

ANNAMALAI UNIVERSITY
FACULTY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF INFORMATION TECHNOLOGY

B.E. Information Technology

(Four-Year Full-Time) DEGREE PROGRAMME

Choice-Based Credit System

Regulations - 2025

Curriculum for Students Admitted in the Academic Year 2025-2026



HANDBOOK

2025

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

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's curriculum shall normally include both theory and practical courses. The total credits for the entire degree Programme are **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 four academic years. For the award of the degree, a student must 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 training in first aid. While the training activities will normally be during weekends, the camp will normally be during the vacation period.

(or)

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

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

5.1 B.E. (Honours) Degree

A student shall be eligible to get an Undergraduate degree with Honours if he/she completes an additional 20 credits. Thus, the total credits are 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 the fifth, sixth, and seventh semesters.

5.2 B.E. Degree with Minor Engineering

A student shall be eligible to get an Undergraduate 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 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 of 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 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 the fifth year, and courses withdrawn during even semesters (IV and VI) must be registered in the even semester of the fifth year.

8.2 Advanced Learners

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

9. Project Work

The student typically registers for a project at the end of the 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 completed the courses of the 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 the 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 students 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 must study three open elective courses offered by other Departments in the Faculty with the approval of the Head of the Department concerned 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 another 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 the 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 credits. Besides, the student may be permitted to claim 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 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, timetable 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 the Head of the Department offering the courses. A separate mark sheet shall be issued for extra one-credit courses.

11.6 NaanMudhalvan (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 25 Marks. Similarly, the break-up of marks for University End Semester exams involves evaluating the performance under the five Course Outcomes with 15 Marks for each Outcome, totalling 75 Marks.

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

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

12.2 Practical Courses

The break-up of Continuous Assessment for the practical courses involves evaluating the performance under the five Course Outcomes uniformly with 8 Marks for each outcome spread over Two tests and Record work, totalling to 40 Marks. Similarly, the break-up of marks 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 will 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 students shall make a 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 semesters for a period of 4 weeks in each year, the student must 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 will function as student counsellors for those students throughout their period of study. Such student counsellors should 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

14.3SC / ST Cell

A separate cell is functioning in the University to safeguard the rights and privileges of the students belonging to the SC/ST category. This cell also informs the students about the various scholarships and fellowships and encourages them to apply for 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 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 the 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, shall be 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, such as tests, assignments, 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 breaks 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 a break from 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 completed that course. Such a course cannot be repeated by the students.

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 the 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 Semester I to VIII Semester) to the corresponding Percentage of marks may be calculated as per the following formula:

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

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

C_i - Credit hours of a course

GP_i - Grade Point of that course

20.1 Honours Degree

The student is required 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 an 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 have to be of 3 credits each, thus totalling 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 becoming 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 a revised mark sheet, paying the stipulated fee, so 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 a 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

an OGPA/CGPA of 6.75 or above for all the courses from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

20.4 Second Class

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

20.5 B.E. Degree with Minor Engineering

The student shall be given an option to earn a Minor Engineering Degree in another discipline of Engineering other than his/her branch of study, provided the student clears all the subjects in the first year in the first attempt and secures an 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 have 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 the Honours Degree is not entitled to pursue a 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 based on 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 based on 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 based on 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 has been a change of syllabi, examinations based on the existing syllabi will be conducted three consecutive times after implementation of the new syllabi in order to enable the students to clear the arrears. Beyond that, the students will have to take up their examinations in equivalent courses, as per the new syllabi, on the recommendations of the Head of the Department concerned.

DETAILS OF COURSE CODE

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

The first two digits relate to the year from which the Regulations commence

7th digit represents the semester, and the 8th and 9th digits represent the serial number of courses.

ANNAMALAI UNIVERSITY
FACULTY OF ENGINEERING AND TECHNOLOGY
B.E. (Four-Year) Degree Programme
Choice Based Credit System (CBCS)
REGULATIONS 2025
CURRICULUM FOR INFORMATION TECHNOLOGY
SEMESTER I

Sl. No.	Course Code	Category	Course	L	T	P/D	CA	FE	Total	Credits
1	25ETBS101	BS-I	Chemistry	3	-	-	25	75	100	3
2	25ETBS102	BS-II	Mathematics-I	3	1	-	25	75	100	4
3	25ETHS103	HS-I	Technical English	2	-	-	25	75	100	2
4	25ETHS104	HS-II	Heritage of Tamils தமிழர்மரபு	1	-	-	25	75	100	1
5	25ETES105	ES-I	Basic Electrical and Electronics Engineering	2	-	-	25	75	100	2
6	25ETES106	ES-II	Basic Mechanical Engg.	3	-	-	25	75	100	3
7	25ETSP107	BSP-I	Chemistry Lab	-	-	3	40	60	100	1.5
8	25ETSP108	ESP-I	Design Thinking	1	-	2	40	60	100	2
9	25ETSP109	ESP-II	Programming for Problem Solving Lab	-	-	3	40	60	100	1.5
10	25ETAC110	AC	NCC /NSS/YRC/Sports							-
Total Credits										20

SEMESTER II

Sl. No.	Course Code	Category	Course	L	T	P/D	CA	FE	Total	Credits
1	25ETBS201	BS-III	Physics	3	-	-	25	75	100	3
2	25ETBS202	BS-IV	Mathematics-II	3	1	-	25	75	100	4
3	25ETHS203	HS-III	Universal Human Values	2	-	-	25	75	100	2
4	25ETHS204	HS-IV	Tamils and Technology தமிழரும் தொழில்நுட்பமும்	1	-	-	25	75	100	1
5	25ETES205	ES-III	Basic Civil Engineering	3	-	-	25	75	100	3
6	25ETES206	ES-IV	Environmental Studies	2	-	-	25	75	100	2
7	25ETBP207	BSP-II	Physics lab	-	-	3	40	60	100	1.5
8	25ETHP208	HSP-I	English Communication Lab	-	-	3	40	60	100	1.5
9	25ETSP209	ESP-III	Electrical Wiring and Earthing Practices Lab	-	-	2	40	60	100	1
10	25ETSP210	ESP-IV	Engineering Graphics & Design	1	-	4	40	60	100	3
Total Credits										22

FIRST SEMESTER

25ETBS101	CHEMISTRY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand water treatment techniques and basic knowledge of surface chemistry.
- To provide knowledge on electrochemical cells and the chemistry involved in corrosion.
- To learn various processes involved in fuel refining and the mechanism involved in energy storage devices.
- To develop knowledge about synthesis of various types of polymers, nanomaterials, and the 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– Breakpoint 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 (H₂-O₂ fuel cell and Solid oxide fuel cell).

UNIT IV Polymers, Nano Materials and Phase rule

Polymers – Polymerization – Types (Addition, condensation and copolymerization) – Mechanism of addition polymerization (Free radical). Plastics– Types (Thermoplastics and Thermosetting plastics) – Preparation, properties and uses of polyethylene, polyvinyl chloride, polystyrene, Nylon and Bakelite. Elastomers – Vulcanization – Synthetic Rubber (Buna-S, Buna-N, Neoprene) – Silicone Rubber. Nanochemistry – Introduction to nano-materials– Synthesis (Precipitation, sol-gel, electrodeposition, and chemical vapour deposition methods) - Carbon nanotubes, Fullerenes, Nanowires, and Nanorods. 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).

TEXTBOOKS

1. Jain, P.C. and Monica Jain (2010) "Engineering Chemistry" Dhanpat Rai & Sons, New Delhi
2. Dara, S.S. and Umare, S.S. (2014) "Textbook of Engineering Chemistry" S. Chand & Co. Ltd., New Delhi.
3. Gopalan, R., Venkappaya, D. and Nagarajan, S. (2008) "Engineering Chemistry" Tata McGraw 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

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

CO\ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	2	2	1	1	–	–	–	–	1
CO2	3	3	2	2	1	1	–	–	–	–	1
CO3	3	3	2	2	1	1	–	–	–	–	1
CO4	3	2	2	3	1	1	–	–	–	–	1
CO5	3	3	3	2	1	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 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 their application in finding area and volume.
- To introduce the fundamentals of functions of a single variable.
- To enable the student to learn infinite series and their nature.
- To introduce the fundamentals of Multivariable Differential Calculus
- To introduce the fundamentals of Multivariable Integral Calculus

UNIT I Basic Calculus

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

UNIT II Single-variable Calculus (Differentiation)

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

UNIT III Sequences and series

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

UNIT IV Multivariable Calculus (Differentiation)

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

UNIT V Multivariable Calculus (Integration)

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

TEXTBOOKS

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 Variables), Khanna Book Publishing Co., 2023.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic Geometry, 9th Edition, Pearson Publishers, 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 Textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

COURSE OUTCOMES

1. Describe the fundamental concepts of differential calculus, integral calculus, sequences and series, multivariable differentiation and multivariable integration applicable to engineering and scientific problems.
2. Apply the principles of single-variable and multivariable calculus, definite integrals, sequences and series to formulate and solve engineering and real-life mathematical problems.
3. Analyze engineering problems involving limits, differentiation, integration, convergence of series, and multivariable functions to interpret mathematical models and obtain appropriate solutions
4. Evaluate alternative mathematical techniques for solving engineering problems involving calculus, optimization, infinite series, and multiple integrals based on accuracy and computational efficiency
5. Develop mathematical models by integrating concepts of differential calculus, integral calculus, multivariable calculus and series for solving multidisciplinary engineering applications

CO\ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	2	2	1	–	–	–	–	–	1
CO2	3	3	2	2	1	–	–	–	–	–	1
CO3	3	3	2	3	1	–	–	–	–	–	1
CO4	3	3	2	3	1	–	–	–	–	–	1
CO5	3	3	3	3	1	–	–	–	–	–	1

25ETHS103	TECHNICAL ENGLISH	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- To ensure that students have good vocabulary
- To make the students participate actively in writing activities
- To practice the unique qualities of professional writing style
- To develop the students' proficiency in communicative skills
- To ensure that the students face the demands of their profession

UNIT I Vocabulary Building

- 1.1 The concept of Word Formation
- 1.2 Root words from foreign languages (Greek, Latin and French) and their use in English
- 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Count and Non-count nouns.
- 1.4 Synonyms, antonyms and standard abbreviations.
- 1.5 Homophones, Homonyms, and one-word substitution.

UNIT II Basic Writing Skills

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

UNIT III Identifying Common Errors in Writing

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

UNIT IV Nature and Style of Sensible Writing

- 4.1 Describing and Defining
- 4.2 Classifying and Providing Evidence 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 workplace
- 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-Lyons and Ben Heasley, Cambridge University Press. 2006.
5. Communication Skills, Sanjay Kumar and Pushp Lata, Oxford University Press. 2011.
6. Exercises in Spoken English, Parts I-III, CIEFL, Hyderabad. Oxford University Press.
7. Raman Meenakshi and Shama, Sangeetha –Technical Communication Principles and Practice, Oxford University Press, New Delhi, 2014.

COURSE OUTCOMES

1. Explain the principles of English vocabulary, word formation, sentence structures, grammatical conventions, and the fundamentals of effective written and oral communication.
2. Apply appropriate vocabulary, grammatical rules, sentence structures, punctuation, coherence techniques, and conventions of professional writing to communicate ideas accurately and precisely.
3. Analyze written and spoken communication to identify grammatical, structural, lexical, and contextual errors and use appropriate strategies to improve clarity, accuracy, and effectiveness.
4. Evaluate different forms of technical and professional communication, including analytical writing, comprehension, formal correspondence, CVs, reports, presentations, and workplace interactions, for their clarity, organization, appropriateness, and effectiveness.
5. Create coherent and audience-appropriate professional communication such as essays, job applications, CVs, emails, reports, minutes, circulars, dialogues, presentations, and interview responses using suitable language and communication strategies.

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	3	–	–	–	–	–	–	3	–	1
CO2	3	3	3	–	–	–	–	1	3	–	1
CO3	3	3	3	3	–	–	–	–	3	–	1
CO4	3	3	3	3	–	1	1	1	3	1	1
CO5	3	3	3	3	–	1	1	1	3	1	1

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

அலகு I: மொழி மற்றும் இலக்கியம்:

3

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

அலகு II: மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை:

3

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

அலகு III: நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:

3

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

அலகு IV: தமிழர்களின் திணைக் கோட்பாடுகள்:

3

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

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

3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிக்கள் - தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.

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

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

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

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

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

TEXT-CUM-REFERENCE BOOKS

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

COURSE OUTCOMES

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

CO\ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	1	–	1	–	1	1	–	1	–	1
CO2	2	2	1	1	–	2	1	1	1	–	1
CO3	2	2	1	2	–	2	1	1	1	–	1
CO4	2	2	1	2	–	3	2	1	1	–	1
CO5	2	1	1	2	–	3	3	2	1	–	3

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

COURSE OBJECTIVES

- Understand the fundamental principles of electrical circuits and their analysis
- Explore the construction, working principles, and applications of various electrical machines
- Gain knowledge of electrical measurement techniques and instrumentation used in the measurement of electrical parameters
- Develop an understanding of analog electronics and their applications
- To teach the basics of digital electronics.

UNIT I Electrical Circuits

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

UNIT II Electrical Machines

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

UNIT III Measurements and Instrumentation

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

UNIT IV Analog Electronics

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

UNIT V Digital Electronics

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

TEXTBOOKS

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

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

CO\ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	1	–	–	–	–	–	–	1	1	–
CO2	3	3	2	2	2	–	1	–	1	1	–
CO3	3	3	2	3	2	–	1	–	1	1	–
CO4	3	3	3	2	2	1	2	1	1	1	1
CO5	3	3	3	2	3	2	2	1	2	2	2

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 processes

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 – coordinates – codes - Applications – Advantages - Limitations – Machining centre – concept. Additive Manufacturing Process – Definition - Classifications - Stereolithography (SLA) process – Direct Metal Laser Sintering (DMLS) - Applications - Advantages – Disadvantages.

TEXTBOOKS

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. Rao P.N. (2013). Manufacturing Technology: Foundry, Forming and Welding–Vol1, McGraw Hill Education.
3. Steven R. Schmid, Serope Kalpakjian. (2009). Manufacturing Processes for Engineering Materials (English), 5th Edition, Pearson India.

COURSE OUTCOMES

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

CO\ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	2	2	1	–	–	–	–	–	1
CO2	3	3	3	2	1	1	–	–	–	1	1
CO3	3	3	2	3	1	1	–	1	–	1	1
CO4	3	3	3	3	1	1	–	1	–	2	1
CO5	3	3	3	3	1	2	1	1	–	2	2

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

COURSE OBJECTIVES

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

LIST OF EXPERIMENTS

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water
5. Determination of the rate constant of a reaction
6. Determination of cell constant and conductance of solutions
7. Potentiometry - determination of redox potential 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

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

CO\PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	1	2	1	–	1	1	1	–	1
CO2	3	3	2	3	1	–	1	1	1	–	1
CO3	3	3	2	3	1	–	–	1	1	–	1
CO4	3	3	2	3	1	–	1	1	2	–	1
CO5	3	3	2	3	1	–	2	3	3	–	2

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 - Brainstorming techniques - Storyboarding 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.

TEXTBOOKS

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

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

CO\PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	3	2	1	1	1	1	1	1	1
CO2	3	3	3	2	1	1	1	2	2	1	1
CO3	3	3	3	3	1	1	1	2	2	1	1
CO4	3	3	3	3	1	1	1	2	2	2	1
CO5	3	3	3	3	1	2	2	3	3	3	2

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.
- To 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 pointers and structures in programs effectively.

LIST OF EXPERIMENTS

1. Familiarization with programming environment
2. Simple computational problems using arithmetic expressions
3. Problems involving if-then-else structures

4. Iterative problems, e.g., sum of series
5. 1D Arrays: searching, sorting
6. 2D arrays and Strings
7. Simple functions
8. Programming for solving Numerical methods
9. Pointers, structures, and dynamic memory allocation
10. File handling

Tutorial 1: Problem solving using computers

Lab1 :

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

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

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	1	–	–	–	–	–	1
CO2	3	3	3	2	1	–	–	1	–	–	1
CO3	3	3	3	3	1	–	–	1	–	–	1
CO4	3	3	3	3	1	–	–	1	–	1	1
CO5	3	3	3	3	1	–	–	1	1	1	2

SECOND SEMESTER

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

COURSE OBJECTIVES

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

- To understand the ray of light undergoing the phenomenon of interference and diffraction.
- To understand the principle and various applications of Laser.
- To develop knowledge in crystal structure and its properties.
- To understand the energy quantization of subatomic particles like electrons.
- Rationalize the law of conservation of energy in solar water heaters 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: Ruby laser – He-Ne laser – Basic applications of lasers in industry.

UNIT III Crystal Physics (7 Lectures)

Introduction to solid Materials – Crystal structure – Geometry of lattice unit cell – Bravais’s lattice – crystal systems –Crystal structures of Materials – (Coordination number, atomic radius, packing factor and packing density) – Types of crystal Lattice (Simple Cubic, Body Centered Cubic, Face Centered Cubic 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 Wavelength –De Broglie wavelength of an electron – The Schrödinger wave Equation – Schrödinger’s time-dependent and time-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.

TEXTBOOKS

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 Textbook 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”, Volumes 1 & 2, Khanna Publishers, New Delhi.
6. Rajput. 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., 1 Edn, New Delhi, 1983.

COURSE OUTCOMES

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

CO \ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	2	2	1	–	–	–	–	–	1
CO2	3	3	2	2	1	–	–	–	–	–	1
CO3	3	3	2	3	1	–	–	–	–	–	1
CO4	3	3	3	3	1	1	–	–	–	–	1
CO5	3	3	3	3	1	1	–	–	–	–	1

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

COURSE OBJECTIVES

- To familiarize linear systems of equations and matrices.
- To solve ordinary differential equations of first and second order.
- To enable 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 integration.

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, Möbius 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).

