ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

B.E. COMPUTER SCIENCE AND ENGINEERING
(Data Science)
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 தமிழர்மரபு	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**
25DSBS301	BS-V	Mathematics – III	3	-	-	25	75	100	3
25DSES302	ES-V	Fundamentals of Digital Computers	3	-	-	25	75	100	3
25DSPC303	PC-I	Data Structures and Algorithms	3	-	-	25	75	100	3
25DSPC304	PC-II	Object Oriented Programming	3	-	-	25	75	100	3
25DSPC305	PC-III	Computer Organisation and Architecture	3	-	-	25	75	100	3
25DSPC306	PC-IV	Fundamentals of Machine Learning	3	-	-	25	75	100	3
25DSPE307	PE-I		3	-	-	25	75	100	3
25DSCP308	PCP-I	Data Structures and Algorithm Lab	-	-	3	40	60	100	1.5
25DSCP309	PCP-II	Machine Learning Lab	-	-	3	40	60	100	1.5
								Total Credits	24

SEMESTER IV									
Course Code	**Category**	**Course**	**L**	**T**	**P/D**	**CA**	**FE**	**Total**	**Credits**
25DSBS401	BS-VI	Discrete Mathematics	3	-	-	25	75	100	3
25DSES402	ES-VI	Python Programming	3	-	-	25	75	100	3
25DSPC403	PC-V	Operating Systems	3	-	-	25	75	100	3
25DSPC404	PC-VI	Database Management Systems	3	-	-	25	75	100	3
25DSPC405	PC-VII	Data Science	3	-	-	25	75	100	3
25DSPC406	PC-VIII	Software Engineering	3	-	-	25	75	100	3
25DSPE407	PE-II		3	-	-	25	75	100	3
25DSCP408	PCP-III	Operating Systems and Database Management Systems Lab	-	-	3	40	60	100	1.5
25DSCP409	PCP-IV	Data Science Lab	-	-	3	40	60	100	1.5
								Total Credits	24

SEMESTER V									
Course Code	**Category**	**Course**	**L**	**T**	**P/D**	**CA**	**FE**	**Total**	**Credits**
25DSPC501	PC-IX	Deep Learning	3	-	-	25	75	100	3
25DSPC502	PC-X	Computer Networks	3	-	-	25	75	100	3
25DSPC503	PC-XI	Data Visualization	3	-	-	25	75	100	3
25DSPC504	PC-XII	Predictive Analytics and Time Series	3	-	-	25	75	100	3
25DSPE505	PE-III		3	-	-	25	75	100	3
25DSOE506	OE-I		3	-	-	25	75	100	3
25DSCP507	PCP-V	Deep Learning Lab	-	-	3	40	60	100	1.5
25DSCP508	PCP-VI	Data Visualization 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**
25DSPC601	PC-XIII	Big Data Analytics	3	-	-	25	75	100	3
25DSPC602	PC-XIV	Internet of Things	3	-	-	25	75	100	3
25DSHS603	HS-V	Business management	3	-	-	25	75	100	3
25DSPE604	PE-IV		3	-	-	25	75	100	3
25DSPE605	PE-V		3	-	-	25	75	100	3
25DSOE606	OE-II		3	-	-	25	75	100	3
25DSCP607	PCP-VII	Big Data Analytics Lab	-	-	3	40	60	100	1.5
25DSCP608	PCP-VIII	Internet of Things Lab	-	-	3	40	60	100	1.5
								Total Credits	21

SEMESTER VII									
Course Code	**Category**	**Course**	**L**	**T**	**P/D**	**CA**	**FE**	**Total**	**Credits**
25DSES701	ES-VII	Research Methodology	3	-	-	25	75	100	2
25DSPC702	PC-XV	Data Analytics with R	3	-	-	25	75	100	3
25DSPC703	PC-XVI	Cloud Computing	3	-	-	25	75	100	3
25DSPE704	PE-VI		3	-	-	25	75	100	3
25DSPE705	PE-VII		3	-	-	25	75	100	3
25DSOE706	OE-III		3	-	-	25	75	100	3
25DSCP707	PCP-IX	Data Analytics with R Lab	-	-	3	40	60	100	1.5
25DSCP708	PCP-X	Cloud Computing 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**
25DSOE801	OE-IV		3	-	-	25	75	100	3
25DSOE802	OE-V		3	-	-	25	75	100	3
25DSPV803	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,

NCC /NSS/YRC/Sports-2.

(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. Digital Image Processing.
7. Mobile Computing.
8. Mobile App Development.
9. Social Media Analytics.
10. Cryptography and Network Security.
11. Natural Language Processing.
12. Block Chain Technology.
13. Graph Analytics.
14. Web Analytics.

15. Data Science & Business Analytics.
16. Ethics in Data Analytics.
17. Augmented Reality and Virtual Reality.
18. Smart Grid Data Analytics.
19. Generative AI & Large Languages Modelling.
20. Information Theory Coding and Cryptography.
21. Real Time & Cloud Data Science.

OE - OPEN ELECTIVES

1. Data Mining.
2. Software Engineering and Devops.
3. Generative AI
4. Block Chain Fundamentals
5. Data Analysis using Open Source Tools
6. Statistical analysis in Data Science
7. Augmented Analytics
8. Cognitive Computing and Big Data Analytics
9. Data Analytics for Engineers
10. Industrial Internet of Things (IIoT)
11. Agile Methodologies.
12. Entrepreneurship Innovation and Startup.
13. Machine Learning with Application to Objects Recognition [Naan Mudhalvan]
14. Full Stack [Naan Mudhalvan]
15. Cloud Essentials [Naan Mudhalvan]

HONORS ELECTIVE

S.No.	Course Coode	Course Name	Credits
1.	25DSHESCN	Big Data Testing Tools	4
2.	25DSHESCN	Big Data Analytics Tools	4
3.	25DSHESCN	Data Management	3
4.	25DSHESCN	Cognitive Computing	3
5.	25DSHESCN	High Performance Big Data Analytics	3
6.	25DSHESCN	Financial Analytics	3

MINOR ENGINEERING ELECTIVE COURSE

S.No.	Course Coode	Course Name	Credits
1.	25DSMISCN	Data Structures and Algorithms	4
2.	25DSMISCN	Python Programming (or) Data Analytics with R	4
3.	25DSMISCN	Data Science	3
4.	25DSMISCN	Ethics in Data Analytics	3
5.	25DSMISCN	Machine Learning (or) Cyber Security	3
6.	25DSMISCN	NoSQL Databases	3

ONE CREDIT COURSES

1. Evolutional Optimization Algorithm lab
2. Image Processing Lab
3. Computer Networks Lab
4. Mobile Application Development Laboratory
5. Professional Communications

VAC

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

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

Text-Cum-Reference Books :

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

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 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

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

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

Course objectives :

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

S.No	LIST OF EXPERIMENTS
1.	**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 / Reference Books :

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria,ExcelBooks, New Delhi,2010
2. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak,1999.
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi,2004.
4. The Story of Stuff(Book).
5. 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 (DATA SCIENCE)

Institute Vision and Mission

VISION

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

MISSION

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

Department Vision and Mission

VISION

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

MISSION

- 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.
- Develop life-long learning ability that allows them to be adaptive and responsive to the changes in career, society, technology, and environment.
- Build student community with high ethical standards to undertake innovative research and development in thrust areas of national and international needs.
- Expose the students to the emerging technological advancements for meeting the demands of the industry.

B.E. COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)

PROGRAMMEEDUCATIONAL 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 and exhibit high levels of professionalism and ethical responsibility.

B.E. COMPUTER SCIENCE & ENGINEERING (Data Science)

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 Data Science and Artificial Intelligence which uses complex machine learning algorithms to build predictive models and to provide the core concepts of computer science as well as data analytics.
PSO2	Learn specialized courses in Data Science to build up the aptitude for applying typical practices and approaches to handle huge amounts of data and then analyze it using data-driven methodologies, communicate it to the information technology leadership teams and understanding the patterns and trends through visualizations.
PSO3	Apply technical and programming skills to deal with vast volumes of data using modern tools and techniques to find unseen patterns, derive meaningful information, to assist companies in making smarter business decisions and to use statistical techniques to draw conclusions.

B.E. COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)

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 and exhibit high levels of professionalism and ethical responsibility.	3	3	2	3

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

B.E. COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)

PROGRAMME OUTCOMES (PO)

After the successful completion of the B.E. COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE) degree programme the students will be able to :

Sl.No.	Programme Outcomes
PO1	**Engineering Knowledge:** Apply the knowledge of mathematics, natural science, computing, engineering fundamentals, and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO3	**Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop system/ components/ processes to meet identified needs with consideration for the public health and safety, whole-life cost, net aero carbon, culture, society, and environmental as required. (WK5)

PO4	**Conduct Investigations of Complex Problems:** Use research-based knowledge including design of experiments, modeling, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. (WK8)
PO5	**Engineering Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling recognizing their limitations to solve complex engineering problems. (WK2 and wk6)
PO6	**The Engineer and the world:** Analyze and evaluate societal and environment aspects while solving complex engineering problems for its impact on sustainability with reference economy, health, safety, legal framework, culture and environment. (WK1, WK5 and WK7)
PO7	**Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusions; adhere to national and international laws. (WK9)
PO8	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse/multidisciplinary teams.
PO9	**Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, languages and learning differences.
PO10	**Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11	**Life-long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

25DSBS301	MATHEMATICS-III	L	T	P	C
		3	0	0	3

Course Objectives:

- To familiarize the basic concepts of partial differential equations, which are helpful in solving real-world problems.
- To introduce Fourier series, which are very useful in the study of computing.
- To solve boundary value problems, which are helpful in investigating the important features of electromagnetic theory.
- To provide basics of Fourier transform, which is useful in solving problems in frequency response of filters 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. Ventakataraman 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,3rdedition,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, Chennai,2004.

Course Outcomes:

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

1. Acquire basic understanding of the most common partial differential equations.
2. Understand the concepts of Fourier series.
3. Ability to solve boundary value problems.
4. Able to investigate signals problems using Fourier transform
5. Familiarize Z-transform that play important roles in many discrete engineering problems.

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

25DSES302	FUNDAMENTALS OF DIGITAL COMPUTERS	L	T	P	C
		3	0	0	3

Course Objectives:

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

UNIT – I NUMBER SYSTEM AND CODES

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

UNIT – II LOGIC GATES

The Inverter, The AND gate, The OR gate, The NAND gate, NOR gate, The Exclusive–OR gate and Exclusive-NOR gate; Boolean Algebra and Logic Simplification - Boolean Operations and Expressions, Laws and Rules, DeMorgan's Theorems, Boolean Expressions and Truth Tables, The Karnaugh Map, SOP minimizations.

UNIT – III COMBINATIONAL LOGIC ANALYSIS

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

UNIT – IV LATCHES AND FLIP-FLOPS

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

UNIT – V MEMORY AND STORAGE

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

Text Books:

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

References:

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

Course Outcomes:

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

1. Acquire knowledge on Digital signals, Logic operations, Boolean algebra, number systems, codes and TTL / CMOS logic based digital lCs,
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	-	-

25DSPC303	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. RS Salaria,"DataStructures",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	3	-
CO4	1	1	-	-	-	-	-	-	-	-	-	2	3	-
CO5	2	2	-	-	-	-	-	-	-	-	-	2	3	-

25DSPC304	**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	-

25DSPC305	COMPUTER ORGANIZATION AND ARCHITECTURE	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the concepts of Bus structure and functional units of a computer.
- To familiarize the working of ALU with its structure and functions.
- To impart the knowledge on hierarchical memory system including cache memories and virtual memory.
- To describe the significance of Semiconductor RAM and ROM memories on Computer.
- To teach the concept of parallel processing on Computer.

UNIT – I INTRODUCTION

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

UNIT – II FUNDAMENTAL CONCEPTS

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

UNIT – III MEMORY

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

UNIT – IV I/O DEVICES

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

UNIT – V PARALLEL PROCESSING

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

Text Books:

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

References:

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

Course Outcomes:

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

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

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

25DSPC306	**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, A press, 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	-	-	-	-	-	-	-	-	-	-	3	1	1
CO2	2	2	1	1	-	-	-	-	-	-	-	3	2	2
CO3	2	1	2	1	-	-	-	-	-	-	-	3	2	2
CO4	2	3	3	2	1	-	-	-	-	-	-	3	3	3
CO5	2	3	3	2	1	-	-	-	-	-	-	3	2	2

25DSCP308	**DATASTRUCTURES 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	1	-	-	-	-	-	-	-	3	2	-
CO2	1	2	2	2	-	-	-	-	-	-	-	3	2	-
CO3	1	2	2	1	-	-	-	-	-	-	-	3	2	-

25DSCP309	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
    a. k-means
    b. Gaussian mixture modeling (GMM)
5. Classification using
    a. Back propagation neural network (BPNN)
    b. Support vector machine (SVM)
6. Construction of decision tree and random forest
7. Implementation of convolutional neural network (CNN) for handwritten digit recognition
8. Object recognition using CNN
9. Face detection and tracking
10. Sequence prediction using recurrent neural network (RNN)
11. Isolated-word speech recognition

Course Outcomes:

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

1. Implement Gaussian densities, regression and principal component analysis algorithms.
2. Design and implement the classification and clustering algorithms 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

25DSBS401	DISCRETE MATHEMATICS	L	T	P	C
		3	0	0	3

Course Objectives:

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

UNIT – I MATHEMATICAL LOGIC

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

UNIT – II SET THEORY AND RELATIONS

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

UNIT – III LATTICE AND BOOLEAN ALGEBRA

Partialorderedset – Hassediagram–Lattices–Properties of Lattices – BooleanAlgebra – Karnaugh map method.

UNIT – IV GROUP AND GROUP CODE

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

UNIT – V GRAPH THEORY

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

Text Books:

1. Veerarajan T,"Discrete Mathematics with GraphTheory and Combinatorics", Tata McGraw Hill Publishing Company Ltd,2014.
2. Discrete Mathematicsand 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:

1. At the end of this course, the students will be able to
2. Acquire the basic concepts in Mathematical Logic and theory of inferences.
3. Understand the concepts of Set theory, Relations, and equivalence classes with matrix representation.
4. Implement Lattice theory and Boolean Algebra in circuit design.
5. Design coding and encoding group codes.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	-	-

25DSES402	**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.
5. Construct an application for solving real-life problems using TKinter and Oracledb packages.

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

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

25DSPC403	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.

4. Maurice Bach, Design of the Unix Operating System, 9th Edition, Prentice Hall of India, 2022.
5. Daniel P. Bovet, Marco Cesati, Understanding the Linux Kernel, 4th Edition, O'Reilly Media, 2022.
6. 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	-

25DSPC404	**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	2	–	–	–	–	–	–	–	–	3	2	–
CO2	2	2	3	–	–	–	–	–	–	–	–	3	2	–
CO3	2	2	3	–	2	–	–	–	–	–	–	3	3	–
CO4	2	3	2	–	–	–	–	–	–	–	–	3	3	–
CO5	2	2	1	–	2	–	–	–	–	–	–	3	2	–

25DSPC405	DATA SCIENCE	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the core activities of data analysis.
- To introduce the concepts of arrays and data structures in Python.
- To understand data storage and file formats and interacting with web APIs and databases.
- To explain the mechanisms for data cleaning, preparation and wrangling.
- To practice plotting, visualization and aggregation of data.

UNIT – I EPICYCLES OF ANALYSIS

Setting the Scene - Epicycle of Analysis - Setting Expectations – Collecting Information - Comparing Expectations to Data -Applying the Epicycle of Analysis Process. Exploratory Data Analysis. Exploratory Data Analysis Checklist: A Case Study -Formulate your question- Read in your data - Check the Packaging - Look at the Top and the Bottom of your Data - ABC: Always be Checking Your "n"s - Validate With at Least One External Data Source - Make a Plot - Try the Easy Solution First.

UNIT – II ARRAYS AND DATA STRUCTURES IN PYTHON

Data Structures and Sequences - Arrays and Vectorized Computation - NumPy ndarray: A Multidimensional Array object – Fast element-wise array functions –Array-oriented programming using arrays - File Input-Output with Arrays - pandas Data Structures –Series, Data Frames, Index Objects - Essential Functionality – Summarizing and Computing Descriptive Statistics.

UNIT – III DATA LOADING, STORAGE, FILE FORMATS

Reading and Writing data in text format – binary data format – interacting with Web APIs – Interacting with databases.

UNIT – IV DATA CLEANING, PREPARATION AND WRANGLING

Data Cleaning: Handling Missing data, Data Transformation - String Manipulation - Categorical Data. Data Wrangling: Join,Combine, Reshape: Hierarchical Indexing - Combining and merging Datasets - Reshaping and Pivoting.

UNIT – V PLOTTING AND DATA AGGREGATION

Plotting and visualization – Matplotlib features - plotting with pandas and seaborn - other python visualization tools -- Data Aggregation and Group Operations – Group operations - Data Aggregation – Apply: General split-apply-combine - Group transforms and "Unwrapped" Group-bys - Pivot Tables and Cross Tabulation.

Text Books:

1. Roger D. Peng and Elizabeth Matsui, " The Art of Data Science -A Guide for Anyone Who Works with Data", Skybrude Consulting, LLC, 2015.
2. Wes McKinney, "Python for Data Analysis, O' Reilly Media, Inc., 3rd Edition, 2022.

References:

1. Joel Grus, "Data Science from Scratch", O'Reilly, First Edition, 2015.
2. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, First Edition, 2016.
3. Samir Madhavan, "Mastering Python for Data Science", PACKT Publishing, 2015.
4. Alberto Boschetti, Luca Massaron, "Python Data Science Essentials", PACKT Publishing, Third Edition, 2018

Course Outcomes:

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

1. Summarize the core activities of data analysis.
2. Describe the data structures suitable for handling data.

3. Familiarize data storage formats and interaction with Web and Databases.
4. Apply data cleaning and transformation techniques on datasets.
5. Create visualization plots and aggregations of data.

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

25DSPC406	**SOFTWARE ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

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

UNIT – I SOFTWARE PROCESS

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

UNIT – II DESIGN CONCEPTS

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

UNIT – III QUALITY MANAGEMENT

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

Assurance-A Strategic Approach to Software Testing-System Testing-The Art of Debugging.

