course Outcomes:

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

1. Explain the basic concepts and classifications of games in game theory
2. Analyze strategic form games and compute Nash equilibria
3. Represent extensive form games and determine subgame perfect equilibria
4. Solve Bayesian games involving incomplete information
5. Evaluate cooperative game solutions using the Core, Shapley value, and other concepts and apply game theory models to problems in economics, computer science, and related 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	1	3	1	-	-	-	-	-	-	-	2	-
CO2	2	3	2	2	2	-	-	-	-	-	-	-	2	-
CO3	2	3	3	3	2	-	-	-	-	-	-	-	3	-
CO4	3	3	2	1	2	-	-	-	-	-	-	-	3	-
CO5	3	2	1	2	3	-	-	-	-	-	-	-	2	-

25AIOESCN	**LARGE LANGUAGE MODELS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand the foundations of language modeling and the evolution to large language models.
- To learn and analyze key neural architectures.
- To learn Transformers and Large Language Models
- To gain practical knowledge of training, fine-tuning, and evaluating LLMs.
- To explore real-world applications and limitations of LLMs.

UNIT – I Introduction to Language Models

NLP basics and text representation-Traditional language models (n-gram, HMMs)-Word embeddings- Word2Vec- GloVe-Limitations of classical models-Transition to deep learning and LLMs

UNIT – II Neural Network Architectures in NLP

RNNs- LSTMs-GRUs – architecture and limitations-Attention mechanism-Positional encoding-Intro to sequence-to-sequence models

UNIT – III Transformers and Large Language Models

Transformer architecture- Encoder-decoder- self-attention-Deep dive- BERT- GPT-2/3/4- T5- XLNet- LLaMA-Fine-tuning vs pre-training-Transfer learning in NLP

UNIT – IV Training, Evaluation and Deployment

Pre-training objectives- MLM- CLM-Datasets- Common Crawl- Wikipedia, etc.-Evaluation metrics-Perplexity- BLEU- ROUGE-Prompt engineering-Deployment using APIs (e.g., HuggingFace, OpenAI)

UNIT – V Ethics, Safety and Responsible AI

Bias- fairness- toxicity in LLMs-Hallucination and factual correctness-Privacy- copyright and misuse concerns-Safety research- RLHF- alignment techniques-Regulatory frameworks (EU AI Act, etc.)

Text Books:

1. Tanmoy Chakraborty, “Introduction to Large Language Models”, Wiley India, First Edition, 2025.
2. Tong Xiao, Jingbo Zhu, “Foundations of Large Language Models”,2025.

References:

1. Dan Jurafsky and James H. Martin, "Speech and Language Processing", Second edition, Pearson Press, 2008.
2. Jacob Eisenstein, "Natural Language Processing", First edition, The MIT Press, 2019.

Course Outcomes:

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

1. Describe the core concepts of statistical and neural language models.
2. Implement and analyze Transformer-based architectures like BERT and GPT.
3. Fine-tune pre-trained LLMs for downstream NLP tasks.
4. Evaluate LLM outputs using standard metrics and apply prompt engineering.
5. Discuss ethical considerations like bias, hallucinations, and misuse of LLMs.

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

25AIOESCN	**AI TOOLS FOR ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce core concepts relevant to engineering
- To explore and use various AI tools applicable to engineering domains.
- To learn to apply AI in solving real-world engineering problems.
- To build practical experience with AI libraries, platforms, and toolkits.
- To enable students to apply AI techniques in simulations ,design optimization and automation

UNIT – I Introduction to AI in Engineering

Overview of AI Tools, Basics of Machine Learning, supervised vs unsupervised Learning Classification, Regression, Clustering, Overfitting, Cross-validation, Feature Engineering, Tools: Scikit-learn, Google Colab, Importance and applications in various branches.

UNIT – II Data Handling and Preprocessing

Data acquisition in engineering systems ,Cleaning, normalization, and transformation, Tools: Pandas, NumPy, Matplotlib, Seaborn ,Deep Learning Foundations, Neural Networks basics ,CNNs and RNNs introduction, Applications in image and signal processing Tools: TensorFlow, Keras, PyTorch

UNIT – III AI in Mechanical Engineering and Civil Engineering

Predictive Maintenance ,CAD + AI, Design Optimization ,Tools: MATLAB, ANSYS + AI plugins, Python for simulation, Structural health monitoring,.Smart cities and infrastructure, Construction automation,Tools: GIS + AI, AutoCAD with AI, Computer Vision (OpenCV)

UNIT – IV AI in Electrical and Electronics Engineering

Smart grids and power systems ,Fault detection and diagnostics,Signal processing with deep learning,Tools: MATLAB Simulink + AI, LTspice + AI, Python for IoT, Natural Language

Processing, Text analysis in documentation and automation, Sentiment analysis for user feedback, Tools: spaCy, NLTK, OpenAI GPT, Hugging Face Transformers, Object detection for robotics/automation Image-based quality inspection - Tools: OpenCV, YOLO, TensorFlow Object Detection API

UNIT – V : Edge AI and IoT Integration

: Embedded AI systems,Real-time prediction on low-power devices, .

Tools: Raspberry Pi, Edge Impulse, Tiny ML, Use of LLMs in design automation, code generation,Prompt engineering, Tools: Chat GPT, Copilot, RunwayML, Midjourney (for concept design)Capstone project: Choose a domain and apply AI tools, Planning, dataset collection, training, testing.

Text Books:

1. Sebastian Raschka, "Python Machine Learning" Packt Birmingham, Mumbai ,Second edition, 2017.

2. Ian Goodfellow, "Deep Learning"MIT press, Cambridge , First edition, 2016.

3. David M, “Artificial intelligence for Engineers”, Kindle , Third edition, 2025.

References:

1. Sridhar Seshadri and Shreeram Iyer, “AI for Everyone” Embassy Books, 1st edition 2024.

2. Nitin Seth, ”Human Edge in the AI Age”, Prime shopping, Second edition 2024.

3. Russell and Norvig, ”Artificial Intelligrnce:A Modern Approach”, Pearson, 4th Edition, April 2020.

4. Patrick Winston, “Artificial Intelligence” ,Pearson Education, Third edition 1992.

Course Outcomes:

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

- Understand key AI/ML concepts and algorithms
- Use AI tools to analyze and interpret engineering data
- Evaluate AI model performance and improve them.
- Apply AI tools for various Engineering tasks
- Develop small scale AI applications in engineering 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	1	2	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO3	1	2	2	-	-	-	-	-	-	-	-	-	2	-
CO4	1	1	2	-	1	-	-	-	-	-	-	-	1	-
CO5	2	1	-	-	2	-	-	-	-	-	-	-	1	-

25AIOESCN	**ANDROID DEVELOPMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand Android platform and application components

- To design user interfaces for mobile applications
- To implement data storage and content access mechanisms
- To integrate multimedia, sensors, and web services
- To 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:

3. Bill Phillips, Chris Stewart, Kristin Marsicano, 'Android Programming: The Big Nerd Ranch Guide', 4th Edition, Big Nerd Ranch Guides, 2019.
4. B.M. Harwani, 'Android Programming Unleashed', Pearson Education, 2013.

References:

5. Reto Meier, Ian Lake, 'Professional Android', 4th Edition, Wrox, 2018.
6. Joseph Annuzzi Jr., Lauren Darcey, Shane Conder, 'Advanced Android Application Development', 4th Edition, Addison-Wesley, 2015.

Course Outcomes:

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

1. Explain Android 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 and 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	-
CO2	2	3	2	2	1	-	-	-	-	-	-	-	2	-
CO3	2	3	3	3	2	-	-	-	-	-	-	-	3	-
CO4	3	3	2	2	2	-	-	-	-	-	-	-	3	-
CO5	3	2	1	2	3	-	-	-	-	-	-	-	2	-

25AIOESCN	INDUSTRIAL INTERNET OF THINGS	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the fundamentals of Industrial Internet of Things.
- To learn about the basics of IIOT protocols.
- To learn about the sensors, actuators and Interfacing .
- To learn about IIoT Network Standards.
- To apply the concept of Data analytics in II0T.

UNIT – I Introduction to IIoT and Industry 4.0

Introduction to IIoT- IoT vs IIoT- Components of IIoT- Sensing- Network- Data Analytics- Industry 4.0 pillars and reference architecture- Use cases in smart manufacturing- healthcare- agriculture.

UNIT – II IIoT Architecture and Protocols

IIoT layered architecture- Physical to Application layer- Fog, Edge- Cloud Computing- Communication Protocols- MQTT- CoAP- OPC-UA- HTTP- AMQP- SCADA systems and their role in IIoT.

UNIT – III Sensors, Actuators and Interfacing

Types of sensors and actuators- Data acquisition systems (DAS)- Interfacing with Arduino- Raspberry Pi- Wireless sensor networks (WSN) in industries.

UNIT – IV IIoT Networking and Communication

Network standards- Modbus- CAN- Profibus- Ethernet/IP- Zigbee- LoRaWAN- 5G- NB-IoT- Network architecture and topologies- Time-Sensitive Networking (TSN)- Fieldbus- Industrial Ethernet.

UNIT – V Data Analytics and ML in IIoT

Role of data analytics in IIoT- Data collection- preprocessing- storage- ML models for fault prediction and optimization-Tools: Apache Spark- Hadoop- Python- Power BI.