TEXTBOOKS

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 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 Textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

COURSE OUTCOMES

1. Describe the fundamental concepts of matrices, vector calculus, ordinary differential equations, Laplace transforms, and complex variable theory applicable to engineering and scientific problems.
2. Apply the principles of matrices, vector differentiation and integration, differential equations, Laplace transforms and complex variables to formulate and solve engineering problems.
3. Analyze mathematical models involving matrices, vector fields, differential equations, Laplace transforms, and complex functions to interpret engineering systems and obtain appropriate solutions.
4. Evaluate suitable mathematical techniques for solving engineering problems involving vector calculus, differential equations, Laplace transforms, and complex analysis based on accuracy, efficiency, and applicability.
5. Develop mathematical models by integrating concepts of matrices, vector calculus, differential equations, Laplace transforms, and complex variable theory for multidisciplinary engineering applications.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	1	–	–	–	–	–	1
CO2	3	3	3	2	1	–	–	–	–	–	1
CO3	3	3	2	3	1	–	–	–	–	–	1
CO4	3	3	2	3	1	–	–	–	–	–	1
CO5	3	3	3	3	1	–	–	–	–	–	1

25ETHS203	UNIVERSAL HUMAN VALUES					L	T	P/D	C
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COURSE OBJECTIVES

- To impart a holistic perspective based on self-exploration about themselves (human being), family, society, and nature/existence.

- To develop clarity about the harmony within human beings, as well as in the family, society and nature/existence.
- To strengthen the capacity for self-reflection.
- To foster commitment and courage 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 beings 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 beings 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 facilities.
- 2.3. Understanding the Body as an instrument of 'I' (I am 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. Identify from one's own life. Differentiate between prosperity and accumulation. Discuss programs for ensuring health vs. dealing with disease

UNIT III

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

- 1.1 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.
- 1.2 Understanding the meaning of Trust; Difference between intention and competence.
- 1.3 Understanding the meaning of respect; difference between respect and differentiation; the other salient values in relationship.
- 1.4 Understanding the harmony in society (society being an extension of family): Resolution, Prosperity, fearlessness (trust), and co-existence as comprehensive Human Goals.
- 1.5 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 is a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

UNIT IV

Understanding Harmony in Nature and Existence - Whole Existence as Coexistence

- 1.1 Understanding the harmony in nature.

- 1.2 Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self- regulation in nature.
- 1.3 Understanding Existence as Co-existence of mutually interacting units in all-pervasive space.
- 1.4 Holistic perception of harmony at all levels of existence.

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

UNIT V

Implications of the above Holistic Understanding of Harmony on Professional Ethics

- 1.1 Natural acceptance of human values.
- 1.2 Definitiveness of Ethical Human Conduct.
- 1.3 Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.
- 1.4 Competence in professional ethics: a. Ability to utilize 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 the above production systems.
- 1.5 Case studies of typical holistic technologies, management models and production systems.
- 1.6 Strategy for transition from the present state to Universal Human Order: a. At the level of the individual: socially and ecologically responsible engineers, technologists and managers. b. At the level of society: as mutually enriching institutions and organizations.
- 1.7 Sum up. Including practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist, etc.

TEXT / REFERENCES

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, 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. Story of Stuff (Book).
5. The Story of My Experiments with Truth- by Mohandas Karamchand Gandhi
6. Small is Beautiful - E. F Schumacher.
7. Slow is Beautiful – Cecile Andrews
8. Economy of Permanence – J. C. Kumarappa
9. Bharat Mein Angreji Raj -Pandit Sunderlal
10. Rediscovering India – by Dharampal
11. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
12. India Wins Freedom - Maulana Abdul Kalam Azad
13. Vivekananda - Romain Rolland (English)
14. Gandhi - Romain Rolland (English)

COURSE OUTCOMES

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

CO\PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	1	1	–	–	–	2	3	–	1	–	1
CO2	1	1	1	–	–	3	3	1	1	–	1
CO3	1	2	1	1	–	3	3	1	1	–	1
CO4	2	2	1	1	–	3	3	1	1	1	1
CO5	2	2	2	1	–	3	3	1	1	1	1

25ETHS204	TAMILS AND TECHNOLOGY தமிழரும் தொழில்நுட்பமும்	L	T	P/D	C
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அலகு I: நெசவு மற்றும் பாணைத் தொழில்நுட்பம்: 3
சங்க காலத்தில் நெசவுத் தொழில் - பாணைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு II: வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: 3
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரம் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

அலகு III: உற்பத்தித் தொழில் நுட்பம்: 3
கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV: வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: 3
அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குழுவித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.

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

TOTAL : 15 PERIODS

UNIT I Weaving and Ceramic Technology: Weaving Industry during the 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 - Coins as source of history - Minting of Coins - Beads making - Industries. Stone beads - Glass beads - Terracotta beads - Shell beads/bone beads - Archaeological evidence - Gemstone types described in Silappathikaram.

UNIT IV Agriculture and Irrigation Technology: Dam, Tank, ponds, Sluice, Significance of KumizhiThoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro-Processing - Knowledge of Sea - Fisheries - Pearl - Conche diving - Ancient Knowledge of Ocean - knowledge specific to 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-REFERENCEBOOKS

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) பொருளுத – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
4. Social Life of Tamils (Dr.K.K. Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
5. Social Life of the Tamils: The Classical Period (Dr.S. Singaravelu) (Published by: International Institute of Tamil Studies).
6. Historical Heritage of the Tamils (Dr.S.V. Subaramanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
7. The Contributions of the Tamils to Indian Culture (Dr.M. Valarmathi) (Published by: International Institute of Tamil Studies.)
8. Keeladi - 'Sangam City Civilization on the bank of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Textbook 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 Textbook and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) –Reference Book.

COURSE OUTCOMES

1. Explain the scientific, technological and architectural contributions of ancient Tamils in the fields of weaving, ceramics, construction, manufacturing and agriculture.
2. Apply the knowledge of traditional Tamil technologies, irrigation practices, material processing and scientific advancements to contemporary engineering and societal contexts.
3. Analyze the technological developments, construction methods, manufacturing techniques and maritime practices of ancient Tamil civilization using historical and engineering perspectives.
4. Evaluate the significance of Tamil scientific heritage, indigenous technologies and digital Tamil advancements in sustainable development and modern applications.
5. Develop awareness and innovative approaches for preserving, promoting, and integrating traditional Tamil scientific knowledge with modern engineering practices.

CO\ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	1	1	1	–	2	1	–	1	–	1
CO2	3	2	2	1	1	3	1	–	1	–	1
CO3	3	3	2	2	1	3	1	–	1	–	1
CO4	3	3	3	2	1	3	1	–	1	1	1
CO5	3	3	3	2	1	3	2	1	1	1	2

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

COURSE OBJECTIVES

- To inculcate knowledge of the essentials of Civil Engineering.
- To impart knowledge on construction materials and their properties.
- To expose the students to the role, significance, and contributions of Civil Engineering in satisfying the social needs.
- To understand the basic knowledge of 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 and requirements of good masonry – Bonds in brickwork – Header, Stretcher, English, Flemish – Stone masonry - Characteristics and 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 rainwater 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.

TEXTBOOKS

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

REFERENCES

1. Palanichamy M.S., Basic Civil Engineering, Tata McGraw Hill Publishing Company Ltd, 2000.
2. Ramamrutham V, Basic Civil Engineering, Dhanpat Rai 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 Johnson and Dhir, RK. Macmillan 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

1. Explain the fundamentals of civil engineering, building components, construction materials

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

CO\ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	2	2	1	1	–	–	–	–	1
CO2	3	3	3	2	1	1	–	–	–	1	1
CO3	3	3	2	3	1	1	–	–	–	1	1
CO4	3	3	3	3	1	1	1	–	–	1	1
CO5	3	3	3	3	1	1	1	1	–	2	1

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

COURSE OBJECTIVES

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

UNIT I Multidisciplinary Nature of Environmental Studies

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

UNIT II Ecosystems

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

UNIT III Biodiversity and Its Conservation

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

man-wildlife conflicts - Endangered and endemic species of India - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT IV Environmental Pollution

Definition - Cause, effects and control measures of Air pollution - Water pollution - Soil pollution - Marine pollution- Noise pollution - Thermal pollution - Nuclear hazards- Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Disaster management: floods, earthquake, cyclone and landslides. Sustainable development - Urban problems related to energy - Water conservation, rainwater 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 equals 5 lecture hours)**

TEXTBOOKS

Agarwal, K.C. Environmental Biology, Nidi Publ, Ltd., Bikaner, 2001

Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email: mapin@icenet.net

REFERENCES

1. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
2. Clark R.S., Marine Pollution, Clanderson Press, Oxford
3. Cunningham, W.P., Cooper, T.H., Gorhani, E & Hepworth, M.T. 2001.
4. Environmental Encyclopedia, Jaico Publ. House, Mumbai, 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. Stockholm Env.Institute, Oxford Univ. Press. 473p.
9. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural
10. History Society, Bombay
11. Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment.
12. Cambridge Univ. Press 1140p.
13. Jadhav, H. & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. 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. Wastewater treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
19. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut. Survey of the Environment, The Hindu (M)
20. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science.

21. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol I and II, Enviro Media.
22. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication.
23. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co., Philadelphia, USA 499p.

COURSE OUTCOMES

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

CO\PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	2	2	1	2	1	–	–	–	1
CO2	3	3	3	2	1	3	1	1	–	–	1
CO3	3	3	2	3	1	3	1	1	–	–	1
CO4	3	3	3	3	1	3	2	1	1	1	1
CO5	3	3	3	3	1	3	3	1	1	1	2

25ETBP207	PHYSICS LABORATORY						L	T	P/D	C
							0	0	3	1.5

COURSE OBJECTIVES

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

LIST OF EXPERIMENTS

1. **Air-Wedge;** To determine the thickness(diameter) of a thin wire by forming interference fringes.
2. **Newton's 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 a spectrometer.
4. **Spectrometer Grating;** To determine the wavelength of the prominent spectral lines of the Mercury (Hg) spectrum using a grating.
5. **Laser Grating;** To determine the wavelength of a given laser source by using the diffraction grating method
6. **Young's Modulus - Non-Uniform bending;** To find the Young's modulus of the material of a uniform bar (metre scale) by non-uniform bending.

7. **Young's Modulus -Uniform bending;** To determine the Young's 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) the moment of inertia of a disc and (ii) Rigidity modulus of a wire by a 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. **Coefficient of Viscosity by Stokes method;** To verify Stokes' law and hence to determine the coefficient of viscosity of a highly viscous liquid.
13. **Young's double-slit experiment;** To determine the nature of the light by observing interference patterns using a double slit.

COURSE OUTCOMES

1. Explain the fundamental principles of interference, diffraction, polarization, elasticity, oscillations, acoustics and fluid mechanics relevant to engineering measurements.
2. Apply appropriate experimental principles and procedures to determine physical parameters such as wavelength, thickness, radius of curvature, elastic modulus, acceleration due to gravity, rigidity modulus and viscosity.
3. Analyze experimental observations, measurements and graphical relationships to determine physical quantities and identify sources of experimental error.
4. Evaluate experimental results by comparing measured values with theoretical or standard values and assess the reliability, accuracy and limitations of the experimental methods.
5. Develop suitable experimental approaches for investigating optical, mechanical, acoustic and fluid-mechanical phenomena using appropriate instruments, data-analysis techniques and collaborative laboratory practices.

CO\PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	1	2	1	–	–	1	–	–	1
CO2	3	3	2	3	1	–	–	1	–	–	1
CO3	3	3	2	3	1	–	–	2	1	–	1
CO4	3	3	2	3	1	–	–	2	1	–	1
CO5	3	3	3	3	1	–	–	3	1	–	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 students' 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 patterns and sounds of English
2. Pronunciation, Stress and Intonation
3. Common Situations – Conversations and Dialogues
4. Communication at the workplace

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

TEXTBOOKS

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 Textbook of English Phonetics for Indian Students”, (Macmillan).
5. “English Skills for Technical Students”, WBSCTE with British Council, OL.

COURSE OUTCOMES

1. Describe the principles of effective listening, speaking, reading, writing, interpersonal communication and presentation skills.
2. Demonstrate effective verbal and non-verbal communication skills in academic and workplace situations.
3. Analyze communication situations based on audience, language, verbal and non-verbal cues, and presentation strategies.
4. Evaluate oral and written communication for clarity, coherence, language proficiency, professional etiquette, and effectiveness.
5. Develop professional communication skills through presentations, group discussions, interviews, and workplace interactions.

CO\ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1								1		2	
CO2					1			1	2	3	1
CO3		1			1			2	2	3	1
CO4		1						2	2	3	1
CO5		1	1		1	1		2	3	3	2

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

COURSE OBJECTIVES

- To create an awareness of electrical safety in industrial and commercial environments.
- To enable understanding of the principles of different types of electrical wiring.
- To offer exposure to 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

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

CO\ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	-	-	-	-	-	-	-	-	-
CO2	3	-	3	-	2	2	-	-	3	-	-
CO3	2	3	2	2	-	-	-	-	3	-	-
CO4	2	2	-	3	2	2	-	-	3	-	-
CO5	2	2	3	2	3	-	-	-	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 for the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)

COURSE OBJECTIVES

- To develop the ability to produce simple engineering drawing and sketches based on current practice

- To develop the means for communication of ideas, thoughts and design of objects, related to engineering applications, to others through drawing
- To develop the skills to read manufacturing and construction drawings used in industry
- To develop a working knowledge of the layout of plant and equipment
- To develop skills in abstracting information from calculation sheets and schematic diagrams to produce working drawings for manufacturers, installers and fabricators

UNIT I Introduction to Engineering Drawing

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

UNIT II Orthographic Projections

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

UNIT III Projections of Regular Solids

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

UNIT IV Sections and Sectional Views of Right Angular Solids

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

UNIT V Isometric Projections

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

OVERVIEW OF COMPUTER GRAPHICS COVERING

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

CUSTOMIZATION & CAD DRAWING

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

ANNOTATIONS, LAYERING & OTHER FUNCTIONS

Applying dimensions to objects and annotations to drawings; Setting up and use of Layers, Printing document step 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 Kanniah (2008), Textbook on Engineering Drawing, Scitech Publishers.
5. (Corresponding set of) CAD Software Theory and User Manuals.

COURSE OUTCOMES

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

CO\ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	3	2	1	—	—	—	1	—	1
CO2	3	3	3	2	1	—	—	—	1	—	1
CO3	3	3	3	3	1	—	—	—	1	—	1
CO4	3	3	3	3	1	—	—	—	1	—	1
CO5	3	3	3	3	1	—	—	1	2	1	2

ANNAMALAI UNIVERSITY
FACULTY OF ENGINEERING AND TECHNOLOGY
B.E.(FourYear)DegreeProgramme (FULL–TIME)

Choice Based Credit System (CBCS)

BRANCH: INFORMATION TECHNOLOGY

COURSES OF STUDY AND SCHEME OF EXAMINATIONS (REGULATION 2025)

SEMESTER – III									
Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
25ITBS301	BS-V	Mathematics –III	3	1	-	25	75	100	3
25ITES302	ES-V	Digital Logic and Microprocessors	3	-	-	25	75	100	3
25ITPC303	PC-I	Computer Architecture and Organization	3	-	-	25	75	100	3
25ITPC304	PC-II	Data Structures and Algorithms	3	-	-	25	75	100	3
25ITPC305	PC-III	Database Management System	3	-	-	25	75	100	3
25ITPC306	PC-IV	Object-Oriented Programming using JAVA	3	1	-	25	75	100	3
25ITPE307	PE-I	Professional Elective – I	2	1	-	25	75	100	3
25ITPCP308	PCP-I	Data structures and Algorithm Lab	-	-	3	40	60	100	1.5
25ITPCP309	PCP-II	Database Management Systems Lab	-	-	3	40	60	100	1.5
						Total Credits			24

SEMESTER– IV									
Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
25ITBS401	BS-VI	Discrete Mathematics	3	-	-	25	75	100	3
25ITES402	ES-VI	Python Programming	2	-	-	25	75	100	3
25ITPC403	PC-V	Operating System	3	-	-	25	75	100	3
25ITPC404	PC-VI	Computer Networks	3	-	-	25	75	100	3
25ITPC405	PC-VII	System Software and Compiler Design	3	-	-	25	75	100	3
25ITPC406	PC-VIII	Software Engineering	3	-	-	25	75	100	3
25ITPE407	PE-II	Professional Elective – II	2	1	-	25	75	100	3
25ITPCP408	PCP-III	Operating System Lab	-	-	3	40	60	100	1.5
25ITPCP409	PCP-IV	Computer Networks Lab	-	-	3	40	60	100	1.5
			Total Credits						24
Students must undergo an internship for 4 weeks during summer vacation, which will be assessed in the forthcoming V Semester.									

SEMESTER- V									
Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
25ITPC501	PC-IX	Computer Graphics and Multimedia	3	-	-	25	75	100	3
25ITPC502	PC-X	Software Metrics and Quality Assurance	3	-	-	25	75	100	3
25ITPC503	PC-XI	Artificial Intelligence	3	-	-	25	75	100	3
25ITPC504	PC-XII	Internet Technology and Web Services	3	-	-	25	75	100	3
25ITPE505	PE-III	Professional Elective – III	3	-	-	25	75	100	3
25ITOE506	OE-I	Open Elective – I [NaaNMudalvan]	3	-	-	25	75	100	3
25ITPCP507	PCP-V	Computer Graphics and Multimedia Lab	-	-	3	40	60	100	1.5
25ITPCP508	PCP-VI	Internet Technology and Web Services 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	4.0
			Total Credits						25

SEMESTER– VI									
Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
25ITPC601	PC-XIII	Analytics and Data Mining	3	-	-	25	75	100	3
25ITPC602	PC-XIV	Digital Image Processing	3	-	-	25	75	100	3
25ITHS603	HS-V	Management Course – Business Management	3	-	-	25	75	100	3
25ITPE604	PE-IV	Professional Elective – IV	3	-	-	25	75	100	3
25ITPE605	PE-V	Professional Elective – V	3	-	-	25	75	100	3
25ITOE606	OE-II	Open Elective –II [NaaNMudalvan]	3	-	-	25	75	100	3
25ITPCP607	PCP-VII	Analytics and Data Mining Lab	-	-	3	40	60	100	1.5
25ITPCP608	PCP-VIII	Digital Image Processing Lab	-	-	3	40	60	100	1.5
Total Credits									21
Students must undergo an internship for 4 weeks during summer vacation, which will be assessed in the forthcoming VII Semester.									