UNIT – IV SOFTWARE CONFIGURATION MANAGEMENT

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

UNIT – V PROJECT ESTIMATION

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

Text Books:

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

References:

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

Course Outcomes:

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

1. Understand the generic view of Software process models and practices in their appropriate models.
2. Describe the various Design concepts, Design Models that provide the structure of software product.
3. Infer the Software quality management approach for developing the quality products.
4. Determine the need for, and an ability to engage in, Software Configuration management. Acquire the knowledge on Software Project estimation techniques and Software Reengineering.

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

25DSCP408	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

25DSCP409	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. Experiment the various data structures and libraries in Python for data science programming.
2. Conduct and present 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

25DSPC501	DEEP LEARNING	L	T	P	C
		3	0	0	3

Course Objectives:

- To present the mathematical, statistical and computational challenges of building neural networks.
- To study the concepts of deep learning.
- To introduce dimensionality reduction techniques.
- To examine the case studies of deep learning techniques.

UNIT – I INTRODUCTION

Introduction to machine learning- Linear models (SVMs and Perceptron, logistic regression) - Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates

UNIT – II CONCEPTS OF DEEP LEARNING

History of Deep Learning- a Probabilistic Theory of Deep Learning- Back propagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep vs Shallow Networks- Convolutional Networks- Generative Adversarial Networks (GAN), Semi supervised Learning

UNIT – III METRIC LEARNING

Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization

UNIT – IV OPTIMIZATION

Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization- Generalization in neural networks- Spatial Transformer Networks-Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level
RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience

UNIT – V ADVANCED TECHNIQUES

Imagenet- Detection-Audio WaveNet-Natural Language Processing Word2Vec - Joint Detection- Bio Informatics- Face Recognition- Scene Understanding- Gathering Image Captions

Text Books:

1. Cosma Rohilla Shalizi, “Advanced Data Analysis from an Elementary Point of View”, 2015.
2. Deng & Yu, “Deep Learning: Methods and Applications”, Now Publishers, 2013.

References:

1. Ian Good fellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MITPress, 2016.
2. Michael Nielsen, “Neural Networks and Deep Learning”, Determination Press, 2015.

Course Outcomes:

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

1. Describe the challenges in Neural networks.
2. Explain the fundamental concepts of deep learning.
3. Train deep learning networks.

4. Apply the methods for optimization in deep learning.
5. Comprehend and develop applications using the concepts of deep learning.

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

25DSPC502	**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. Summarize the devices, protocols and standards to design a network.
3. Construct and implement the concept of switching and routing.
4. Select appropriate protocol and techniques related to transport layer in order to maintain consistent flow of information.
5. Illustrate 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	-	-

25DSPC503	**DATA VISUALISATION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand the concepts and significance of data visualization.
- To learn the visualization idioms and map data attributes to graphical attributes.
- To evaluate the effectiveness of visualization designs.
- To comprehend the considerations in information dashboard design.

- To gain knowledge on information dashboard design

UNIT – I INTRODUCTION

Visualization Definition and Need – Data Abstraction – Data Semantics and Types - Data Types – Dataset Types (DL) – Attribute Types – Semantics – Task Abstraction – Analyze tasks abstractly –Actions– Targets – Analyzing and Deriving.

UNIT – II ANALYSIS

Four levels for Validation – Reasons to Validate – Four levels of Design – Angles of Attack – Threats to Validity – Validation Approaches – Validation Examples – Marks and Channels – Defining Marks and Channels – Using Marks and Channels – Channel Effectiveness – Relative versus Absolute Judgements – Rules of Thumb to be followed – No unjustified 3D - No unjustified2D – Eyes beat memory – Resolution over Immersion – Overview, Zoom, Filter, Details on demand – Responsiveness is required – Get it Right in Black and White..

UNIT – III TABLES AND SPATIAL DATA

Arrange by Keys and Values – Express: Quantitative Values – Separate, Order, and Align: Categorical Regions – Matrix Alignment: Two Keys – Volumetric Grid: Three Keys – Recursive Subdivision: Multiple Keys – Spatial Axis Orientation – Spatial Layout Density – Arrange Spatialdata – Geometry – Scalar Fields: One Value – Vector Fields: Multiple Values – Tensor Fields: Many Values.

UNIT – IV NETWORKS, TREES, MAP COLOR

Connection: Link Marks – Matrix Views - Connection versus Matrix – Containment: Hierarchy Marks – Map Color and Other Channels – Color Theory – Color maps – Other Channels – Reduce items and attributes – Reasons to Reduce - Filter – Aggregate – Manipulate View – Reasons for Change - Change View over Time – Select Elements – Navigate: Changing Viewpoint, Reducing Attributes. Embed: Elide—Superimpose-- Distort

UNIT – V INFORMATION DASHBOARD DESIGN

Dashboards – Purpose – Importance – Reasons for Failure – Common Mistakes in Dashboard Design – Assessing what is needed from dashboards – Fundamental considerations in dashboard design

Text Books:

1. Tamara Munzner, “Visualization Analysis and Design”, CRC Press, 2014.
2. Clause O Wilke, “Fundamentals of Data Visualization”, Shroff Publshers,First Edition 2019.

References:

1. Ben Fry, “Visualizing Data”, O’Reilly, 2008.
2. Andy Kirk, “Data Visualization: A Successful Design Process”, PACKT Publishing, 2012.
3. Alexander Telea, “Data Visualization Principles and Practice”, CRC Press, Second Edition, 2014.
4. Stephen Few, “Information Dashboard Design: Displaying Data for At-a-glance Monitoring”, Analytics Press, Second Edition, 2013

Course Outcomes:

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

1. Design and create data visualizations.
2. Apply data transformations such as aggregation and filtering for visualization.
3. Evaluate choice of colour and visual encoding suitable for visualization.
4. Build visual presentations of wide variety of data for effective communication.
5. Use knowledge of perception and cognition to design information dashboards

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

25DSPC504	PREDICTIVE ANALYTICS AND TIME SERIES	L	T	P	C
		3	0	0	3

Course Objectives:

- To know various predictive data analysis models.
- To understand how to use predictive analytics tools to analyze real-life business problems.
- To provide distinctive knowledge on implementation of simple linear and logistic regression models.
- To understand the basic statistical techniques required for forecasting.

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", Pearson Education, Global Edition, 2021.
2. U Dinesh Kumar, "Business Analytics: The Science of Data-Driven Decision Making", Wiley India Pvt. Ltd., 2nd Edition, 2017.

References:

1. Thomas W. Miller, "Modeling Techniques in Predictive Analytics with Python and R: A Guide to Data Science", Pearson Education, 1st Edition, 2014.
2. Daniel T. Larose and Chantal D. Larose, "Data Mining and Predictive Analytics", John Wiley & Sons Inc., 2nd Edition, 2015.
3. Barry Keating, J. Holton Wilson, Shovan Chowdhury and John Galt Solutions Inc., "Forecasting and Predictive Analytics with ForecastX", McGraw Hill, 7th Edition, 2020.
4. Purba Halady Rao, "Business Analytics: An Application Focus", PHI Learning, Kindle Edition, 2013.

Course Outcomes:

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

1. Analyze the suitability of Predictive Models for effective business decisions.
2. Acquire the skills on Linear and Logistic Regression.
3. Investigate the dummy modelling and panel data model.
4. Understand the basic statistical techniques required for forecasting.
5. 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	-	-

25DSCP507	**DEEP LEARNING LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives:

- To learn how to create and manipulate tensors using Tensorflow tool.
- To get to know Applied Deep Learning with PyTorch.
- To create and manipulate applications for artificial intelligence in the Scala programming language.
- To learn Character-Level RNN.

LIST OF EXERCISES

1. Introduction to Tensor Flow.
2. Learning about Features and Outliers.
3. Working with Training Sets and Test Sets.
4. Scala program to demonstrate example of collection list and for loop.
5. Appending and merging Lists using scala.
6. Scala List class and pattern matching.
7. L2 Regularization and Correlated Features.
8. Classifying Names with a Character-Level RNN.
9. Generating Shakespeare with a Character-Level RNN.

Course Outcomes:

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

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

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

25DSCP508	**DATA VISUALIZATION LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives:

- To learn the interface in Tableau / MS-Excel for creating visualisations.
- To understand the methods for drawing charts and graphs.
- To learn the use of maps and tables in creating visualisation.
- To prepare dashboard design for data analytics applications.

LIST OF EXERCISES

1. Study of interface, screen and visual cues in Tableau / MS-Excel
2. Connecting with various data sources
3. Working with measures and dimensions
4. Working with Colours
5. Working with Expressions, Functions, Date, Time
6. Drawing Charts and Graphs
7. Creating Maps
8. Working with Table Calculations
9. Sorting Data
10. Applying Filters
11. Dashboard design

Course Outcomes:

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

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

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

25DSPC601	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives:

- To acquire the basics of Hadoopv2 configuration and administration.
- To understand concepts of Map Reduce design patterns namely summarization, filtering, data organization, join, output and Meta patterns.
- To develop Map Reduce applications.
- To solve data warehouse problems using Hive.
- To transfer data using Pig, HBase, Mahout and Sqoop between Hadoop and relational databases.

UNIT – I INTRODUCTION

Data Explosion and Big Data Analytics: An overview – Introduction – Evolution of Database Technology – Elements of Big Data – Big Data System Components – Big Data Analytics – Applications of Big Data Technology – Analytical Theory – Analytic Techniques – Real-time Analysis – Big Data: -Hardware, Technology, Foundations, Security privacy.

UNIT – II HADOOPV2 CONFIGURATION AND ADMINISTRATION

Hadoop v2 : Introduction - Setting up Hadoop v2 in local machine - Writing a Word Count MapReduce application - Adding a combiner step to the Word Count MapReduce program - Setting up HDFS - Setting up Hadoop YARN in a distributed cluster environment using Hadoop v2 - Setting up Hadoop ecosystem - HDFS command-line file operations - Running the Word Count program in a distributed cluster environment - Using Hadoop YARN on Cloud Environments - Hadoop Configurations, Unit Tests, and Other APIs.

UNIT – III DEVELOPING COMPLEX MAPREDUCE APPLICATIONS

Introduction - Hadoop data types - Custom Hadoop Writable data type - Hadoop key type - Emitting data from a Mapper - Hadoop Input Format- Adding support for new input data formats - Formatting the results of MapReduce computations – Hadoop Output Formats - Writing multiple outputs - Intermediate data partitioning - Secondary sorting – sorting Reduce input values - Using Hadoop with legacy applications – Hadoop streaming - Adding dependencies between MapReduce jobs - Hadoop counters to report custom metric

UNIT – IV ANALYTICS AND APPLICATIONS USING MAPREDUCE

Analytics : Introduction - Simple analytics using MapReduce - Performing GROUP BY - Calculating frequency distributions and sorting - Plotting the results using gnuplot -

Calculating histograms - Calculating Scatter plots - Parsing a complex dataset with Hadoop - Joining two datasets Applications : Content-based recommendations - Classification using the naïve Bayes - Assigning advertisements to keywords - Data preprocessing using Hadoop streaming and Python.

UNIT – V HADOOP ECOSYSTEM – APACHE HIVE

Creating databases and tables using Hive CLI Simple SQL-style data querying using Apache Hive -Creating and populating Hive tables and views using Hive query results-Utilizing different storage formats in Hive - storing table data using ORC files-Using Hive built-in functions-Hive batch mode - using a query file -Performing a join with Hive -Creating partitioned Hive tables -Writing Hive User-defined Functions (UDF) -Hadoop Ecosystem II – Pig, HBase, Mahout, and Sqoop

Text Books:

1. Thilina Gunarathne, "HadoopMapReducev2 Cookbook", Packt Publishing Ltd., Second Edition,2015.
2. Donald Miner and Adam Shook, "MapReduce Design Pattern", O'Reilly Media Inc
   First Edition, 2012

References:

1. Garry Turkington, "Hadoop Beginner's Guide", Packt Publishing Ltd.,First Edition, 2013.
2. Tom White, "Hadoop: The Definitive Guide", O'Reilly Media Inc.,Fourth Edition,2015.
3. Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wrox, First Edition, 2013.
4. Thangaraj M, Suguna S and Sudha G, "Big Data Analytics: Concepts, Techniques, Tools and Technologies, First Edition, 2022.

Course Outcomes:

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

1. Configure and administer Hadoop v2, Hadoop YARN, and HDFS clusters.
2. Design MapReduce patterns such as summarization and filtering patterns.
3. Develop MapReduce patterns such as join patterns, metapatterns, output Patterns.
4. Solve large-scale analytics problems using MapReduce-based applications.
5. Tackle complex problems using Apache Hive, Pig, Hbase, Mahout and Sqoop.

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

25DSPC602	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

Course Objectives:

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

UNIT – I INTRODUCTION TO IOT

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

UNIT – II M2M AND SYSTEM MANAGEMENT

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

UNIT – III DEVELOPING INTERNET OF THINGS

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

UNIT – IV RASPBERRY PI WITH PYTHON AND ARDUINO

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

UNIT – V CASE STUDIES ILLUSTRATING IOT DESIGN

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

Text Books:

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

References:

1. Dieter Uckelmann, Mark Harrison, Florian Michahelles, “Architecting the Internet of Things”, Springer, 2011.
2. Pethuru Raj and Anupama C.Raman, “The Internet of Things: EnablingTechnologies 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	-	-

25DSHS603	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", McGraw Hill Education,Eleventh Edition, 2020
2. Stoner, Freeman and Gilbert, "Management", Pearson,Sixth Edition, 2018.

References:

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

25DSCP607	BIG DATA ANALYTICS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To learn how to setup standalone Hadoopv2 on a local machine, Hadoop YARN and Hadoop ecosystem in a distributed cluster environment and HDFS.
- To gather knowledge to executeHadoopMapReducev2 computations on standalone Hadoopv2 on a local machine and distributed cluster environment.
- To understand how to runHadoopMapReducev2 computations using Amazon Elastic MapReduce cloud environment.
- To perform simple experiments on Pig, Hive, Hbase and Sqoop.

LIST OF EXERCISES

1. Study on setting up standalone Hadoopv2 on a local machine and Hadoop YARN in a distributed cluster environment.
2. Write a MapReduce application to count the number of occurrences of words in a dataset and run it using the Hadoop local mode.
3. Write a MapReduce application to count the number of occurrences of words in a dataset and run it in the Hadoop distributed cluster environment.
4. Execute Word Count MapReduce application (count the number of occurrences of words in a dataset) on Amazon Elastic MapReduce (EMR).
5. Write a MapReduce application to calculate simple aggregate metrics about the weblog dataset.
6. Write a MapReduce application to group web server log data and calculate histogram and other analytics.
7. Write a MapReduce application to calculate frequency distributions; the number of hits received by each URL.
8. Write a MapReduce application to calculate the correlation between two datasets using scatter plots.
9. Write a MapReduce application to parse the Tomcat e-mail list dataset that has complex data format using Hadoop by writing an input formatter.
10. Write a MapReduce application to join two MBOX-formatted e-mail datasets.
11. Install and Run Hive and then use Hive to Create, Alter and drop databases, tables, views, functions and indexes.
12. Import Data from a Relational Database to HBase using Sqoop.

Course Outcomes:

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

1. Install standalone Hadoop v2 on a local machine and Hadoop YARN in a distributed cluster environment.
2. Execute MapReduce applications on Amazon Elastic MapReduce.
3. Formulate new solutions using Pig, Hive, Hbase and Sqoop.

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

25DSCP608	INTERNET OF THINGS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

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

LIST OF EXERCISES

1. Write 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

25DSES701	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 equip students with skills 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”, New Age International,4th Edition, 2019.
2. Ranjit Kumar, “Research Methodology: A Step-by-Step Guide for Beginners”, SAGE Publications,5th Edition,2019.
3. John W. Creswell and J. David Creswell, “Research Design: Qualitative, Quantitative, and Mixed Methods Approaches”, SAGE Publications,5th Edn.,2018.

References:

1. Leedy, P.D., and Ormrod, J.E., "Practical Research: Planning and Design", Pearson,11th Edition, 2016.
2. Greenfield, T., and Greener, S., "Research Methods for Postgraduates", Wiley,3rd Edition,2016.
3. Montgomery, D.C., "Design and Analysis of Experiments", Wiley,9th Edition, 2017.
4. Cohen, L., Manion, L., & Morrison, K., "Research Methods in Education", Routledge, 8th Edition,2017.
5. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets", 5th 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 basicresearch 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 andtechniques.
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	-	-

25DSPC702	**DATA ANALYTICS WITH R**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To gain the basic concepts of Univariate, Multivariate data and relationships between two variables.
- To learn 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 learn the predictive analysis by various regression statistical methods.

- To handle missing data gracefully using multiple imputation ;Identify and manage problematic data points.

UNIT – I INTRODUCTION TO DATA AND ITS RELATIONSHIP

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

UNIT – II PROBABILITY AND HYPOTHESIS TESTING

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

UNIT – III BAYESIAN METHODS AND BOOTSTRAP

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

UNIT – IV PREDICTIVE ANALYSIS

Predicting Continuous Variables: Linear models - Simple linear regression - Simple linear regression with a binary predictor - Multiple regression - Regression with a non-binary predictor - Kitchen sink regression - The bias-variance trade-off - Linear regression diagnostics. Predicting Changes with Time: Creating and plotting time series - Components of time series - Time series decomposition - White noise - Autocorrelation - Smoothing - ETS and the state space model - Interventions for improvement. Predicting Categorical Variables: k-Nearest neighbors - Logistic regression - Decision trees - Random forests - Choosing a classifier.

UNIT – V IMPLEMENTATION OF DATA ANALYSIS

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

Text Books:

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

References:

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

Course Outcomes:

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

1. Get the knowledge about the data and its relationship by applying various statistical methods.
2. Acquire the knowledge on probability and different hypothesis testing methods.
3. Analyze different Bayesian methods to test the sample taken independently.
4. Apply the predictive analysis by various regression statistical methods.
5. Apply various statistical methods for analysis of the real-world data using R language.