Text Books:

1. Alasdair Gilchrist, “Industry 4.0: The Industrial Internet of Things”, Apress, 2017.
2. Sandeep Misra, Chandana Roy, Anandarup Mukherjee, “Introduction to Industrial Internet of Things and Industry 4.0” , Taylor & Francis, First Edition, 2021.

References:

1. Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat, “Industrial Internet of Things: Cybermanufacturing Systems”, Springer, 2017.
2. Giacomo Veneri, Antonio Capasso, “Hands-On Industrial Internet of Things: Create a Powerful Industrial IoT Infrastructure Using Industry 4.0”, Packt Publishing, 2018.
3. Tariq Jha, Tariq, Joshi, Solanki, “Industrial Internet of Things: Technologies, Design, and Applications”, Routledge, 2020.

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

25AIOESCN	**BLOCK CHAIN FUNDAMENTALS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand the foundational principles of block chain, including decentralization, cryptography and consensus mechanisms.
- To analyze and implement block chain solutions for secure data storage, data integrity, and provenance in DS and ML systems.
- To integrate block chain with machine learning workflows, such as federated learning and privacy-preserving ML techniques.
- To understand and apply smart contracts in decentralized applications (dApps).
- To evaluate the scalability, privacy, and security challenges of block chain in data science and machine learning applications.

UNIT – I Introduction & Cryptographic Foundations

Block chain: Definitions and History, Block chain Structure: Blocks, Chains, Hashing, and Transactions, Introduction to Decentralization and Distributed Ledger Technology, Block chain vs. Traditional Databases, Use Cases of Block chain Beyond Crypto currencies, Cryptography Basics: Public/Private Key Encryption, Digital Signatures, Hash Functions, Block chain security: How Cryptographic Techniques Ensure Data Integrity, Introduction to Hashing Algorithms (SHA-256, Merkle Trees), Role of Cryptography in Decentralization and Trust.

UNIT – II Consensus Algorithms, Smart Contracts and Decentralized Applications (dApps)

Consensus Mechanisms: Proof of Work (PoW), Proof of Stake (PoS), Delegated PoS, Blockchain Consensus for Decentralization and Trustless Transactions, Practical Byzantine Fault Tolerance (PBFT). Challenges: Scalability, Security, and Energy Consumption. Real-World Blockchain Networks: Bitcoin, Ethereum, Hyperledger. Smart Contracts Definition and Use Cases: Introduction to Ethereum and Solidity (Smart Contract Language), Deploying and Interacting with Smart Contracts, Decentralized Autonomous Organizations (DAOs) and Governance. Practical Use Cases: Tokenization, Crowd funding and Voting.

UNIT – III Data Integrity in Data Science & Privacy-Preserving Machine Learning

Block chain for Secure Data Storage and Provenance, Data Integrity and Immutability in Block chain. Use Cases: Block chain for Auditing, Medical Data, and Scientific Research, Integration of Block chain with Data Warehousing and Big Data. Introduction to Privacy-Preserving ML Techniques. Federated Learning: A Block chain-based Approach to Privacy in ML, Block chain for Secure Aggregation and Model Sharing, Differential Privacy and Homomorphic Encryption in Block chain. Use Case: Block chain-based Federated Learning for Healthcare Data.

UNIT – IV Block chain in Algorithmic Systems & Block chain for Scalable ML Models

Blockchain for Transparent and Auditable Algorithms, Decentralized Machine Learning Models on Block chain, Blockchain and Algorithmic Fairness: Ensuring Accountability. Use Cases: Block chain for Transparent AI and Governance, Scalability Challenges of Block chain in ML Workflows. Layer 2 Solutions: Side chains, Plasma, Rollups, and Channels, Integration with Cloud Computing for Scalable ML Models. Tokenizing ML Models: Creating and Trading AI Models on Block chain.

UNIT – V Challenges and Limitations of Block chain in ML and Final Project

Block chain Latency and Throughput Issues in ML, Privacy and Security Challenges: Data Ownership, GDPR Compliance, Energy Consumption and Environmental Concerns with Block chain, Governance, Ethics, and the Future of AI and Block chain, final project- integrating block chain with a machine learning or data science problem, Block chain Solutions for AI Transparency, Secure Data Sharing, or Federated Learning, Reviewing and Critiquing Real-World Applications of Block chain in ML.

Text Books:

1. Andreas M. Antonopoulos, "Mastering Bitcoin", 3rd Edition, O'Reilly Media, 2017.
2. Imran Bashir, "Mastering Blockchain", 3rd Edition, Packt Publishing, 2020.
3. Joseph Holbrook, "Blockchain Basics", 2nd Edition, Apress, 2021.

References:

1. Andreas M. Antonopoulos, "Mastering Bitcoin", 3rd Edition, O'Reilly Media, 2017.
2. Imran Bashir, "Mastering Blockchain", 3rd Edition, Packt Publishing, 2020.
3. Joseph Holbrook, "Blockchain Basics", 2nd Edition, Apress, 2021.
4. Melanie Swan, "Blockchain: Blueprint for a New Economy", 1st Edition, O'Reilly Media, 2015.

Course Outcomes:

At the end of the course, the students should be able to,

1. Comprehend the foundational concepts behind block chain: distributed ledger, public-key cryptography, hashing, and the double-spend & Byzantine generals problems.
2. Explain various consensus mechanisms (PoW, PoS, PBFT, DPoS) and their trade-offs in permissionless and permissioned blockchains.
3. Develop and deploy smart contracts and decentralized applications using platforms like Ethereum, Hyperledger Fabric, or Corda.
4. Analyze blockchain security, privacy, anonymity techniques (e.g. Zk-SNARKs), and vulnerabilities such as 51% attacks or Sybil attacks.
5. Evaluate real-world blockchain use cases in finance, supply chain, identity management, and enterprise ecosystems.

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

25AIOESCN	BASICS OF ROBOTICS	L	T	P	C
		3	0	0	3

Course Objectives:

- To enlighten the students about the fundamentals of robotic systems.
- To impart basic knowledge of Robots and its roles in Automation.
- To understand the features and operation of automation products.
- To understand ethical and professional responsibilities.
- To teach the application of fuzzy logic in robotics.

UNIT – I Introduction

Classification of Robots-Industrial Robots- Autonomous Mobile -Humanoid Robots-Educational Robots-The Generic -Differential Drive-Proximity -Ground -Embedded-The Algorithmic Formalism-Sensors: Classification of Sensors-Distance Sensors-Cameras and onther sensors-Range, Resolution, Precision, Accuracy- Nonlinearity.

UNIT – II Reactive Behavior

Braitenberg Vehicles-Reacting to the Detection of an Object-Reacting and Turning-Line Following-Braitenberg's Presentation of the Vehicles-Finite State Machines: State Machines-Reactive Behavior with State-Search and Approach-Implementation of Finite State Machines.

UNIT – III Robotic Motion and Odometry

Distance, Velocity and Time- Acceleration as Change in Velocity-From Segments to Continuous Motion-Navigation by Odometry-Linear Odometry-Odometry with Turns-Errors in Odometry-Wheel Encoders-Inertial Navigation Systems-Degrees of Freedom and Numbers of Actuators-The Relative Number of Actuators and DOF.

UNIT – IV Control

Control Models-On-Off Control-Proportional (P) Controller-Proportional-Integral (PI)Controller-Proportional-Integral-Derivative (PID) Controller- Local Navigation: Obstacle Avoidance- Wall Following- Wall Following with Direction- The Pledge Algorithm-Following a Line with a Code-Ants Searching for a Food Source- A Probabilistic Model of the Ants' Behavior- A Finite State Machine for the Path Finding Algorithm.

UNIT – V Localization

Determining Position from Objects whose Position is Known - Global Positioning System-Probabilistic Localization- Uncertainty in Motion- Fuzzy Logic Control:Fuzzify-ApplyRules-Defuzzify-Image Processing:Obtaining Images-Image Enhancement-Edge Detection-corner detection-Recognizing Blobs.

Text Books:

1. Mordechai Ben-Ari, Francesco Mondada, "Elements of Robotics", Springer, 2018.
2. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, AshishDutta, "Industrial Robotics, Technology programming and Applications", McGrawHill, 2012.

References:

1. S.R. Deb, Sankha Deb, "Robotics Technology and Flexible Automation", 2nd edition, Tata McGraw Hill Education, 2010.
2. Richard D. Klafter, Thomas .A, Chri Elewski, Michael Negin, "Robotics Engineering an Integrated approach", PHI Learning., 2009.
3. Carl D. Crane and Joseph Duffy, "Kinematic Analysis of Robot manipulators", Cambridge University press, 2008.
4. Bharat Bhushan, "Springer Handbook of Nanotechnology", Springer, 2004.

Course Outcomes:

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

1. Know the basics of robot.
2. Understand the reactive behavior of robotics.
3. Get an idea about robot motion and sensors.
4. Develop path finding algorithms to control the motion of robot.
5. Apply fuzzy logic in robotic systems.

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

25AIOESCN	**AGILE METHODOLOGIES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand Agile values, principles, and compare with traditional methods.
- To apply Scrum roles, artifacts, and events in projects.
- To describe key practices of XP, Kanban, Lean, and other Agile models.
- To plan and manage Agile projects using estimation and tracking techniques.
- To use Agile tools and understand scaling frameworks like SAFe and Spotify.