SEMESTER– VII

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
25ETES701	ES	Research Methodology	2	-	-	25	75	100	2
25ITPC702	PC-XVI	Internet of Things	3	-	-	25	75	100	3
25ITPC703	PC-XVII	Network and Information Security	3	-	-	25	75	100	3
25ITPE704	PE-VI	Professional Elective – VI	3	-	-	25	75	100	3
25ITPE705	PE-VII	Professional Elective – VII	3	-	-	25	75	100	3
25ITOE706	OE-III	Open Elective –III [NaaNMudalvan]	3	-	-	25	75	100	3
25ITPCP707	PCP-IX	Network Security Lab	-	-	3	40	60	100	1.5
25ITPCP708	PCP-X	Internet of Things Lab	-	-	3	40	60	100	1.5
25ETIT709	IT-II	Industrial Training / Rural Internship / Innovation / Entrepreneurship	<i>Four weeks during the summer vacation at the end of VI Semester</i>				100	100	4.0
			Total Credits						24

SEMESTER– VIII

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
25ITPE801	PE-VIII	Professional Elective – VIII	3	-	-	25	75	100	3
25ITPE802	PE-IX	Professional Elective – IX	3	-	-	25	75	100	3
25ITPV803	PV-I	Project Work and Viva-Voce	-	PR 10	S 2	40	60	100	6
Total Credits									12

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

HS	Humanities and Social Sciences including Management courses
BS	Basic Science courses
ES	Engineering Science Courses
CA	Continuous Assessment Marks
FE	Final Exam Marks

LIST OF PROFESSIONAL ELECTIVES		
Professional Elective – I		
1.	25ITPE307	Theory of Computation
2.	25ITPE307	Signals and Systems
3.	25ITPE307	Principles and Practices of Communication Systems
4.	25ITPE307	Wireless Communication
5.	25ITPE307	Virtualization
6.	25ITPE307	Robotic Process Automation
7.	25ITPE307	Cognitive Science
8.	25ITPE307	Ethical Hacking
Professional Elective – II		
1.	25ITPE407	Introduction to Machine Learning
2.	25ITPE407	Cyber-Physical Systems
3.	25ITPE407	3D Printing and Design
4.	25ITPE407	Mobile Ad hoc and Wireless Sensor Networks
5.	25ITPE407	UI and UX Design
6.	25ITPE407	Software Defined Networks
7.	25ITPE407	Software Testing and Quality Assurance
8.	25ITPE407	Information Coding Theory
Professional Elective – III		
1.	25ITPE505	Mobile Computing
2.	25ITPE505	Image and Video Analytics
3.	25ITPE505	Parallel Computing
4.	25ITPE505	Network Management Systems
5.	25ITPE505	Object-Oriented Analysis and Design
6.	25ITPE505	Social Network Information Analysis
7.	25ITPE505	Business Intelligence
8.	25ITPE505	Modern Cryptography
Professional Elective – IV		
1.	25ITPE604	Distributed Computing
2.	25ITPE604	Soft Computing
3.	25ITPE604	Cyber Law and Ethics
4.	25ITPE604	Pattern Recognition and Visual Recognition
5.	25ITPE604	Business Analytics
6.	25ITPE604	Game Theory
7.	25ITPE604	Cryptocurrency and Blockchain Technologies
8.	25ITPE604	Computer Vision
Professional Elective – V		
1.	25ITPE605	Analysis and Design of Service-Oriented Architecture
2.	25ITPE605	Digital and Mobile Forensics
3.	25ITPE605	Bio Informatics
4.	25ITPE605	GIS and Remote Sensing
5.	25ITPE605	Text and Speech Analysis
6.	25ITPE605	Cyber Forensics and Information Security
7.	25ITPE605	Social Network Security
8.	25ITPE605	Human Computer Interaction

Professional Elective – VI		
1.	25ITPE704	Cloud and Edge Computing
2.	25ITPE704	Recommender Systems
3.	25ITPE704	Next Generation Networks
4.	25ITPE704	Storage Technologies
5.	25ITPE704	DevOps
6.	25ITPE704	Game Development
7.	25ITPE704	Fundamentals of VR/AR/MR
8.	25ITPE704	Engineering Secure Software Systems
Professional Elective – VII		
1.	25ITPE705	Deep Learning
2.	25ITPE705	Quantum Computing
3.	25ITPE705	Security and Privacy in Cloud
4.	25ITPE705	Satellite Communication
5.	25ITPE705	Exploratory Data Analysis
6.	25ITPE705	Penetration Testing Methodologies
7.	25ITPE705	Cloud Service Management
8.	25ITPE705	Fundamentals of Reversible and Quantum Computing
Professional Elective – VIII		
1.	25ITPE801	Free and Open-Source Software
2.	25ITPE801	Data Analytics
3.	25ITPE801	5G Wireless Networks
4.	25ITPE801	Optical Communication
5.	25ITPE801	Drone Technology
6.	25ITPE801	E-Learning Techniques
7.	25ITPE801	Unix Internals
8.	25ITPE801	Supply Chain Management
Professional Elective – IX		
1.	25ITPE802	E-Commerce
2.	25ITPE802	Enterprise Resource Planning
3.	25ITPE802	Entrepreneurship and Startups
4.	25ITPE802	Information Ethics
5.	25ITPE802	e-Business
6.	25ITPE802	System Modeling and Simulation
7.	25ITPE802	Intellectual Property Rights
8.	25ITPE802	Mobile Application Development

LIST OF OPEN ELECTIVES		
Open Elective – I		
	25ITOE506	Cyber Security [NaaNMudalvan]
	25ITOE506	Industry 4.0
	25ITOE506	Robotics simulation for Manufacturing
	25ITOE506	Smart Energy Grid
	25ITOE506	Augmented & Virtual Reality Development
Open Elective – II		
	25ITOE606	Fullstack Development [NaaNMudalvan]
	25ITOE606	Cloud Essentials
	25ITOE606	Cloud Computing

	25ITOE606	Big Data Analytics
	25ITOE606	Data Science for Engineers
Open Elective – III		
	25ITOE706	Blockchain Technology [NaaNMudalvan]
	25ITOE706	Front-End Information Technology with React
	25ITOE706	Big Data
	25ITOE706	Data Engineering
	25ITOE706	Data Science Foundation

LIST OF HONOURS ELECTIVES			
S. No	CODE	COURSE	Credits
1.	25ITHESCN	Information System Audit	4
2.	25ITHESCN	Generative AI	4
3.	25ITHESCN	Predictive Analytics	3
4.	25ITHESCN	Heterogeneous Computing	3
5.	25ITHESCN	Agile Software Development	3
6.	25ITHESCN	IoT-based Smart Systems	3

LIST OF MINOR ENGINEERING ELECTIVES			
S. No	CODE	COURSE	Credits
1.	25ITMISCN	Introduction to Information Technology	3
2.	25ITMISCN	Fundamentals of Object Oriented Programming	3
3.	25ITMISCN	Data Communication and Computer Networks	4
4.	25ITMISCN	Basics of Computer Graphics and Multimedia	3
5.	25ITMISCN	Information Security	3
6.	25ITMISCN	Fundamentals of Data Mining	4

ONE CREDIT COURSES		
S. No	CODE	COURSE
1.	25ITOCSCN	Office Automation Tools Lab
2.	25ITOCSCN	Socially Relevant Project Lab
3.	25ITOCSCN	Professional Communication
4.	25ITOCSCN	Web and Social Media Analytics Lab
5.	25ITOCSCN	Hardware and Troubleshooting Lab
6.	25ITOCSCN	Adobe Experience Manager Lab
7.	25ITOCSCN	Mobile Application Development Lab

VALUE ADDED COURSES		
S. No	CODE	COURSE
1.	25EINTVAC01	Web Development
2.	25EINTVAC02	Mobile Application Development
3.	25EINTVAC03	Big Data Technologies
4.	25EINTVAC04	Foundation of Data Science
5.	25EINTVAC05	Introduction to Cyber Security

DEPARTMENT OF INFORMATION TECHNOLOGY

VISION

To produce globally competent, quality technocrats, to inculcate values of leadership and research qualities, and to play a vital role in the socio-economic progress of the nation.

MISSION

- M1: To partner with the University community to understand the information technology needs of faculty, staff and students.
- M2: To develop dynamic IT professionals with a globally competitive learning experience by providing high-quality education.
- M3: To involve graduates in understanding need-based research activities and disseminate the knowledge to develop entrepreneurial skills.

PROGRAMME EDUCATIONAL OBJECTIVES

- PEO1: To offer students with **core competence** in mathematical, scientific, and basic engineering rudiments necessary to prepare, analyze, and solve hardware/software engineering problems and/or also to pursue advanced study or research.
- PEO2: To educate students with a good **scope** of knowledge in core areas of IT and related engineering to comprehend engineering trade-offs, analyze, design, and synthesize data and technical concepts to create novel products and solutions for real-life problems.
- PEO3: To instil in students the ability to maintain high **proficiency** and ethical standards, effective oral and written communication skills, to work as part of teams on multidisciplinary projects and in diverse professional environments, and relate engineering issues to society, global economy, and to emerging technologies.
- PEO4: To equip our graduates with **an** awareness of the lifelong learning needed for a successful professional career and to introduce them to written ethical codes and guidelines, perform with excellence, demonstrate leadership and demonstrate good citizenship.

PROGRAMME OUTCOMES (POs)

After the successful completion of the B.E. Information Technology degree programme, the students will be able to:

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and the cultural, societal, and environmental considerations.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of the limitations.

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to professional engineering practice.

PO 7: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

PO 8: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 9: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 10: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 11: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

At the time of graduation, the students will be able to:

PSO 1: Apply the fundamental concepts of Information Technology to design, develop, and test various real-time applications in the areas of Computer Networking, Wireless Communication, and Information Systems and Security.

PSO 2: Solve complex engineering problems using the latest Information Technology tools and skills to arrive at cost-effective and appropriate solutions.

PSO 3: Apply the knowledge of management principles and soft skills to carry out Information Technology projects with social and environmental awareness to have a successful career and as an entrepreneur.

Mapping Programme Educational Objectives (PEOs) with Programme Outcomes (POs)				
	PEO1	PEO2	PEO3	PEO4
PO1	✓	✓	✓	
PO2	✓	✓		✓
PO3	✓	✓		✓
PO4		✓	✓	✓
PO5	✓	✓	✓	
PO6			✓	✓
PO7			✓	✓
PO8	✓	✓	✓	✓
PO9			✓	✓
PO10	✓	✓	✓	✓
PO11	✓	✓	✓	✓

THIRD SEMESTER

25ITBS301	MATHEMATICS – III	L	T	P	C
		3	1	0	3

COURSE OBJECTIVES

- To illustrate the principles of partial differential equations for modelling and solving engineering problems.
- To interpret Fourier series techniques for representing periodic functions and analyzing engineering phenomena.
- To apply boundary value problem formulations for solving heat conduction, wave propagation, and related physical systems.
- To examine Fourier transform methods for signal analysis, frequency-domain representation, and engineering applications.
- To design mathematical solutions using Z-transforms for discrete systems and difference equations.

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

Dirichlet'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 and Difference Equations

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

TEXTBOOKS

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

REFERENCES

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

COURSE OUTCOMES

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

1. Explain the principles of partial differential equations, Fourier series, boundary value problems, Fourier transforms, and Z-transforms for engineering applications.
2. Apply mathematical techniques to solve engineering problems involving differential equations, transforms, and boundary value formulations.

3. Analyze continuous and discrete engineering systems using partial differential equations, Fourier methods, and Z-transform techniques.
4. Evaluate appropriate analytical methods for solving engineering problems involving transforms, boundary value problems, and difference equations.
5. Develop mathematical models and solution strategies using partial differential equations, Fourier analysis, and Z-transform techniques for engineering applications.

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

25ITES302	DIGITAL LOGIC AND MICROPROCESSORS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- State number systems, logic gates, flip-flops, 8085/8086 architecture, and peripheral chips.
- Describe Boolean simplification, sequential circuit operation, and microprocessor/peripheral functioning.
- Use logic gates and K-maps to design combinational and sequential circuits.
- Differentiate combinational vs. sequential circuits, and 8085 vs. 8086 architectures.
- Assess suitable circuits, addressing modes, and peripheral chips for given applications.
- Develop microprocessor-based systems using 8086 programming and peripheral interfacing.

UNIT I

Introduction: Review of number systems - Logic gates: NAND, NOR gate as universal building blocks -Simplification of four-variable Boolean equations using Karnaugh maps Combinational Logic circuits: Half adder, Full adder, Half subtractor, Full subtractor - 4-bit parallel adder and subtractor - 3-bit binary decoder – Decimal to BCD encoder – 8-to-1 multiplexer, 1-to-8 Demultiplexer

UNIT II

Sequential Logic Circuits: Flip-flops: SR flip-flop, Edge-triggered flip-flops (SR, D, JK and T), Master-slave JK flip-flop - 4-bit binary asynchronous and synchronous counter - Decade counter (asynchronous and synchronous) - Shift registers (SISO, SIPO, PISO, PIPO) - Ring counter – Memories (RAM, ROM, EPROM, FLASH)

UNIT III

The 8085 Microprocessor Architecture: Pin diagram - CPU architecture – Flags-Interrupts – Instruction Set-Addressing mode

UNIT IV

The 8086 Microprocessor: Pin diagram, CPU architecture, addressing mode, segmentation-minimum mode, maximum mode operations -Memory Interfacing-I/O interfacingProgramming model of 8086: Programming model of 8086, Addressing modes, Instruction Formats, Instruction set, Assembler directives and Assembly language Programming of 8086.

UNIT V

Peripheral Chips: Block diagram – pin diagram, 8255 (PPI), 8254 (Timer), 8257 (DMA), 8259 (PIC), 8251 (USART), 8279 (Keyboard and Display Interfacing)

TEXTBOOKS

1. Ramesh Gaonkar, “Microprocessor Architecture, Programming, and Applications with the 8085”, Sixth Edition, Penram International Publishing, 2013.
2. Morris Mano, “Digital logic and Computer design”, 4th Edition, Pearson, 2008.

REFERENCES

1. Yu-Cheng Liu, Glenn A. Gibson, “Microcomputer Systems: The 8086/8088 Family Architecture Programming and Design”, Second Edition, Pearson, 2015.
2. R.K. Gaur, “Digital Electronics and Microcomputers”, Dhanpat Rai Publications, 2012.

COURSE OUTCOMES

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

1. List number systems, logic gates, flip-flops, 8085/8086 instruction sets, and peripheral chips (8255, 8254, 8257, 8259, 8251, 8279).
2. Explain Boolean simplification using K-maps, sequential circuit operation, 8085/8086 architecture, and the functioning of peripheral interfacing chips.
3. Design combinational circuits (adders, subtractors, encoders, multiplexers), sequential circuits (counters, shift registers), and write 8085/8086 language programs.
4. Differentiate combinational vs. sequential circuits, synchronous vs. asynchronous counters, 8085 vs. 8086 architecture, and various memory/peripheral chip functions.
5. Develop and justify microprocessor-based systems integrating combinational/sequential logic circuits, 8086 programming, and peripheral chip interfacing for real-world applications.

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

25ITPC303	COMPUTER ARCHITECTURE AND ORGANIZATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- State basic concepts of web architecture, HTML5/CSS3, XML, scripting, Node.js, and web services.
- Describe browser-server communication, XML processing, and scripting/web service architectures.
- Use HTML5, CSS3, and XML to build structured, styled web pages.
- Differentiate client-side vs. server-side scripting, parsing methods, and service architectures.
- Assess suitable technologies for scripting, Node.js backends, and web services.
- Develop an integrated web application using HTML5/CSS3, XML, scripting, Node.js-MongoDB, and web services.

UNIT I Basic Computer Organization and Design

Block Diagram of Computer-Instruction Codes – Computer Registers – Instruction Cycle – Memory reference Instructions – Input – Output and Interrupt Design of Basic Computer – ALU design.

UNIT II Basic Processing Unit

Fundamental concepts-Execution of a complete instruction – Multiple bus organization – Hardwired control –Microprogrammed control – Pipelining: Basic concepts – Data hazards – Instruction hazards – Influence on Instruction sets – Data path and control considerations – Superscalar processors, VLIW, Parallel and Vector Processors.

UNIT III Memory Organization

Memory hierarchy – main memory – Memory chip Organization- auxiliary memory –Associate memory – Virtual memory – Cache memory – Cache algorithms, Cache Hierarchy, Cache coherence protocols, Performance, Interleaving, On chip Vs Off chip Memories/Caches.

UNIT IV Input-Output Organization

Input-output interface – asynchronous data transfer – modes of transfer – priority interrupt – DMA –Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI, USB).

UNIT V Advanced Processor Architecture

Parallel processing and its challenges- Instruction-level parallelism – Flynn's classification – Hardware multithreading: SISD, MIMD, SIMD, SPMD and Vector multithreading – Multicore processors: Shared memory multiprocessor and cluster multiprocessor.

TEXTBOOKS

1. Carl Hamacher, Zvonko G. Vranesic, Safwat G. Zaky, “Computer Organization”, McGraw-Hill, 5th edition, 2014
2. David A. Patterson and John L. Hennessy, " Computer Organization and Design", Morgan Kauffman / Elsevier, Fifth edition, 2014.
3. Morris Mano, "Computer System Architecture ", Prentice Hall of India, Third Edition, 2008.

REFERENCES

1. William Stallings, “Computer Organization and Architecture”, Prentice-Hall of India, 7th Edition, 2016.
2. John P. Hayes, “Computer Architecture and Organisation”, McGraw Hill,2012.
3. Morris Mano, "Computer System Architecture ", Prentice Hall of India, Third Edition, 2008.
4. Vincent P. Heuring, Harry F. Jordan, “Computer System Architecture”, Pearson Education, Second Edition, 2005.
5. Govindarajalu, “Computer Architecture and Organization, Design Principles and Applications", Tata McGraw Hill, First edition, 2005.