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

25DSPC703	**CLOUD COMPUTING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand the core concepts of Cloud, Parallel and Distributed Computing.
- To familiarize about Virtualization and Cloud Computing Architecture.
- To impart the basic knowledge of Concurrent computing and high-Throughput Computing.
- To explain the importance of ANEKA Platform and Data-Intensive Computing.
- To analyze the recent developments in Cloud Computing.

UNIT – I INTRODUCTION

Cloud computing at a glance - Historical developments - Building cloud computing environments - Principles of Parallel and Distributed Computing: Parallel vs. distributed computing - Elements of parallel computing - Elements of distributed computing - Technologies for distributed computing.

UNIT – II VIRTUALIZATION AND CLOUD COMPUTING ARCHITECTURE

Introduction - Characteristics of virtualized environments - Taxonomy of virtualization techniques - Virtualization and cloud computing - Pros and cons of virtualization – Cloud Computing Architecture: The cloud reference model - Types of clouds - Economics of the cloud - Open challenges.

UNIT – III CONCURRENT COMPUTING AND HIGH-THROUGHPUT COMPUTING

Concurrent Computing: Introducing parallelism for single-machine computation - Programming applications with threads - Multithreading with Aneka - Programming applications with Aneka threads - High-Throughput Computing: Task computing - Task-based application models - Aneka task-based programming.

UNIT – IV ANEKA PLATFORM AND DATA-INTENSIVE COMPUTING

Aneka: Framework overview - Anatomy of the Aneka container - Building Aneka clouds - Cloud programming and management - Data-Intensive Computing: What is data-intensive computing? - Technologies for data-intensive computing – Aneka Map Reduce programming.

UNIT – V INDUSTRIAL PLATFORMS AND NEW DEVELOPMENTS

Cloud Platforms in Industry: Amazon web services - Google AppEngine - Microsoft Azure - Cloud Applications: Scientific applications - Business and consumer applications - Advanced topics in Cloud Computing: Energy efficiency in clouds - Market-based management of clouds - Federated clouds/InterCloud - Third-party cloud services.

Text Books:

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, “Mastering Cloud Computing”, Tata McGraw Hill, 2013.
2. A. Srinivasan and J. Suresh, “Cloud Computing: A Practical Approach for learning and implementation”, 1st Edition, Pearson, 2014.

References:

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. John W. Rittinghouse and James F. Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
3. Danielle Ruest, Nelson Ruest, “Virtualization: A Beginner’s Guide”, McGraw-Hill Osborne Media, 2009.

Course Outcomes:

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

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

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

25DSCP707	**DATA ANALYTICS WITH R LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives:

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

LIST OF EXERCISES

1. Learning R-Basic Mathematical and General Commands.
2. Write a R program to perform the Matrix Operations such as Addition (+), Subtraction (-), Multiplication (%*%), Transpose (t), Inverse (solve()) and Diagonal of a Matrix (diag) using matrix, rbind and cbind commands.
   a. Input matrix is fixed.
   b. Get the input matrix from Keyboard)
3. Create a data frame called student data, explore the structure of the data and process it using a) data.frame() b) read. table()
4. 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

25DSCP708	CLOUD COMPUTING LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To understand foundational concepts and architectures in cloud computing, virtualization, and parallel/distributed systems.
- To implement and deploy scalable, concurrent, and data-intensive applications using cloud platforms and tools like Aneka, AWS, Azure, or GCP.

LIST OF EXERCISES

1. Study of Cloud Computing 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

Professional Electives

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

Course Objectives:

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

UNIT – I APPLETS AND ABSTRACT WINDOW TOOLKIT (AWT)

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

UNIT – II NETWORK AND DATABASE PROGRAMMING

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

UNIT – III SWING AND BEANS

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

UNIT – IV APPLICATIONS IN DISTRIBUTED ENVIRONMENT

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

UNIT – V SPRING FRAMEWORK AND HIBERNATE FRAMEWORK

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

Text Books:

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

References:

1. D.T. Editorial Services "Java 8 Programming Black Book", Wiley, 2015.
2. Santosh Kumar K, "Spring and Hibernate", Mc.Graw Hill Education, 2nd Edition, 2013.
3. George Reese, "Database Programming with JDBC and Java", O'Reilly Media Publication, 2nd Edition, 2000.

Course Outcomes:

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

25DSPESCN	**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														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	2	2	1	-	-	-	-	-	2	2	1
CO2	3	3	3	2	3	-	-	-	2	-	-	3	3	2
CO3	3	3	3	2	3	-	-	-	2	-	-	3	3	2
CO4	3	3	3	2	3	2	-	-	2	-	-	3	3	3
CO5	3	3	3	2	3	-	-	-	2	-	-	3	3	3

25DSPESCN	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 Edition, OReilly Media, 2009.
2. Matt Doyle, Beginning PHP 5.3, Wiley Publishing,2013.
3. Tom Christiansen, brian d foy, Larry Wall, Jon Orwant, “Programming Perl”, 4th Edition, OReilly Media, 2012.

References:

1. Steve Suehring, “MySQL Bible”, John Wiley, 2002.
2. Philosophy of GNU URL: http://www.gnu.org/philosophy/.
3. Linux Administration URL: http://www.tldp.org/LDP/lame/LAME/linux-admin-made-easy/.
4. Perl Programming book at http://www.perl.org/books/beginning-perl/.

Course Outcomes:

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

1. Identify information about Free and Open Source Software projects from software releases and from sites on the internet.

2. Understand the fundamentals of Linux operating system.
3. Understand database basic concepts and database administration tasks.
4. Recognize the concept of PHP programming to develop web applications.
5. Develop scripts for text processing and to implement modular code using subroutines and packages.

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

25DSPESCN	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	-	-	-	-	-	-	-	-	2	2	-
CO2	2	-	3	-	-	-	-	-	-	-	-	2	2	-
CO3	3	-	3	-	-	-	-	-	-	-	-	2	2	-
CO4	3	-	3	2	2	-	-	-	-	-	-	2	2	-
CO5	2	-	3	3	2	-	-	-	-	-	-	2	2	-

25DSPESCN	NOSQL DATABASES	L	T	P	C
		3	0	0	3

Course Objectives:

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

UNIT – I INTRODUCTION TO NOSQL

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

UNIT – II DATA MODELS

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

UNIT – III DOCUMENT DATABASE

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

UNIT – IV KEY VALUE DATABASE

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

UNIT – V COLUMN AND GRAPH DATABASE

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

Text Books:

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

References:

1. Luc Perkins, Eric Redmond and Jim R. Wilson, "Seven Database in Seven Weeks : A Guide to Modern Databases and the NoSQL Movement", The Pragmatic Bookshelf, 2 nd Edition,2012.
2. Aaron Ploetz, Devram Kandhare, Sudarshan Kadambi and Xun (Brian) Wu "Seven NoSQL Databases in a Week: Get up and running with the fundamentals and functionalities of seven of the most popular NoSQL databases",packt Publishing, 2018.
3. Gaurav Vaish, "Getting Started with NoSql",Packt Publishing, 2013.
4. Adam Flower,"NoSQL for Dummies", John Wiley & Sons Inc, 2015.

Course Outcomes:

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

1. Compare NOSQL databases with each other and Relational database Systems.
2. Explain the concepts of Replication, distribution, sharding, and resilience in a NOSQL database.
3. Demonstrate the knowledge of Document Databases.
4. Describe the features of Key- Value databases.
5. Analyze the features of Column and Graph Databases.

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

25DSPESCN	DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

Course Objectives:

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

UNIT – I FUNDAMENTALS

Digital imaging: Introduction – Steps in image processing systems – Image acquisition – Image Sampling and Quantization – Pixel relationships – Linear and nonlinear operations. OpenCV : Installing and importing cv2 – Reading, writing and displaying images – Color spaces and conversions – Understanding image as Arrays. Learning tools: Introduction to Jupyter Notebook and Google Colab – Setting up Environment – Benefits of Notebook-based Learning.

UNIT – II IMAGE ENHANCEMENT

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

UNIT – III IMAGE SEGMENTATION

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

UNIT – IV MULTI RESOLUTION ANALYSIS AND COMPRESSION

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

UNIT – V MORPHOLOGICAL PROCESSING AND CASE STUDIES

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

Text Books:

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

References:

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

Course Outcomes:

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

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

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

25DSPESCN	**MOBILE COMPUTING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce the concepts of mobile communication and architecture of mobile devices.
- To analyze the GSM, GPRS and UMTS network technologies and protocols.
- To educate the students about the mobile IP and transport layer issues in mobile networks.
- To expose the learners to ad hoc and sensor networks and their applications.
- To provide knowledge on recent trends in mobile platforms, operating systems and applications.

UNIT – I INTRODUCTION TO MOBILE COMPUTING

Mobile Computing Architecture – Mobile Devices – Wireless Communications – Cellular Networks – GSM, GPRS – Services and Architecture – Mobility Management – SMS – MMS – Wireless LANs – IEEE 802.11 Standards – Mobile IP – Wireless Access Protocol.

UNIT – II MOBILE NETWORKS AND TRANSPORT LAYER

Mobile IP – Dynamic Host Configuration Protocol – Mobile Transport Layer – TCP over Wireless – Indirect TCP – Snooping TCP – Mobile TCP – Fast Retransmit / Fast Recovery – Transmission/Timeout Freezing – Selective Retransmission – Transaction Oriented TCP.

UNIT – III WIRELESS NETWORKS AND ROUTING

Ad Hoc Wireless Networks – Introduction – Issues – MAC Protocols – Routing Protocols – Destination Sequenced Distance Vector – Dynamic Source Routing – Wireless Sensor Networks – Architecture – Data Dissemination – Data Gathering – MAC Protocols for Sensor Networks.

UNIT – IV MOBILE PLATFORMS AND APPLICATIONS

Mobile Device Operating Systems – Android – iOS – Mobile App Development Environments – App Development: Native, Web and Hybrid Apps – App Store and Play Store Deployment – Mobile UI Design – Context-aware and Location-based Services.

UNIT – V SECURITY AND FUTURE DIRECTIONS

Mobile Security Issues – Authentication – Encryption – VPN – Cloud Support for Mobile Computing – Mobile Cloud Architecture – IoT and Mobile Integration – Edge Computing – Future Trends and Research Directions.

Text Books:

1. Jochen Schiller, "Mobile Communications", Pearson Education, 2nd Edition, 2012.
2. Asoke K Talukder, Roopa R Yavagal, "Mobile Computing – Technology, Applications and Service Creation", Tata McGraw Hill, 2010.

References:

1. Raj Kamal, "Mobile Computing", Oxford University Press, 2nd Edition, 2012.
2. Rappael C. Wong, "Mobile Computing", McGraw-Hill Education, 2015.

Course Outcomes:

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

1. Explain the architecture, components, and standards of mobile communication and computing.
2. Analyze mobile transport protocols and routing strategies in mobile networks.
3. Evaluate the functioning and design of ad hoc and sensor networks.
4. Develop and deploy applications on various mobile platforms with awareness of design constraints.
5. 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	-

25DSPESCN	MOBILE APPLICATION DEVELOPMENT	L	T	P	C
		3	0	0	3

Course Objectives:

- To demonstrate their understanding of the fundamentals of Android operating systems.
- To develop their skills of using Android software development tools.
- To describe ability to develop software with reasonable complexity on mobile platform.
- To facilitate students to understand android SDK.
- To help 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. Interpret and analyze Android platform architectures and features to learn best practices in android programming.
2. Design the User Interface for mobile applications.
3. Apply Intents, Broadcast receivers and Internet services in Android App.
4. Develop database management system to retrieve and/or store data for mobile application.
5. Evaluate and select appropriate solutions to the mobile computing platform.

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	-

25DSPESCN	**SOCIAL MEDIA ANALYTICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To gain an understanding of social media analytics concepts, techniques, and tools.
- To understand how social media data is obtained analyzed and visualized.
- To know how to improve brand perception and engagement.
- To understand how users interact with a website and social media presence, identify areas for Improvement to achieve business goals.
- To identify how users interact with your app or mobile site, optimize performance and Improve the user experience.

UNIT – I INTRODUCTION

Social Media Analytics Overview- grading and attendance policies- Business Social Media Analytics: Definition, Benefits, and Challenges. Foundations of Media Analytics. The Case for Measurement- Goal Setting, Goal Alignment, and Objectives.

UNIT – II SOCIAL MEDIA TEXT ANALYTICS

Introduction- Netlytic Text Analytics- Sentiment Analysis Collecting social media data using APIs, collecting tweets by hash tags, user, or keyword- Social Media Network Analytics- Collecting social media data through web scrawling, collecting web contents.

UNIT – III USER GENERATED CONTENT AND SOCIAL LISTENING

Big Data analytics and sentiment analysis- Social Media ROI & SWOT Analysis- Text Mining of User-Generated Content (UGC). Social Media Marketing and Analytics. Trends in social and digital marketing Paid/Earned/Owned media and Inbound/Outbound.

UNIT – IV WEB ANALYTICS

Introduction- Google analytics- Google Analytics Accounts– How to set up Google Analytics Account? - Customer Relationship Management (CRM) analytics, Analysis vs intuition, the "Digital" Marketing Mix, Web Metrics with Google Analytics, web Analytics report.

UNIT – V MOBILE ANALYTICS AND SOCIAL COMMUNITIES

Mobile path to purchase- mobile couponing, mobile showrooming and location based advertising- Mobile advertising- cross- device synergies- mobile commerce, and mobile apps. Social communities and Facebook Analytics.

Text Books:

1. Matthew A. Russell, “Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Google+, GitHub, and More”, O’ Reilly Publication. Elseiver Inc., Second Edition, 2014
2. Krish Krishnan Shawn Rogers, “Social Data Analytics”, Morgan Kaufmann series, Elseiver Science , 2014.

References:

1. Avinash Kaushik, “Web Analytics 2.0: The Art of Online Accountability and Science of
   Customer Centricity” (Author) Publisher: Sybex; Wiley Publishing, Inc, First edition, 2009.
2. Jennifer Golbeck, “Analyzing the Social Web”, Publisher: Morgan Kaufmann, First Edition, 2013.
3. Marshall Sponder, “Social Media Analaytics: Effective Tools for Building, Interpreting and using Metrics”, McGraw-Hill Education, First edition, 2013.

Course Outcomes:

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

1. Understand the basic principles of social media analytics
2. Know about the social media data and text analysis
3. Understand user generated content and social media marketing.
4. Identify and learn the different types of web analytics.
5. Recognize knowledge about the mobile analytics and communities.

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

25DSPESCN	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the basic concepts of Computer security and Cryptography.
- To impart knowledge about Symmetric key algorithms and AES.
- To provide basic knowledge of Asymmetric key algorithms and Digital signatures.
- To familiarize the basic properties and concepts of Digital certificates and public key Infrastructure (PKI)
- To explain about Firewalls, Virtual private networks, Secure Socket Layer, Transport Layer Security, Secure Electronic Transaction and E-mail security.

UNIT – I Introduction

Need for security - Principles of Security - Types of Attacks - Plain text and Cipher Text - Substitution techniques - Caesar Cipher - Mono alphabetic Cipher - Polygram - Polyalphabetic Substitution - Playfair - Hill Cipher - Transposition techniques - Encryption and Decryption - Symmetric and Asymmetric Key Cryptography - Steganography - KeyRange and Key Size -Possible Types of Attacks.

UNIT – II Cryptography Algorithms

Algorithms types and modes - Overview of Symmetric key Cryptography - Data Encryption Standard (DES) - International Data Encryption Algorithm (IDEA) - RC4 - RC5 - Blowfish - Advanced Encryption Standard (AES).

UNIT – III Asymmetric Key Cryptography

Brief history of Asymmetric Key Cryptography - Overview of Asymmetric Key Cryptography - RSA algorithm - Symmetric and Asymmetric key cryptography together - Digital Signatures -Knapsack Algorithm - Some other algorithms (Elliptic curve Cryptography - ElGamal - problems with the public key exchange).

UNIT – IV Primary Key Management

Digital Certificates-Private Key Management - The PKIX Model - Public Key Cryptography Standards (PKCS) - XML - PKI and Security - Hash functions - Key Predistribution - Blom's Scheme - Diffie-Hellman Key Predistribution - Kerberos - Diffie-Hellman Key Exchange - The Station-to-station Protocol.

UNIT – V TCP/IP and Firewalls

Introduction to TCP/IP - Firewalls - IP Security - Virtual Private Networks (VPN) - Intrusion -Internet Security Protocols: Basic concepts - Secure Socket Layer (SSL) - Transport Layer Security (TLS) - Secure Hyper Text Transfer Protocol (SHTTP) - Time Stamping Protocol (TSP) - Secure Electronic Transaction (SET) - SSL Vs SET - 3D Secure Protocol - Electronic Money - E-mail Security - Wireless Application Protocol (WAP) Security - Security in GSM - Security in 3G.

Text Books:

1. William Stallings, "Cryptography and Network Security", Pearson Education, 8th Edition, 2024.
2. Jonathan Katz, Yehuda Lindell, "Introduction to Modern Cryptography", A Chapman & Hall Book, CRC Press, 3rd edition, 2025.
3. Atul Kahate "Cryptography and Network Security", Tata McGrawHill, 4th Edition, 2013.
4. Charlie Kauffman, Radia Perlman, Mike Spciner, "Network Security", Pearson Education, 2nd Edition, 2012.

References:

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

Course Outcomes:

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

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

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

25DSPESCN	**NATURAL LANGUAGE PROCESSING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To familiarize the students with the basic concepts of Natural Language Processing and Information Retrieval.
- To study the concepts related to the processing of words.
- To learn the grammatical structure of a sentence, and to identify relationships between words .
- To understand the meaning of text, going beyond simply recognizing words and their order to grasp the intended message.
- To study how context influences the meaning of language and to gain knowledge on natural language generation and machine translation.

UNIT – I INTRODUCTION

Origin of Natural Language processing – Language and Knowledge– Processing Indian Languages – NLP applications–Introduction to language modelling – Various grammar-based Language Models – Statistical language model – Introduction to Information Retrieval-Information Retrieval Models.