UNIT – I Introduction to Agile

Agile Manifesto and Principles - Traditional vs Agile Methodologies - Benefits and Challenges of Agile - Overview of Agile Models: Scrum, XP, Kanban, Lean, Crystal

UNIT – II Scrum Framework

Scrum Roles: Product Owner, Scrum Master, Development Team - Scrum Artifacts: Product Backlog, Sprint Backlog, Increment - Scrum Events: Sprint, Sprint Planning, Daily Scrum, Sprint Review, Sprint Retrospective - Scrum Board and Burn-down Charts

UNIT – III Extreme Programming (XP) and Other Agile Models

XP Practices: Pair Programming, TDD, Continuous Integration, Refactoring - Kanban and Lean Concepts - Feature Driven Development (FDD) - Agile Modelling and Agile Unified Process (AUP)

UNIT – IV Agile Project Management

Agile Project Planning and Tracking - Estimation Techniques: Planning Poker, T-Shirt Sizing - Velocity and Burndown Charts - Risk Management in Agile Projects

UNIT – V Scaling Agile and Agile Tools

Scaling Agile: SAFe, LeSS, Spotify Model - Agile Tools: JIRA, Trello, VersionOne - Agile Metrics and KPIs - Case Studies and Industry Practices

Text Books:

1. Ken Schwaber and Mike Beedle, 'Agile Software Development with Scrum', Pearson Education, 2002.
2. Robert C. Martin, 'Agile Principles, Patterns, and Practices in C#', Pearson Education, 2006.

References:

1. Craig Larman, 'Agile and Iterative Development: A Manager's Guide', Addison-Wesley,2004.
2. Alistair Cockburn, 'Agile Software Development: The Cooperative Game', Addison-Wesley, 2006..
3. Mike Cohn, 'User Stories Applied: For Agile Software Development', Addison-Wesley, 2004.
4. James Shore and Shane Warden, 'The Art of Agile Development', O'Reilly Media,2008.

Course Outcomes:

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

1. Explain Agile principles and compare Agile with traditional software development methods
2. Apply Scrum framework including roles, events, and artifacts in project scenarios
3. Describe practices of XP, Kanban, Lean, and other Agile models
4. Plan and manage Agile projects using estimation, velocity, and tracking tools
5. Use Agile tools like JIRA and Trello, and understand scaling frameworks like SAFe and Spotify and Analyze case studies to understand Agile practices in industry contexts

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

25AIOESCN	**AUTONOMOUS DRONES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand the features and essential elements of UAV.
- To learn navigation and guidance techniques for UAV.
- To design, model, and simulate UAV systems using appropriate tools.
- To assemble, program, and integrate quadcopter hardware and software.
- To perform testing, calibration, and control operations for achieving autonomous flight.

UNIT – I Introduction to UAV

UAV: Definition, History; Difference between aircraft and UAV; DGCA Classification of UAVs; Types and Characteristics of Drones: Fixed, Multi-rotor, and Flapping Wing; Applications: Defense, Civil, Environmental monitoring.

UNIT – II Basics of Flight and Aerodynamics

Different types of flight vehicles; Components and functions of an airplane; Forces acting on Airplane; Physical properties and structure of the atmosphere; Aerodynamics – aerofoil

nomenclature, aerofoil characteristics, Angle of attack, Mach number, Lift and Drag, Propulsion and airplane structures.

UNIT – III UAV Elements

Components: Arms, motors, propellers, electronic speed controller (ESC), flight controller; Propulsion, Data Link; Sensors and Payloads: GPS, ITU, Light Detection and Ranging (LiDAR), Imaging cameras, Classification of payload based on applications.

UNIT – IV UAV Navigation

Hyper-spectral sensors; Laser Detection and Range (LADAR); Synthetic Aperture Radar (SAR); Thermal cameras; Ultra-sonic detectors; Case study on payloads. Introduction to navigation systems and types of guidance; Mission Planning and Control.

UNIT – V Design & Simulation of UAV

Introduction to CAD; Design of UAV components; Structural Analysis using CAE; Aerodynamic Analysis using CFE; Manufacturing of the components of UAVs: 3D printing; Case studies.

Text Books:

1. Andey Lennon, "Basics of R/C Model Aircraft Design", Model Airplane News Publication,1996.
2. John Baichtal, "Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs", 2015.

References:

1. 1 K. Valavanis, George Vachtsevanos, "Handbook of Unmanned Aerial Vehicles", New York, Springer, Boston, Massachusetts: Credo Reference, 2014.
2. DGCA RPAS Guidance Manual, Revision 3 – 2020.

Course Outcomes:

At the end of the course, the students should be able to

1. Explain the types and characteristics of UAVs and their applications.
2. Illustrate the concepts of aerodynamics of flight vehicle.
3. Demonstrate UAV elements.
4. Identify and explain the components, sensors and payload of UAVs, their navigation and guidance.
5. Design and perform structural, aerodynamic analysis of UAV components.

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

25AIOESCN	ENTREPRENEURSHIP, INNOVATION AND STARTUP	L	T	P	C
		3	0	0	3

Course Objectives:

- To develop entrepreneurial mindset and skills.
- To understand innovation processes and types.
- To equip students with tools for developing business models and startups.

- To introduce government and private startup support systems.
- To encourage ethical and sustainable entrepreneurship.

UNIT – I Introduction to Entrepreneurship

Definition, Evolution, and Importance of Entrepreneurship- Characteristics and Types of Entrepreneurs- Entrepreneurial Mindset and Motivation- Role of Entrepreneurship in Economic Development- Myths and Realities of Entrepreneurship.

UNIT – II Innovation and Creativity

Meaning and Concept of Innovation- Design Thinking for Innovation- Innovation Life Cycle- Incremental Vs Radical Innovation-Inbound and Outbound Ideation-Open and Other Innovative Ideation Methods.

UNIT – III Business Model and Plan Development

Business Planning and Fund Raising: Identifying, assessing and validation of the idea- Identifying the target segment and market share- creating an effective B-Plan- Market research, Financial, Market and Technical feasibility- Fund raising and valuation-Idea pitching.

UNIT – IV Legal and Financial Aspects

Legal aspects: Permits, Registrations and compliances- Intellectual Property Rights- Contracts. Financial aspects- Working capital management- Financial management and long-term investments- Capital structure and taxation- Brake even analysis.

UNIT – V Contemporary Issues

Legal forms of entrepreneurial organizations- Debt, Equity, Angle and Venture Capital markets for Start-ups, Growth and Development stages- new venture finance- Initial Public Offer (IPO) Governmental initiatives to encourage start ups - Business Incubations and its benefits-Protection of Intellectual Property.

Text Books:

3. 1.Drucker, P. F. , “Innovation and entrepreneurship: Practice and principles”, (Rev. ed.). Harper Business, 2006.
4. 2.Khanka, S. S. , “Entrepreneurial development”, S. Chand Publishing, 2007.

References:

a. Blank, S., & Dorf, B, “The startup owner's manual: The step-by-step guide for building a great company”,K&S Ranch Press, 2012.
b. Aulet, B, “Disciplined entrepreneurship, 24 steps to a successful start up”,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	-	1	-
CO2	2	3	-	-	-	-	-	-	-	-	2	-	2	-
CO3	2	3	-	-	2	-	2	-	2	-	2	-	3	-
CO4	-	2	2	-	2	1	-	-	-	-	2	-	2	-
CO5	1	-	-	-	-	-	2	2	-	-	2	-	2	-

HONOURS ELECTIVES

21AIHESCN	COMPUTATIONAL NEUROSCIENCE	L	T	P	C
		3	0	0	3

Course Objectives:

- Understand the fundamental principles of neural computation and neural modeling.
- Analyze and model single neuron dynamics using biophysical and mathematical approaches.
- Provide computational models of neural networks and their learning mechanisms.
- Impart information processing in sensory and cognitive systems using quantitative tools.
- Develop insights into real-world applications of computational neuroscience.

UNIT – I Introduction to Computational Neuroscience

Basics of neurons and neural systems, Structure and function of the nervous system, Action potentials and membrane potentials, Hodgkin-Huxley model, Integrate-and-fire models, Cable theory basics, Synaptic transmission, Neurotransmitters and receptors, Computational goals of neurons, Role of noise in neural computation

UNIT – II Neuronal Dynamics and Biophysical Modeling

Phase-plane analysis, Bifurcations in neuronal dynamics, FitzHugh-Nagumo model, Spike generation and adaptation, Ionic current modeling, Conductance-based models, Parameter sensitivity, Single neuron coding, Spike train variability Software tools for simulation

UNIT – III Neural Network Models and Plasticity

Feedforward and recurrent neural networks, Hebbian learning, STDP, Winner-take-all networks, Attractor networks, Hopfield networks, Associative memory, Cortical circuit modeling, Neural population dynamics, Stability and convergence

UNIT – IV Neural Coding and Information Representation

Rate coding vs. temporal coding, Population coding, Mutual information and entropy, Neural tuning curves, Bayesian decoding, Principal Component Analysis, Independent Component Analysis, Dimensionality reduction, Neural manifolds, Representational similarity analysis

UNIT – V Applications, Tools, and Ethics

Brain-Computer Interfaces, Neuromorphic computing, Neuroimaging data modeling, Computational psychiatry and disease modeling, Neural prosthetics, AI and brain-inspired computing, Deep learning and neuroscience, Open-source tools for computational neuroscience
Ethical implications in neurotechnology, Future challenges and frontiers

Text Books:

1. Wulfram Gerstner, Werner M. Kistler, Richard Naud, Liam Paninski, “Neuronal Dynamics: From Single Neurons to Networks and Models of Cognition”, Cambridge University Press, 2014
2. David Sterrat, Bruce Graham, Andrew Gillies, David Willshaw, “Principles of Computational Modelling in Neuroscience”, Cambridge University Press, 2nd Edition, 2024

References:

1. Thomas Trappenberg, "Fundamentals of Computational Neuroscience", 3rd Edition, Oxford University Press, 2023
2. Peter Dayan & Laurence F. Abbott, "Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems", MIT Press, Expanded Edition, 2021
3. Eric Kandel, James Schwartz, Thomas Jessell, "Principles of Neural Science", 6th Edition, McGraw-Hill, 2021

Course Outcomes:

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

1. Explain the biological and mathematical basis of neuron and synapse models.
2. Apply differential equations and numerical methods to simulate neuronal dynamics.
3. Analyze network-level behaviour and plasticity using computational tools.
4. Interpret information encoding and decoding mechanisms in neural systems.
5. Evaluate computational neuroscience applications & ethical implications in neurotechnology.