WEB RESOURCES

1. <http://www.inetdaemon.com/tutorials/computers/hardware/cpu/>
2. <https://inst.eecs.berkeley.edu/~cs152/sp18/>
3. http://users.ece.cmu.edu/~jhoe/doku/doku.php?id=18447_introduction_to_computer_architecture

COURSE OUTCOMES

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

1. Interpret core web concepts — client/server model, protocols, HTML5/CSS3 elements, XML syntax, JS/JSP/Servlet basics, Node.js modules, and SOAP/WSDL/UDDI components.
2. Explain browser-server communication, XML processing (DOM/SAX/XSL), the JSP/Servlet lifecycle, Node.js's async event model, and web service/microservice architecture.
3. Build responsive HTML5/CSS3 pages, well-formed XML documents, JS/JSP/Servlet-based interactive scripts, Node.js–MongoDB applications, and functional SOAP web services.
4. Compare CSS positioning/transformation techniques, DOM vs. SAX parsing, JSP vs. Servlets, sync vs. async Node.js execution, and SOAP vs. microservices architecture.

- Design and develop an integrated web application combining HTML5/CSS3, XML data exchange, client/server scripting, Node.js–MongoDB backend, and a web service/microservice layer for a real-world B2B/B2C scenario.

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

25ITPC304	DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To illustrate the impact of data structures and algorithm design on computational efficiency.
- To interpret searching, sorting, and algorithm analysis techniques for problem solving.
- To apply linear and non-linear data structures for efficient data organization and manipulation.
- To examine algorithmic strategies for implementing trees, graphs, and hashing techniques.
- To develop optimized solutions using appropriate data structures and algorithms for computational problems.

UNIT I

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis.

UNIT II

Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queues: Simple Queue, Circular Queue, Priority Queue; Operations on each type of Queues: Algorithms and their analysis.

UNIT III

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

UNIT IV

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications for Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

UNIT V

Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

TEXTBOOKS

1. Ellis Horowitz, Sartaj Sahni, “Fundamentals of Data Structures”, Illustrated Edition, Computer Science Press.

REFERENCES

1. Mark Allen Weiss, “Algorithms, Data Structures, and Problem Solving with C++”, Illustrated Edition, Addison-Wesley Publishing Company
2. R. G. Dromey, “How to Solve it by Computer”, 2nd Impression, Pearson Education.

COURSE OUTCOMES

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

1. Explain the principles of algorithm analysis, searching, sorting, linear and non-linear data structures, and graph representations for computational problem solving.
2. Apply appropriate data structures, searching, sorting, and algorithmic techniques to develop efficient solutions for computational problems.
3. Analyze the performance of data structures and algorithms using complexity analysis to select suitable approaches for diverse applications.
4. Evaluate alternative data structures and algorithmic strategies based on efficiency, scalability, and computational requirements.
5. Develop optimized software solutions by integrating suitable data structures, algorithm design techniques, and complexity analysis.

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

25ITPC305	DATABASE MANAGEMENT SYSTEM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand database architecture, data models, DDL/DML, query languages, storage, transactions, and security concepts.
- Design schemas and implement SQL queries, indexing, concurrency, and access-control techniques.
- Analyze data models, normalization, query optimization, storage strategies, and security threats.
- Assess efficiency and robustness of database designs, query plans, and concurrency/security schemes.
- Design secure, optimized database systems for real-world and distributed applications.

UNIT I

Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).

Data models: Entity-relationship model, network model, relational and object-oriented data models, integrity constraints, data manipulation operations.

UNIT II

Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, open-source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL Server.

Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.

Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

UNIT III

Storage strategies: Indices, B-trees, hashing.

UNIT IV

Transaction processing: Concurrency control, ACID properties, Serializability of scheduling, locking and timestamp-based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

UNIT V

Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

Advanced topics: Object-oriented and object-relational databases, logical databases, Web databases, Distributed databases, Data warehousing and data mining.

TEXTBOOKS

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", 6th Edition, McGraw-Hill.

REFERENCES

1. J. D. Ullman, "Principles of Database and Knowledge-Base Systems", Vol 1, Computer Science Press.
2. R. Elmasri and S. Navathe, "Fundamentals of Database Systems", 5th Edition, Pearson Education
3. Serge Abiteboul, Richard Hull, Victor Vianu, "Foundations of Databases", Addison-Wesley

COURSE OUTCOMES

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

1. Summarize database architecture, data models, DDL/DML, SQL, indexing, ACID properties, concurrency/recovery, and security concepts.
2. Design schemas, execute SQL queries, implement indexing, and apply concurrency and access-control mechanisms.
3. Analyze normalization, query plans, indexing performance, transaction schedules, and security vulnerabilities.
4. Assess database designs, optimization strategies, concurrency/recovery schemes, and security mechanisms for efficiency.
5. Design a complete, secure, optimized database system covering schema, queries, storage, transactions, and access control.

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

25ITPC306	OBJECT-ORIENTED PROGRAMMING USING JAVA	L	T	P	C
		3	1	0	3

COURSE OBJECTIVES

- To illustrate object-oriented programming principles for developing reusable software solutions.
- To interpret inheritance, polymorphism, interfaces, and packages for modular application development.
- To apply exception handling, multithreading, and file processing techniques in Java applications.
- To examine database connectivity using JDBC and event-driven GUI programming with Java.
- To develop robust Java applications integrating object-oriented concepts, database access, and graphical user interfaces.

UNIT I

OOP concepts: Classes and objects, data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, procedural and object-oriented programming paradigm. Java programming: History of java, comments data types, variables, constants, scope and life time of variables, operators, operator hierarchy, expressions, type conversion and casting, enumerated types, control flow statements, jump statements, simple java stand alone programs, arrays, console input and output, formatting output, constructors, methods, parameter passing, static fields and methods, access control, this reference, overloading methods and constructors, recursion, garbage collection, exploring string class.

UNIT II

Inheritance: Inheritance hierarchies, super and subclasses, member access rules, super keyword, preventing inheritance: final classes and methods, the object class and its methods; Polymorphism: dynamic binding, method overriding, abstract classes and methods; Interface: Interfaces VS Abstract classes, defining an interface, implement interfaces, accessing implementations through interface references, extending interface; Packages: Defining, creating and accessing a package, understanding CLASSPATH, importing packages.

UNIT III

Exception Handling: Benefits of exception handling, the classification of exceptions, exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throws and finally, rethrowing exceptions, exception specification, built-in exceptions, creating own exception subclasses. Multithreading: Differences between multiple processes and multiple threads, thread states, creating threads, interrupting threads, thread priorities, synchronizing threads, inter-thread communication.

UNIT IV

Files: streams, byte streams, character streams, text input/output, binary input/output, random access file operations, file management using file class: Connecting to Database, querying a database and processing the results, updating data with JDBC

UNIT V

GUI Programming with Java: The AWT class hierarchy, introduction to Swing, Swing vs AWT, hierarchy for Swing components. Containers: JFrame, JApplet, JDialog, JPanel, overview of some Swing components: JButton, JLabel, JTextField, JTextArea, simple applications. Layout management: Layout manager types, border, grid, and flow. Applets: Inheritance hierarchy for applets, differences between applets and applications, life cycle of an applet, passing parameters to applets.

TEXTBOOKS

1. Herbert Schildt and Dale Skrien, “Java Fundamentals – A Comprehensive Introduction”, McGraw Hill, 1st Edition, 2013.
2. Herbert Schildt, “Java the Complete Reference”, McGraw-Hill, Osborne, 7th Edition, 2011.
3. T. Budd, “Understanding Object- Oriented Programming with Java”, Pearson Education, Updated Edition (New Java 2 Coverage), 1999.

REFERENCE BOOKS

1. P. J. Dietel and H. M. Dietel, “Java How to Program”, Prentice Hall, 6th Edition, 2005.
2. P. Radha Krishna, “Object-Oriented Programming through Java”, CRC Press, 1st Edition, 2007.
3. S. Malhotra and S. Choudhary, “Programming in Java”, Oxford University Press, 2nd Edition, 2014

WEB REFERENCES

1. <http://java.sun.com>
2. <http://www.oracle.com/technetwork/java/index.html>
3. <http://java.sun.com/javase>
4. <http://www.oracle.com/technetwork/java/javase/overview/index.html>
5. <http://download.oracle.com/javase/7/docs/api/index.html>

COURSE OUTCOMES

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

1. Explain object-oriented programming principles, Java language features, exception handling, multithreading, database connectivity, and GUI programming concepts.
2. Apply object-oriented principles, Java programming constructs, JDBC, and GUI components to develop efficient software applications.
3. Analyze Java applications using inheritance, polymorphism, exception handling, multithreading, file processing, and database integration techniques.
4. Evaluate Java-based software solutions by selecting appropriate object-oriented, database, multithreading, and graphical user interface techniques.
5. Develop robust Java applications by integrating object-oriented programming, database connectivity, file handling, multithreading, and GUI frameworks.

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

25ITPCP308	DATA STRUCTURES AND ALGORITHMS LAB	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES

- To implement basic and linked data structures — List, Stack, Queue ADTs, linked lists, binary search, and tree traversals — using array and linked representations.
- To analyze and compare the efficiency of sorting techniques and graph algorithms such as Dijkstra's and DFS.
- To design and develop real-world applications using linked lists, stacks, and queues.

LIST OF EXERCISES

1. Array implementation of List ADT, Stack ADT, Queue ADT.
2. Implementation of a singly linked list (addition, deletion, insertion in all positions).
3. Implementation of a doubly linked list (addition, deletion, insertion in all positions).
4. Implementation of Stack and Queues using a linked list.
5. Implementation of binary search technique.
6. Program for tree traversal (inorder, postorder, preorder).
7. Implementation of Quick sort, Merge sort, Shell sort.
8. Implementation of Dijkstra's algorithm.
9. Implementation of Depth First Search.
10. Applications of Linked List, Stack and Queue in the real world.

COURSE OUTCOMES

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

1. Implement basic and linked data structures - List, Stack, Queue ADTs, singly/doubly linked lists, binary search, and tree traversals - using array and linked list representations.
2. Analyze and compare the efficiency of sorting techniques (Quick, Merge, Shell sort) and graph algorithms (Dijkstra's, DFS) for solving computational problems.
3. Design and develop real-world applications using linked lists, stacks, and queues to solve practical problems.

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

25ITPCP309	DATABASE MANAGEMENT SYSTEM LAB	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES

- To understand the concepts of relational databases, SQL commands, database design, and normalization through practical exercises.
- To apply SQL, PL/SQL, database objects, joins, subqueries, functions, procedures, triggers, and exception handling to solve database problems.
- To design, implement, and evaluate efficient database applications using appropriate SQL techniques and database management concepts.

LIST OF EXERCISES

1. Implementation of queries for student database
2. Data Definition Language – with constraints and without constraints
3. Data Manipulation Language – Insert, Delete, Update, Select and Truncate
4. Transaction Control Statement – Commit, Savepoint, Rollback
5. Data Control Statement – Grant, Revoke
6. Data Projection Statement – Multi-column, alias name, arithmetic operations, distinct records, concatenation, WHERE clause
7. Data Selection Statement – BETWEEN, AND, NOT IN, LIKE, relational operators and logical operators
8. Aggregate functions – count, maximum, minimum, sum, average, order by, group by, having
9. Join queries – inner join, outer join, self join, Cartesian join, or cross join
10. Subqueries – in, not in, some, any, all, exists, not exists
11. Set operations – union, union all, intersect, minus
12. Database objects – synonym, sequences, views and index
13. Cursor
14. Functions and procedures
15. Trigger
16. Exceptions
17. Packages
18. Factorial of a number
19. Checking whether a number is prime or not
20. Fibonacci series
21. Reverse the string
22. Swapping of numbers
23. Odd or even number
24. Duplication of records

COURSE OUTCOMES

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

1. Demonstrate database creation, SQL commands (DDL, DML, DCL, TCL), queries, and relational database concepts through practical implementation.
2. Apply SQL functions, joins, subqueries, set operations, database objects, PL/SQL programs, procedures, functions, triggers, and exception handling to solve database problems.
3. Design, implement, and evaluate a database application using normalization, E-R concepts, and SQL techniques to develop efficient real-world database solutions.

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

FOURTH SEMESTER

25ITBS401	DISCRETE MATHEMATICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Provide a strong foundation in mathematical logic, set theory, lattice theory, Boolean algebra, algebraic structures, coding theory, and graph theory for solving computing problems.
- Develop analytical skills to model, represent, and analyze mathematical structures, logical systems, relations, groups, codes, and graphs used in Information Technology.
- Enable students to apply mathematical concepts, algorithms, and algebraic techniques in designing efficient computational models and solving engineering problems.
- Strengthen students' ability to evaluate mathematical models, coding techniques, graph algorithms, and logical reasoning for real-world Information Technology applications.
- Prepare students to design and implement mathematical and graph-based solutions using discrete mathematical principles for advanced computing and research applications.

UNIT I Mathematical Logic

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

UNIT II Set Theory and Relations

Set operations – Ordered pairs and Cartesian product – Relations – Types of relations – Operations on relations – Properties of relations – Equivalence classes – Partition of a set – Matrix and Graphical representation of relations.

UNIT III Lattice and Boolean Algebra

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

UNIT IV Group and Group Code

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

UNIT V Graph Theory

Graphs – Special simple graphs – Matrix representation of graphs – Paths, cycles and connectivity – Eulerian and Hamiltonian graphs – Shortest path algorithms.

TEXTBOOKS

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

REFERENCES

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

COURSE OUTCOMES

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

1. Explain the principles of mathematical logic, set theory, lattice theory, Boolean algebra, algebraic structures, coding theory, and graph theory used in Information Technology.
2. Analyze logical expressions, mathematical relations, lattices, algebraic structures, coding techniques, and graph models to solve engineering problems.
3. Apply mathematical reasoning, Boolean algebra, coding methods, and graph algorithms to develop solutions for computational and engineering applications.

- Evaluate mathematical models, coding schemes, graph algorithms, and algebraic structures to determine efficient and reliable solutions for complex problems.
- Design mathematical models and computational solutions using concepts of logic, set theory, Boolean algebra, coding theory, and graph theory to address real-world Information Technology challenges.

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

25ITES402	PYTHON PROGRAMMING	L	T	P	C
		2	0	0	3

COURSE OBJECTIVES

- To understand the fundamentals of Python programming, programming constructs, and control structures.
- To develop Python programs using data structures, functions, modules, and standard packages.
- To apply object-oriented programming concepts for designing modular applications.
- To implement file handling, exception handling, networking, and database operations using Python.
- To design interactive graphical user interface (GUI) applications using Tkinter.

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

UNIT II Strings, Lists, Tuples, Sets, and Dictionaries

String basics and methods –Formatting strings and numbers– Basics and methods of Lists, Tuples, Sets, and Dictionaries.

Functions: Simple and mathematical Python built-in functions - Defining a user-defined function – Calling a function –Functions with/without return values – Positional, keyword, and default arguments – Passing arguments by reference values – Modularizing code -The scope of variables – Returning multiple values – Lambda functions.

Modules and Packages: Importing modules – Random module - Generating random numbers and ASCII characters – Introduction to standard Python packages: NumPy, Pandas, and Matplotlib.

UNIT III Object-Oriented Programming

Introduction to object-oriented programming – Basic principles of object – oriented programming in Python – Class definition, Object creation – Python object system – Object representation, Attribute binding - Inheritance - Operator overloading– Python special modules - Memory management, and Special properties of classes including properties, slots, and private attributes.

UNIT IV Files, Exception Handling, and Network Programming

Introduction –Text input and output – File operations using Python – Binary IO using pickling - Exception handling – Raising exceptions – Processing exceptions using exception objects – Defining custom exception classes – Client-server architecture- Sockets – Creating and executing TCP and UDP client-server.

UNIT V Database and GUI Programming

DBM database – SQL database – GUI programming using Tkinter: Introduction – Getting started with Tkinter – Processing events – The widget classes – canvas – Geometry managers – Displaying images – Menus – Popup menus – Mouse, key events, and bindings –List boxes – Animations – Scrollbars – Standard dialog boxes–Grids.

TEXTBOOKS

1. Y. Daniel Liang, Introduction to Programming using Python, Pearson Education, 2013.
2. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021
3. Wesley J Chun “Core Python Applications Programming”, Prentice Hall, 2012.

REFERENCE BOOKS

1. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, First Edition, 2021.
2. G Venkatesh and Madhavan Mukund, “Computational Thinking: A Primer for Programmers and Data Scientists”, First Edition, Notion Press, 2021.
3. Eric Matthes, “Python Crash Course: A Hands-on Project-Based Introduction to Programming”, Second Edition, No Starch Press, 2019.
4. Martin C. Brown, “Python: The Complete Reference”, 4th Edition, McGraw-Hill, 2018.
5. Mark Lutz, “Learning Python, Powerful OOPs”, O’Reilly, 2011.
6. <https://www.python.org/>

COURSE OUTCOMES

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

1. Describe control structures, variable scope, module imports, class definition, file I/O, exception handling, TCP/UDP sockets, and Tkinter event-driven programming.
2. Implement programs using loops, functions, data structures, OOP, file handling, custom exceptions, socket communication, and Tkinter GUI with database connectivity.
3. Contrast iterative constructs, function types, procedural vs OOP design, exception propagation, TCP vs UDP protocols, and DBM vs SQL database approaches.
4. Select and justify appropriate data structures, function types, OOP design patterns, exception strategies, network protocols, and database and GUI design choices.
5. Design and develop modular, object-oriented, networked, and data-driven applications integrating functions, classes, file handling, sockets, databases, and Tkinter GUIs.

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

25ITPC403	OPERATING SYSTEM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Introduce the fundamentals of operating systems, including process, memory, file, and device management.
- Explain operating system concepts, scheduling, synchronization, deadlocks, and memory management.
- Apply operating system algorithms and resource management techniques to solve computing problems.
- Analyze the performance of operating system algorithms and resource management techniques.
- Evaluate operating system strategies for efficient and reliable system performance.