UNIT – II WORDS

Regular expressions – Finite state Automata – Survey of English Morphology - Finite State Morphological parsing-Speech Sounds and Phonetic Transcription-Phoneme and Phonological Rules-Dealing with Spelling Errors-Spelling Error Patterns-Probabilistic Models-N_gram models of syntax – Counting words – Unsmoothed N_grams – Smoothing – Speech Recognition architecture – Hidden Markov models.

UNIT – III SYNTAX

English Word classes– Tagsets– Part of Speech Tagging – Transformation based tagging – Context free rules and trees – The noun phrase – Verb phrase – Finite state and context free grammars – Top _down parsing – Bottom_ up parsing – Feature structures – Unification of Feature Structures-Feature Structure in the Grammer-Implementing Unification –Constraints – Probabilistic context free grammars – Probabilistic Lexicalized context free grammars.

UNIT – IV SEMANTICS

Computational Desiderata for Representations- Meaning Structure of Language-First order predicate calculus- Syntax Driven Semantic analysis – Attachments – Idioms and Compositionality – Relations among Lexemes and their Senses-WordNet-Internal Structure of Words.

UNIT – V PRAGMATICS

Introduction to Discourse Processing- Cohesion- Reference Resolution – Discourse Coherence and Structure- Introduction to Natural Language Generation – Architecture of NLG Systems-Generation tasks and Representations- Introduction to Machine Translation-Machine Translation Approaches.

Text Books:

1. Samuel Burns, Natural Language Processing: A Quick Introduction to NLP with Python and NLTK, 1st Edition, 2019.
2. Yoav Goldberg, Graeme Hirst, Neural Network Methods for Natural Language Processing, Morgan and Claypool Life Sciences, 2017.

References:

1. Jacob Eisenstein,Introduction to Natural Language Processing,MIT Press, 2019.
2. Daniel Jurafsky and James H Martin, Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition, Pearson Education, Sixth Edition, 2011.
3. Nitin Indurkhya and Fred J. Damerau, Handbook of Natural Language Processing, Second edition, Chapman & Hall/Crc: Machine Learning & Pattern Recognition, CRC press, 2010.
4. Ehud Reiter, Robert Dale, Building Natural Language Generation Systems, Cambridge University Press, 2009.

Course Outcomes:

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

1. Understand the basic concept of Natural Language Processing, NLP applications and Language modelling.
2. Know the processing of words and algorithms used to process the words.
3. Recognize the parts of speech and phrase structure grammars for English.
4. Identify the semantic analysis and internal structure of words.
5. Recognize the practical use of language in context and various methods of machine translation.

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

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

Course Objectives:

- To introduce the foundational concepts and components of block chain 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 block chain systems.
- To provide insight into block chain platforms and their use in various domains.

UNIT – I INTRODUCTION TO BLOCKCHAIN

Overview of Block chain – Characteristics – Structure – Block – Transactions – Distributed Ledger – Types of Block chain – 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 – Block chain-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 – Block chain 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 block chain technology.
2. Analyze consensus mechanisms and cryptographic methods in block chain systems.
3. Design and implement smart contracts and decentralized applications.
4. Evaluate different block chain platforms and their development tools.
5. Assess security and privacy aspects of block chain 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	-

25DSPESCN	GRAPH ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the core principles of graph theory and analytics.
- To explore different types of graph models and their applications.
- To analyze algorithms used in large-scale graph processing.
- To develop the ability to solve complex problems using graph analytics techniques.
- To apply graph analytics to real-world applications in computer science and data science.

UNIT – I INTRODUCTION TO GRAPH ANALYTICS

Graphs: Definitions, types (directed, undirected, weighted, etc.), and representations (adjacency matrix/list) - Characteristics of real-world graphs: Web, social, and biological networks - Role and importance of graph analytics in various domains.

UNIT – II GRAPH ALGORITHMS BASICS

Graph traversal: Breadth-First Search (BFS), Depth-First Search (DFS) - Shortest path algorithms: Dijkstra's algorithm, Bellman-Ford algorithm - Minimum Spanning Tree (MST): Prim's and Kruskal's algorithms.

UNIT – III GRAPH METRICS AND MEASURES

Centrality measures: Degree, Closeness, Betweenness, Eigenvector - Clustering coefficient, Graph density, and diameter - Community detection and connected components.

UNIT – IV LARGE-SCALE GRAPH PROCESSING

Graph partitioning techniques- Distributed graph processing models: Pregel, Apache Graph - Introduction to graph databases: Neo4j-Tools and frameworks: GraphX, NetworkX, SNAP

UNIT – V APPLICATIONS OF GRAPH ANALYTICS

Case studies: Social network analysis, fraud detection, and recommendation systems - Applications in cyber security and biological data analysis - Building practical solutions using graph-based models

Text Books:

1. Rohit kumar and Amol Deshpande, Graph Analytics: Practical Approaches for Learning from Graph Data, Packet Publishing, 2018.
2. Mark Newman, "Networks: An Introduction", Oxford University Press, 2010.

References:

1. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning about a Highly connected world", Cambridge University Press, 2010.
2. Jure Leskovec, Anand Rajaraman, and Jeff Ullman, "Mining of Massive Datasets", Cambridge University Press,2020 (3rd Edition)
3. Barabasi, "Network Science", Cambridge University Press,2016.
4. Charu Aggarwal, "Graph Management ana Analysis: A Machine Learning Perspective", Springer,2022.

Course Outcomes:

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

1. Describe the fundamentals of graph theory and different types of graphs.
2. Apply graph traversal and path-finding algorithms.
3. Analyze graph structures using centrality, clustering, and connectivity measures.
4. Implement and evaluate large-scale graph algorithms using frameworks.
5. Solve practical problems using graph-based data models in various domains.

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

25CSPESCN	WEB ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the growing connectivity and complexity in the world ranging from small groups to World Wide Web.
- To gain a practical understanding of common monitoring or analysis tasks and techniques used in web analytics
- To evaluate different types of software tools, techniques, and reports that are relevant to web analytics
- To make informed decisions on how to analyze and interpret web channel data and understand the difficulties and issues involved.

UNIT – I INTRODUCTION

Web Analytics 2.0: State of the Analytics Union - State of the Industry - Web Analytics 2.0. Clickstream analysis : Eight Critical Web Metrics - Bounce Rate - Exit Rate - Conversion Rate – Engagement - Web Metrics Demystified - Strategically-aligned Tactics. Practical solution : Web Analytics Primer - Web Analytics Report – Foundational Analytical Strategies - Everyday Clickstream Analyses - Perspectives on Key Web Analytics Challenges.

UNIT – II MEASURING SUCCESS AND LEVERAGING QUALITATIVE DATA

Measuring success: Five examples of actionable outcome - conversion rates - macro and micro conversions - Quantifying Economic Value - measuring success for a non ecommerce website - Measuring B2B Websites. Leveraging qualitative data: lab usability - usability alternative – surveys - web enabled emerging user research options. Testing and experimentation: A Primer on Testing Options: A/B and MVT, Actionable Testing Ideas, Controlled Experiments, Creating and Nurturing a Testing Culture.

UNIT – III INFORMATION RETRIEVAL

Search engines: Search challenge – History of search engines – Architecture and components – Crawling – Indexing. Link analysis: Web graph – link-based ranking – page rank - hypertext induced topic search – Link-based analysis. Recommendation and diversification for the web: Pruning information – Recommendation systems – Result diversification. Advertising in search.

UNIT – IV COMPETITIVE INTELLIGENCE ANALYSIS AND EMERGING ANALYTICS

Competitive Intelligence analysis: CI data sources, types and secrets - website traffic analysis - search and keyword analysis - segmentation analysis. Emerging analytics: measuring the new social web - Analyzing offline customer experiences – Analyzing mobile customer experiences - measuring the success of blogs - quantifying the impact of twitter - Analyzing Performance of Videos.

UNIT – V GOOGLE ANALYTICS

Google Analytics contribution - Creating implementation plan - Working of Google analytics: Data collection and processing – Reports – Tracking code. Tracking visitor clicks, Outbound links, Non html files - Google analytics accounts and profiles: Google analytics accounts - Creating a Google Analytics Account - Profiles.

Text Books:

1. Avinash Kaushik, “Web Analytics 2.0: The Art of Online Accountability”, John Wiley & Sons, 2009.
2. Stefano Ceri, Alessandro Bozzon, Marco Brambilla, Emanuele Della Valle, PieroFraternali, Silvia Quarteroni, ”Web Information retrieval”, Springer,2013.

References:

1. Justin Cutroni, "Google Analytics", O'Reilly, First Edition 2010.
2. Hansen, Derek, Ben Sheiderman, Marc Smith ,"Analyzing Social Media Networks with NodeXL: Insights from a Connected World", Morgan Kaufmann, 2011.
3. Wasserman. S, Faust. K, "Social network analysis: Methods and applications", New York: Cambridge University Press,1994.
4. Feras Alhlou, Shiraz Asif, Eric Fettman, "Google Analytics Breakthrough: From Zero to Business Impact", Wiley 2016.

Course Outcomes:

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

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

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

25DSPESCN	**DATA SCIENCE AND BUSINESS ANALYTICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce concepts, techniques and tools they need to deal with various facets of data science practice.
- To build data collection and integration.
- To build the basic types of data and basic statistics.
- To understand the use of business analytics for decision making.
- To educate the appropriate analytics and generate solutions.
- To investigate model and analyse the business situation using analytics.

UNIT – I INTRODUCTION TO DATA SCIENCE

Definition of Data Science- datafication - current landscape of perspectives - statistical inference –statistical modelling, probability distributions, fitting a model–over fitting. Basics of R**:** programming with R, basic data types. Types of Data:Attributes and measurement, the type of an attribute, describing attributes by the number of values, asymmetric attributes, binary attribute, nominal attributes, ordinal attributes, numeric attributes, discrete versus continuous attributes. Basic Statistical Descriptions of Data: Measuring the central tendency:

mean, median, and mode. Measuring the Dispersion of Data: Range, quartiles, variance, standard deviation, and inter- quartile range, graphic displays of basic statistical descriptions of data.

UNIT – II VECTORS, MATRICES, FACTORS AND DATA FRAMES, LISTS

Vectors, Matrices: Creating and naming matrices, matrix sub setting, arrays, class. Factors and Data Frames: Factor levels, summarizing a factor, ordered factors, comparing ordered factors, introduction to data frame, sub setting of data frames, extending data frames, sorting data frames. Lists: creating a list: creating a named list, accessing list elements, elements, merging lists, and converting lists to vectors.

Conditionals and Control Flow: Relational operators and vectors, logical operators and vectors, conditional Statements. Iterative programming in R:While loop, For loop, looping over list. Functions in R:writing a function in R, nested functions, function scoping, recursion, loading an R package, mathematical functions in R.

UNIT – III Business Analytics

Introduction to Business Analytics (BA): Business analytics - terminologies, process, importance, relationship with organisational decision making, analytics in decision making, BA for competitive advantage.

Managing Resources for Business Analytics: Managing BA personnel, data and technology. Organisational structures aligning BA. Managing information policy, data quality and change in BA.

UNIT – IV Organization of Business Analytics

Descriptive analytics: Introduction to descriptive analytics – visualising, and exploring data - descriptive statistics - sampling and estimation - probability distribution for descriptive analytics - analysis of descriptive analytics.

Predictive analytics: Introduction to predictive analytics - logic and data driven models - predictive analysis modelling and procedure - data mining for predictive analytics. Analysis of predictive analytics.

UNIT – V Prescriptive Analytics

Introduction to Prescriptive analytics: Prescriptive Modelling - Non Linear Optimisation - Demonstrating Business Performance Improvement.

Text Books:

1. Doing Data Science, Straight Talk from The Frontline. Cathy O'Neiland Rachel Schutt ,O'Reilly, 2014
2. Marc J. Schniederjans, Dara G. Schniederjans and Christopher M. Starkey, " Business Analytics Principles, Concepts, and Applications - What, Why, and How" , Pearson Ed, 2014.
3. Christian Albright S and Wayne L. Winston, "Business Analytics - Data Analysis and Decision Making", Fifth edition, Cengage Learning, 2015.
4. Sharda, Ramesh, Delen, Dursun, Turban, Efraim, Business Intelligence, Analytics, Data Science, and AI. Pearson, 5th Ed., Global Edition, 2024.

References:

1. Mishra, Durgesh, Yang, Xin-She, Unal, Aynur, Jat, Dharm Singh, Data Science and Big Data Analytics, Springer Singapore, 2025.
2. Weber, Willi, Zwingmann, Tobias, Augmented Analytics: Enabling Analytics Transformation for Data-Informed Decisions, Wiley, 2024.
3. Cremonezi, Leo, A Cool Guide to Statistics and Data Science, Independently Published, 2025.

Course Outcomes:

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

1. Understand basic terms what Statistical Inference means.
2. Identify probability distributions commonly used as foundations for statistical modelling. Fit a model to data. Utilize R elements for data handling.
3. Analyse and demonstrate knowledge of data analytics, ability of think critically in making decisions based on data and deep analytics.
4. Utilize technical skills in predicative and prescriptive modelling to support business decision-making.
5. Understand the ability to translate data in to clear, action able in sights.

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

25DSPESCN	**ETHICS IN DATA ANALYTICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce the ethical challenges and responsibilities in data science and analytics.
- To educate students on data privacy, ownership, and consent frameworks.
- To analyze the implications of algorithmic decision-making and bias.
- To expose learners to regulatory, legal, and professional standards in data analytics.
- To prepare students to build responsible and fair data-driven systems.

UNIT – I INTRODUCTION TO DATA ETHICS

Ethics and Data Science – Importance of Ethics in Analytics – Foundations of Ethical Theories – Ethical Dilemmas – Professional Codes of Ethics (ACM, IEEE).

UNIT – II PRIVACY, OWNERSHIP AND CONSENT

Data Privacy Principles – Ownership of Data – Data Collection and Consent – Anonymization and De-identification – GDPR and Other Privacy Laws – Ethical Use of Personal Data.

UNIT – III ALGORITHMIC FAIRNESS AND ACCOUNTABILITY

Bias in Data and Algorithms – Fairness Metrics – Discrimination in Automated Decisions – Transparency – Explainability – Accountability Mechanisms – Case Studies.

UNIT – IV SOCIAL IMPACT AND RESPONSIBLE DATA PRACTICES

Social and Cultural Implications – Ethical Issues in AI and Big Data – Misinformation and Manipulation – Digital Divide – Data for Social Good – Responsible Data Governance.

UNIT – V REGULATIONS, STANDARDS AND BEST PRACTICES

Legal Frameworks – Data Protection Acts – Industry Standards – Ethical Audits – Risk Assessments – Implementing Ethical Guidelines in Data Projects – Future Trends in Data Ethics.

Text Books:

1. Mike Loukides, Hilary Mason, DJ Patil, “Ethics and Data Science”, O'Reilly Media, 2018.
2. Cathy O’Neil, “Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy”, Crown Publishing, 2016.

References:

1. Rodolfo Milanés, “Ethics in Data Science”, Springer, 2021.
2. Kord Davis, “Ethics of Big Data”, O’Reilly Media, 2012.

Course Outcomes:

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

1. Explain ethical theories and their application to data analytics scenarios.
2. Evaluate data privacy, consent, and ownership issues with respect to regulatory frameworks.
3. Identify and mitigate bias and unfairness in data-driven algorithms.
4. Assess the societal impact of data analytics and apply responsible data practices.
5. Apply legal, ethical and professional standards to ensure accountability and fairness in analytics projects.

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

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

25DSPCSCN	AUGMENTED REALITY AND VIRTUAL REALITY	L	T	P	C
		3	0	0	3

Course Objectives:

- To explain the conceptual differences between virtual reality and Augmented Reality.
- To provide the insight into the current virtual reality hardware and software.
- To make the students understand various modelling approaches and its management.
- To Illustrate the Challengers of Augmented Reality and its software development.
- To make the students to build a Virtual Reality Application.

UNIT – I INTRODUCTION TO VIRTUAL REALITY

Defining Virtual Reality, Key elements of virtual reality experience, Virtual Reality, Telepresence, Augmented Reality and Cyberspace. Bird's-Eye View: Hardware, Software, Human Physiology and Perception.

UNIT – II INPUT DEVICES: (TRACKERS, NAVIGATION, AND GESTURE INTERFACES)

Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces. Output Devices: Graphics displays, sound displays & haptic feedback

UNIT – III MODELLING

Geometric modelling, Kinematics modelling, Physical modelling, Behaviour modelling, Model management.

UNIT – IV AUGMENTED REALITY AND SOFTWARE DEVELOPMENT

Taxonomy, Technology and Features of Augmented Reality, AR Vs VR, Challenges with AR, AR systems and functionality, Augmented Reality Methods, Visualization Techniques for Augmented Reality, enhancing interactivity in AR Environments, Evaluating AR systems AR software, Camera parameters and camera calibration, Marker-based augmented reality, AR Toolkit.

UNIT – V INTERACTION & AUDIO

Interaction - Motor Programs and Remapping, Locomotion, Manipulation, Social Interaction. Audio -The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering. Interaction - Motor Programs and Remapping, Locomotion, Manipulation, Social Interaction. Audio -The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering.

Text Books:

1. "Virtual Reality Technology", Second Edition, Gregory C. Burdea & Philippe Coiffet, John Wiley & Sons, Inc, 2017.
2. "Virtual Reality", Steven M. LaValle, Cambridge University Press, 2016.

References:

1. Rajesh K. Maurya, "Computer Graphics with Virtual Reality System", 3rd Edition, Wiley Publication, 2018.
2. William R. Sherman and Alan B. Craig, "Understanding Virtual Reality Interface, Application, and Design", 2nd Edition, Morgan Kaufmann Publishers, Elsevier, 2019.
3. Grigore C. Burdea, Philippe Coiffet, "Virtual Reality Technology", 2nd Edition, Wiley,2017.
4. K.S. Hale and K. M. Stanney, "Handbook on Virtual Environments", 2nd Edition, CRC Press, 2015.

Course Outcomes:

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

1. Explain the conceptual differences between virtual reality and Augmented Reality.
2. Provide the insight into the current virtual reality hardware and software.
3. Compare various modelling approaches in AR and its management.
4. Illustrate the Challengers of Augmented Reality and its software development.
5. Build a simple Virtual Reality Application.