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

21AIHESCN	**ROBOT LEARNING AND SENSORIMOTOR CONTROL**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce the structure, classification, and performance parameters of robotic systems.
- To analyze robotic motion using rigid body transformations and rotation matrices.
- To understand the fundamentals of computer vision for robotic perception.
- To develop efficient path planning and trajectory optimization methods for robots.
- To apply joint and force control strategies in robotic systems.

UNIT – I Introduction

Robotics-Components and structure of robots: Symbolic representation-degrees of freedom and workspace-classification of robots-common kinematic arrangements-robotic systems-accuracy and repeatability-wrists and end effectors.

UNIT – II Rigid Motions and Homogeneous Transformations

Representing positions-representing rotations-in plane-in 3D-rotational transformations-composition of rotations-current coordinate frame-fixed frame-parameterizations of rotations-Euler Angles-Roll, pitch, yaw angles-axis/angle representation-homogeneous transformations.

UNIT – III Computer Vision

Geometry of image formation-camera coordinate frame-perspective projection-image plane and the sensor array-camera calibration - extrinsic camera parameters-intrinsic camera parameters -

determining the camera parameters-segmentation and thresholding - connected components-position and orientation.

UNIT – IV Planning and Optimization

Path planning and collision avoidance: The configuration space-path planning using configuration space potential fields-planning using workspace potential fields-using random motions to escape local minima-probabilistic roadmap methods. Trajectory planning: Trajectories for point-to-point motion-trajectories for paths specified via points.

UNIT – V Cue Integration and Sensorimotor Adaptation

Independent Joint Control: Actuator dynamics - set point tracking-Feedforward control and computed torque - drive train dynamics. Force Control: Constrained dynamics - static force/torque relationships - constraint surfaces-natural and artificial constraints-network models and impedance-force control strategies.

Text Books:

1. Mordechai Ben-Ari, Francesco Mondada, " Elements of Robotics" , Springer, 2018.
2. Howie Choset, Kevin Lynch, seth Hutchinson, George Kantor, Wolfram Burgard, Lydia Kavraki and Sebastian Thrun, "Principles of robot motion: Theory, algorithms and implementations", MIT Press, 2005.

References:

1. Bilanchi, Matteo, Moscatelli, Alessandro (Eds.), "Human and robot hands: Sensorimotor synergies to bridge the gap between neuro science and robotics, Springer series in Touch and Haptic systems, Springer, 2016.
2. Mikell P Groover &Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, "Industrial Robotics: Technology programming and Applications", McGraw-Hill, 2012.
3. Carl D. Crane and Joseph Duffy, "Kinematic Analysis of Robot manipulators", Cambridge University press, 2008.
4. Mark W. Spong, Seth Hutchinson, M. Vidyasagar, "Robot dynamics and control", Second edition, John Wiley & Sons, 2004.

Course Outcomes:

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

1. Understand the components, classification, and structure of robotic systems.
2. Apply homogeneous transformations and rotational parameterizations in 3D.
3. Utilize computer vision principles for image formation and processing in robotics.
4. Design and implement robotic path and trajectory planning algorithms.
5. Analyze joint and force control methods for robotic manipulation tasks.

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

21AIHESCN	HUMAN COMPUTER INTERACTION	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the history of evolution of Human Computer Interaction.
- To provide the design HCI experiments.
- To teach various interaction models of HCI.
- To develop skills in building interfaces for HCI.
- To identify different essential application areas of HCI.

UNIT – I Historical Context and Interaction Elements

Introduction - Memex – Sketchpad – Mouse - Xerox star - Birth of HCI -Growth of HCI and GUIs – Human factor : Sensors – Responders - The brain –Language - Human performance - Interaction Elements : Hard controls and soft controls – Control-display relationships - Natural versus learned relationships - Mental models and metaphor – Modes -Mobile context - Interaction errors.

UNIT – II Designing HCI Experiments

Ethics – Experiment design – Variables – independent, dependent, control, random, confounding - Task and procedure – Participants – Hypothesis testing : Analysis of variance – Chi-square test - Parametric tests - Non-parametric tests.

UNIT – III Interaction Models and Design Issues

Interaction models : Descriptive models - Predictive models - Design issues - Quality of Service : Introduction, Models of response, Time impacts, Expectations and attitudes, User productivity, Variability in response time, Frustrating experiences - Balancing function and fashion, Error messages, Design - Information search and Visualization : Searching in textual documents and Database querying, Multimedia document searches, Advanced filtering and search interfaces, Information visualization.

UNIT – IV Mobile Interfaces

Mobile ecosystem - Application frameworks - Types of mobile applications- Mobile information architecture - Mobile design – Elements - Mobile web Apps - Mobile 2.0 –- Mobile web development-WebKit.

UNIT – V Web Interfaces

In-Page Editing - Drag and Drop - Direct selection - Contextual tools – Overlays - Inlays - Virtual pages - Process flow – Use transitions – Patterns.

Text Books:

1. I. Scott Mackenzie, “Human-Computer Interaction – An Empirical Research Perspective”, Elsevier, 2013.
2. Ben Shneiderman and Catherine Plaisant, “Designing the User Interface: Strategies for Effective Human-Computer Interaction”, Addison-Wesley, 2010.
3. Brian Fling, “Mobile Design and Development”, O’Reilly Media, First Edition, 2009.
4. Bill Scott and Theresa Neil, “Designing Web Interfaces”, O’Reilly Media, First Edition 2009.

References:

1. Alan Dix, Janet Finlay, Gregory D. Abowd and Russell Beale, “Human Computer Interaction”, Pearson Education, Third Edition, 2004.
2. Meena, K and Sivakumar, R, “Human-Computer Interaction”, PHI Learning, First Edition, 2014.
3. Gerard Jounghyun Kim, “Human-Computer Interaction - Fundamentals and Practice”, Auerbach Publications, First Edition, 2015.
4. Kent L. Norman and Jurek Kirakowski, “The Wiley Handbook of Human Computer Interaction Volume 1”, John Wiley and Sons Ltd, 2018.

Course Outcomes:

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

1. Understand the importance of HCI.
2. Design effective experiments for HCI.
3. Utilize different models of interaction and understand the design issues of HCI.
4. Develop suitable mobile interfaces for HCI.
5. Build web interfaces for effective interaction between human and computer.

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

21AIHESCN	**ENTERPRISE DEEP LEARNING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand the foundational concepts of deep learning in an enterprise context.
- To explore scalable architectures and frameworks for building deep learning solutions.
- To gain hands-on experience with distributed training and large-scale deployment.
- To integrate MLOps practices for lifecycle management of deep learning models.
- To evaluate real-world enterprise applications and ethical aspects of AI deployment.

UNIT – I Deep Learning Fundamentals

History and evolution of deep learning- Neural network basics: perceptrons, activation functions, backpropagation- Loss functions and optimization techniques - Regularization and initialization techniques.

UNIT – II Architectures and Frameworks

Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), Transformers, Transfer Learning and Pre-trained Models - Deep learning frameworks: TensorFlow, PyTorch, Keras, Model building and training pipelines.

UNIT – III Scalable Training in Enterprises

Data engineering for deep learning - Distributed training strategies - Model parallelism and data parallelism Using GPU and TPU infrastructure for enterprise-scale training.

UNIT – IV Deployment and MLOps

Model deployment tools: TensorFlow Serving, TorchServe - Containerization using Docker and Kubernetes - CI/CD pipelines and monitoring - Model versioning and rollback strategies.

UNIT – V Application and Trends

Enterprise use cases: NLP, computer vision, recommendation systems - AutoML and hyperparameter – tuning - Federated learning and edge deployment -Ethics, bias, and interpretability

in enterprise AI.

Text Books:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "'Deep Learning", MIT Press, 2016.
2. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 2nd Edition, O'Reilly,2022.

References:

1. Jeremy Howard & Sylvain Gugger, "'Deep Learning for Coders with fastai and PyTorch ", O'Reilly,2023.
2. Emmanuel Ameisen, " Deep Learning for Engineers", Manning, 2021.
3. Chip Huyen, "Designing Machine Learning Systems" , O'Reilly, 2022.
4. Andriy Burkov, "Machine Learning Engineering", True Positive Inc,2020.