UNIT I Introduction to Os and System Structure

Introduction: Concept of Operating Systems (OS), Generations of OS, Types of OS, OS Services, Interrupt handling and System Calls, Basic architectural concepts of an OS, Concept of Virtual Machine, Resource Manager view, process view and hierarchical view of an OS.

UNIT II Process Management and Scheduling Algorithms

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, and Response Time. Scheduling algorithms: Pre-emptive and non-pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling; Real-time scheduling: RM and EDF.

UNIT III Process Synchronization, Threads and Deadlocks

Inter-process Communication: Concurrent processes, precedence graphs, Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Semaphores, Strict Alternation, Peterson's Solution, The Producer / Consumer Problem, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dining Philosopher Problem, Barber's shop problem. Concurrent Programming: Critical region, conditional critical region, monitors, concurrent languages, communicating sequential process (CSP); Deadlocks - prevention, avoidance, detection and recovery. Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreading. Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention and Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

UNIT IV Memory Management

Memory Management: Basic concepts, Logical and Physical address maps, Memory allocation: Contiguous Memory allocation – Fixed and variable partition– Internal and External fragmentation and Compaction. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page allocation, Partitioning, Paging, Page fault, Working Set, Segmentation, Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

UNIT V File Systems, I/O and Device Management

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. I/O Hardware: I/O devices, Device controllers, Direct Memory Access, Principles of I/O. Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks. Case Study: NIX OS file system, shell, filters, shell programming, programming with the standard I/O, UNIX system calls.

COURSE OUTCOMES

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

1. Explain the architecture, services, and core functions of operating systems, including process, memory, file, and device management.
2. Apply operating system algorithms for process scheduling, synchronization, deadlock handling, memory allocation, and file management.
3. Analyze the performance of CPU scheduling, synchronization, deadlock prevention, memory management, and disk scheduling techniques.
4. Evaluate operating system strategies and resource management policies based on performance, efficiency, and reliability.
5. Design efficient operating system solutions by integrating process management, synchronization, memory management, and file/device management concepts for real-world applications.

TEXTBOOKS

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne. Operating System Concepts, Wiley, 10th Edition, 2019.
2. Tanenbaum, Andrew S., and Albert S. Woodhull. Operating systems: design and implementation. Vol. 68. Englewood Cliffs: Prentice Hall, 1997.

REFERENCE BOOKS

1. Remzi H. Arpaci-Dusseau, Andrea C. Arpaci-Dusseau, Operating Systems: Three Easy Pieces, Arpaci-Dusseau Books, Inc, 2015.
2. Dhamdhere, Dhananjay M. Operating systems: a concept-based approach, 2E. Tata McGraw-Hill Education, 2006.
3. Deitel, Harvey M., Paul J. Deitel, and David R. Choffnes. Operating systems. Delhi. Pearson Education: Dorling Kindersley, 2004.
4. Milenković, Milan. Operating systems: concepts and design. McGraw-Hill, Inc., 1987.

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

25ITPC404	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce the fundamental concepts of computer networks, network hardware/software, and reference models (OSI, TCP/IP).
- To understand the design issues, protocols, and error control mechanisms of the Data Link Layer and Medium Access sublayer.
- To study the working of the Network Layer, including routing algorithms, congestion control, and IPv4/IPv6.

- To gain knowledge of Transport Layer protocols (TCP, UDP) and their role in reliable data communication.
- To familiarize students with Application Layer protocols and services such as DNS, HTTP, FTP, SMTP, SNMP, and Telnet

UNIT I Introduction

Network applications, network hardware, network software, reference models: OSI, TCP/IP, Internet, connection-oriented network X. 25, frame relay. The physical layer: Theoretical basis for communication, guided transmission media, wireless transmission, the public switched telephone networks, mobile telephone system.

UNIT II The Data Link Layer

Design issues, error detection and correction, elementary datalink protocols, sliding window protocols, example datalink protocols- HDLC, the datalink layer in the internet. The medium access sublayer: channel allocation problem, multiple access protocols, Ethernet, Data Link Layer switching, Wireless LAN, Broadband Wireless, Bluetooth.

UNIT III The Network Layer

Network layer design issues, routing algorithms, Congestion control algorithms, Internetworking, the network layer in the Internet (IPv4 and IPv6), Quality of Service.

UNIT IV The Transport Layer

Transport service, elements of transport protocol, Simple Transport Protocol, Internet transport layer protocols: UDP and TCP.

UNIT V The Application Layer

Domain name system, electronic mail, World Wide Web: architectural overview, dynamic web document and HTTP. APPLICATION LAYER PROTOCOLS: Simple Network Management Protocol, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet.

TEXTBOOKS

1. Behrouz A. Forouzan, “Data Communications and Networking”, 4th Edition, McGraw- Hill.
2. William Stallings, “Data and Computer Communication”, 8th Edition, Pearson Prentice Hall India.

REFERENCES

1. Andrew S. Tanenbaum, “Computer Networks”, 8th Edition, Pearson New International Edition.
2. Douglas Comer, “Internetworking with TCP/IP”, Volume 1, 6th Edition, Prentice Hall of India.
3. W. Richard Stevens, “TCP/IP”, Illustrated, Volume 1, Addison-Wesley, United States of America.

COURSE OUTCOMES

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

1. Explain the working principles of transmission media, error detection/correction, routing/congestion control algorithms, TCP/UDP mechanisms, and application layer protocols (DNS, HTTP, FTP, SMTP, SNMP, Telnet).
2. Apply data link protocols (HDLC, sliding window), MAC protocols (Ethernet, Wi-Fi, Bluetooth), IPv4/IPv6 addressing, and transport/application protocols to solve networking problems.
3. Analyze performance of multiple access protocols, routing/congestion algorithms, QoS mechanisms, and transport protocols (TCP/UDP) for given network scenarios spanning physical to application layers.
4. Compare and evaluate reference models, switching techniques (X.25, Frame Relay), wireless technologies, and application layer services to justify suitable network design choices.
5. Design network solutions integrating physical media selection, data link/MAC protocols, network layer routing, transport protocols, and application layer services to meet specified requirements.

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

25ITPC405	SYSTEM SOFTWARE AND COMPILER DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the major functions of system software and the interaction between hardware and software.
- To identify the design, functions, and implementation of assemblers, linkers, loaders, macro processors, and system software tools.
- To understand the fundamental concepts and practical implementation of compilers.
- To apply context-free grammar and parsing techniques in compiler design.
- To understand and develop syntax trees, symbol tables, intermediate representations, and target code generation techniques.

UNIT I

Basics of System Software and Assembler, Loaders and Linkers: Introduction – System software and SIC/XE machine architecture-Basic assembler functions: Assembler algorithms and data structures – Machine-dependent assembler features – Machine-independent assembler features. Basic loader functions: Design of an Absolute Loader – A Simple Bootstrap Loader – Machine-dependent loader features – Machine-independent loader features.

UNIT II

Macro Processors and Other System Software: Basic macro processor functions – Macro Definition and Expansion – Macro Processor Algorithm and data structures – Implementation examples: MASM Macro Processor – Text editors – Overview of Editing Process – User Interface-Editor Structure-Interactive Debugging Systems – Debugging functions and capabilities – Relationships with Other parts of the system – User Interface Criteria – Virtual Machines.

UNIT III

Compiler – Lexical Analysis: Phases of Compiler – Compiler Construction Tools – Lexical Analysis: Role of a Lexical analyzer – input buffering – specification and recognition of tokens – Finite Automata – Designing a lexical analyzer generator – Pattern matching based on NFA.

UNIT IV

Compiler– Syntax Analysis, Syntax-Directed Translation: Role of Parser – Top-down parsing – recursive descent and predictive parsers (LL) – Bottom-Up parsing – Operator precedence parsing – LR, SLR and LALR parsers – parser generators – syntax-directed translation – S-attributed definition– L-attributed definition.

UNIT V

Compiler – Code Generation, Optimization: Intermediate languages – graphical representations – DAGs – Three address code-types of three address statements – syntax directed translation into three address code-implementation of three address statements – Code Optimization: Machine dependent and machine independent code generation – Sources of optimization – Code Generation – Semantic stacks – evaluation of expressions – control structures and procedure calls.

TEXTBOOKS

1. Leland Beck, – “System Software-An Introduction to Systems Programming”, Pearson Education, Inc., Third Edition, 2008
2. A.V. Aho, R. Shethi and J. D. Ullman; “Compilers – Principles, Techniques and Tools”, Pearson Education, Second Edition, 2002.

REFERENCES

1. D.M. Dhamdhare, "Systems Programming and Operating Systems", Tata McGraw Hill Company, Second Edition, 2009.
2. John J. Donovan, “Systems Programming”, Tata McGraw Hill Company, Second Edition, 2000.
3. V. Raghavan, “Principles of Compiler Design”, Tata McGraw Hill Education Publishers, 2010.
4. Srimanta Pal, “Systems Programming”, Oxford University Press, 2011.

COURSE OUTCOMES

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

1. Recognize and describe the core concepts, components, and principles of system software and compiler design.
2. Utilize appropriate algorithms and methods to address problems in system software and compiler design.
3. Examine and distinguish various algorithms, methods, and strategies employed in system software and compiler design.
4. Assess and validate the efficiency and appropriateness of techniques used in system software and compiler design.
5. Formulate and implement effective solutions for system software and compiler design problems.

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

25ITPC406	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the fundamentals of software engineering processes, ethics, and process models.
- To learn requirements engineering including elicitation, specification, and validation techniques.
- To study system modeling and architectural design patterns for software systems.
- To gain knowledge of software testing techniques, evolution, maintenance, and reuse.
- To understand risk management, project planning, quality standards, and dependable/secure systems.

UNIT I

Professional software development – Software engineering ethics - Process activities- Software specification, Software design and implementation, Software validation, Software evolution – Software process models.

UNIT II

Functional requirements - Non-Functional requirements – Requirements engineering processes - Requirements elicitation – Requirements elicitation techniques: Interviewing, Ethnography – Requirements Specification – Requirements validation – Requirements change.

UNIT III

Context models – Interaction models, Structural models, Behavioural models, Model-driven engineering, Architectural Design- Architectural Views- Architectural Patterns: Layered, Repository, Client- Server, Pipe-and-Filter, Overview of Design and Implementation.

UNIT IV

Testing Fundamentals – Test Plan creation – Test case generation – Testing techniques: Black Box and White Box, Levels of Testing, Types of Testing, Validation and Verification – Object-Oriented Testing - Test-Driven Development. Evolution processes - Software Maintenance – Software Reengineering – Software reuse: Reuse landscape, Application frameworks, Application system reuse – Component-based software engineering.

UNIT V

Risk Management: risk identification, risk analysis, risk planning, risk monitoring-Managing People- Project Planning- Process, Scheduling, Estimation techniques, Software configuration management, Software Quality, Software standards – the ISO9001 standards framework. Overview of dependable systems, Safety-critical systems- Safety requirements, Safety Engineering processes, Security and organizations – Cybersecurity –Socio-technical resilience.

TEXTBOOKS

1. Ian Sommerville, “Software Engineering”, 10th Edition, Pearson Education Asia, 2016.

REFERENCES

1. Roger S. Pressman, “Software Engineering – A Practitioner’s Approach”, Ninth Edition, McGraw Hill International Edition, 2016.

COURSE OUTCOMES

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

1. Explain software engineering ethics, process activities, process models, requirements engineering concepts, system modeling, testing fundamentals, and risk/quality management principles.
2. Apply requirements elicitation techniques, architectural patterns (Layered, Client-Server, Pipe-and-Filter), testing techniques (Black-Box/White-Box), and project planning/estimation techniques to software development scenarios.

3. Analyze functional/non-functional requirements, structural/behavioral/context models, test cases across testing levels, and risks in software projects.
4. Evaluate architectural design choices, software reuse strategies, verification/validation outcomes, and compliance with quality standards (ISO 9001) and safety/security requirements.
5. Design software specifications, system architectures, test plans, and risk/project management strategies incorporating dependability, safety, and security for real-world software systems.

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

25ITPCP408	OPERATING SYSTEM LAB	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES

- To acquire knowledge of UNIX/Linux commands and system calls and develop programs in a Linux environment.
- To understand and implement process management and process synchronization techniques used in operating systems.
- To study and practice various memory management mechanisms and their applications in operating systems.

LIST OF EXERCISES

1. Study of basic UNIX/Linux commands
2. Shell Programming - I
 - a) To write a Shell program to count the number of words in a file.
 - b) To write a Shell program to calculate the factorial of a given number.
 - c) To write a Shell program to generate the Fibonacci series.
 - d) Write a Shell Program to wish the user based on the login time.
3. Shell Programming - II
 - a) Loops
 - b) Patterns
 - c) Expansions
 - d) Substitutions
4. Programs using the following system calls of the UNIX/Linux operating system: fork, exec, getpid, exit, wait, close, stat, open dir, read dir.
5. Process control system calls - demonstration of fork, exec, and wait
6. Deadlock avoidance using semaphores.
7. Program to simulate preemptive and non-preemptive process scheduling algorithms.
8. Implementation of process scheduling
9. Illustration of interprocess communication strategies

10. Implementation of mutual exclusion by semaphores
11. Deadlock prevention & avoidance algorithms
12. Virtual memory: paging and segmentation
13. Implementation of page replacement algorithms
14. Implementation of disk scheduling algorithms
15. Implementation of file structures

COURSE OUTCOMES

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

1. Understand and apply Linux commands, system calls, process management, and synchronization techniques.
2. Analyze and implement IPC mechanisms, multithreading concepts, and process synchronization methods.
3. Evaluate and implement memory management, page replacement, and file allocation and organization techniques.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Program Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	3	–	–	1	1	–	2	3	2	–
CO2	3	3	2	2	3	–	–	2	1	1	2	3	3	1
CO3	3	3	2	3	3	–	–	1	1	1	2	3	3	1

25ITPCP409	COMPUTER NETWORKS LAB	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES

- Implement network programming concepts using socket programming and communication protocols.
- Analyze network protocols, routing algorithms, and performance using simulation tools.
- Design secure and efficient network applications using networking and security techniques.

LIST OF EXERCISES

1. Implementation of a socket program for Echo/Ping/Talk commands.
2. Creation of a socket between two computers and enabling file transfer between them.
3. Using (a.) TCP (b.) UDP
4. Implementation of a program for Remote Command Execution (Two M/Cs may be used).
5. Implementation of a program for CRC and Hamming code for error handling.
6. Write code for simulating Sliding Window Protocols.
7. Create a socket for HTTP for web page upload & download.
8. Write a program for TCP module Implementation. (TCP services).
9. Write a program to implement RCP (Remote Capture Screen).
10. Implementation (using NS2/Glomosim) and Performance evaluation of the following routing protocols:
 - a. Shortest path routing
 - b. Flooding

- c. Link State
- d. Hierarchical

11. Broadcast /Multicast routing.
12. Implementation of ARP.
13. Throughput comparison between 802.3 and 802.11.
14. Study of Key distribution and Certification schemes.
15. Design of an E-Mail system
16. Implementation of Security Compromise on a Node using NS2 / Glomosim
17. Implementation of Various Traffic Sources using NS2 / GloMoSim

COURSE OUTCOMES

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

1. Implement network applications using socket programming and communication protocols.
2. Analyze network protocols, routing algorithms, error control, and network performance.
3. Design and evaluate secure and efficient network applications.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Program Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	–	3	–	–	–	1	–	2	3	3	–
CO2	3	3	2	2	3	–	–	–	1	–	2	3	3	–
CO3	3	3	3	2	3	2	1	–	2	–	2	3	3	1

FIFTH SEMESTER

25ITPC501	COMPUTER GRAPHICS AND MULTIMEDIA	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand graphics fundamentals, coordinate systems, primitives, 2D/3D transformations and viewing, multimedia concepts and data standards.
- Apply transformation, viewing, and clipping techniques for 2D/3D graphics; apply multimedia interface standards in system design.
- Develop OpenGL programming skills for graphics primitives and transformations; analyze multimedia architecture and I/O technologies.
- Analyze object representation, visible surfaces, color models, design multimedia databases and hypermedia systems.

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

Multimedia File Handling and Hypermedia: Compression and Decompression – Data and File Format Standards – Multimedia I/O Technologies – Digital Voice and Audio – Video, Image and Animation – Full Motion Video – Storage and Retrieval Technologies – Multimedia Authoring and User Interface – Hypermedia Messaging.

TEXTBOOKS

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

REFERENCES

1. Francis S. Hill Jr. and Stephen M Kelley, “Computer Graphics Using OpenGL”, Third Edition, Prentice Hall, 2007.
2. Foley, Vandam, Feiner, and Hughes, “Computer Graphics: Principles and Practice”, Second Edition, Pearson Education, 2003.
3. Ralf Steinmetz and Klara Steinmetz, "Multimedia Computing, Communications and Applications", Pearson Education, 2004.
4. Judith Jeffcoate, “Multimedia in practice: Technology and Applications”, PHI, 1998.

COURSE OUTCOMES

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

1. Describe graphics system fundamentals, coordinate representation, 2D/3D transformation concepts, multimedia components, and file formats.
2. Explain graphics primitives and OpenGL basics, apply 2D/3D transformation and viewing techniques, and describe multimedia data interface standards.
3. Implement graphics primitives using OpenGL, apply clipping algorithms and 3D object representation, and analyze multimedia architectures and I/O technologies.
4. Analyze implementation algorithms for primitives, investigate visible surface detection, splines, color models, and evaluate multimedia database design and storage technologies.
5. Evaluate 2D/3D transformation and rendering using OpenGL, design/develop multimedia databases, compression solutions, and hypermedia systems.

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

25ITPC502	SOFTWARE METRICS AND QUALITY ASSURANCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Provide knowledge of software metrics and measurement.
- Develop understanding of product, process, and quality metrics.
- Introduce Software Quality Assurance principles and quality management tools.
- Familiarize students with software quality models and standards.
- Enable software quality assessment, auditing, and process improvement.

UNIT I Introduction to Software Metrics

Fundamentals of measurement - Scope of software metrics - Measurement theory –Software measurement validation- Software metrics data collection – Analysis methods.