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

25DSPESCN	SMART GRID DATA ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the architecture and technologies used in smart grids.
- To gain knowledge on data acquisition and preprocessing in the smart grid environment.
- To apply data analytics and machine learning for grid fault detection and maintenance.
- To explore clustering and classification techniques specific to smart grid data.
- To use modern tools and platforms for real–time grid monitoring and analysis.

UNIT – I INTRODUCTION TO SMART GRIDS

Smart Grid Architecture: Components and Functions – Traditional Grid vs. Smart Grid – Measurement Technologies: Smart Meters, Advanced Metering Infrastructure (AMI), Phasor Measurement Units (PMUs), Supervisory Control and Data Acquisition (SCADA) – Types of Data in Smart Grids : Structured, Semi-Structured, Unstructured.

UNIT – II DATA ACQUISITION AND PREPROCESSING

Big data Concepts in Smart Grids – Data Sources : Smart Meters, Sensor Networks – Data Formats CSV, JSON, XML – Time-series Data Characteristics in Smart Grids – Data Quality Issues: Missing Data, Noise, Outliers – Data Preprocessing: Normalization, Feature Extraction, Imputation Methods.

UNIT – III DATA ANALYTICS AND FAULT DETECTION

Outage and Fault Prediction using Data Analytics – Condition Monitoring and Predictive Maintenance – Machine Learning Models: Decision Trees, SVM, Neural Networks – Anomaly Detection in Smart Grid Data – Cyber Security Analytics in Smart Grids.

UNIT – IV Clustering & Classification in Smart Grids

Clustering: K–Means, Hierarchical, Density-Based Clustering – Dimensionality Reduction – Feature Selection Techniques – Classification Algorithms: Naive Bayes, Logistic Regression – Applications in Grid Data Analytics – Model Evaluation Metrics: Accuracy, RMSE, MAE, Confusion Matrix.

UNIT – V Tools, Platforms and Case Studies

Big Data Tools: Hadoop, Spark – Real Time Streaming Analytics: Apache Kafka, Flink – Visualization Tools: Tableau, Power BI – Case Studies: Demand Response, Load Profiling and Forecasting at Multiple Time Horizons, Customer Behavior Analytics, Cybersecurity Incidents in Smart Grids.

Text Books:

1. Bernd M. Buchholz & Z. Styczynski, "Smart Grids – Fundamentals & Technologies", Springer, second edition, 2020.
2. James Momoh, "Smart Grid: Fundamentals of Design and Analysis", Wiley, 2012.
3. Stuart Borlase, "Smart Grids: Infrastructure, Technology and Solutions", CRC Press, first edition, 2017.

References:

1. Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu and Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley, 2012.
2. Stuart Borlase, "Smart Grids Advanced Technologies and Solutions", CRC Press, 2018.

Course Outcomes:

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

1. Explain the components and communication structure of smart grids.
2. Acquire and pre-process time-series data from smart meters and sensors.
3. Apply machine learning models for fault prediction and grid maintenance.
4. Analyze energy usage and detect anomalies using clustering and classification algorithms.
5. Implement smart grid analytics using modern tools and platforms.

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

25DSPESCN	GENERATIVE AI & LARGE LANGUAGES MODELLING	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the basics of Generative AI.
- To know the basics of Text Generation.
- To understand the process of generating videos.
- To know about GAN and its variants.
- To understand and Apply Gen AI tools.

UNIT – I INTRODUCTION TO GEN AI

Historical Overview of Generative modeling - Difference between Gen AI and Discriminative Modeling – Importance of generative models in AI and Machine Learning – Types of Generative models – GANs, VAEs, autoregressive models and Vector quantized Diffusion models - Understanding if probabilistic modeling and generative process - Challenges of Generative Modeling – Future of Gen AI – Ethical Aspects of AI – Responsible AI – Use Cases.

UNIT – II GENERATIVE MODELS FOR TEXT

Language Models Basics – Building blocks of Language models - Transformer Architecture – Encoder and Decoder – Attention mechanisms - Generation of Text – Models like BERT and GPT models – Generation of Text – Auto encoding – Regression Models – Exploring ChatGPT – Prompt Engineering – Designing Prompts– Revising Prompts using Reinforcement Learning from Human Feedback (RLHF) - Retrieval Augmented Generation – Multimodal LLM – Issues of LLM like hallucination.

UNIT – III GENERATION OF IMAGES

Introduction to Generative Adversarial Networks – Adversarial Training Process – Nash Equilibrium – Variational Autoencoders – Encoder-Decoder Architectures - Stable Diffusion Models – Introduction to Transformer-based Image Generation – CLIP – Visual Transformers ViT- Dall-E2 and Dall-E3, GPT-4V – Issues of Image Generation models like Mode Collapse and Stability.

UNIT – IV GENERATION OF PAINTING, MUSIC, AND PLAY

Variants of GAN – Types of GAN - Cyclic GAN – Using Cyclic GAN to Generate Paintings – Neural Style Transfer – Style Transfer - Music Generating RNN – MuseGAN – Autonomous agents – Deep Q Algorithm – Actor-critic Network.

UNIT – V OPEN SOURCE MODELS AND PROGRAMMING FRAMEWORKS

Training and Fine tuning of Generative models – GPT4All - Transfer learning and Pretrained models - Training vision models – Google Copilot - Programming LLM – LangChain – Open Source Models – Llama - Programming for TimeSformer – Deployment – Hugging Face.

Text Books:

1. Denis Rothman, “Transformers for Natural Language Processing and Computer Vision”, Packt Books, Third Edition, 2024

References:

1. David Foster, “Generative Deep Learning”, O’Reily Books, 2024.
2. Altaf Rehmani, “Generative AI for Everyone”, BlueRose One, 2024.

Course Outcomes:

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

1. Understand the concepts of Generative Modelling.
2. Apply Gen AI to Generating Texts.
3. Understand and Apply Gen AI for generating images.
4. Understand and Apply Gen AI for generating video.
5. Apply Open Source Tools for solving problems using Gen AI.

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

25DSPESCN	INFORMATION THEORY CODING AND CRYPTOGRAPHY	L	T	P	C
		3	1	0	3

Course Objectives:

- To explain key concepts such as entropy, mutual information, and channel capacity, and understand their significance in communication systems.
- To analyze and apply source coding techniques like Huffman coding and Shannon-Fano coding for lossless data compression.
- To design and analyze block codes, cyclic codes, and convolutional codes for error detection and correction in digital communication systems.
- To study and implement advanced coding methods such as BCH, Reed-Solomon, Turbo, and LDPC codes suitable for high-reliability applications.
- To understand symmetric and asymmetric cryptographic techniques including DES, AES, and RSA, and their applications in secure communication.

UNIT – I INFORMATION THEORY BASICS

Introduction to Information Theory - Uncertainty, Entropy, and Information - Properties of Entropy - Mutual Information and Conditional Entropy - Source Coding Theorem - Shannon's Theorem and Shannon-Fano Coding - Huffman Coding - Prefix Codes and Optimality - Kraft-McMillan Inequality.

UNIT – II DISCRETE MEMORYLESS CHANNELS AND CAPACITY

Discrete Memoryless Channel (DMC) - Channel Matrix and Channel Diagram - Mutual Information and Channel Capacity - Channel Coding Theorem - Capacity of Symmetric Channels - Binary Symmetric Channel (BSC) - Binary Erasure Channel (BEC) - Shannon's Channel Coding Theorem - Differential Entropy and Gaussian Channels (introductory)

UNIT – III SOURCE AND ERROR CONTROL CODING

Introduction to Error Control Coding - Types of Codes: Block Codes, Linear Codes - Generator and Parity-Check Matrices - Syndrome Decoding - Hamming Codes - Minimum Distance and Error Detection/Correction - Cyclic Codes and CRC - Convolutional Codes – Representation and Basic Decoding

UNIT – IV ADVANCED CODING TECHNIQUES

Maximum Likelihood Decoding - Viterbi Algorithm for Convolutional Codes - Trellis Diagram - BCH Codes: Encoding and Decoding - Reed-Solomon Codes: Principles and Applications - Turbo Codes – Concepts and Applications - LDPC (Low-Density Parity Check) Codes – Basics

UNIT – V CRYPTOGRAPHY FUNDAMENTALS

Introduction to Cryptography – Goals and Types - Classical Cryptosystems – Caesar Cipher, Monoalphabetic Cipher - Symmetric Key Cryptography – DES, AES - Asymmetric Key

Cryptography – RSA Algorithm - Key Distribution and Management - Hash Functions and Digital Signatures - Message Authentication Codes (MACs) - Applications of Cryptography in Data Security

Text Books:

1. Christof Paar & Jan Pelzl, "Understanding Cryptography: From Established Symmetric and Asymmetric Ciphers to Post-Quantum Algorithms", 2nd Edition, Springer, 2024.
2. Jonathan Katz & Yehuda Lindell, "Introduction to Modern Cryptography", 3rd Edition, 2020.
3. William Stallings, "Cryptography and Network Security: Principles and Practice", 8th Edition, 2022.
4. R. Bose, "Information Theory, Coding and Cryptography", 2nd edition., New Delhi, India: Tata McGraw-Hill, 2008.

References:

1. Thomas M. Cover and Joy A. Thomas, "Elements of Information Theory",2nd edition, Wiley, 2006.
2. Bernard Sklar, "Digital Communications: Fundamentals and Applications", Pearson, 1987.
3. Ranjan Bose, "Information Theory, Coding and Cryptography", 3rd edition, Tata McGraw Hill, 2008.
4. William Stallings, "Cryptography and Network Security", 8th edition, Pearson, 2022.
5. Simon Haykin, "Communication Systems", 5th edition, Wiley, 2009

Course Outcomes:

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

1. Define and explain the fundamental concepts of information theory such as entropy, information content, mutual information, and channel capacity.
2. Design and implement lossless source coding algorithms like Huffman and Shannon-Fano coding for efficient data compression.
3. Analyze and construct linear block codes, cyclic codes, and convolutional codes to perform error detection and correction in communication systems.
4. Evaluate and apply advanced coding techniques such as BCH, Reed-Solomon, Turbo codes, and LDPC for high-performance error correction.
5. Understand and implement cryptographic techniques including symmetric and asymmetric encryption algorithms (e.g., DES, AES, RSA) and digital signatures.

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

25DSPESCN	REAL-TIME AND CLOUD DATA SCIENCE	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the basics of real-time data processing and its applications.
- To familiarize with cloud storage solutions and data warehousing options.
- To understand the principles of MLOps and its importance in model deployment.
- To learn to deploy machine learning models using a micro web framework.
- To apply real-time data processing and MLOps principles to a project..

UNIT – I INTRODUCTION TO REAL-TIME DATA

Overview of real-time data and its applications - Introduction to Kafka: architecture, producers, consumers, and topics - Spark Streaming: basics, DStreams, and Structured Streaming- Hands-on exercise: Setting up Kafka and Spark Streaming

UNIT – II CLOUD TOOLS OVERVIEW

Introduction to cloud computing and its benefits - AWS S3: storage, buckets, and objects - Google BigQuery: data warehousing, querying, and data loading - Hands-on exercise: Working with AWS S3 and Google BigQuery

UNIT – III BASICS OF MLOPS

Introduction to MLOps and its importance- CI/CD: continuous integration and continuous deployment - Model deployment: containerization using Docker - Hands-on exercise: Setting up a CI/CD pipeline

UNIT – IV MODEL DEPLOYMENT WITH FLASK

Introduction to Flask: a micro web framework - Model deployment: creating a RESTful API - Hands-on exercise: Deploying a machine learning model using Flask.

UNIT – V ADVANCED TOPICS

Advanced topics in real-time data processing and MLOps - Project: Deploying a real-time machine learning model using Kafka, Spark Streaming, and Flask - Hands-on exercise: Working on a project that integrates all the concepts learned in the course.

Text Books:

1. Neha Narkhede, Gwen Shapira, Todd Palino, “The Definitive Guide: Real-time data and stream processing at scale”, O’REILLY, 2017
2. Matei Zaharia and Bill Chambers, “ Spark: The Definitive Guide - Big Data Processing Made Simple”, Wiley Publications, January 2018
3. C. Osipov, “MLOps Engineering at Scale”, 1st ed. O'Reilly Media, 2023.

References:

1. M. Kleppmann, “Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems”, 1st ed. O'Reilly Media, 2017.
2. G. Santanna,“Cloud Computing: Concepts, Technology & Architecture”, 1st ed. Wiley, 2018.
3. Burkov, “Machine Learning Engineering”, 1st ed. Andriy Burkov, 2020
4. M. Grinberg, “Flask Web Development: Developing Web Applications with Python”, 2nd ed. O'Reilly Media, 2018.
5. E. Ameisen, “Building Machine Learning Powered Applications: Going from Idea to Product” , 1st ed. O'Reilly Media, 2020.

Course Outcomes:

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

1. Design a real-time data pipeline using Kafka and Spark Streaming.
2. Use AWS S3 and Google Big Query for storing and querying large datasets.
3. Implement a CI/CD pipeline for machine learning model deployment.
4. Deploy a machine learning model as a RESTful API using Flask.
5. Develop a real-time machine learning model deployment pipeline using Kafka Spark Streaming, and Flask.

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

OPEN ELECTIVES

25DSOESCN	DATA MINING	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the basics of data warehousing components.
- To educate the students on Data warehousing Architecture and Implementation.
- To provide knowledge on data mining system development with the process of KDD.
- To analyse and solve data mining problems using machine learning algorithms.
- To provide insight into statistical data analysis.

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 AND THE KDD PROCESS

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. Jiawei Han, Jian Pei and Hanghang Tong, Data Mining: Concepts and Techniques, Fourth Edition, 2022.
2. G. K. Gupta, "Introduction to Data Min Data Mining with Case Studies", Prentice Hall of India, Easter Economy Edition, 2006.
3. 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.
4. Bruce Ratner, "Statistical and Machine learning –Learning Data Mining, techniques for better Predictive Modeling and Analysis to Big Data", CRC Press, Second Edition, 2011.

Course Outcomes:

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

1. Understand the functionality of the data mining and warehousing components.
2. Develop the Data warehousing Architecture and deployment
3. Design a data mining system using KDD process
4. Compare various techniques which enhance the data modelling.
5. Analyse the concepts of 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	-
CO2	2	2	1	-	2	-	-	-	-	-	-	-	2	-
CO3	1	-	1	-	2	-	-	-	-	-	-	-	2	-
CO4	1	2	2	2	-	1	-	-	-	-	-	-	2	-
CO5	1	2	1	2	1	-	-	-	-	-	-	-	1	-

25DSOESCN	**SOFTWARE ENGINEERING AND DevOps**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand the phases of development of a Software Project.
- To understand the major considerations for enterprise integration and deployment concepts of Requirements engineering and Analysis Modeling.
- To learn Fundamental concepts of DevOps
- To learn about Management Tools.

UNIT – I SOFTWARE PROCESS

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

UNIT – II DESIGN CONCEPTS

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

UNIT – III QUALITY MANAGEMENT

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

UNIT – IV DEVOPS ASSESSMENT

Fundamental concepts of Agile and DevOps-DevOps assessment, Maturity levels and DevOps implementation

UNIT – V MANAGEMENT TOOLS

Tools to orchestrate, ALM, SCM, code quality, deployment ,infrastructure management, cloud security, Technology stacks- micro soft, database.Atlassian tool stack ,phabricator ,Jenkins, puppet ,IBM bluemix, pivotal cloud foundary(PCF),AWS, openshift,HP fortify..

Text Books:

1. Roger S. Pressman, “Software Engineering – A Practitioner’s Approach”, Seventh Edition, McGraw Hill International Edition, 2010.
2. Ian Sommerville, “Software Engineering”, 9th Edition, Pearson Education Asia, 2011.
3. Wiley,Deepak Gaikwad,Viral Thakkar Learn DevOps concepts and Methodology

References:

1. Kelkar S.A., “Software Engineering”, Prentice Hall of India Pvt Ltd, 2007.
2. Stephen R.Schach, “Software Engineering”, Tata McGraw–Hill Publishing Company Limited, 2007.
3. Nasib Singh Gill, “Software Engineering”, Khanna Publishing House.
4. K.K. Aggarwal & Yogesh Singh, “Software Engineering”, New Age International.

Course Outcomes:

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

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

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

25DSOESCN	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", 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	-

25DSOESCN	**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 TO BLOCK CHAIN TECHNOLOGY & CRYPTOGRAPHIC FOUNDATIONS OF BLOCK CHAIN

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 BLOCK CHAIN AND DATA INTEGRITY IN DATA SCIENCE & PRIVACY-PRESERVING MACHINE LEARNING ON BLOCK CHAIN

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 & FINAL PROJECT: BLOCK CHAIN FOR SECURE AND TRANSPARENT AI/ML SYSTEMS

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, Students work on a final project integrating block chain with a machine learning or data science problem, Presenting 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	2	-	-	-	-	-	-	1	-
CO2	2	2	3	3	3	2	1	2	1	1	1	-	2	-
CO3	1	1	1	1	1	2	-	-	-	-	-	-	1	-
CO4	1	2	3	3	3	2	-	-	-	-	-	-	2	-
CO5	1	2	3	3	3	2	1	2	1	1	1	-	2	-

25DSOESCN	**DATA ANALYSIS USING OPEN SOURCE TOOLS**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

- To acquire knowledge on handling data with one and two variables.
- To develop skills to perform time series and multivariate analysis
- To explain the tests and methods in classical statistics for data analysis
- To impart knowledge on clustering techniques
- To provide an understanding on reporting and dashboards

UNIT – I SINGLE AND TWO VARIABLES

A Single Variable: Shape and Distribution - Dot and Jitter Plots - Histograms and Kernel Density Estimates - Histograms - Kernel Density Estimates - Optional: Optimal Bandwidth Selection - The Cumulative Distribution Function - Optional: Comparing Distributions with Probability Plots and QQ Plots Rank-Order Plots and Lift Charts - Only When Appropriate: Summary Statistics and Box Plots -Summary Statistics Box-and-Whisker Plots - Tool: NumPy. - Two Variables: Establishing Relationships - Scatter Plots - Conquering Noise: Smoothing Splines -LOESS-Examples - Residuals - Logarithmic Plots - Linear Regression - Graphical Analysis and Presentation -Tool: matplotlib - Using matplotlib Interactively - Case Study: LOESS with matplotlib-Managing Properties The matplotlib Object Model and Architecture.