Course Outcomes:

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

1. Understand core principles and mathematical foundations of deep learning.
2. Design and implement CNN/RNN/Transformer models using DL frameworks.
3. Scale deep learning training for enterprise-level datasets and systems.
4. Deploy and monitor deep learning models using MLOps techniques.
5. Analyze and implement enterprise applications using 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	2	1	-	-	-	-	-	-	-	-	-	2	-
CO2	2	3	2	2	1	-	-	-	-	-	-	-	2	-
CO3	2	3	3	3	2	-	-	-	-	-	-	-	3	-
CO4	3	3	2	2	2	-	-	-	-	-	-	-	3	-
CO5	3	2	1	2	3	-	-	-	-	-	-	-	2	-

21AIHESCN	**STOCHASTIC PROCESS AND QUEUING THEORY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand the foundational concepts of random processes applicable in data-driven systems.
- To explore queuing theory and its applications in computer, communication, and service systems.
- To evaluate advanced queuing models in the context of system performance.
- To provide mathematical tools for modeling and analyzing uncertainty.
- To enable students to apply probabilistic reasoning to real-world problems in AI and ML.

UNIT – I Random Processes

Classification – Stationary process – Markov process – Poisson process – Random telegraph process.

UNIT – II Correlation and Spectral Densities

Autocorrelation functions – Cross-correlation functions – Properties – Power spectral density – Cross spectral density – Properties.

UNIT – III Linear Systems with Random Inputs

Linear Time Invariant (LTI) system – System transfer function – LTI systems with random inputs – Auto and cross-correlation functions of input and output.

UNIT – IV Queuing Models

Markovian queues – Birth and death processes – Single and multi-server models – Little's formula – Finite waiting rooms – Queues with impatient customers: Balking and reneging.

UNIT – V Advanced Queuing Models

Finite source models – M/G/1 queue – Pollaczek–Khinchin formula – M/D/1 and M/Ek/1 models – Series queues – Open Jackson networks.

Text Books:

1. M.B.K. Moorthy, K. Subramani, A. Santha, "Probability and Random Processes", SciTech Publications, 7th Ed., 2015.
2. D. Gross, J.F. Shortle, J.M. Thompson, C.M. Harris, "Fundamentals of Queueing Theory", Wiley, 4th Ed., 2014.

References:

1. U. Narayan Bhat, "An Introduction to Queueing Theory", Birkhäuser, 2015.
2. Robert G. Gallager, "Stochastic Processes: Theory for Applications", Cambridge Univ. Press, 2013.
3. J. Medhi, "Stochastic Models in Queueing Theory", Academic Press, 2nd Ed., 2003.
4. K.S. Trivedi, "Probability and Statistics with Reliability, Queueing and Computer Science Applications", Wiley, 2nd Ed., 2002.

Course Outcomes:

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

1. Apply the concepts of random processes to analyze real-time systems.
2. Use correlation and spectral density techniques for modeling signal and noise behavior.
3. Analyze LTI systems with random inputs relevant to AI/ML tasks.
4. Apply basic queuing models to evaluate system performance.
5. Analyze and interpret advanced queuing models in complex 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	2	1	2	-	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	2	-
CO3	3	3	3	2	1	-	-	-	-	1	-	-	3	-
CO4	3	2	3	2	1	-	-	-	-	1	-	-	2	-
CO5	3	2	3	3	2	1	-	-	-	1	-	-	2	-

21AIHESCN	CNN FOR VISUAL RECOGNITION	L	T	P	C
		3	0	0	3

Course Objectives:

- To acquire basic knowledge of deep learning principles.
- To understand CNNs, their fundamental processes and their applications.
- To recognize, identify and understand visual information from single image or video sequence.
- To explore CNN for visual recognition.
- To build generative models and encoders.

UNIT – I Machine Learning for Computer Vision

A brief history of computer vision- Challenges in Computer Vision - Machine Learning for Vision-Machine Learning Basics - Learning Algorithms - Capacity, Overfitting and Underfitting- Hyper parameters and Validation - Estimators, Bias and Variance - Maximum Likelihood Estimation - Bayesian Statistics - Supervised Learning Algorithms - Unsupervised Learning Algorithms - Stochastic Gradient Descent - Building a Machine Learning Algorithm - Challenges Motivating Deep Learning.

UNIT – II Deep Learning and Convolutional Networks

Deep Feedforward Networks -Example: Learning XOR - - Gradient-Based Learning - Hidden Units Architecture Design Back-Propagation and Other Differentiation Algorithms Convolutional Networks -The Convolution Operation -Motivation - Pooling - Convolution and Pooling as an Infinitely Strong Prior -Variants of the Basic Convolution Function -Structured Outputs-Data Types-Efficient Convolution Algorithms -Random or Unsupervised Features -The Neuroscientific Basis for Convolutional Networks

UNIT – III Convolutional Neural Networks Architectures

Popular CNN Model Architectures -Introduction to ImageNet-LeNet- AlexNet architecture- VGGNet architecture-GoogLeNet architecture-Architecture insights-Inception module- ResNet architecture- Convolutional Networks for Detection and Segmentation.

UNIT – IV Recurrent Neural networks and Reinforcement Learning

Recurrent Neural Networks-Recurrent Neurons-Training RNNs-Deep RNNs-LSTM Cell-GRU Cell-Reinforcement Learning- Deep Reinforcement Learning

UNIT – V Autoencoders, Generative Models with Adversarial Learning

Generative Models- Taxonomy of Generative models - PixelRNN - PixelCNN-variational auto encoders (VAE) - generative adversarial network(GAN)- Visualizing and Understanding - Feature visualization and inversion -Adversarial examples - DeepDream and style transfer.

Text Books:

1. Ragav Venkatesan, Baoxin Li, “Convolutional Neural Networks in Visual Computing: A Concise Guide”, CRC Press, 2018.
2. Ian Goodfellow and YoshuaBengio and Aaron Courville, “Deep Learning”, MIT press, 2016

References:

1. Pradeep Pujari, Md. Rezaul Karim, Mohit Sewak, “Practical Convolutional Neural Networks”, Packt Publishing, February 2018.
2. Charu C. Aggarwal, “Neural Networks and Deep Learning: A Textbook”, Springer, September 2018.

3. Salman Khan, Hossein Rahmani, Syed Afaq Ali Shah, Mohammed Bennamoun, Gerard Medioni, Sven Dickinson, "A Guide to Convolutional Neural Networks for Computer Vision", Morgan & Claypool, 2018.
4. Xavier Alameda, Elisa Ricci, "Multimodal Behaviour Analysis in the wild: Advances and challenges", 1st Edition, Academic Press, 2018.

Course Outcomes:

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

1. Understand the challenges in computer vision.
2. Acquire knowledge of how deep learning algorithms could be used in computer vision.
3. Understand the advantages and trade-offs of various CNN and RNN architectures.
4. Apply CNN for object detection and segmentation.
5. Apply generative adversarial networks (GANs) for Visual Recognition.

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

21AIHESCN	**MACHINE LEARNING FOR PREDICTIVE DATA ANALYSIS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To provide a comprehensive understanding of machine learning concepts for predictive data analytics.
- To explain data preparation, feature engineering, and problem framing techniques.
- To introduce supervised learning methods such as classification and regression with practical applications.
- To understand model evaluation, performance improvement, and model selection.
- To introduce unsupervised learning techniques and highlight ethical considerations in machine learning.

UNIT – I Introduction to Machine Learning

Overview of Machine Learning for Predictive Data Analytics, Types of Machine Learning: Supervised, Unsupervised, Reinforcement the Predictive Data Analytics Workflow, Introduction to Key Terminologies: Features, Labels, Models, Training, Testing, Challenges in Machine Learning

UNIT – II Data Preparation and Representation

Importance of Data Quality, Data Preprocessing Techniques: Cleaning, Handling Missing, Data, Normalization, Feature Engineering and Selection, Data Splitting: Training, Validation, Testing Sets, Introduction to Overfitting and Underfitting.

UNIT – III Supervised Learning: Classification

Introduction to Classification Problems, Decision Trees for Classification, k-Nearest Neighbors (k-NN) , Naïve Bayes Classifier, Model Evaluation: Confusion Matrix, Accuracy, Precision, Recall, F1-score.

UNIT – IV Supervised Learning: Regression

Understanding Regression and its Applications, Simple and Multiple Linear Regression, Evaluating Regression Models: Mean Squared Error, R^2 , Overfitting in Regression Models, Introduction to Regularization Techniques.

UNIT – V Unsupervised Learning and Model Evaluation

Clustering Techniques: k-Means Clustering, Introduction to Hierarchical Clustering, Dimensionality Reduction (PCA Overview), Cross-validation Techniques, Ethical Aspects and Responsible Machine Learning.

Text Books:

1. D. Kelleher, B. Mac Namee, and A. D'Arcy, Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, and Case Studies, 2nd ed. Cambridge, MA: The MIT Press, 2020.
2. A. C. Müller and S. Guido, Introduction to Machine Learning with Python: A Guide for Data Scientists. Sebastopol, CA: O'Reilly Media, 2016.

References:

1. C. M. Bishop, "Pattern Recognition and Machine Learning",New Delhi, India: Springer (Indian Print), 2006.
2. T. Hastie, R. Tibshirani, and J. Friedman, "The Elements of Statistical Learning: Data Mining, Inference, and Prediction", 2nd ed. New Delhi, India: Springer (Indian Print), 2009.
3. A. C. Müller and S. Guido, "Introduction to Machine Learning with Python: A Guide for Data Scientists". Mumbai, India: Shroff Publishers & Distributors (O'Reilly Indian Print), 2017.