UNIT II Product and Quality Metrics

Measurement of internet product attributes - size and structure - external product attributes measurement of quality - Software quality metrics - product quality - process quality - metrics for software maintenance.

UNIT III Fundamentals of Software Quality Assurance

SQA basics - Software quality in business context – Planning for software quality assurance – Product quality and process quality – Software process models - Total Quality Management - 7QC Tools and Modern Tools.

UNIT IV Quality Assurance Models

Models for Quality Assurance - ISO-9000 – Series – CMM – CMMI - Test Maturity Models, SPICE, Malcolm Baldrige Model – P - CMM.

UNIT V Software Quality Assurance Trends

Software Process - PSP and TSP - OO Methodology, Clean-room software engineering, Defect injection and prevention - Internal Auditing and Assessments - Inspections & Walkthroughs.

TEXTBOOKS

1. Norman Fenton, James Bieman. “Software Metrics: A Rigorous and Practical Approach”, Third Edition, 2014

REFERENCES

1. Norman E. Fenton and Shari Lawrence Pfleeger, “Software metrics”, International Thomson Computer Press, 1997.
2. Stephen H. Kan, “Metrics and models in software quality engineering”, Second edition, Addison-Wesley Professional, 2002.
3. William A. Florac and Areitor D. Carletow, “Measuring the Software Process”, Addison – Wesley, 1995.
4. Robert B. Grady, “Practical Software Metrics for Project Management and Process Improvement”, Prentice Hall, 1992.

COURSE OUTCOMES

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

1. Understand software metrics, quality metrics, SQA concepts, quality models, and software quality practices.
2. Apply software metrics, quality assurance techniques, and quality tools in software development.
3. Analyze software quality data, processes, defects, and quality assurance practices.
4. Evaluate software quality models, standards, auditing methods, and inspection techniques.
5. Design software quality assurance solutions for continuous process improvement.

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

25ITPC503	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand AI foundations, agents, logic, uncertainty, and deep learning concepts across all units.
- Apply search, game theory, inference, Bayesian/temporal reasoning, and MDP techniques to problems.
- Analyze agent, reasoning, and decision-making models for their strengths and limitations.

- Evaluate search, knowledge-representation, and decision strategies for real-world suitability.
- Create Deep learning applications (CNN/RNN) integrated with agent reasoning and decision-making.

UNIT I

Introduction: What is AI? - The Foundations of Artificial Intelligence - The History of Artificial Intelligence - The State of the Art - Risks and Benefits of AI. Intelligent Agents: Agents and Environments - Good Behavior: The Concept of Rationality - The Nature of Environments - The Structure of Agents - Problem-Solving Agents - Example Problems. Search Algorithms - Uninformed Search Strategies - Informed (Heuristic) Search Strategies - Local Search and Optimization Problems. Game Theory - Optimal Decisions in Games - Heuristic Alpha-Beta Tree Search - Monte Carlo Tree Search.

UNIT II

Logical Agents - Knowledge-Based Agents – Logic - Propositional Logic - Propositional Theorem Proving - Effective Propositional Model Checking - Agents Based on Propositional Logic - Syntax and Semantics of First-Order Logic - Using First-Order Logic - Knowledge Engineering in First-Order Logic. Propositional vs. First-Order Inference - Unification and First-Order Inference - Forward Chaining - Backward Chaining – Resolution - Ontological Engineering - Categories and Objects - Events - Mental Objects and Modal Logic - Reasoning Systems for Categories - Algorithms for Classical Planning.

UNIT III

Acting under Uncertainty - Bayes' Rule and Its Use - Representing Knowledge in an Uncertain Domain - The Semantics of Bayesian Networks - Exact Inference in Bayesian Networks - Approximate Inference for Bayesian Networks - Time and Uncertainty - Inference in Temporal Models - Hidden Markov Models - Kalman Filters - Dynamic Bayesian Networks - Relational Probability Models - Open-Universe Probability Models

UNIT IV

Combining Beliefs and Desires under Uncertainty - Utility Functions - Multiattribute Utility Functions - The Value of Information - Sequential Decision Problems - Algorithms for MDPs - Bandit Problems - Properties of Multiagent Environments - Non-Cooperative and Cooperative Game Theory - Making Collective Decisions

UNIT V

Deep Learning: Simple Feedforward Networks - Computation Graphs for Deep Learning - Convolutional Networks - Learning Algorithms – Generalization - Recurrent Neural Networks – Applications: Recurrent Neural Networks for NLP - Classifying Images using CNN. Humans and Robots.

REFERENCES

1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 4th edition, Pearson, 2020.
2. Kevin Knight, Elaine Rich, Shivashankar B. Nair, “Artificial Intelligence”, 3rd Edition, McGraw Hill Education India, 2017.
3. Lavika Goel, Artificial Intelligence: Concepts and Applications, Wiley India, 2021
4. Deepak Khemani, “Artificial Intelligence”, Tata McGraw Hill Education, 2013.

COURSE OUTCOMES

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

1. Describe AI foundations & agents, logic-based knowledge representation, Bayesian/temporal reasoning, decision-theoretic models, and deep network structures.
2. Apply search/game strategies, logical inference, Bayesian inference, MDP algorithms, and CNN/RNN models to solve AI problems.
3. Analyze agent performance, chaining/resolution reasoning, exact vs. approximate inference, multiagent decisions, and deep network generalization.

- Evaluate search strategies, reasoning schemes, probabilistic models, sequential decision algorithms, and deep learning approaches for real-world use.
- Design an intelligent system combining agent-based problem solving, knowledge-based reasoning, uncertainty handling, decision-making, and deep learning applications like image/NLP classification.

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

25ITPC504	INTERNET TECHNOLOGY AND WEB SERVICES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Foundational knowledge of web architecture, protocols, HTML5, and CSS3 for structured, styled web pages.
- Work with XML documents, namespaces, DOM/SAX parsing, and XSL transformations for data exchange.
- Build dynamic, interactive web apps using client/server-side scripting (JavaScript, JSP, and Servlets).
- Design and analyze asynchronous, event-driven backend apps using Node.js with MongoDB.
- Evaluate and build web services/microservices (SOAP, WSDL, UDDI) for B2B/B2C requirements.

UNIT I Introduction

Basic Web Concepts - Web-based Client/Server model -Web Protocols- Working of web browser - Browser & Server Communication - History of HTML / XHTML / HTML5 – HTML5 Structural Elements Images – HTML5 Form Elements and Attributes- DHTML- CSS3- Selectors- Positioning elements Colors-Shadows-Gradients–Transitions and Transformations.

UNIT II XML

Introduction to XML - XML fundamentals - Well-formed XML documents - XML Namespaces - Document Object Model (DOM) - Simple API for XML (SAX) - Extensible Stylesheet Language (XSL).

UNIT III Scripting Languages

Client-side scripting - Introduction to JavaScript – Arrays – Control statements –Events – Cookies - Introduction to CGI Concepts - Server-side Technologies: Java Server Pages - System Architecture Basic JSP life cycle-JSP elements: Variables and objects – Methods-Implicit Objects- Parsing Request Strings-Session Management. - Java Servlets - Servlet life cycle.

UNIT IV Application Development Using Node Js

Introduction to Node.js- Installing Node.js - Using Events, Listeners, Timers, and Callbacks in Node.js – Introduction to MongoDB - Accessing MongoDB from Node.js.

UNIT V Web Services Building Blocks

Architecting Web Services: Business motivations for web services, B2B, B2C-Web Services Building Blocks: SOAP, WSDL, UDDI - Creating, Publishing, Testing and Describing a Web Service - Microservices Introduction.

COURSE OUTCOMES

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

1. Recall web architecture, HTML5/CSS3, XML rules, JS/JSP/Servlet basics, Node.js/MongoDB, and SOAP/WSDL/UDDI concepts.
2. Explain browser-server communication, XML processing (DOM/SAX/XSL), JSP/Servlet lifecycle, Node.js async model, and B2B/B2C motivations.
3. Build responsive web pages, well-formed XML docs, dynamic scripted apps with sessions, Node.js-MongoDB apps, and SOAP/WSDL services.
4. Analyze browser-server interactions, DOM vs SAX/XSL, client vs server-side scripting, Node.js callbacks/MongoDB ops, and SOA vs microservices.
5. Evaluate/design a styled front-end, XML interchange system, JS/JSP/Servlet app, Node.js-MongoDB backend, and a deployed web service/microservice.

TEXTBOOKS

1. Deital&Deital, "Internet and World Wide Web-How to Program", Pearson Education, Fifth Edition, 2023.
2. Brad Dayley, Brendan Dayley, and Caleb Dayley, Node.js, MongoDB and Angular Web Development: The definitive guide to using the MEAN stack to build web applications, 2nd Edition, Pearson Education, 2018
3. Ron Schmelzer et al. "XML and Web Services", Pearson Education, 2008.

REFERENCES

1. Robert W. Sebesta, "Programming with World Wide Web", Pearson Education, Eighth Edition, 2020. (Web-Based Applications and Their Technologies)
2. Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", Pearson Education, Second Edition, 2007
3. Rashim Mogha, V. V Preetham. V.V. "Java Web Services Programming", Wiley Dream Tech, New Delhi, Java 2 Enterprise Edition, 2011. (Server-Side Technologies)

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

25ITPCP507	COMPUTER GRAPHICS AND MULTIMEDIA LAB	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES

- To understand Principles of graphics algorithms, transformations, clipping, and multimedia tools.

- To apply Bresenham's algorithms, 2D/3D transformations, clipping techniques, and multimedia software to create graphical outputs.
- To create Fractal images, animations, and multimedia content (audio/video/image) using graphics tools and software

LIST OF EXERCISES

- 1) Implementation of Bresenham's algorithm – Line and Circle.
- 2) Implementation of Bresenham's algorithm – Ellipse.
- 3) Implementation of Line, Circle, and Ellipse attributes.
- 4) Two-dimensional transformations – Translation, Rotation, Scaling, Reflection, Shear.
- 5) Cohen-Sutherland 2D line clipping and windowing.
- 6) Sutherland – Hodgman polygon clipping algorithm.
- 7) Three-dimensional transformations – Translation, Rotation, Scaling.
- 8) Drawing three-dimensional objects and scenes.
- 9) Line DDA, chain of diamonds, chessboard.
- 10) Generating Fractal images

11) GIMP

- a) Creating Logos.
- b) Simple Text Animation.

12) Audacity

- a. Silencing, Trimming and Duplicating the Audio Signal.
- b. Giving the Advancing Effect to the Audio Signal.

13) Windows Movie Maker

- a. Applying effects to Video.
- b. Creating Titles in Video.

14) Swish

- i. Text Effects.
- ii. Pre-loader.

15) Flash

- a. Changing the shape of the object.
- b. Image viewing using Mask.

16) Photo Impact

- a. Text Effects.
- b. Image Slicing.

COURSE OUTCOMES

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

1. Implement line, circle, and ellipse drawing using Bresenham's algorithms, 2D/3D geometric transformations, and line/polygon clipping techniques (Exp 5–6) to render and manipulate graphical objects
2. Analyze and construct 3D scenes and objects, pattern-generation algorithms like DDA, chain of diamonds, and chessboard, and fractal image structures to evaluate rendering behavior and geometric patterns
3. Design multimedia content using GIMP for logos and text animation, Audacity for audio editing/effects, Windows Movie Maker for video effects and titles, Swish for text effects and pre-loaders, Flash for shape morphing and masking, and Photo Impact for text effects and image slicing.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Program Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	–	3	–	–	1	–	–	1	3	2	–
CO2	2	3	2	2	3	–	–	1	–	–	1	3	2	–
CO3	1	1	3	1	3	1	–	2	1	–	2	2	3	1

25ITPCP508	INTERNET TECHNOLOGY AND WEB SERVICES LAB	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES

- Analyze the design requirements of websites and construct interactive, dynamic web pages.
- Demonstrate and apply scripting languages by writing simple scripts to build dynamic features on a website.
- Design and develop database applications integrated with web interfaces.

LIST OF EXPERIMENTS

1. Creation of interactive websites - Design using HTML and authoring tools
2. Web page design using CSS, Frames, filters, etc.
3. Case studies like trading systems, a portal system, a reservation system, etc., using Client and Server-Side Technologies
4. Develop applications using XML.
5. Write programs using Servlets:
 - i. To invoke servlets from HTML forms
 - ii. Session tracking using hidden form fields and Session tracking for a hit count
6. Design web pages using the following frameworks: Servlets, Node.js
7. Accessing MongoDB from Node.js
8. Creating, Publishing, Testing and Describing simple Web services
9. Creation of personal Information System

COURSE OUTCOMES

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

1. List robot components/classification, actuator/sensor types, and AI concepts/techniques.
2. Explain robot working principles, actuator/sensor operation, and AI problem-solving approaches.
3. Apply robotic components to handling/assembly tasks, search techniques to state-space problems, and ROS programming to motion planning.

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

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

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

COURSE OBJECTIVES

- Provide exposure to industrial, rural, innovation, and entrepreneurial environments.
- Develop professional, technical, and communication skills through practical training and internships.
- Enhance analytical and problem-solving skills by addressing real-world challenges.
- Strengthen decision-making and evaluation skills in industrial and entrepreneurial practices.
- Encourage innovation, entrepreneurship, and the development of sustainable solutions for societal needs.

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

The students will individually undertake a training program in reputed concerns in the field of Information Technology during summer vacation (at the end of fourth semester) for a minimum stipulated period of four weeks. At the end of training, the student must submit a detailed report on the training undertaken within ten days from the commencement of the fifth semester. The student will be evaluated by a team of staff members nominated by the Head of the Department through a viva-voce examination.

COURSE OUTCOMES

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

1. Interpret industrial practices, rural development activities, innovation processes, and entrepreneurial concepts.
2. Apply technical knowledge, professional ethics, communication, and teamwork skills in industrial or rural internship activities.
3. Analyze real-world industrial or societal problems using appropriate engineering and management practices.
4. Evaluate industrial processes, entrepreneurial opportunities, and innovative solutions based on technical, economic, and societal considerations.
5. Develop innovative or entrepreneurial solutions, technical reports, and professional presentations to address industrial or societal challenges.

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

SIXTH SEMESTER

25ITPC601	ANALYTICS AND DATA MINING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Describe the principles of data mining, machine learning, and data preprocessing.
- Apply association rule mining techniques to extract meaningful patterns from data.
- Examine classification and prediction techniques for data analysis.
- Evaluate clustering and outlier detection methods for knowledge discovery.
- Develop data mining solutions using ensemble learning techniques for real-world applications.

UNIT I Introduction

Data Mining Functionalities, Confluence of Data Mining: Machine Learning – Deep Learning, Data Preprocessing: Data Summarization - Data Cleaning - Data Transformation - Data Reduction: Dimensionality Reduction Techniques.

UNIT II Association Mining

Basic Concepts, Types of Association Rules, Frequent Itemset Mining Methods.

UNIT III Classification and Prediction

Introduction, Decision Tree Induction, Bayesian Classification, Neural Networks: Architecture - Perceptron - Backpropagation, Support Vector Machine, k-Nearest Neighbor, Prediction: Linear Regression, Accuracy measures, Model Evaluation.

UNIT IV Cluster Analysis

Similarity and distance measures, Hierarchical Methods, Partitioning Methods, Density-Based Methods. Outlier detection: Statistical Distribution Based Methods, Proximity Based Methods, Density Based Methods, Deviation Based Methods.

UNIT V Ensemble Learning

Introduction, Bagging, Boosting, Random Forest, Class Imbalance Problem, Multiclass Problem, Mining Time Series Data.

TEXTBOOKS

1. Jiawei Han, Micheline Kamber and Jian Pei, "Data Mining: Concepts and Techniques", Third Edition, Elsevier, 2012.
2. Pang Ning Tan, Michael Steinbach, Anuj Karpatne and Vipin Kumar, "Introduction to Data Mining", Second Edition, Pearson Education, UK, 2019.

REFERENCES

1. Mohammed J. Zaki and Wagner Meira, "Data Mining and Analysis: Fundamental Concepts and Algorithms", Cambridge India, 2014.
2. Rajan Chattammvelli, "Data Mining Methods", Second Edition, Narosa Publishers, 2016.
3. Gupta G K, "Introduction to Data Mining with Case Studies", Second Edition, PHI Learning, 2014.
4. Mehmed Kantardzic, "Data Mining: Concepts, Models, Methods, and Algorithms", Third Edition, Wiley- IEEE Press, 2019.

COURSE OUTCOMES

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

1. Interpret the principles, techniques, and applications of data preprocessing, pattern discovery, predictive modeling, cluster analysis, ensemble learning, and time series mining for knowledge extraction.
2. Utilize appropriate data mining methodologies to preprocess data, discover associations, build predictive models, identify clusters and outliers, and analyze temporal data.

- Investigate the behavior, strengths, and limitations of data preprocessing, association mining, classification, clustering, outlier detection, ensemble learning, and time series mining techniques across diverse datasets.
- Appraise and justify the selection of suitable data mining techniques by considering data characteristics, model performance, and application requirements for effective knowledge discovery.
- Formulate comprehensive data mining solutions by integrating preprocessing, pattern mining, predictive modeling, cluster analysis, ensemble learning, and time series analytics to support intelligent decision-making.

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

25ITPC602	DIGITAL IMAGE PROCESSING				L	T	P	C
					3	0	0	3

COURSE OBJECTIVES

- Illustrate the fundamentals of digital image acquisition, representation, and processing.
- Employ image enhancement and filtering techniques to improve image quality.
- Examine image transformation, compression, and morphological operations for efficient image analysis.
- Assess image segmentation methods for extracting meaningful regions and objects.
- Construct image analysis applications by integrating feature extraction, pattern classification, and intelligent vision techniques.

UNIT I

Introduction: The Origins of Digital Image Processing - Examples of Fields that Use Digital Image Processing - Fundamental Steps in Digital Image Processing - Components of an Image Processing System.

Digital Image Fundamentals: Elements of Visual Perception - Light and the Electromagnetic Spectrum - Image Sensing and Acquisition - Image Sampling and Quantization - Some Basic Relationships Between Pixels - Arithmetic Operations - Set and Logical Operations - Basic Set Operations - Logical Operations - Spatial Operations.