UNIT – II TIME SERIES ANALYSIS AND MULTIVARIATE ANALYSIS

Time As a Variable: Time-Series Analysis - Examples - The Task - Requirements and the Real World - Smoothing - Running Averages - Exponential Smoothing - The Correlation Function - Examples - Implementation Issues - Filters and Convolutions - scipy.signal. - More Than Two Variables: Graphical Multivariate Analysis - False-Color Plots - Multiplots - The Scatter-Plot Matrix - The Co-Plot - Variations - Composition Problems - Changes in Composition - Multidimensional Composition: Tree and Mosaic Plots - Novel Plot Types - Glyphs - Parallel Coordinate Plots - Interactive Explorations - Querying and Zooming - Linking and Brushing - Grand Tours and Projection Pursuits - Tools for Multivariate Graphics - R Experimental Tools - Python Chaco Library. A Data Analysis Session - Tool: gnuplot

UNIT – III CLASSICAL STATISTICS

What You Really Need to Know About Classical Statistics - Genesis - Statistics Defined – Statistics Explained Example: Formal Tests Versus Graphical Methods - Controlled Experiments Versus Observational Studies-Design of Experiments - Perspective - Bayesian Statistics - The Frequentist Interpretation of Probability The Bayesian Interpretation of Probability - Bayesian Data Analysis: A Worked Example - Bayesian Inference: Summary and Discussion - Tool: R

UNIT – IV CLUSTERING

Finding Clusters - What Constitutes a Cluster? - A Different Point of View - Distance and Similarity Measures - Common Distance and Similarity Measures - Numerical data - Categorical data - String data Special-purpose metrics - Clustering Methods - Center Seekers - Tree Builders - Neighborhood Growers Pre- and Postprocessing - Scale Normalization - Cluster Properties and Evaluation - A Special Case: Market Basket Analysis - A Word of Warning - Tools: Pycluster and the C Clustering Library

UNIT – V REPORTING, BUSINESS INTELLIGENCE, AND DASHBOARDS

Business Intelligence - Reporting - Corporate Metrics and Dashboards - Recommendations for a Metrics Program - Data Quality Issues - Data Availability - Data Consistency - Tools: Berkeley DB and SQLite.

Text Books:

1. Philipp K. Janert, "Data Analysis with Open Source Tools", O'Reilly Media Inc., First Edition, 2010, ISBN: 978-0596802356.

References:

1. Jeffrey Strickland, "Data Analytics using Open Source Tools", lulu.com, 2016, ISBN: 978-1365270413
2. Florrent Buisson, "Behavioral Data Analysis with R and Python", O'Reilly Media Inc., 2021, ISBN: 9781492061373.
3. Wes Mckinney, "Python for Data Analysis", O'Reilly Media Inc., Third Edition, 2022.

4. Chantal D. Larose, Daniel T. Larose, Shaukat Ali Shahee, "Fundamentals of Data Science using Python and R", Wiley, 2024, ISBN: 9789363860759.

Course Outcomes:

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

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

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

25DSOESCN	**STATISTICAL ANALYSIS IN DATA SCIENCE**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand statistical concepts relevant to data science.
- To explore and visualize datasets using descriptive statistics and plots.
- To apply probability and distributions for data modeling.
- To conduct hypothesis testing and statistical inference on real-world datasets.
- To build and evaluate regression models using real datasets.

UNIT – I INTRODUCTION TO STATISTICS IN DATA SCIENCE

Importance of statistics in data science, Types of data: qualitative vs. quantitative, Levels of measurement: nominal, ordinal, interval, ratio, Scales of data and data collection methods, Sampling techniques: random, stratified, cluster, Overview of population vs. sample, Introduction to statistical software, Data wrangling: missing values, outliers, Data cleaning and preprocessing, Real-world data sources and formats

UNIT – II DESCRIPTIVE STATISTICS AND DATA VISUALIZATION

Measures of central tendency: mean, median, mode, Measures of dispersion: range, variance, standard deviation, Percentiles, quartiles, and IQR, Measures of shape: skewness and kurtosis, Covariance and correlation, Frequency distributions, Histograms and bar charts, Boxplots and violin plots, Scatter plots and pair plots

UNIT – III PROBABILITY AND PROBABILITY DISTRIBUTIONS

Basic probability theory and set operations, Conditional probability and independence, Bayes' theorem and its applications, Random variables: discrete and continuous, Probability mass function and probability density function, Binomial distribution, Poisson distribution, Normal

distribution and its properties, Central Limit Theorem, Standardization and Z-scores

UNIT – IV STATISTICAL INFERENCE AND HYPOTHESIS TESTING

Sampling distributions, Point and interval estimation, Confidence intervals for means and proportions, Hypothesis formulation, Type I and Type II errors, One-sample and two-sample z-tests, t-tests, Chi-square tests for independence and goodness-of-fit, One-way ANOVA, p-values and effect sizes

UNIT – V REGRESSION AND PREDICTIVE MODELING

Simple linear regression: model, assumptions, interpretation, Multiple linear regression, Multicollinearity and variance inflation factor, Logistic regression: binary outcomes, Model diagnostics: residual analysis, Model selection criteria: AIC, BIC, Overfitting and underfitting, Cross-validation and train-test split, Evaluation metrics: MSE, RMSE, MAE, confusion matrix, ROC, Regression implementation

Text Books:

1. James D. Miller, Statistics for Data Science, Packt Publishing, 2nd Edition, 2023.
2. Peter Bruce, Andrew Bruce, Peter Gedeck, Practical Statistics for Data Scientists, O'Reilly Media, 2nd Edition, 2020.

References:

1. Moore, McCabe, Craig, Introduction to the Practice of Statistics, W.H. Freeman, 10th Edition, 2023.
2. Alan Agresti, Statistical Methods for the Social Sciences, Pearson, 5th Edition, 2023.
3. Kutner, Nachtsheim, Neter, Applied Linear Statistical Models, McGraw-Hill, 5th Edition, 2020.

Course Outcomes:

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

1. Understand and explain the role of statistics in data science.
2. Analyze and summarize datasets using descriptive statistics and visualizations.
3. Apply probability theory and statistical distributions in modeling data uncertainty.
4. Conduct hypothesis testing and construct confidence intervals in data-driven decision-making.
5. Develop and evaluate linear and logistic regression models for prediction 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	1	1	2	-	1	-	-	-	1	1	1	-	1	-
CO2	1	2	-	-	-	2	-	1	-	-	-	-	1	-
CO3	1	-	-	1	2	-	1	-	-	2	2	-	1	-
CO4	-	2	-	-	-	1	-	-	-	-	-	-	-	-
CO5	1	-	-	-	2	-	2	-	1	-	1	-	-	-

25DSOESCN	AUGUMENTED ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the fundamental principles and benefits of Augmented Analytics (AA) in modern organizations.
- To explain how AA transforms traditional business processes and decision-making.
- To demonstrate the role of technology and organizational readiness in enabling AA.
- To enable learners to identify and apply augmented workflows across business use-cases.
- To familiarize real-world case studies for understanding the practical applications of AA.

UNIT – I INTRODUCTION TO AUGMENTED ANALYTICS

The Business Transformation - Industries Heavily Impacted by Digital Transformation - The Analytics Problem: Finding Your Analytics Purpose - Industry Examples - The Concept of Analytical Maturity - Definition - The Five I's of Augmented Analytics - Overcoming the Limitations of Traditional Analytics Approaches - Augmented Workflows - The Benefits of Augmented Analytics - Key Enablers of Augmented Analytics – The limitations and challenges of Augmented Analytics.

UNIT – II PREPARING PEOPLE AND THE ORGANIZATION FOR AUGMENTED ANALYTICS

Tailoring Augmented Analytics for Different Organizational Roles - The Center of Excellence - Driving Transformational Change with the Influence Model - Cultivating a Data-Literate Culture - The Enablement Program.

UNIT – III AUGMENTED WORKFLOWS

Types of Workflow Augmentation - The Analytics Use-Case Approach: Finding Workflows to Augment - Balancing Automation and Integration - The Use-Case Library - Technical Requirements for Implementing AA - Infrastructure Setup Challenges - IT System Integration Challenges - Governance Challenges.

UNIT – IV AUGMENTED FRAMES

Aneka: Framework overview - Anatomy of the Aneka container - Building Aneka clouds - Cloud programming and management - Data-Intensive Computing: What is data-intensive computing? - Technologies for data-intensive computing – Aneka Map Reduce programming.

UNIT – V CASE STUDY AND APPLIED EXAMPLES

The Underwriting Process - Types of Augmented Workflows in Underwriting - Example 1: Location Workflow - Example 2: Benchmarking Workflow - Example 3: Proposal Workflow - Example 4: Improved Forecasting in Agile Projects - Example 5: Quick Sales Intelligence.

Text Books:

1. Willi Weber and Tobias Zwingmann," Augmented Analytics Enabling Analytics Transformation for Data-Informed Decisions", O'Reilly Media, Inc, 1st Edition, 2024.
2. Vukani Mzinyati, "Augmented Analytics: Changing the Way We Work, Analyze, and Make Decisions", 1st Edition, Wiley, 2021.

References:

1. Thomas H. Davenport, "Analytics at Work: Smarter Decisions, Better Results", Harvard Business Review Press.

2. Bernard Marr, "Data Strategy: How to Profit from a World of Big Data, Analytics and the Internet of Things", Kogan Page, 2017.
3. Judith Hurwitz, "Cognitive Computing and Big Data Analytics", Wiley, 2015.
4. Bill Schmarzo, "Big Data MBA: Driving Business Strategies with Data Science", Wiley, 2015.
5. Gartner Reports on Augmented Analytics and Business Intelligence.

Course Outcomes:

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

1. Explain the concepts, benefits, and enablers of Augmented Analytics.
2. Understand the readiness and role of people and organizations in AA transformation.
3. Analyze different types of augmented workflows and the challenges in their implementation.
4. Describe the technical framework and architecture of augmented frames.
5. Apply the concepts of AA to real-world use-cases and case studies for informed decision-making.

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

25DSOESCN	**COGNITIVE COMPUTING AND BIG DATA ANALYTICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- Understand the fundamental principles and characteristics of cognitive computing.
- Explore various big data technologies and frameworks.
- Identify the major tools and platforms used for building cognitive systems.
- Develop simple cognitive applications using APIs and cognitive toolkits.
- Understand the ethical considerations in the deployment of intelligent systems

UNIT – I THE FOUNDATION OF COGNITIVE COMPUTING

Cognitive computing as a new generation - The uses of cognitive systems – Understanding cognition – Two systems of judgement and choice - Elements of the cognition system – Design principles of cognitive system – Components – Building the corpus – Bringing data into the cognitive system – Machine Learning - Hypothesis Generation and Scoring – Presentation and Visualization services.

UNIT – II RELATIONSHIP BETWEEN BIG DATA AND COGNITIVE COMPUTING

Dealing with Human-Generated data – Defining Big Data – The Architectural foundation for Big Data – Analytical Data Warehouses – Hadoop – Integration of Big Data with Traditional Data – Representing Knowledge in Taxonomy and Ontologies – Models for knowledge representation – Implementation consideration.

UNIT – III APPLYING ADVANCED ANALYTICS TO COGNITIVE COMPUTING

Key capabilities in Advanced Analytics – Using Advanced Analytics to create Value – The business implications of Cognitive Computing – Preparing for change – Advantages of disruptive models – The difference a cognitive system approach – Meshing Data together differently – using Business knowledge to plan for the future – Building business specific solution – Making Cognitive Computing a reality.

UNIT – IV THE PROCESS OF BUILDING A COGNITIVE APPLICATION

The Emerging Cognitive Platform - defining a objective – defining a domain - understanding the intended users and defining the attributes – defining question and exploring insights – creating and refining the corpora – training and testing – IBM's Watson as a cognitive system.

UNIT – V COGNITIVE APPLICATIONS ACROSS THE HEALTHCARE ECOSYSTEM

Foundations of Cognitive computing for Healthcare – Constituents in the Healthcare Ecosystem – Learning from patterns in Healthcare Data – Building on a foundation of Big Data Analytics – Starting with a cognitive Application for Healthcare – using a cognitive application to improve clinical teaching – cognitive computing in government.

Text Books:

1. Judith Hurwitz, Marcia Kaufman, Adrian Bowles, 'Cognitive Computing and Big Data Analytics', Wiley, 2015.
2. Raj Kamal, Preeti Saxena, 'Big Data Analytics', McGraw Hill Education, 2019

References:

1. Michael Minelli, Michele Chambers, Ambiga Dhiraj, 'Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends', Wiley, 2013.
2. Tom White, 'Hadoop: The Definitive Guide', O'Reilly Media, 2015.
3. Ian H. Witten, Eibe Frank, Mark A. Hall, 'Data Mining: Practical Machine Learning Tools and Techniques', Elsevier, 2016.
4. Anand Rajaraman, Jeffrey David Ullman, 'Mining of Massive Datasets', Cambridge University Press, 2011

Course Outcomes:

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

1. Define cognitive computing and its key characteristics.
2. Explain the five V's of Big data and their significance.
3. Define machine learning and the architecture of neural networks.
4. Understand the structure and components of a cognitive analytics framework.
5. Develop basic cognitive applications using APIs and software platforms.

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

25DSOESCN	**DATA ANALYTICS FOR ENGINEERS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce Data Analytics and Characteristics of Big data.
- To understand the fundamentals of Statistical data analysis
- To acquire knowledge on standard algorithms used for prediction
- To familiarize the concept of data visualization.
- To develop Data analytics Applications

UNIT – I INTRODUCTION TO DATA ANALYTICS

Data Analytics Overview, Data Analytics Importance, Big Data analytics, Characteristic of Big data, Terminologies in Data Analytics, Types of Data, Qualitative and Quantitative data, Analytics Problem Solving

UNIT – II STATISTICAL DATA ANALYSIS AND TYPES OF DATA ANALYTICS

Basic statistics - mean - median - mode, Statistical Parameters, Inferential Statistics, and Hypothesis Testing. Normal Distribution of Data, Correlations and Linear Regression. Descriptive Analytics, Diagnostic Analytics, Predictive Analytics and Prescriptive Analytics, Data Analytics - Amazon Example, Data Analytics Benefits in Decision Making, Data Analytics Benefits: Cost Reduction.

UNIT – III PREDICTIVE DATA ANALYTICS

Introduction, Associative Analytics, Classification: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Model Evaluation and Selection, Techniques to Improve Classification Accuracy, Clustering: K-Mean Clustering, Data Analytics using SQL.

UNIT – IV DATA VISUALIZATION FOR DECISION MAKING

Introduction, Data Visualization, Understanding Data Visualization, commonly used Visualization, Various Plots, Importance of Data Visualization, Data Visualization Tools, Dashboard based Visualization.

UNIT – V ANALYTICS FRAMEWORK AND LATEST TRENDS

Introduction, Case Study: Customer Analytics Framework: Data Understanding, Data Preparation, Modelling, Model monitoring, Latest Trends in Data Analytics – Automated Machine Learning, Open-source AI

Text Books:

1. Acharya Seema and Chellappan, “Big Data and Analytics”, Willey India Pvt. Ltd., 2015.
2. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services, Willey India Pvt. Ltd, 2016.

References:

1. Hastie, T., Tibshirani, R, Friedman, J. “The dements of statistical learning: data mining”, inference and prediction. Springer, 2009.
2. Bart Baesens,”Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", John Wiley & Sons, 2014.
3. Bharti Motwarni ,“Data Analytics with R”, Wiley, 2019.

Course Outcomes:

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

1. Explain the fundamental terms in data analytics.
2. Apply statistical methods for data analysis.
3. Understand classification and clustering algorithms.
4. Apply data visualization tools.
5. Design and develop applications to determine the insight existence with complex data.

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

25DSOESCN	**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",First Edition,2020.

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	-

25DSOESCN	AGILE METHODOLOGIES	L	T	P	C
		3	0	0	3

Course Objectives:

- Understand Agile values, principles, and compare with traditional methods.
- Apply Scrum roles, artifacts, and events in projects.
- Describe key practices of XP, Kanban, Lean, and other Agile models.
- Plan and manage Agile projects using estimation and tracking techniques.
- 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.
2. Robert C. Martin, 'Agile Principles, Patterns, and Practices in C#', Pearson Education.

References:

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

Course Outcomes:

At the end of the course, 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.

6. 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	-

25DSOESCN	**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:

1. Drucker, P. F. , "Innovation and entrepreneurship: Practice and principles", Revised Edition, Harper Business, 2006.
2. Khanka, S. S. , "Entrepreneurial development",S. Chand Publishing, 2007.

References:

1. Blank, S., & Dorf, B, "The startup owner's manual: The step-by-step guide for building a great company", K&S Ranch Press, 2012
2. Aulet, B, "Disciplined entrepreneurship, 24 steps to a successful 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	-

HONORS ELECTIVES

25DSHESCN	BIG DATA TESTING TOOLS	L	T	P	C
		3	0	0	3

Course Objectives:

- To describe and analyze Big Data tools integrated with MapReduce concepts.
- To understand the principles and processes of ETL Testing.
- To evaluate testing strategies using Hive and HQL for data-driven systems.
- To explore application and data administration testing using MongoDB.
- To implement and debug distributed applications using Scala and Spark in a Data Science context.

UNIT – I INTRODUCTION TO HADOOP WITH MAPREDUCE

Analyzing the data with Unix Tools – Hadoop Map and Reduce – Scaling out – Hadoop Streaming – HDFS architecture – Classic MapReduce and YARN – Failure handling – Job scheduling – Task execution – Input/output formats – MapReduce features.

UNIT – II BIG DATA AND ETL TESTING FUNDAMENTALS

Transactional vs Analytical Databases – Big Data Stores – Hadoop Ecosystem – ETL concepts – Principles of ETL Testing – Data mapping – Testing methods: incremental loads, multiple sources, data permutations – Manual & automated testing – Test planning and defect types.