Course Outcomes:

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

1. Demonstrate an understanding of machine learning concepts and their role in predictive data analytics.
2. Prepare and analyse data for machine learning tasks using appropriate techniques.
3. Apply classification and regression algorithms to real-world problems.
4. Analyse model performance using suitable metrics and improve model effectiveness.
5. Explain unsupervised learning approaches and assess the ethical implications of machine learning 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	2	-	-	-	-	-	-	-	-	2	-	-
CO2	2	2	2	-	-	-	-	-	-	-	-	2	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	2	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	2	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	2	-	-

MINOR ENGINEERING ELECTIVE COURSES

21AIMISCN	PRINCIPLES OF ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the fundamental concepts, definitions, and goals of artificial intelligence and intelligent agents.
- To enable students to apply classical and heuristic search strategies, including adversarial search for problem-solving and game-playing.
- To develop the ability to represent knowledge formally using propositional and first-order logic and perform reasoning using inference techniques.
- To familiarize students with planning methods, uncertainty reasoning using probability, and machine learning concepts such as supervised learning and decision trees.
- To educate practical AI applications in natural language processing, expert systems, and ethical considerations in real-world domains.

UNIT – I Introduction to Artificial Intelligence

Introduction: Definitions of AI – Acting humanly vs. thinking humanly – Thinking rationally vs. acting rationally. Intelligent Agents: Agents and Environments – Nature of Environments – Structure of Agents. Problem-Solving Agents: Formulating Problems – Example Problems. Uninformed Search Strategies: Breadth-First Search – Depth-First Search – Iterative Deepening Search. Constraint Satisfaction Problems (CSP): Overview – Example Problems.

UNIT – II Informed Search and Adversarial Search

Heuristic Search Strategies: Greedy Best-First Search – A* Search – Heuristic Functions. Local Search Algorithms: Hill Climbing – simple and steepest ascent. Adversarial Search: Game Playing – Minimax Algorithm – Alpha-Beta Pruning.

UNIT – III Knowledge and Reasoning

Knowledge-Based Agents: The Wumpus World. Logic: Propositional Logic – Syntax and Semantics – Inference – Resolution – Forward and Backward Chaining. First-Order Logic – Syntax and Semantics –Inference in First-Order Logic – Unification – Resolution – Forward and Backward Chaining in FOL.

UNIT – IV Planning and Uncertainty

Classical Planning: STRIPS Representation – Planning Graphs – Partial-Order Planning. Planning and Acting in the Real World: Hierarchical Planning – Time and Resources. Reasoning Under Uncertainty: Probability Basics – Bayes' Rule. Probabilistic Reasoning: Inference in Bayesian Networks. Basic Learning Concepts: Learning from Observations – Supervised Learning – Decision Trees – Cross-Validation.

UNIT – V Natural Language Processing, Expert Systems, and AI Applications

Natural Language Processing: Text Preprocessing – Syntactic Analysis – Semantic Analysis. Expert Systems: Knowledge Acquisition – Inference Engines – Applications. AI Ethics: Privacy – Fairness – Bias – Autonomous Systems – Societal Impact. AI Applications: Healthcare – Finance – Transportation – Education.

Text Books:

1. Stuart Russell and Peter Norvig**,** "*Artificial Intelligence: A Modern Approach"*, 4th Edition**,** Pearson Education, 2020.
2. Elaine Rich, Kevin Knight, and Shivashankar B. Nair**, "***Artificial Intelligence"*, 4th Revised Edition**,** MedTech Science Press, 2024.
3. Nils J. Nilsson**, "***Artificial Intelligence: A New Synthesis"*, Paperback Reprint Edition**,** Morgan Kaufmann, 2011.

References:

1. George F. Luger**, "***Artificial Intelligence: Structures and Strategies for Complex Problem Solving"*, **6th** Edition**,** Pearson Education, 2009.
2. Kevin P. Murphy**,** "*Machine Learning: A Probabilistic Perspective"*, 1st Edition**,** MIT Press, 2012.
3. Patrick H. Winston**, "***Artificial Intelligence"*, 3rd Edition, Addison Wesley, 1992.
4. Peter Jackson**,** "*Introduction to Expert Systems"*, 3rd Edition, Addison-Wesley, 1998.

Course Outcomes:

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

1. Identify key concepts of artificial intelligence, intelligent agents, and problem-solving paradigms.
2. Implement uninformed and informed search algorithms, including game-playing strategies.
3. Investigate knowledge using propositional logic, first-order logic to perform logical reasoning using resolution and inference mechanisms.
4. Design classical planning solutions, apply probabilistic reasoning and supervised learning techniques to real-world problems.
5. 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	-
CO2	3	3	3	2	3	-	-	-	-	1	-	-	3	-
CO3	3	3	2	2	2	-	-	-	-	1	-	-	3	--
CO4	3	3	3	3	3	-	-	-	-	-	1	-	3	-
CO5	2	1	-	-	-	3	3	2	1	-	2	-	2	-

21AIMISCN	**FUNDAMENTALS OF MACHINE LEARNING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce fundamentals of machine learning, regression and normal densities.
- To provide in-depth knowledge about the classification algorithms used in machine learning.
- To understand the clustering algorithms and methods of reducing the dimension of feature vectors.
- To familiarize the different deep learning architectures.
- To understand the methods of combining evidence from two or more machine learning

techniques.

UNIT – I Linear and Logistic Regression and Normal Distribution

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

UNIT – II Classification Algorithms

Perceptron and back propagation neural network - k-nearest-neighbor 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", 3rd 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. Construct 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	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	2	2	1	1	-	-	-	-	-	-	-	-	2	-
CO3	2	1	2	1	-	-	-	-	-	-	-	-	2	-
CO4	2	3	3	2	1	-	-	-	-	-	-	-	3	-
CO5	2	3	3	2	1	-	-	-	-	-	-	-	2	-

21AIMISCN	DEEP LEARNING FOR VISUAL COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives:

- To educate students on the mathematical and machine learning basics of deep learning for Visual Computing.
- To understand the knowledge about deep learning.
- To familiarize students with various deep learning Visual Computing tools namely Python, TensorFlow, Scala, PyTorch, etc.
- To prepare the test environment for deep learning of Visual Computing.
- To teach geometric and radiometric visual computing.

UNIT – I Applied Math and Machine Learning Basics

Linear algebra - Probability and Information theory - Numerical computation - Machine Learning basics - Modern Practical Deep Networks - Deep Feedforward Networks - Regularization for Deep Learning - Optimization for training Deep Models - Convolutional Networks - Sequence Modeling: Recurrent and Recursive Nets - Practical Methodology - Applications.

UNIT – II Deep Learning Research

Linear Factor Models - Autoencoders - Representation Learning - Structured Probabilistic Models for Deep Learning - Monte Carlo methods - Confronting the partition function - Approximate inference - Deep Generative Models.

UNIT – III Fundamentals of Image Based Visual Computing

Data - Visualization - Discretization - Representation - Noise - Techniques - Interpolation-Geometric Intersections Convolution - Linear systems - Linear filters - Implementation details - Spectral analysis - Discrete Fourier Transform - Polar Notation - Periodicity of frequency domain - Aliasing - Extension for 2D Interpretation - Duality - Feature detection - Edge detection - Feature detection - Other non-linear filters.

UNIT – IV Geometric Visual Computing

Geometric Transformations - Homogeneous coordinates - Linear Transformations - Euclidean and Affine Transformations - Concatenation of Transformations - Coordinate systems - Properties of concatenation - Projective Transformation - Degrees of freedom - Non-Linear Transformations. The Pinhole Camera - The Model - Considerations in the practical camera - Epipolar geometry - Background - Correspondences in Multi-View geometry - Fundamental matrix - Essential matrix - Rectification - Applying Epipolar geometry.

UNIT – V Radiometric Visual Computing

Light - Radiometry - Photometry and color - Color reproduction - Modeling additive color mixtures - Color management - Modeling Subtractive Color Mixture - Limitations - Photometric processing - Histogram processing - Image composition - Photometric stereo visual content synthesis - The Diverse Domain - Modeling - Processing – Rendering - Application - Interactive Graphics pipeline - Geometric Transformation of Vertices - Clipping and Vertex Interpolation of Attributes - Rasterization and Pixel Interpolation of Attributes - Realism and Performance - Illumination - Shading - Shadows - Texture mapping - Bump Mapping - Environment mapping - Transparency - Accumulation buffer - Back Face Culling - Visibility Culling - Graphics programming - Development of Graphics Processing Unit - Development of Graphics APIs and libraries - The Modern GPU and CUDA.

Text Books:

1. Aditi Majumder, M. Gopi, “Introduction to Visual Computing: Core Concepts in Computer Vision, Graphics, and Image Processing”, CRC Press, First Edition, 2018.

2. Ian Good fellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press, First Edition, 2016.

References:

1. Jon Krohn, Beyleveld Grant and Bassens Aglaé, "Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence", Addison-wesley, First Edition, 2019.
2. Hyatt Saleh, "Applied Deep Learning with PyTorch, Packt", First Edition, 2019.
3. Pradeep Pujari, Md. and Rezaul Karim, Mohit Sewak, "Practical Convolutional Neural Networks", Packt Publishing, First Edition, February2018.
4. Ragav Venkatesan and Baoxin Li, "Convolutional Neural Networks in Visual Computing(Data-Enabled Engineering)", CRC Press, First Edition, September 2017.