UNIT II

Intensity Transformations: Background - The Basics of Intensity Transformations and Spatial Filtering - Some Basic Intensity Transformation Functions.

Histogram Processing: Histogram Equalization - Histogram Matching - Local Histogram Processing - Using Histogram Statistics for Image Enhancement.

Spatial Filtering: Fundamentals of Spatial Filtering - Smoothing Spatial Filters - Sharpening Spatial Filters.

Filtering in the frequency domain: Image Smoothing Using Lowpass Frequency Domain Filters - Image Sharpening Using High Pass Filters - Selective Filtering.

UNIT III

Image Transforms: Fourier-Related Transforms - Walsh-Hadamard Transforms - Slant Transform - Haar Transform - Wavelet Transforms.

Image Compression: Fundamentals - Huffman Coding -Golomb Coding - Arithmetic Coding - LZW Coding - Run-length Coding - Symbol-based Coding - Bit-plane Coding - Block Transform Coding -Predictive Coding - Wavelet Coding - Digital Image Watermarking.

Morphological Image Processing: Preliminaries - Erosion and Dilation - Opening and Closing - The Hit-or-Miss Transform - Some Basic Morphological Algorithms.

UNIT IV

Image Segmentation: Fundamentals - Point, Line, and Edge Detection - Thresholding - Segmentation by Region Growing and by Region Splitting and Merging - Region Segmentation Using Clustering and Superpixels- Region Segmentation Using Graph Cuts - Segmentation Using Morphological Watersheds - The Use of Motion in Segmentation.

UNIT V

Feature Extraction: Background - Boundary Preprocessing- Boundary Feature Descriptors - Region Feature Descriptors - Principal Components as Feature Descriptors - Scale-Invariant Feature Transform (SIFT).

Image Pattern Classification: Patterns and Pattern Classes - Pattern Classification by Prototype Matching - Bayes Classifier for Gaussian Pattern Classes –Developing Image processing applications using Neural Networks and Deep Learning.

TEXTBOOKS

1. Rafael C. Gonzales, Richard E. Woods, Digital Image Processing, Fourth Edition, Pearson, 2018.
2. Anil K. Jain, “Fundamentals of Digital Image Processing”, Pearson Education India, 2015.

REFERENCES

1. AL. Bovik, “The Essential Guide to Image Processing”, Second Edition, Elsevier, 2009.
2. S. Sridhar, “Digital Image Processing”, Second Edition, Oxford University, 2016.
3. Jayaraman S., Esaki Rajan S., T. Veerakumar, “Digital Image Processing”, Tata McGraw Hill Pvt. Ltd., Second Reprint, 2010.
4. Bhabatosh Chanda, Dwejesh Dutta Majumder, “Digital Image Processing and Analysis”, PHI Learning Pvt. Ltd., Second Edition, 2011.
5. Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, PHI Learning Pvt. Ltd., First Edition, 2011.
6. 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. Interpret the principles of digital image acquisition, enhancement, image transformation, segmentation, and pattern classification for image analysis.
2. Utilize image enhancement, transforms, compression, morphological, segmentation, and feature extraction techniques to process and analyze digital images.
3. Investigate the effectiveness of filtering, transforms, compression, segmentation, feature extraction, and classification methods for solving image processing problems.
4. Appraise appropriate image processing methodologies by selecting suitable enhancement, transforms, segmentation, feature extraction, and classification techniques for diverse application domains.

- Formulate intelligent image processing solutions by integrating image enhancement, transform, compression, segmentation, feature extraction, and deep learning-based classification techniques for real-world vision applications.

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

25ITHS603	MANAGEMENT COURSE- BUSINESS MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To provide engineers with an understanding of business and management.
- To develop skills in leadership, decision-making, and strategic planning.
- To integrate management knowledge into technical and engineering projects
- To introduce concepts of entrepreneurship, innovation, and business ethics.

UNIT I Introduction to Management

Definition, Nature, and Scope of Management - Functions of Management: Planning, Organizing, Leading, Controlling - Evolution of Management Thought: Scientific Management, Administrative, Human Relations, and Modern Approaches - Roles of a Manager in Engineering and Technology Sectors

UNIT II Organizational Behavior and Human Resource Management

Basics of Organizational Behavior: Personality, Perception, Attitudes, Motivation - Leadership and Decision-Making in Organizations - Teamwork and Group Dynamics in Engineering Projects - Basics of Human Resource Management: Recruitment, Training, Performance Appraisal - Work Ethics and Employee Relations

UNIT III Financial & Cost Management

Basics of Financial Accounting: Balance Sheet, Profit & Loss Statement - Cost Accounting for Engineers: Fixed, Variable, and Overhead Costs - Break-even Analysis and Budgeting - Capital Investment Decision-Making: NPV, IRR, Payback Period - Financial Planning in Engineering Projects

UNIT IV Marketing & Operations Management

Basics of Marketing: Market Segmentation, Product Life Cycle, Branding - Marketing Strategies for Engineering Products - Basics of Operations Management: Supply Chain, Inventory Control, Lean Manufacturing - Quality Control and Six Sigma in Engineering

UNIT V Entrepreneurship & Startups

Fundamentals of Entrepreneurship and Business Planning - Innovation and Design Thinking in Business - Legal Aspects of Starting a Business: Company Registration, Intellectual Property Rights (IPR) - Government Policies for Startups in Engineering - Case Studies of Successful Engineering Entrepreneurs

COURSE OUTCOMES

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

1. Recall the fundamental concepts of management, finance, marketing, operations, and entrepreneurship relevant to engineering.
2. Explain the principles of management, organisational behaviour, financial management, and business practices.
3. Apply management tools and business concepts to engineering projects and organizational activities.
4. Examine managerial decisions, business strategies, and operational practices to support organizational effectiveness.
5. Develop innovative, ethical, and sustainable business solutions by integrating management and entrepreneurial concepts.

REFERENCE BOOKS

1. Robbins, S. P., & Coulter, M. (2021). Management (14th ed.). Pearson.
2. Koontz, H., & Weihrich, H. (2010). Essentials of management (8th ed.). McGraw-Hill Education.
3. Tripathi, P. C., & Reddy, P. N. (2012). Principles of management (5th ed.). Tata McGraw-Hill.
4. Robbins, S. P., & Judge, T. A. (2019). Organizational behavior (18th ed.). Pearson.
5. Dessler, G. (2020). Human resource management (16th ed.). Pearson.
6. Chandra, P. (2019). Financial management: Theory and practice (10th ed.). McGraw-Hill Education.
7. Pandey, I. M. (2015). Financial management (11th ed.). Vikas Publishing House.
8. Kotler, P., & Keller, K. L. (2016). Marketing management (15th ed.). Pearson.
9. Heizer, J., Render, B., & Munson, C. (2020). Operations management: Sustainability and supply chain management (13th ed.). Pearson.
10. Khanka, S. S. (2013). Entrepreneurship development (1st ed.). S. Chand Publishing.
11. Additional References
12. Griffin, R. W. (2022). Management (13th ed.). Cengage Learning.
13. Daft, R. L. (2020). Management (13th ed.). Cengage Learning.
14. Luthans, F. (2021). Organizational behavior (14th ed.). McGraw-Hill Education.
15. Noe, R. A., Hollenbeck, J. R., Gerhart, B., & Wright, P. M. (2021). Fundamentals of Human Resource Management (8th ed.). McGraw-Hill Education.
16. Ross, S. A., Westerfield, R. W., & Jaffe, J. (2021). Corporate finance (13th ed.). McGraw-Hill Education.
17. Gitman, L. J., & Zutter, C. J. (2019). Principles of managerial finance (15th ed.). Pearson.
18. Lamb, C. W., Hair, J. F., & McDaniel, C. (2022). Marketing (14th ed.). Cengage Learning.
19. Chase, R. B., Jacobs, F. R., & Aquilano, N. J. (2020). Operations and supply chain management (15th ed.). McGraw-Hill Education.
20. Hisrich, R. D., Peters, M. P., & Shepherd, D. A. (2020). Entrepreneurship (11th ed.). McGraw-Hill Education.
21. Scarborough, N. M., & Cornwall, J. R. (2019). Essentials of entrepreneurship and small business management (9th ed.). Pearson.
22. Gopalaswamy, A. K. (2020). Management case studies with Indian perspectives. Cengage Learning.
23. Subramanian, R. (2021). Business laws and management. Tata McGraw-Hill.
24. Dutta, A. K. (2019). Cases in financial management. Pearson India.
25. Reddy, Y. V. (2020). Economic policies and India's reform agenda: New thinking. Oxford University Press.

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

25ITPCP607	ANALYTICS AND DATA MINING LAB				L	T	P	C
					0	0	3	1.5

COURSE OBJECTIVES

- To identify and analyze categorical, nominal, and real-valued attributes relevant to business decisions such as pricing, credit assessment, and customer demographics.
- To build, train, and evaluate classification models such as Decision Trees, rule-based classifiers, IBk, and Naïve Bayes using data mining tools.
- To validate and optimize model performance through cross-validation, pruning, cost-sensitivity analysis, and comparative evaluation across algorithms.

LIST OF EXPERIMENTS

1. List all the categorical (or nominal) attributes and the real-valued attributes separately.
2. What attributes do you think might be crucial in making the credit assessment? Come up with some simple rules in plain English using your selected attributes.
3. What attributes do you think might be crucial in making the bank assessment?
4. One type of model that you can create is a Decision Tree – train a Decision Tree using the complete dataset as the training data. Report on the model obtained after training.
5. Suppose you use your above model trained on the complete dataset and classify credit good/bad for each of the examples in the dataset. What % of examples can you classify correctly? (This is also called testing on the training set) Why do you think you cannot get 100% training accuracy?
6. Find out the correctly classified instances, root mean squared error, kappa statistics, and mean absolute error for the weather dataset.
7. Is testing on the training set, as you did above, a good idea? Why or why not?
8. One approach for solving the problem encountered in the previous question is using cross-validation. Describe what cross-validation is briefly. Train a Decision Tree again using cross-validation and report your results. Does your accuracy increase/decrease? Why?
9. Check to see if the data shows a bias against "foreign workers" (attribute 20), or "personal status" (attribute 9). One way to do this (perhaps rather simple-minded) is to remove these attributes from the data set and see if the decision tree created in those cases is significantly different from the full dataset case, which you have already done. To remove an attribute, you can use the preprocess tab in Weka's GUI Explorer. Did removing these attributes have any significant effect? Discuss.
10. Load the "weather.arff" data set in Weka and run the ID3 classification algorithm. What problem do you have, and what is the solution?
11. Another question might be, do you really need to input so many attributes to get good results? Maybe only a few would do. For example, you could try just having attributes 2, 3, 5, 7, 10, 17

(and 21, the class attribute (naturally)). Try out some combinations. (You had removed two attributes in problem 7. Remember to reload the arff data file to get all the attributes initially before you start selecting the ones you want.)

12. Sometimes, the cost of rejecting an applicant who has good credit (case 1) might be higher than accepting an applicant who has bad credit (case 2). Instead of counting the misclassifications equally in both cases, give a higher cost to the first case (say cost 5) and a lower cost to the second case. You can do this by using a cost matrix in Weka. Train your Decision Tree again and report the Decision Tree and cross-validation results. Are they significantly different from results obtained in problem 6 (using equal cost)?
13. Do you think it is a good idea to prefer simple decision trees instead of having long, complex decision trees? How does the complexity of a Decision Tree relate to the bias of the model?
14. Run the J48 and 1Bk classifiers using the cross-validation strategy with various fold levels. Compare the accuracy results.
15. You can make your Decision Trees simpler by pruning the nodes. One approach is to use Reduced Error Pruning – Explain this idea briefly. Try reduced error pruning for training your Decision Trees using cross-validation (you can do this in Weka) and report the Decision Tree you obtain. Also, report your accuracy using the pruned model. Does your accuracy increase?
16. (Extra Credit): How can you convert a Decision Tree into "if-then-else rules"? Make up your own small Decision Tree consisting of 2 - 3 levels and convert it into a set of rules. There also exist different classifiers that output the model in the form of rules-one such classifier in Weka is rules. PART, train this model, and report the set of rules obtained. Sometimes just one attribute can be good enough in making the decision- yes, just one! Can you predict what attribute that might be in this dataset? The oneR classifier uses a single attribute to make decisions (it chooses the attribute based on minimum error). Report on the rule obtained by training a oneR classifier. Rank the performance of J48, PART, and oneR.
17. Run J48 and Naïve Bayes classifiers on the following datasets and determine the accuracy:
 1. vehicle.arff
 2. kr-vs-kp.arff
 3. glass.arff
 4. wave-form-5000.arff

On which datasets does Naïve Bayes perform better?

COURSE OUTCOMES

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

1. Apply attribute selection and Decision Tree classification techniques to build predictive models for credit, banking, and demographic datasets.
2. Analyze classifier performance using accuracy measures, cross-validation, attribute bias, and cost-sensitive evaluation to assess the reliability and fairness of the generated models.
3. Evaluate and compare Decision Trees, rule-based classifiers, IBk, and Naïve Bayes models across datasets, and justify the choice of an optimal classifier based on complexity, accuracy, and pruning outcomes.

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

25ITPCP608	DIGITAL IMAGE PROCESSING LAB	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES

- To read, preprocess, and analyze digital images using fundamental point and spatial domain processing techniques.
- To implement histogram, transform, and frequency domain-based techniques for image enhancement and analysis.
- To develop, evaluate, and apply image segmentation, morphological, compression, and recognition techniques for real-world applications.

LIST OF EXERCISES

1. Reading the image and performing various pre-processing
2. Implementing point processing techniques
3. Implementing spatial domain filters
4. Implementing histogram processing techniques
5. Implementing image transforms
6. Implementing frequency domain filters
7. Implementing image segmentation algorithms
8. Implementing morphological operations
9. Edge detection using Sobel and Prewitt masks
10. Image compression
11. Object recognition
12. Image classification
13. Mini project to develop a real-world application

COURSE OUTCOMES

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

1. Apply point processing, spatial domain filtering, and histogram processing techniques to preprocess and enhance digital images.
2. Analyze image transforms, frequency domain filters, edge detection masks, and morphological operations to extract meaningful features from images.
3. Design and develop image segmentation, compression, classification, and object recognition solutions, and evaluate their effectiveness through a real-world mini project application.

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

SEVENTH SEMESTER

22ETES701	RESEARCH METHODOLOGY	L	T	P	C
		2	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 analyse 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 problems, literature review, hypothesis formulation, data collection, analysis. Qualities of good research. Research ethics – Avoiding plagiarism and misconduct

UNIT II Literature Review and Problem Identification

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

UNIT III Research Design and Data Collection

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

UNIT IV Data Analysis and Interpretation

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

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.

TEXTBOOKS

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

REFERENCES

1. Leedy, P.D., and Ormrod, J.E., 'Practical Research: Planning and Design', 11th Edition, Pearson.
2. Greenfield, T., and Greener, S., 'Research Methods for Postgraduates', 3rd Edition, Wiley.
3. Montgomery, D.C., 'Design and Analysis of Experiments', 9th Edition, Wiley.

4. Cohen, L., Manion, L., & Morrison, K., 'Research Methods in Education', 8th Edition, Routledge.
5. Deborah E. Bouchoux, 'Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets', 5th.

COURSE OUTCOMES

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

1. Identify the fundamental concepts of research methodology, research design, data analysis, and research and publication ethics.
2. Summarize the principles of literature review, data collection methods, research tools, and intellectual property rights.
3. Utilize appropriate research methods, analytical tools, and scientific writing techniques in engineering research.
4. Differentiate research methods, data interpretation techniques, and publication practices for effective outcomes.
5. Design a research proposal or technical report by following ethical and publication standards.

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

25ITPC702	INTERNET OF THINGS				L	T	P	C
					3	0	0	3

COURSE OBJECTIVES

- To understand the fundamentals of IoT, its physical design, communication models, and protocols.
- To gain knowledge of IoT protocol standardization efforts and their working principles.
- To understand various IoT reference architectures and design guidelines.
- To understand the concepts of Web of Things and IoT middleware platforms.
- To acquire knowledge of domain-specific IoT applications across various real-world sectors.

UNIT I Introduction

Definition and characteristics of IoT, Physical design of IoT, IoT protocols, IoT communication models, IoT communication APIs, Communication protocols, Embedded Systems, working principles of Sensors and actuators, Reading from sensors, Communication through Bluetooth, Wi-Fi.

UNIT II IOT Protocols

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BACnet protocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security

UNIT III IOT Architecture

IOT Architecture: M2M high-level ETSI architecture - IETF architecture for IoT OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture- clustering principles in an Internet of Things Architecture - The Role of Context – Design guidelines.

UNIT IV Web of Things

Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence

UNIT V Case Study of IoT Applications

Domain-specific IoTs – Home automation, Cities, Environment, Energy, Retail logistics, Agriculture, Industry, Health and lifestyles.

TEXTBOOKS

1. Arshdeep Bhaga, Vijay Madi Setti, “Internet of Things – A hands-on approach”, Universities Press, 2015
2. Dieter Uckelmann, Mark Harrison, Michael's, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
3. The Internet of Things: Enabling Technologies, Platforms and Use Cases by Pethuru Raj and Anupama

REFERENCES

1. Hongbo Zhou, The Internet of Things in the Cloud: A Middleware Perspective, CRC Press, 2012.
2. Jan Holler, Vlasios Tsitsis, Catherine Mulligan, Stamatis Karnowski, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
3. Olivier Hersent, David Bosworth, Omar Elloumi, “The Internet of Things – Key applications and Protocols”, Wiley, 2012.
4. Francis daCosta, “Rethinking the Internet of Things: A scalable Approach to connecting Everything, Apress Publications, 2013.

COURSE OUTCOMES

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

1. Explain the fundamental concepts, characteristics, physical design, and communication models of the Internet of Things.
2. Apply knowledge of sensors, actuators, and IoT protocols to build basic IoT communication systems.
3. Analyze various IoT reference architectures and protocol standards to design suitable architectural models for IoT systems.
4. Design unified IoT-WoT architectures using Web of Things concepts and middleware platforms.
5. Build real-time domain-specific applications such as home automation, healthcare, and agriculture using IoT architectural and clustering concepts to design.