UNIT – III BIG DATA TESTING USING HIVE AND HQL

Hadoop architecture – Challenges in Big Data Testing – Testing types: mapping, filtering, sorting, joining, transformation, lookup – HQL for querying – Statistical validation techniques – Comparison methods.

UNIT – IV TESTING ON MONGODB

Application-level operations: killing, preheating, compacting – Data administration: authentication, indexing – Performance tracking – Replication monitoring – Admin tools for diagnostics and debugging.

UNIT – V TESTING SCALA AND SPARK APPLICATIONS

Testing in distributed environments – Challenges – Unit testing, integration testing of Spark applications – Debugging Spark jobs: local vs cluster mode – Spark application monitoring on YARN – Debugging tools (Eclipse for Scala).

Text Books:

1. TomWhite, “Hadoop: The Definitive Guide”,O’Reilly Publication, Third Edition,2012.
2. Kristina Chodorow, “MongoDB: The Definitive Guide: Powerful and Scalable Data Storage”, O'Reilly Media, Inc. 2013.

References:

1. Eric Sammer, “Hadoop Operations: A Guide for Developers and Administrators”, O’Reilly Publication, 2012.
2. Rudy Lai, BartłomiejPotaczek, “Hands-On Big Data Analytics with PySpark: Analyze large datasets and discover techniques for testing, immunizing, and parallelizing Spark jobs”, Packt Publishing Ltd, 2019.
3. Md. Rezaul Karim and Sridhar Alla, “Scala and Spark for Big Data Analytics: Explore the concepts of functional programming, data streaming, and machine

learning", Packtpunblising Ltd., 2017.
4. Ralph Kimball, Joe Caserta, "The Data Warehouse ETL Toolkit: Practical Techniques for Extracting, Cleaning, Conforming, and Delivering Data", John Wiley &Sons. 2011.

Course Outcomes:

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

1. Understand the performance and execution of Hadoop MapReduce for big data.
2. Describe and apply principles of ETL testing across multiple data sources.
3. Use Hive and HQL for executing and validating data transformation tests.
4. Manage and test MongoDB operations and monitor NoSQL environments.
5. Conclude the testing methods through the testing tools on distributed environment.

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

25DSHESCN	**BIG DATA ANALYTICS TOOLS**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

Course Objectives:

- To analyze differences between batch-first and streaming-first architectures.
- To implement Flink processing with features like time handling, watermarks, and consistency.
- To design graph schemas and index strategies using Neo4j.
- To compose complex Cypher queries incorporating transactions, uniqueness, and traversal logic.
- To configure Kafka producers and consumers with proper serialization, partitioning, and offset handling.

UNIT – I APACHE FLINK

Apache Flink - Consequences of Not Doing Streaming Well - Goals for Processing Continuous Event Data - Evolution of Stream Processing Technologies - First Look at Apache Flink - Flink in Production - Where Flink Fits - Stream-First Architecture - Traditional Architecture versus Streaming Architecture - Message Transport and Message Processing - The Transport Layer: Ideal Capabilities - Streaming Data for a Microservices Architecture - Beyond Real-Time Applications - Geo-Distributed Replication of Streams - What Flink Does - Different Types of Correctness - Hierarchical Use Cases: Adopting Flink in Stages.

UNIT – II ADVANCED FEATURES OF APACHE FLINK

Handling Time - Counting with Batch and Lambda Architectures - Counting with Streaming Architecture - Notions of Time – Windows - Time Travel – Watermarks - A Real-World Example: Kappa Architecture at Ericsson - Stateful Computation - Notions of Consistency - Flink Checkpoints: Guaranteeing Exactly Once - Savepoints: Versioning State - End-to-End Consistency and the Stream Processor as a Database - Flink Performance: the Yahoo! Streaming Benchmark - Batch Is a Special Case of Streaming - Batch Processing Technology- Case Study: Flink as a Batch Processor.

UNIT – III INTRODUCTION TO NEO4J

Neo4j - Graph data in a relational database - Graph data in Neo4j - SQL joins versus graph traversal on a large scale - Neo4j in NoSQL space - Neo4j: the ACID-compliant database - Data model for Neo4j - Domain modelling - Modelling graph data structures - Using the Neo4j API - Node labels - Traversing using the Neo4j Core Java API - Traversing using the Neo4j Traversal API - Creating the index entry - Finding the user by their email - Automatic indexing - The cost/benefit trade-off of indexing.

UNIT – IV APPLICATION DEVELOPMENT WITH NEO4J

Introduction to Cypher - Cypher syntax basics - Updating your graph with Cypher- Advanced Cypher - Transaction basics - Transactions in depth - Integration with other transaction management systems - Transaction events - Traversal ordering - Expanding relationships - Managing uniqueness - Bidirectional traversals.

UNIT – V KAFKA

Meet Kafka - Publish/Subscribe Messaging - Enter Kafka – Reasons to use Kafka - The Data Ecosystem – Kafka's Origin - Producer Overview - Constructing a Kafka Producer - Sending a Message to Kafka - Configuring Producers – Serializers – Partitions – Old Producer APIs - Kafka Consumer Concepts - Creating a Kafka Consumer - The Poll Loop - Configuring Consumers - Commits and Offsets - Rebalance Listeners – Deserializers - Standalone Consumer - Older Consumer APIs.

Text Books:

1. Ellen Friedman and Kostas Tzoumas, "Introduction to Apache Flink - Stream Processing for Real Time and Beyond", O'Reilly Media, Inc., First Edition, 2016.
2. Aleksa Vukotic, Nicki Watt, "Neo4j in Action", Manning Publications, First Edition, 2015.

References:

1. Neha Narkhede, Gwen Shapira, and Todd Palino, "Kafka: The Definitive Guide Real-Time Data and Stream Processing at Scale", O'Reilly Media, Inc., First Edition, 2017.
2. Fabian Hueske, VasilikiKalavri, "Stream Processing with Apache Flink: Fundamentals, Implementation, and Operation of Streaming Applications", O'Reilly Media, Inc., First Edition, 2019.
3. Sylvain Roussy, Nicolas Mervaillie, Nicolas Rouyer, "Neo4j- a Graph Project Story", D-Booker Editions, 2019.
4. Mark Needham, Amy E. Hodler, "Graph Algorithms: Practical Examples in Apache Spark" and Neo4j, O'Reilly Media, Inc., 2019.
5. Prashant Kumar Pandey, "Kafka Streams - Real-time Stream Processing", Learning Journal, 2019.

Course Outcomes:

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

1. Evaluate situations to determine when streaming-first architecture is appropriate.
2. Construct a working Flink pipeline that ensures exactly-once state consistency.
3. Demonstrate efficient graph traversals and index utilization via Neo4j APIs.
4. Apply transactional Cypher operations to update and traverse graphs correctly.
5. Implement a reliable Kafka messaging pipeline capable of handling real-world streaming workloads.

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

25DSHESCN	**DATA MANAGEMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To provide an understanding of database concepts and data models.
- To develop skills in designing and managing databases for real-world applications.
- To introduce query languages and database programming concepts.
- To explore data storage, indexing, and optimization techniques.
- To analyze the role of data management in Data Science projects and applications.

UNIT – I INTRODUCTION TO DATA MANAGEMENT & RELATIONAL DATABASES AND SQL BASICS

Introduction, Data Types: Structured, Unstructured, Semi-structured Data Role of Data Management in Data Science and Honors Research. The Data Life Cycle: Collection, Storage, Processing, and Analysis. Overview of Database Systems: Relational vs. Non-Relational Relational Database Design Principles Tables, Keys, and Relationships Introduction to SQL: Basic Queries, Aggregations, Joins Data Integrity: Constraints, Normalization Indexing for Performance.

UNIT – II ADVANCED SQL AND DATABASE DESIGN & NOSQL DATABASES AND DATA MODELS

Advanced SQL Queries: Sub queries, Window Functions, CTEs, Database Normalization and De-normalization. Database Transactions: ACID Properties, Isolation Levels, Schema Design for large-Scale Data Projects Optimizing Database Performance: Indexes, Query Execution Plans, NoSQL Database Types: Key-Value, Document, Column-Family, Graph Databases Comparing SQL vs. NoSQL for Data Science Data Models in NoSQL: Flexible Schemas, Sharding, Working with MongoDB and Cassandra When to Use NoSQL vs. Relational Databases.

UNIT – III DATA WAREHOUSING AND ETL & BIG DATA TECHNOLOGIES FOR DATA MANAGEMENT

Introduction to Data Warehouse. Purpose and Design ETL Processes: Extract, Transform, Load Data Integration and Transformation for Analytics Popular ETL Tools (e.g., Apache NiFi, Talend)

Data Warehousing with Amazon Redshift and Google Big Query Introduction to Big Data: Volume, Variety, Velocity Hadoop Ecosystem: HDFS, MapReduce, YARN Apache Spark: Data Processing at Scale Managing Big Data with NoSQL (Cassandra, HBase) Cloud-Based Big Data Solutions (AWS, Azure, Google Cloud).

UNIT – IV DATA GOVERNANCE AND SECURITY & CLOUD-BASED DATA MANAGEMENT

Data Governance, Key Principles and Frameworks, Data Quality Management: Data Cleansing, Validation, and Consistency, Privacy, Security, and Compliance: GDPR, HIPAA, Data Protection Laws. Role of Metadata in Data Management Data Stewardship: Ensuring Data Accessibility and Security. Cloud Computing: Benefits and Challenges for Data Management. Cloud Storage Solutions: AWS S3, Google Cloud Storage, Azure Blob Managed Databases in the Cloud (RDS, Big Query, DynamoDB) Data Lakes and Data Warehouses in the Cloud Cloud Security and Cost Optimization.

UNIT – V DATA INTEGRATION AND DATA PIPELINES & DATA MANAGEMENT FOR MACHINE LEARNING

Data Integration Strategies for Multi-Source Systems. Real-Time Data Streaming: Apache Kafka, AWS Kinesis, Building Data Pipelines for Scalable Analytics and Machine Learning, Data Transformation and Loading for Real-Time Analytics, Automation of Data Pipelines using Apache Airflow, Data Preparation for Machine Learning: Cleaning, Transformation, and Feature, Engineering, Data Pipelines for Machine Learning: Data Collection to Model Deployment Data Management Tools for ML Projects (e.g., DVC, MLflow). Version Control for Data: Tracking Data Changes and Models, Managing Large Datasets in ML Projects.

Text Books:

1. Elmasri, R., and Navathe, S. B., "Fundamentals of Database Systems", 7th Edition, Pearson, 2016.
2. Korth, H. F., Silberschatz, A., and Sudarshan, S., "Database System Concepts", 6th Edition, McGraw-Hill, 2019.

Reference Books:

1. Ramakrishnan, R., and Gehrke, J., "Database Management Systems", 3rd Edition, McGraw-Hill, 2014.
2. Pramod J. Sadalage, and Martin Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", 1st Edition, Addison-Wesley, 2012.

Course Outcomes:

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

1. Understand database concepts, architectures, and data models.
2. Use SQL effectively for database queries and management.
3. Design and normalize relational schemas for efficient storage.
4. Apply indexing, query optimization, and transaction control methods.
5. Analyze advanced database technologies and their applications in Data Science with project management 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	3	2	2	-	2	-	-	-	-	1	-	-	1	-
CO2	2	3	2	2	3	-	-	-	1	2	-	-	2	-
CO3	2	3	3	3	3	-	-	-	1	2	1	-	1	-
CO4	3	2	3	2	3	-	-	-	-	1	2	-	2	-
CO5	2	1	2	2	1	2	1	3	2	2	3	-	2	-

25DSHESCN	COGNITIVE COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the fundamental concepts, evolution, and need for cognitive computing and its core technologies like AI, ML, NLP, and neural networks.
- To educate various machine learning paradigms and deep learning architectures used in cognitive systems for language and pattern understanding.
- To familiarize students with knowledge representation techniques and reasoning strategies including ontologies, logic-based systems, and probabilistic models.
- To teach the role of cognitive computing in decision-making and advanced analytics in real-world domains like healthcare and business.
- To train cognitive computing frameworks, integration with emerging technologies, and address ethical and societal implications.

UNIT – I FOUNDATIONS OF COGNITIVE COMPUTING

Evolution and Need for Cognitive Computing - Key Components: Artificial Intelligence, Machine Learning, Natural Language Processing, Neural Networks - Understanding Cognition: Human-like reasoning and decision-making - Cognitive Systems vs Traditional Systems - Two Systems of Judgment (System 1 and System 2 Thinking) - Use Cases: Cognitive computing in healthcare, finance, customer support.

UNIT – II MACHINE LEARNING & NLP IN COGNITIVE SYSTEMS

Machine Learning Paradigms: Supervised, Unsupervised, Reinforcement Learning - Cognitive ML Algorithms: Decision Trees, SVM, k-NN, Clustering - Deep Learning for Cognition: CNN, RNN, LSTM – Architectures and Applications - NLP for Cognitive Applications: - Language Models: N-gram, HMM, Transformers - Text Analytics, Sentiment Analysis, Named Entity Recognition (NER) - Building Data Corpus and Hypothesis Generation.

UNIT – III KNOWLEDGE REPRESENTATION AND COGNITIVE REASONING

Knowledge Representation Models: Ontologies, Taxonomies, Frames, Semantic Web - Logic-based Representations: Propositional & First-order logic - Reasoning Methods in Cognitive Systems: Deductive, Inductive, and Probabilistic Reasoning - Bayesian Networks and Decision Trees - Uncertainty and Fuzzy Logic - Cognitive Architectures: ACT-R, Soar, CLARION, Hybrid Approaches: Sigma, OpenCog.

UNIT – IV COGNITIVE DECISION MAKING & ANALYTICS

Cognitive Decision-Making Models - Decision Support Systems (DSS) and Knowledge-Based Agents - Cognitive Bias and Ethical Decision Making - Advanced Analytics in Cognitive Systems: Feature extraction, pattern recognition, predictive modeling - Business and Government Applications: Watson and DeepQA Architecture - Personalized Medicine, Smart Cities, Customer Experience.

UNIT – V COGNITIVE FRAMEWORKS, CLOUD, AND FUTURE TRENDS

Cognitive Computing Frameworks and Platforms : IBM Watson, Microsoft Azure Cognitive Services - Role of Big Data and Streaming Analytics (Hadoop, Spark) - Integration with Emerging Technologies: IoT, Edge Computing, Cloud, Distributed Systems - Neuromorphic Engineering and Explainable AI - Challenges and Ethical Issues: Bias, Privacy, Transparency, and Societal Impacts - Future of Cognitive Computing: Autonomous Cognitive Agents, Real-time Learning, Quantum Cognition.

Text Books:

1. Raghavendra S. K., S. Gupta**,**Cognitive Computing: Theory and Applications, Elsevier,1st Edition, 2018.
2. Judith Hurwitz, Marcia Kaufman, Adrian Bowles**,**Cognitive Computing and Big Data Analytics, Wiley, 1st Edition, 2015.

References:

1. Stuart Russell, Peter Norvig**,**Artificial Intelligence: A Modern Approach,Pearson, 4th Edition, 2020.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville**,**Deep Learning, MIT Press,1st Edition, 2016.
3. Steven Bird, Ewan Klein, Edward Loper**,**Natural Language Processing with Python, O'Reilly Media, 1st Edition,2009.
4. Ronald J. Brachman, Hector J. Levesque**,**Knowledge Representation and Reasoning, Morgan Kaufmann, 1st Edition,2004.

Course Outcomes:

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

1. Describe the fundamental concepts, evolution, and key technologies underpinning cognitive computing, including AI, ML, NLP, and neural networks.
2. Apply machine learning paradigms and deep learning architectures to solve problems within cognitive systems.
3. Construct and utilize knowledge representation models and reasoning techniques such as logic-based, probabilistic, and fuzzy systems in cognitive applications.
4. Analyze cognitive decision-making models and apply cognitive computing techniques in real-world domains such as healthcare, finance, and governance.
5. Evaluate cognitive computing platforms and frameworks, assess their integration with emerging technologies, and examine ethical and societal implications.

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

25DSHESCN	HIGH PERFORMANCE BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the architecture and challenges of high-performance big data analytics.
- To Analyze high-throughput storage and compute systems for big data applications.
- To implement in-memory, real-time, and parallel analytic techniques for large-scale data.
- To evaluate high-performance frameworks and tools.
- To apply analytics for real-world domains and assess ethical, privacy and scalability concerns.

UNIT – I ARCHITECTURE AND INFRASTRUCTURE

High-performance vs traditional big-data systems, Cluster, grid, and cloud architectures, High-speed networking, Distributed file systems, Shared-nothing vs shared-everything designs, SSD/NVMe and hierarchical storage, Hardware accelerators, Workload characterization and benchmarking, Scalability and fault tolerance, Energy-efficient design and sustainability.

UNIT – II STORAGE AND COMPUTE SOLUTIONS

Data partitioning and indexing strategies, In-memory databases and caching, Columnar storage and NoSQL systems, Mainframe and HPC-integration models, Data codesign: compute-storage co-optimization, Load balancing and data locality, RDMA-based data movement, Job scheduling and resource management, Storage hierarchy optimization, Reliability, replication, and consistency.

UNIT – III PARALLEL AND REAL-TIME ANALYTICS

MapReduce and parallel algorithms, Spark, Flink, and real-time streaming, In-database analytics and query pushdown, Real-time ETL and stream processing, Parallel machine learning, GPU-accelerated analytics pipelines, Batch vs streaming trade-offs, Workflow orchestration, Fault recovery in real-time processes, Monitoring and real-time logging frameworks.

UNIT – IV FRAMEWORKS, TOOLS AND OPTIMIZATION

Hadoop ecosystem tools, Performance profiling and tuning, Cache/buffer management and memory optimizations, Benchmark suites, Model-serving in real-time pipelines, Visual analytics and dashboards, Autoscaling and elasticity policies, DevOps and CI/CD for data pipelines, Performance debugging and bottleneck analysis.

UNIT – V APPLICATIONS, SECURITY AND ETHICS

Use cases: healthcare, finance, IoT, social media, Real-time anomaly detection and predictive analytics, Visualization and interpretability techniques, Data security, privacy, and complianceEthical AI, bias detection, and fairness, Data governance frameworks, Cost-performance trade-offs in cloud deployments, Green computing practices, Ethical decision-making in analytics.