Course Outcomes:

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

1. Understand Deep learning for Visual Computing and able to setup development environment.
2. Implement image classification and learning.
3. Investigate object detection and implement convolutional neural network autoencoding.
4. Understand Geometric visual computing.
5. Familiarize students with radiometric visual computing.

Mapping of Course Outcomes with Programme Outcomes														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	2	1	1	-	-	-	-	-	-	2	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	3	-	1	1	-	-	-	-	-	-	-	2	-	-
CO4	2	1	2	2	2	-	-	-	-	-	-	2	-	-
CO5	1	2	2	-	3	-	-	-	-	-	-	2	-	-

21AIMISCN	**MOBILE APP DEVELOPMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To demonstrate their understanding of the fundamentals of Android operating systems.
- To develop their skills of using Android software development tools.
- To describe their ability to develop software with reasonable complexity on mobile platform.
- To train students to understand android SDK.
- To teach students to gain a basic understanding of Android application development.

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 the course, the students should be able to

1. 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. Investigate and select appropriate solutions to the mobile computing platform.

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

21AIMISCN	**INTERNET OF THINGS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce the fundamentals of Internet of Things.
- To expose 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, Mark Harrison, Florian Michahelles, "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, 2017.
3. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press 2013.

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

21AIMISCN	**ROBOTICS AND AI**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce students to the foundations of robotic systems and intelligent behaviour.
- To analyze AI techniques applicable in robotic perception, planning, and control.
- To understand reactive, deliberative, and learning-based robotic behaviours.
- To integrate computer vision and machine learning into autonomous robotic systems.
- To explore real-world applications of intelligent robotics in industries and services.

UNIT – I Introduction to Robotics and AI

Classification of Robots: Industrial, Mobile, Humanoid-Social Robots-Components of a Robotic System: Sensors, Actuators, Controllers-AI in Robotics: Symbolic AI vs. Sub-symbolic AI-Role of AI in Perception, Planning, and Decision-making-Case Studies: Self-driving Cars, Delivery Robots, Industrial Arms.

UNIT – II Reactive Behavior and Rule-Based AI

Braitenberg Vehicles and Behavioral Robotics-Finite State Machines (FSMs): Modeling, Transitions, State Diagrams-Rule-Based AI: Production Systems-IF-THEN Rules-Behavior Trees and Decision Trees-Subsumption Architecture and Layered Control-Rule-Based Systems and Expert Systems in Robotics-Designing Reactive Agents for Obstacle Avoidance and Navigation, Wall Following, Line Following.

UNIT – III Robotic Kinematics, Motion Planning and Learning

Degrees of Freedom (DOF)-Forward and Inverse Kinematics-Manipulator Kinematics and Denavit–Hartenberg Convention (overview)-Trajectory Generation and Interpolation, Path Planning Algorithms: A*, D*, RRT, PRM-Motion Control: PID Control, Feedforward and Feedback Control-Reinforcement Learning (RL): Basics, Q-learning, SARSA-Deep Reinforcement Learning (DQN, PPO) in navigation and control-Markov Decision Processes (MDPs) for robot decision-making.

UNIT – IV Computer Vision and Robotic Perception

Camera Models and Calibration-Image Processing: Color Models, Filtering, Edge Detection-Blob Detection-Object Recognition: Feature Detection (SIFT, ORB)-Template Matching-Deep Learning for Vision: CNNs, YOLO-SSD-Visual SLAM: Concepts and Approaches-Depth Estimation with Stereo Vision and RGB-D Cameras-Sensor Fusion for Perception (e.g., LIDAR + Camera)-Applications: Face Detection, Gesture Recognition, Autonomous Driving Vision.

UNIT – V Cognitive AI and Human-Robot Interaction

Natural Language Processing (NLP) in Robotics: Speech Recognition, Command Parsing-Probabilistic Robotics: Bayesian Filters, Kalman and Particle Filters-Fuzzy Logic Control: Membership Functions, Rule Base, Defuzzification-Ethics in Robotics: Bias, Safety, Privacy, Job Displacement-Human-Robot Interaction (HRI): Social Intelligence, Affective Computing-Cloud Robotics and Internet of Robotic Things (IoRT)- Autonomous Decision-Making: Planning under Uncertainty, Game Theory (intro).

Text Books:

1. Mordechai Ben-Ari, Francesco Mondada,"Elements of Robotics", Springer, 2018.
2. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson, 4th Edition.
3. Mikell P. Groover, Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, "Industrial Robotics, Technology programming and Applications", McGraw Hill, 2012.

References:

1. Peter Corke, Robotics, "Vision and Control", Springer, 2017.
2. Sebastian Thrun et al., "Probabilistic Robotics", MIT Press, 2005.
3. Richard D. Klafter et al., "Robotics Engineering", PHI, 2009.
4. Sutton & Barto, "Reinforcement Learning: An Introduction", MIT Press, 2018.

Course Outcomes:

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

1. Describe the architecture and components of intelligent robotic systems.
2. Design and implement behaviour-based models using AI techniques.
3. Apply machine learning and motion planning in robotic control.
4. Integrate vision and sensor data for real-time perception in robots.
5. Develop autonomous robots capable of decision-making and interaction

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

ONE CREDIT COURSES

25AIOCSCN	DATA SCIENCE LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To load various kinds of data and display them in various formats for better understanding.
- To learn to collect, explore, clean, munge and manipulate data.
- To understand how statistics and probability is used in data science applications.

LIST OF EXERCISES

1. Study of Python Data Science Environment (NumPy, SciPy, matplotLib, Pandas, Scikit-learn).
2. Operations on Python Data Structures.
3. Reading data from various sources (Text files, CSV files, Excel files, HTML/XML files, JSON files).
4. Exploring data through simple visualization tools like charts and graphs using matplotlib.
5. Data cleansing operations for handling missing data.
6. Data Wrangling (Filtering, Pivoting dataset, Melting Shifted Datasets, Merging Melted data, Concatenating data, Exporting Data).
7. Data Aggregation (Grouping, Group wise operations and transformations).
8. Data Transformations (Rescaling and Dimensionality Reduction).
9. Measuring Central Tendency, Variability and Correlation.
10. Creating, Plotting and Understanding Probability Distributions.
11. Hypothesis Testing.
12. Creating and Displaying Geographic Maps.
13. Handling Graph Data.
14. Creating and Displaying Heat Maps.
15. Developing a simple spam filter application.

Course Outcomes:

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

1. Utilize the various data structures and libraries in Python for data science programming.
2. Implement statistical measurements, hypothesis and tests on data.
3. Develop practical applications covering the concepts of Data Science

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

25AIOCSCN	DATA VISUALIZATION LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To utilize Business Intelligence (BI) technology (Tableau) to apply data visualizations.
- To define patterns and relationships in the data.

- To teach students to work with different formats of data sets.

LIST OF EXERCISES

1. Understanding Data, What is data, where to find data, Foundations for building Data Visualizations.
2. Getting started with Tableau Software using Data file formats, Connecting your Data to Tableau, creating basic charts(line, bar charts, Tree maps), Using the Show me panel.
3. Tableau Calculations, Overview of SUM, AVR, and Aggregate features, Creating custom calculations and fields.
4. Applying new data calculations to your visualizations, Formatting Visualizations, Formatting Tools and Menus, Formatting specific parts of the view.
5. Editing and Formatting Axes, Manipulating Data in Tableau data, Pivoting Tableau data.
6. Structuring your data, Sorting and filtering Tableau data, Pivoting Tableau data.
7. Advanced Visualization Tools: Using Filters, Using the Detail panel, using the Size panels, customizing filters, Using and Customizing tooltips, Formatting your data with colours.
8. Creating Dashboards & amp; Storytelling, creating your first dashboard and Story, Design for different displays, adding interactivity to your Dashboard, Distributing & Publishing your Visualization.
9. Tableau file types, publishing to Tableau Online, Sharing your visualizations, printing, and Exporting.
10. Creating custom charts, cyclical data and circular area charts, Dual Axis char.

Course Outcomes:

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

1. Understand Tableau concepts of Dimensions and Measures.
2. Develop Programs and understand how to map Visual Layouts and Graphical Properties.
3. Utilize graphical user interfaces to create Frames for providing solutions to 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	3	2	1	-	-	2	-	-	-	-	-	-	-	2
CO2	2	1	-	-	-	1	-	-	-	-	-	-	-	2
CO3	1	1	1	-	-	1	-	-	-	-	-	-	-	2

25AIOCSCN	**MOBILE APP DEVELOPMENT LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives:

- To teach the students how to develop Applications for android environments.
- To develop user interface applications.
- To train 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 User Name, 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 dialling 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 user names 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 the course, the students should be able to

1. Analyze all the components and their properties of various Emulators for selecting suitable emulator.
2. Apply essential Android programming concepts for developing efficient mobile app.
3. Develop Android applications related to various layouts.