Text Books:

1. Pethuru Raj, Anupama Raman, Dhivya Nagaraj & Siddhartha Duggirala, “High-Performance Big-Data Analytics: Computing Systems and Approaches”, Springer, 2015.
2. Dhabaleswar K. Panda, Xiaoyi Lu & Dipti Shankar, High-Performance Big

Data Computing", MIT Press, 2022.

References:

1. Ivo D. Dinov, "Data Science and Predictive Analytics: Biomedical and Health Applications using R", 2nd Edition, Springer, 2023.
2. Brij B. Gupta (ed.), "Digital Forensics and Cyber Crime Investigation: Recent Advances & Future Directions", CRC Press, 2024.

Course Outcomes:

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

1. Explain system-level requirements for high-performance big data processing.
2. Design storage and compute architectures for large-scale data analytics.
3. Implement real-time and in-memory analytics workflows using modern frameworks.
4. Optimize and benchmark analytic pipelines for performance and scalability.
5. Apply big data analytics in domains such as social media and 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	–	2	1	–	–	–	1	–	–	1	–	2	–
CO2	–	1	–	–	1	2	–	–	1	–	–	–	2	–
CO3	1	1	2	–	–	–	1	–	–	–	1	–	2	–
CO4	1	–	–	–	1	–	–	–	2	–	–	–	2	–
CO5	1	1	1	–	2	–	1	–	–	–	–	–	2	–

25DSHESCN	**FINANCIAL ANALYTICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To train students to use statistical methods for modeling and predicting financial crisis.
- To understand how to evaluate market sentiments and apply statistical models.
- To learn to improve the exchange strategies in foreign entries and exits.
- To predict the best income strategies.
- To identify the best working income statement portfolio with price statistics and apply binomial model for option data.

UNIT – I FINANCIAL ANALYTICS

Financial Statistics: Financial Returns-Capital Asset Pricing Model-Financial Securities- Bond Investments-Stock Investments-The Housing Crisis-The Euro Crisis-Securities - Datasets and Visualization- Adjusting for Stock Splits-Securities in Data Importing-Data Cleansing-Quoting.

UNIT – II GAUGING THE MARKET SENTIMENT

Markov Regime Switching Model - Reading the Market Data-Bayesian Reasoning - The Beta Distribution -Prior and Posterior Distributions - Examining Log Returns for Correlation - Momentum Graphs.

UNIT – III TRADING STRATEGIES

Foreign Exchange Markets- Chart Analytics - Initialization and Finalization - Momentum Indicators -Bayesian Reasoning within Positions - Entries - Exits -Profitability -Short- Term Volatility -The State Machine.

UNIT – IV PREDICTION FOR BEST INCOME

Best Income Statement Portfolio -Reformatting Income Statement Growth Figures- Obtaining Price Statistics -Combining the Income Statement with Price Statistics- Prediction Using Classification Trees and Recursive Partitioning-Comparing Prediction Rates among Classifiers

UNIT – V BINOMIAL MODEL FOR OPTIONS

Applying Computational Finance - Risk-Neutral Pricing and No Arbitrage -High Risk- Free ate Environment - Convergence of Binomial Model for Option Data - Put–Call Parity - From inomial to Log-Normal.

Text Books:

1. Mark J. Bennett , Dirk L. Hugen, "Financial Analytics with R", Cambridge University Press,2016.
2. Erich, A. Helfert, "Financial Analysis: Tools and Techniques- AGuide for Managers", McGraw Hill, 2010.

References:

2. James C. Vanhorne, "Fundamentals of Financial Management", PHI. 11th Edition Learning,2012.
3. Brigham, Ehrhardt, "Financial Management Theory and Practice",Cengage Learning, 12th edition, 2010.
3. Prasanna Chandra, "Financial Management", Tata,9th edition, 2012.

Course Outcomes:

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

1. Describe the knowledge in financial statistics in terms of capital, returns, investment, bonds and financial risks.
2. Evaluate market sentiments.
3. Explain foreign exchange marketing strategies.
4. Predict best income strategies using classification Trees and Recursive partitioning techniques.
5. Apply binomial model for option data.

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

MINOR ENGINEERING ELECTIVE COURSES

25DSMISCN	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. RS 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	-
CO2	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-	2	-

25DSMISCN	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	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	-	2	-	-	-	-	-	-	-	-	-	-	2	-
CO3	-	-	2	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	1	-	3	-
CO5	-	-	-	3	2	-	-	-	-	-	1	-	3	-

25DSMISCN	**DATA ANALYTICS WITH R**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To gain the basic concept of Univariate, Multivariate data and relationships between two variables.
- To learn 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 learn the predictive analysis by various regression statistical methods.
- To handle missing data gracefully using multiple imputation; Identify and manage problematic data points.

UNIT – I INTRODUCTION TO DATA AND ITS RELATIONSHIP

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

UNIT – II PROBABILITY AND HYPOTHESIS TESTING

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

UNIT – III BAYESIAN METHODS AND BOOTSTRAP

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

UNIT – IV PREDICTIVE ANALYSIS

Predicting Continuous Variables: Linear models - Simple linear regression - Simple linear regression with a binary predictor - Multiple regression - Regression with a non-binary predictor - Kitchen sink regression - The bias-variance trade-off - Linear regression diagnostics. Predicting Changes with Time: Creating and plotting time series - Components of time series - Time series decomposition - White noise - Autocorrelation - Smoothing - ETS and the state space model - Interventions for improvement. Predicting Categorical Variables: k-Nearest neighbors - Logistic regression - Decision trees - Random forests - Choosing a classifier.

UNIT – V IMPLEMENTATION OF DATA ANALYSIS

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

Text Books:

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

References:

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

Course Outcomes:

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

1. Get the knowledge about the data and its relationship by applying various statistical methods.
2. Acquire the knowledge on probability and different testing hypothesis testing methods.
3. Analyze different Bayesian methods to test the sample taken independently.
4. Apply the predictive analysis by various regression statistical methods.
5. Apply various statistical methods for analysis of the real-world data using R language.

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

25DSMISCN	DATA SCIENCE	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the core activities of data analysis.
- To introduce the concepts of arrays and data structures in Python.
- To understand data storage and file formats and interacting with web APIs and databases.
- To explain the mechanisms for data cleaning, preparation and wrangling.
- To practice plotting, visualization and aggregation of data.

UNIT – I EPICYCLES OF ANALYSIS

Setting the Scene - Epicycle of Analysis - Setting Expectations – Collecting Information - Comparing Expectations to Data -Applying the Epicycle of Analysis Process. Exploratory Data Analysis. Exploratory Data Analysis Checklist: A Case Study -Formulate your question- Read in your data - Check the Packaging - Look at the Top and the Bottom of your Data - ABC: Always be Checking Your "n"s - Validate With at Least One External Data Source - Make a Plot - Try the Easy Solution First.

UNIT – II ARRAYS AND DATA STRUCTURES IN PYTHON

Data Structures and Sequences - Arrays and Vectorized Computation - NumPy ndarray: A Multidimensional Array object – Fast element-wise array functions –Array-oriented programming using arrays - File Input-Output with Arrays - pandas Data Structures –Series, Data Frames, Index Objects - Essential Functionality – Summarizing and Computing Descriptive Statistics.

UNIT – III DATA LOADING, STORAGE, FILE FORMATS

Reading and Writing data in text format – binary data format – interacting with Web APIs – Interacting with databases.

UNIT – IV DATA CLEANING, PREPARATION AND WRANGLING

Data Cleaning: Handling Missing data, Data Transformation - String Manipulation - Categorical Data - Data Wrangling: Join,Combine, Reshape: Hierarchical Indexing - Combining and merging Datasets - Reshaping and Pivoting.

UNIT – V PLOTTING AND DATA AGGREGATION

Plotting and visualization – Matplotlib features - plotting with pandas and seaborn - other python visualization tools -- Data Aggregation and Group Operations – Group operations - Data Aggregation – Apply: General split-apply-combine - Group transforms and "Unwrapped" Group-bys - Pivot Tables and Cross Tabulation.

Text Books:

1. Roger D. Peng and Elizabeth Matsui, " The Art of Data Science -A Guide for Anyone Who Works with Data", Skybrude Consulting, LLC, 2015.
2. Wes McKinney, "Python for Data Analysis, O' Reilly Media, Inc., 3rd Edition, 2022.

References:

1. Joel Grus, "Data Science from Scratch", O'Reilly, First Edition, 2015.
2. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, First Edition, 2016.
3. Samir Madhavan, "Mastering Python for Data Science", PACKT Publishing, 2015.
4. Alberto Boschetti, Luca Massaron, "Python Data Science Essentials",PACKT Publishing, Third Edition, 2018

Course Outcomes:

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

1. Summarize the core activities of data analysis.
2. Describe the data structures suitable for handling data
3. Familiarize data storage formats and interaction with Web and Databases.
4. Apply data cleaning and transformation techniques on datasets.
5. Create visualization plots and aggregations of data.

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

25DSMISCN	**ETHICS IN DATA ANALYTICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce the ethical challenges and responsibilities in data science and analytics.
- To educate students on data privacy, ownership, and consent frameworks.
- To analyze the implications of algorithmic decision-making and bias.
- To expose learners to regulatory, legal, and professional standards in data analytics.
- To prepare students to build responsible and fair data-driven systems.

UNIT – I INTRODUCTION TO DATA ETHICS

Ethics and Data Science – Importance of Ethics in Analytics – Foundations of Ethical Theories – Ethical Dilemmas – Professional Codes of Ethics (ACM, IEEE).

UNIT – II PRIVACY, OWNERSHIP AND CONSENT

Data Privacy Principles – Ownership of Data – Data Collection and Consent – Anonymization and De-identification – GDPR and Other Privacy Laws – Ethical Use of Personal Data.

UNIT – III ALGORITHMIC FAIRNESS AND ACCOUNTABILITY

Bias in Data and Algorithms – Fairness Metrics – Discrimination in Automated Decisions – Transparency – Explainability – Accountability Mechanisms – Case Studies.

UNIT – IV SOCIAL **IMPACT** AND RESPONSIBLE DATA PRACTICES

Social and Cultural Implications – Ethical Issues in AI and Big Data – Misinformation and Manipulation – Digital Divide – Data for Social Good – Responsible Data Governance.

UNIT – V REGULATIONS, STANDARDS AND BEST PRACTICES

Legal Frameworks – Data Protection Acts – Industry Standards – Ethical Audits – Risk Assessments – Implementing Ethical Guidelines in Data Projects – Future Trends in Data Ethics.

Text Books:

1. Mike Loukides, Hilary Mason, DJ Patil, "Ethics and Data Science", O'Reilly Media, 2018.
2. Cathy O'Neil, "Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy", Crown Publishing, 2016.

References:

1. Rodolfo Milanés, "Ethics in Data Science", Springer, 2021.
2. Kord Davis, "Ethics of Big Data", O'Reilly Media, 2012.

Course Outcomes:

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

1. Explain ethical theories and their application to data analytics scenarios.
2. Evaluate data privacy, consent, and ownership issues with respect to regulatory frameworks.
3. Identify and mitigate bias and unfairness in data-driven algorithms.
4. Assess the societal impact of data analytics and apply responsible data practices.
5. Apply legal, ethical and professional standards to ensure accountability and fairness in analytics projects.

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

25DSMISCN	**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, 3rdEdition, MIT Press, 2014.
2. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006
3. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.
4. Navin Kumar Manaswi, Deep Learning with Applications using Python, Apress, 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	-	-	-	-	-	-	-	-	-	-	-	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	-

25DSMISCN	**CYBER SECURITY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

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

- To understand the fundamental concepts and importance of cyber security.
- To explore various types of cyber-attacks and protection mechanisms.
- To learn about cryptography, network security, and system security tools.
- To understand security protocols and legal frameworks governing cyber security.
- To develop skills for detecting, preventing, and responding to cyber threats.

UNIT – I INTRODUCTION TO CYBER SECURITY

Overview of Cyber Security, Threats and Vulnerabilities, Types of Attacks: Phishing, DoS, Malware, Ransomware, Cyber Security Goals: Confidentiality, Integrity, Availability (CIA), Security Mechanisms: Authentication, Authorization, Auditing, Cybersecurity Frameworks.

UNIT – II CRYPTOGRAPHY

Symmetric vs Asymmetric Cryptography, Algorithms: AES, DES, RSA, Hash Functions: SHA, MD5, Digital Signatures and Certificates, Key Management and Public Key Infrastructure (PKI)

UNIT – III NETWORK SECURITY

Network Security Fundamentals, Firewalls and VPNs, Intrusion Detection Systems and Intrusion Prevention Systems, Wireless Network Security, Secure Protocols - HTTPS, SSL/TLS, IPsec

UNIT – IV SYSTEM AND WEB SECURITY

OS Security: Access Control, Antivirus, Patches, Secure Coding Practices, Web Application Security: SQL Injection, XSS, CSRF, Web Application Firewalls (WAFs), Browser Security, Email Security, Mobile Device Security

UNIT – V CYBER LAWS, ETHICS AND FORENSICS

IT Act 2000 and Amendments, Cyber Crime and Legal Aspects, Ethics in Cyber Security, Cyber Forensics Tools and Techniques, Case Studies: Real-world Attacks and Responses

Text Books:

1. Nina Godbole & Sunit Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley India, 2025

2. William Stallings, Cryptography and Network Security: Principles and Practice, 8th Edition, Pearson, 2020

References:

1. Brij B. Gupta, Digital Forensics and Cyber Crime Investigation: Recent Advances & Future Directions, 2024
2. Mark Stamp, Information Security: Principles and Practice, 5th Edition, 2019
3. Charles P. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", 5th Edition, Pearson, 2015

Course Outcomes:

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

1. Describe core concepts of cyber security, threats, and vulnerabilities.
2. Apply cryptographic techniques to secure data and communication.
3. Analyze network security threats and configure firewalls and intrusion detection systems.
4. Implement security policies and practices for operating systems and web applications.
5. Understand cyber laws, ethical practices, and digital forensics procedures.

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

25DSMISCN	**NOSQL DATABASES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

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

UNIT – I INTRODUCTION TO NOSQL

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

UNIT – II Data Models

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

UNIT – III Document Database

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

UNIT – IV Key Value Database

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

UNIT – V Column and Graph Database

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

Text Books:

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

References:

1. Luc Perkins, Eric Redmond and Jim R. Wilson, “Seven Database in Seven Weeks : A Guide to Modern Databases and the NoSQL Movement”, The Pragmatic Bookshelf, 2 ndEdition,2012.
2. Aaron Ploetz, Devram Kandhare, Sudarshan Kadambi and Xun (Brian) Wu “Seven NoSQL Databases in a Week: Get up and running with the fundamentals and functionalities of seven of the most popular NoSQL databases”,packt Publishing, 2018.
3. Gaurav Vaish, “Getting Started with NoSql”,Packt Publishing, 2013.
4. Adam Flower,”NoSQL for Dummies”, John Wiley & Sons Inc, 2015.

Course Outcomes:

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

1. Compare NOSQL databases with each other and Relational database Systems.
2. Explain the concepts of Replication, distribution,sharding,and resilience in a NOSQL database.
3. Demonstrate the knowledge of Document Databases.
4. Describe the features of Key- Value databases.
5. Analyze the features of Column and Graph Databases.

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

ONE CREDIT COURSES

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

Course Objectives:

- Understand basic concepts and types of optimization problems, Genetic Algorithms.
- Explore Particle Swarm and other evolutionary techniques.
- Use tools to simulate and evaluate optimization methods.

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
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. Understand and formulate different types of optimization problems.
2. Implement Genetic Algorithm to solve optimization problems.
3. Apply Particle Swarm Optimization and other evolutionary 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	3	2	2	2	-	-	-	-	-	-	-	-	-	2
CO2	2	3	3	3	2	-	-	-	-	-	-	-	-	3
CO3	2	3	3	3	3	-	-	-	-	-	-	-	-	3
CO4	3	3	2	2	2	-	-	-	-	-	-	-	-	2
CO5	3	2	2	2	3	-	-	-	-	-	-	-	-	3

25DSOCSCN	IMAGEPROCESSING LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

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

LIST OF EXERCISES

(Exercises can be carried out using python programming**)**

1. Perform negative and logarithmic transformations on an image.
2. Convert a color image to grayscale and simulate sampling and quantization of an image.
3. Extract and display a Region of Interest (ROI) from an image.
4. Display individual color components(R,G,B,Cr,CB,H,S,I) of a color image.
5. Implement histogram equalization to enhance contrast for a full image and part of grayscale image.
6. Apply Smoothening and Sharpening filters to an image in spatial domain for noise reduction.
7. Transform an image to frequency domain using FFT.
8. Perform edge detection using Sobel, Prewitt, and Canny operators.
9. Apply global and adaptive thresholding for segmentation.
10. Perform image segmentation using watershed algorithm.
11. Construct Gaussian and Laplacian pyramids of an image.
12. Implement wavelet decomposition and reconstruction using Haar wavelets.
13. Implement Huffman coding and decoding for a given image.
14. Compute PSNR and MSE between original and compressed images.
15. Perform dilation and erosion operations on a binary image.
16. Perform skeletonization and extract boundaries of objects.

Assignment: Apply morphological operations for fingerprint recognition.

Course Outcomes:

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

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

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

25DSOCSCN	**COMPUTER NETWORKS LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives:

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

LIST OF EXERCISES

Networking Commands.

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

Course Outcomes:

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

1. Make use of network administration commands and demonstrate their use in different network scenarios.
2. Implement the Socket programming for Client Server Architecture, Analyze the Packet Contents of different Protocols and Implementation of the routing Protocols.

3. Demonstrate an ability to listen and answer the viva questions related to programming skills needed for solving real-world problems in Computer science and Engineering.

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

25DSOCSCN	MOBILE APPLICATION DEVELOPMENT LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To learn how to develop Applications for android environments.
- To learn how to develop user interface applications.
- To learn how to develop URL related applications.

LIST OF EXERCISES

1. (a) 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

25DSOCSCN	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	-

VAC

25EDSVAC01	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

25EDSVAC02	**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	-

25EDSVAC03	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