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

25AIOCSCN	CLOUD COMPUTING LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To understand foundational concepts of cloud computing.
- To familiarize with the 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 Architecture 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 student 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
CO2	3	3	3	2	-	-	-	-	-	-	-	-	-	3
CO3	3	3	-	-	-	-	-	-	2	-	3	-	-	3

25AIOCSCN	PROFESSIONAL COMMUNICATIONS	L	T	P	C
		0	1	0	1

Course Objectives:

- Enhance the Employability and Career Skills of students.
- Orient the students towards grooming as a professional.
- Make them Employable Graduates.
- Develop their confidence and help them attend interviews successfully.

UNIT – I

Introduction to Soft Skills - Hard skills & soft skills - employability and career Skills - Grooming as a professional with values - Time Management - General awareness of Current Affairs.

UNIT – II

Self-Introduction - organizing the material - Introducing oneself to the audience – introducing the topic - answering questions - individual presentation practice - presenting the visuals effectively - 5 minute presentations.

UNIT – III

Introduction to Group Discussion - Participating in group discussions – understanding group dynamics - brainstorming the topic - questioning and clarifying - GD strategies – activities to improve GD skills.

UNIT – IV

Interview etiquette - dress code - body language - attending job interviews - telephone/skype interview - one to one interview & panel interview – FAQs related to job interviews.

UNIT – V

Recognizing differences between groups and teams - managing time – managing stress -networking professionally - respecting social protocols - understanding career management -developing a long-term career plan - making career changes.

Recommended Software:

1. Globearena
2. Win English

References:

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015.
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015.
3. Interact English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016.
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.

Course Outcomes:

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

1. 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

25EAIVAC01	GENERATIVE AI	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the core principles and motivation behind generative models.
- To explore architectures such as VAEs, GANs, and Transformers used for data synthesis.
- To acquire the knowledge of various generative models for image generation, style transfer and text generation.
- To understand the application of prompt engineering and transformer-based LLMs.
- To implement and evaluate generative models using real-world datasets and APIs.

UNIT – I An Introduction to Generative AI

Definition, Motivation & Applications, Why Use Generative Models- Use Cases & Advantages, Discriminative vs Generative Models, Taxonomy of Generative Models, Probability and Data Distributions, Evaluation Metrics for Generative Models, Challenges (Mode Collapse, Overfitting, Instability) & Ethics in Generative AI

UNIT – II Fundamentals of Generative Models

Autoencoders: Regularized & Variational Autoencoders, Stochastic Encoders & Decoders, Autoregressive Models: Fully Visible sigmoid Belief Network (FVSBN), Neural Autoregressive Density Estimation (NADE), Masked Autoencoder for Distribution Estimation (MADE)

UNIT – III Generative Adversarial Networks (GANs)

GAN Architecture: Generator and Discriminator Networks, Loss Functions (Minimax) and Training Challenges, Vanilla GANs, Deep Convolutional GANs (DCGANs), Progressive GANs, Applications: Image Generation, Style Transfer, Image-to-Image Translation (Pix2Pix), Super-Resolution, and Data Augmentation.

UNIT – IV Transformers and Prompt Engineering

Self-Attention, Transformer Basics, Transformers, BERT, Large Language Models, Masked Language Modeling (MLM), Next Sentence Prediction (NSP), Generative Pretrained Transformers (GPT), Task-specific GPT Fine-tuning, Prompt Engineering, Hugging Face pretrained Transformers, Hugging Face APIs.

UNIT – V Language Models and Applications

OpenAI GPT-3, 3.5, 4, OpenAI APIs, Working with the OpenAI Playground, Content Filtering, Text Generation and Transformation, Text Classification and Categorization, Building GPT-powered Question Answering Applications and Chatbots, Mini Projects using Large Language Models.

Text Books:

1. David Foster, Generative Deep Learning, 2nd Edition, O'Reilly Media, 2023
2. Joseph Babcock, Raghav Bali, Generative AI with Python and TensorFlow 2, Packt Publishing Ltd., UK, 2021.

References:

1. Denis Rothman, Transformers for Natural Language Processing, 2nd Edition, Packt Publishing, 2023
2. Sabit Ekin, Prompt Engineering for Chat GPT: A Quick Guide to Techniques, Tips, and Best Practices, DOI: 10.36227/techrxiv. 22683919.v2, 2023
3. Chris Fregly, Antje Barth, Shelbee Eigenbrode, Generative AI on AWS: Building Context-Aware Multimodal Reasoning Applications, O'Reilly, 2023
4. Auffarth, B., Generative AI with LangChain: Build Large Language Model (LLM) Apps with Python, ChatGPT, and Other LLMs, Packt Publishing, 2023

Course Outcomes:

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

25EAIVAC02	**IOT FOR INDUSTRIAL AND HEALTHCARE APPLICATIONS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

1. Define the basics concepts of IOT.
2. Understand IIOT and IIOT analytics.
3. Understand the IOT SECURITY and IIOT Applications.
4. To provide exposure to the routing protocols used in medical IoT devices.
5. To comprehend on applications of IoT in the field of healthcare.

UNIT – I INTRODUCTION TO IOT

Introduction to IoT – Physical design of IoT – Logical design of IoT – IoT enabling technologies – IoT levels and deployment templates – Cloud computing – Deployment models – Service models – Service management – Cloud security – Communication protocols – CoAP – MQTT.

UNIT – II INDUSTRIAL IoT

IIoT-Introduction, Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models, Industrial IoT- Layers: IIoT Sensing, IIoT Processing, IIoT Communication, IIoT Networking.

IIOT ANALYTICS - Big Data Analytics and Software Defined Networks, Machine Learning and Data Science, Julia Programming, Data Management with Hadoop

UNIT – III IOT SECURITY and IIOT Applications

IOT SECURITY - Industrial IoT: Security and Fog Computing - Cloud Computing in IIoT, Fog Computing in IIoT, Security in IIoT.

CASE STUDY : Industrial IOT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies: Milk Processing and Packaging Industries, Manufacturing Industries

UNIT – IV IOT IN HEALTHCARE

IoT in Healthcare – Challenges in current healthcare systems – IoT healthcare services – Big data in IoT – Architecture of apache flume and spark – Wireless Body Area Networks (WBAN) Routing Protocols – Medium access control – Issues of WBAN.

UNIT – V REAL TIME HEALTHCARE APPLICATIONS

Case Studies – Wearable sensor network for remote health monitoring – IoT based location aware smart healthcare framework – Analysis of recovery of mobility through inertial navigation techniques and virtual reality – Control and remote monitoring of muscle activity and simulation in the rehabilitation process.

Text Books:

1. Chandan K.Reddy, Charu C. Aggarwal, "Health Care data Analysis", First edition, CRC, 2015.
2. Vikas Kumar, "Health Care Analysis Made Simple", Packt Publishing, 2018.
3. Industry 4.0: The Industrial Internet of Things", by Alasdair Gilchrist (Apress), 2017
4. "Industrial Internet of Things: Cybermanufacturing Systems"by Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer), 2017
5. Hands-On Industrial Internet of Things: Create a powerful Industrial IoT by Giacomo Veneri, Antonio Capasso, Packt, 2018.

References:

1. Valentina Emilia Balas and Souvik Pal, Healthcare Paradigms in the Internet of Things Ecosystem, Academic Press, 2021.
2. Arsheep Bahga and Vijay Madisetti, Internet of Things: A Hands-on Approach, Universities Press, 2015.
3. Rajkumar Buyya and Amir Vahid Dastjerdi, Internet of Things Principles and Paradigms, Elsevier Inc, 2016.

Course Outcomes:

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	-

25EAIVAC03	5G TECHNOLOGIES	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the evolution of wireless networks.
- To familiarize with the fundamentals of 5G networks.
- To investigate the processes associated with 5G architecture.
- To teach spectrum sharing and spectrum trading.
- To practice the security features in 5G networks.

UNIT – I EVOLUTION OF WIRELESS NETWORKS

Networks evolution: 2G, 3G, LTE, 4G, Evolution of radio access networks, Need for 5G, 4G versus 5G, Next Generation core (NG-core), visualized Evolved Packet core (vEPC).

UNIT – II 5G CONCEPTS AND CHALLENGES

Fundamentals of 5G technologies, Overview of 5G core network architecture, 5G new radio and cloud technologies, Radio Access Technologies (RATs), EPC for 5G.

UNIT – III NETWORK ARCHITECTURE AND THE PROCESSES

5G Architecture and Core, Network Slicing, Multi Access Edge Computing (MEC), Visualization of 5G Components, End-to-End System Architecture, Service Continuity, Relation to EPC and edge computing. 5G protocols: 5G NAS, NGAP, GTP-U, IPSec and GRE.

UNIT – IV DYNAMIC SPECTRUM MANAGEMENT AND MM-WAVES

Mobility management, Command and control, Spectrum sharing and Spectrum trading, Cognitive radio based on 5G, Millimeter waves.

UNIT – V SECURITY IN 5G NETWORKS

Security features in 5G networks, Network domain security, User domain security, Flow based QoS framework, Mitigating the threats in 5G.

Text Books:

1. Saro Velrajan, "An Introduction to 5G Wireless Networks: Technology, Concepts and Use cases", First Edition, 2020.
2. Stephen Rommer, "5G Core networks: Powering Digitalization", Academic Press, 2019.

References:

1. Amitabha Ghosh, Rapeepat Ratasuk, *"Essentials of 5G Technology",* Cambridge University Press, 2020.
2. Jonathan Rodriguez, *"Fundamentals of 5G Mobile Networks",* Wiley, 2015.

Course Outcomes:

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

1. 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