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

25ITPC703	INFORMATION AND NETWORK SECURITY											In	T	P	C
												3	0	0	3

COURSE OBJECTIVES

- To introduce the fundamental concepts of computer and network security, including security attacks, services, mechanisms, and cryptographic models.
- To familiarize learners with symmetric and asymmetric cryptographic algorithms, including their design, implementation, and key management.
- To develop skills in applying hash functions, message authentication, and digital signature schemes for ensuring data integrity and authenticity.
- To enable the evaluation of security protocols such as SSL/TLS, HTTPS, and SSH used in securing web communications.
- To cultivate the ability to design and integrate cryptographic techniques into secure network and web-based systems.

UNIT I Introduction

Need for Security, Computer Security Concepts, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security, Symmetric Cipher Model, Substitution Techniques, Transposition Techniques.

UNIT II IOT Protocols

Block Cipher Principles, The Data Encryption Standard (DES), A DES Example, The Strength of DES, Block Cipher Design Principles, Stream Ciphers, RC4, Advanced Encryption Standard (AES) with Structure, Transformation Functions, Key Expansion, Example, and Implementation, Block Cipher Modes of Operation, Key Management and Distribution for Symmetric Encryption.

UNIT III IOT Architecture

Introduction to Number Theory, Principles of Public-Key Cryptosystems, RSA Algorithm, its computational aspects and security, Diffie-Hellman Key Exchange, Man-in-the-Middle attack, Key Management and Distribution for Asymmetric Encryption.

UNIT IV Web of Things

Authentication Requirements, Application of Cryptographic Hash Function, Requirements and Security of Hash Function, Secure Hash Algorithm (SHA), Message Authentication Codes, Message Authentication Functions, Requirements and Security of MACs, MACs based on Hash Functions

UNIT V Case Study of IoT Applications

Digital Signature, Its Properties, Requirements and Security, Various Digital Signature Schemes (ElGamal and Schnorr), Remote User-Authentication Principles, Remote User-Authentication with Symmetric and Asymmetric Encryption. Web Security Threats and Approaches, SSL Architecture and Protocol, Transport Layer Security, HTTPS and SSH.

TEXTBOOKS

1. William Stallings, "Cryptography and Network Security, Principles and Practice", Pearson Education, India, 2017.

REFERENCES

1. Atul Kahate, "Cryptography and Network Security", Tata McGraw-Hill, India
2. Forouzan, "Cryptography & Network Security", PHI
3. Mark Stamp, "Information Security Principles and Practice", Wiley India Edition
4. N Harini, T R Padmanabhan, C K Shyamala, "Cryptography and Security", Wiley-India

COURSE OUTCOMES

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

1. Describe security concepts, attacks, services, and mechanisms along with symmetric and asymmetric cryptographic algorithms. Explain authentication mechanisms, digital signatures, and web security protocols.
2. Apply symmetric and asymmetric cryptographic techniques, including DES, AES, RSA, and Diffie-Hellman, for secure data transmission. Implement hash functions, MACs, and SSL/HTTPS/SSH protocols for secure communication.
3. Analyze the strength, vulnerabilities, and design principles of block ciphers and public-key cryptosystems. Examine the security of hash functions, digital signatures, and web security protocols.
4. Evaluate the effectiveness of encryption algorithms and key management strategies against security threats. Assess the robustness of authentication mechanisms and SSL/TLS-based web security protocols.
5. Design secure communication systems by integrating cryptographic algorithms and authentication mechanisms. Develop secure web-based solutions using SSL/TLS, HTTPS, and SSH protocols.

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

25ITPCP707	NETWORK SECURITY LAB	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES

- To introduce classical and modern cryptographic algorithms, including Caesar, Playfair, Hill, S-DES, Diffie-Hellman, and RSA.
- To develop hands-on skills in implementing encryption-decryption techniques using programming and tools like CrypTool and Wireshark.
- To enable the analysis and evaluation of network security mechanisms through practical implementation and real-world case studies.

LIST OF EXERCISES

1. To implement Caesar cipher encryption-decryption.
2. To implement Monoalphabetic cipher encryption-decryption.
3. To implement Playfair cipher encryption-decryption.
4. To implement Polyalphabetic cipher encryption-decryption.
5. To implement Hill cipher encryption-decryption.
6. To implement Rail Fence and Columnar transposition cipher encryption-decryption.
7. To implement the Simplified Data Encryption Standard.
8. To implement the Diffie-Hellman key exchange method.
9. To implement the RSA encryption-decryption algorithm.
10. Demonstrate and perform various encryption-decryption techniques with Cryptool.
11. Study and use the open-source packet analyser Wireshark to understand security mechanisms of various network protocols.
12. Detailed case study: Real-world implementation of Network Security Algorithm/Concept.

COURSE OUTCOMES

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

1. Describe the working principles of classical and modern cryptographic algorithms and the role of tools like Cryptool and Wireshark.
2. Implement and analyze various encryption-decryption techniques using programming, Cryptool, and Wireshark for network protocol security.
3. Evaluate the effectiveness of cryptographic techniques and design case study-based solutions for real-world network security applications.

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

25ITPCP708	INTERNET OF THINGS LAB	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES

- To design applications to interact with various sensors and actuators for real-world data acquisition.
- To design and develop IoT communication protocols for efficient data transmission.
- To design and develop IoT applications using Arduino/Raspberry Pi for real-world scenarios.
- To enable seamless communication between IoT devices and cloud platforms.
- To develop IoT-based web applications using the Django Framework.

LIST OF EXERCISES

1. IoT kit introduction: Hardware and software (programming environment), IDE.

- To study various IoT protocols – 6LowPAN, IPv4/IPv6, Wi-Fi, Bluetooth, and MQTT.
- IoT Application Development Using sensors and actuators (temperature sensor, light sensor, infrared sensor).
- Basic signal processing (sampling, filtering, quantization, computation, storage).
- Analyse the given data for Preprocessing, data handling, and computing with Python.
- To study the Raspberry Pi development board and to implement LED blinking applications.
- To develop an application to send and receive data with Arduino using HTTP requests.
- To develop an application that measures the room temperature and posts the temperature Value on the cloud platform.
- To develop an application that measures the moisture of soil and posts the sensed data over the Google Firebase cloud platform.
- To develop an application for measuring distance using an ultrasonic sensor and post the distance value on the Google Cloud IoT platform.
- Develop a Communication M2M protocol for connectivity of IoT-CPS system with cloud (IoT platform).
- Develop a simple application based on sensors.
- Develop IoT applications using Django Framework and Firebase/ Bluemix platform.
- Develop a commercial IoT application.

HARDWARE/SOFTWARE REQUIREMENTS

- The universal microcontroller development board
- 8051 Daughter Board
- Raspberry Pi 3B+ Original
- Arduino Daughter Board
- Humidity + IR Sensor Interface
- Ultrasonic Sensors
- Open-source software: Django Framework
- Open cloud architectures like Bluemix, Development platforms like Firebase.

COURSE OUTCOMES

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

- Apply sensor and actuator interfacing techniques to acquire, process, and analyze real-world data for IoT applications.
- Develop IoT applications using Arduino, Raspberry Pi, and related hardware platforms integrated with communication protocols such as MQTT, Wi-Fi, and Bluetooth.
- Design and implement cloud-connected IoT and web-based applications using Django Framework and platforms such as Firebase/Bluemix for real-world and commercial use cases.

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

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

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

COURSE OBJECTIVES

- To expose students to technical and professional skill requirements prevailing in IT industries.
- To impart professional skills for identifying and solving real-world problems in industries.
- To train students to design innovative solutions for industry-relevant problems.
- To motivate students towards entrepreneurship and startup development.
- To develop communication and technical report writing skills through presentations and documentation.

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

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

COURSE OUTCOMES

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

1. Understand the day-to-day functioning of IT industries and the technical and professional skills required for industry roles.
2. Develop and refine technical and professional skills through hands-on industrial training and work experience.
3. Design innovative solutions for industry requirements by integrating academic knowledge with practical industrial exposure.
4. Develop entrepreneurial solutions such as startup products or services based on industry or societal requirements.
5. Communicate technical knowledge and internship experience effectively through structured reports and presentations.

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

EIGHTH SEMESTER

25ITPV803	PROJECT WORK AND VIVA VOCE	L	PR	S	C
		0	10	2	6

COURSE OBJECTIVES

- Identify engineering problems through literature review and problem analysis.
- Apply engineering knowledge, research methods, and modern tools to develop appropriate solutions.
- Analyze and validate the developed solutions using suitable testing and evaluation techniques.
- Evaluate solutions based on performance, feasibility, ethics, quality, and societal impact.
- Design and present a complete engineering project with effective implementation, documentation, and technical communication.

METHOD OF EVALUATION

- Students in a group of 3 to 4 work on a topic approved by the Head of the Department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor.
- The progress of the project is evaluated based on a minimum of three reviews. The review committee will be constituted by the Head of the Department.
- A project report is required at the end of the semester.
- The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

COURSE OUTCOMES

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

1. Explain the problem statement, project objectives, and relevant background through a systematic literature review.
2. Apply appropriate methodologies and modern IT tools to design solutions for the identified problem.
3. Analyze the proposed solution by designing experiments, conducting investigations, and interpreting the results.
4. Evaluate the effectiveness of the developed solution using appropriate performance metrics, graphs, tables, and charts.
5. Prepare and present a comprehensive technical report and presentation demonstrating professional communication skills.

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

PROFESSIONAL ELECTIVES – I

25ITPE307	THEORY OF COMPUTATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To illustrate the concepts of finite automata, regular expressions, and deterministic finite automata.
- To interpret formal grammar, context-free languages, and grammar simplification techniques.
- To apply pushdown automata for recognizing and solving context-free language problems.
- To examine Turing machines, computability, and language hierarchy in computational models.
- To evaluate decidability, computability, and computational complexity of formal language problems.

UNIT I Finite Automata

Introduction- Basic Mathematical Notation and techniques- Finite State systems – Basic Definitions – Finite Automaton – DFA and NDFA – Finite Automaton with ϵ - moves –Regular Languages- Regular Expression – Equivalence of NFA and DFA – Equivalence of NDFA's with and without ϵ -moves – Equivalence of finite Automaton and regular expressions –Minimization of DFA- - Pumping Lemma for Regular sets – Problems based on Pumping Lemma.

UNIT II Grammars

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

UNIT III Pushdown Automata

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

UNIT IV Turing Machines

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

UNIT V Unsolvable Problems and Computable Functions

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

TEXTBOOKS

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

REFERENCES

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

edition, New Delhi, 2002.

4. Kamala Krithivasan and Rama R, "Introduction to Formal Languages, Automata Theory and Computation", Pearson Education, 2009.

COURSE OUTCOMES

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

1. Explain the principles of finite automata, formal grammar, pushdown automata, Turing machines, and computational complexity in language recognition and computation.
2. Apply automata, grammar transformations, pushdown automata, and Turing machine concepts to solve formal language and computation problems.
3. Analyze regular languages, context-free languages, computability models, and complexity classes using formal computational techniques.
4. Evaluate computational models, decidability, language hierarchies, and complexity classifications for solving theoretical computer science problems.
5. Develop formal computational models and language representations using automata, grammar, Turing machines, and complexity analysis.

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

25ITPE307	SIGNALS AND SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To illustrate the fundamental concepts of continuous-time and discrete-time signals and systems.
- To interpret the behavior and characteristics of linear time-invariant systems using convolution and system properties.
- To apply Fourier, Laplace, and Z-transform techniques for signal and system analysis.
- To examine state-space representation, frequency-domain analysis, and sampling principles in signal processing.
- To evaluate continuous and discrete-time systems for engineering and information processing applications.

UNIT I

Signals and systems as seen in everyday life, and in various branches of engineering and science.

Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability.

UNIT II

Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input-output behaviour with periodic convergent inputs. Characterization of causality and stability of linear shift-invariant systems. System representation through differential equations and difference equations.

UNIT III

Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. The idea of signal space and orthogonal bases.

UNIT IV

The Laplace Transform, notion of eigen functions of LSI systems, a basis of eigen functions, region of convergence, poles and zeros of system, Laplace domain analysis, solution to differential equations and system behavior.

The z-Transform for discrete-time signals and systems - eigenfunctions, region of convergence, z-domain analysis.

UNIT-V

State-space analysis and multi-input, multi-output representation. The state-transition matrix and its role. The Sampling Theorem and its implications - Spectra of sampled signals.

Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects. Relation between continuous and discrete-time systems.

TEXTBOOKS

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.
2. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
3. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.

REFERENCES

1. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, 1998.
2. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition, 1999.
3. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, 1998.
4. Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley and Sons, 1995.
5. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.
6. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH, New Delhi, 2001.
7. Ashok Ambardar, "Analog and Digital Signal Processing", 2nd Edition, Brooks/ Cole Publishing Company (An international Thomson Publishing Company), 1999.

COURSE OUTCOMES

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

1. Explain the principles of signals, systems, LSI systems, transform techniques, state-space models, and sampling concepts for engineering applications.
2. Apply convolution, Fourier, Laplace, and Z-transform techniques to analyze continuous-time and discrete-time signals and systems.
3. Analyze signal and system behavior using frequency-domain methods, state-space representation, and sampling theory.
4. Evaluate continuous and discrete-time systems by interpreting transform-domain characteristics, stability, and signal reconstruction techniques.
5. Develop mathematical models and analytical solutions for signal processing systems using transform methods and state-space analysis.

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

25ITPE307	PRINCIPLES AND PRACTICES OF COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To illustrate the principles and spectral characteristics of analog modulation techniques.
- To interpret the statistical properties and significance of random processes in communication systems.
- To examine the impact of noise and its influence on communication system performance.
- To apply transmission efficiency concepts and digital communication techniques for reliable data transmission.
- To evaluate the theoretical limits and coding principles established by Information Theory.

UNIT I Amplitude Modulation

Introduction to Modulation, Need for Modulation, Ordinary Amplitude Modulation – Modulation index, Sidebands, AM Power, Double Sideband Suppressed Carrier Modulation, Single Sideband Modulation, Vestigial Sideband Modulation, AM demodulation, Applications of AM.

UNIT II Angle Modulation

Angle Modulation fundamentals, Frequency Modulation – Modulation index and sidebands, Narrowband FM, Wideband FM, Principles of Phase Modulation, Frequency Modulation versus Amplitude Modulation, FM demodulation, Frequency Division Multiplexing, Applications of FM.

UNIT III Signal Sampling and Analog Pulse Communication

Ideal Sampling, Pulse Amplitude Modulation, Pulse Width Modulation, Pulse Position Modulation. DIGITAL COMMUNICATION TECHNIQUES: Quantization, Digital Transmission of Data, Parallel and Serial Transmission, Data Conversion, Time Division Multiplexing, Pulse Code Modulation, Delta Modulation.

UNIT IV Transmission of Binary Data in Communication Systems

Digital Codes, Principles of Digital Transmission, Transmission Efficiency, Modem Concepts and Methods – FSK, BPSK, Error Detection and Correction.

UNIT V Information Theory

Discrete Memoryless source, Information, Entropy, Mutual Information - Discrete Memoryless channels – Binary Symmetric Channel, Channel Capacity - Shannon - Hartley law – Source coding theorem - Shannon – Fano & Huffman codes.

TEXTBOOKS

1. Louis E. Frenzel, "Principles of Electronic Communication Systems", 3rd Edition. Tata McGraw-Hill.
2. Wayne Tomasi, "Electronic Communications Systems", 5th Edition, Pearson Education.

REFERENCES

1. Lathi B.P, "Modern Digital and Analog Communication Systems", Oxford University Press, Third Edition, 2007.
2. Sklar B, "Digital Communication Fundamentals and Applications", Pearson Education, Second Edition, 2009.
3. Papoulis A, "Probability, Random Variables and Stochastic Processes", McGraw-Hill, Third Edition, 1991.
4. Hsu H.P, "Schaum Outline Series - Analog and Digital Communications", TMH, 2006.
5. Couch L, "Modern Communication Systems", Pearson, 2001

COURSE OUTCOMES

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

1. Explain the principles of analog and digital communication, modulation, transmission, and information theory.
2. Apply modulation, sampling, multiplexing, and coding techniques for efficient communication.
3. Analyze communication system performance using transmission, error control, and channel characteristics.
4. Evaluate communication methods based on bandwidth, reliability, efficiency, and information-theoretic concepts.
5. Design communication solutions by integrating modulation, digital transmission, coding, and information theory principles.

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

25ITPE307	WIRELESS COMMUNICATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Introduce wireless system evolution, cellular concepts, propagation models, modulation, and multiple access schemes.
- Build understanding of cellular systems, propagation, modulation, and multiple access principles.
- Enable application of frequency reuse, propagation models, modulation/coding, and multiple access schemes in system design.
- Develop ability to analyze interference, capacity, propagation effects, and technique performance.
- Enable assessment of cellular designs, propagation models, and modulation/access techniques.

- Prepare students to design complete wireless communication systems.

UNIT I Introduction to Wireless Communications

History and evolution of mobile radio systems. Types of mobile wireless services/systems- Cellular, WLL, Paging, Satellite systems, Standards, Future trends in personal wireless systems.

UNIT II Cellular Concepts and System Design Fundamentals

Cellular concept and frequency reuse, Multiple Access Schemes, channel assignment and handoff, Interference and system capacity, Trunking and Erlang capacity calculations.

UNIT III Mobile Radio Propagation Models

Radio wave propagation issues in personal wireless systems, Propagation models, Multipath fading and baseband impulse response models, parameters of mobile multipath channels, Antenna systems in mobile radio.

UNIT IV Modulation Techniques

Overview of analog and digital modulation techniques, Performance of various modulation techniques - Spectral efficiency, Error rate, Power Amplification, Equalizing Rake receiver concepts, Diversity and space-time processing, Speech coding and channel coding.

UNIT V System Examples and Design Issues

Multiple Access Techniques-FDMA, TDMA and CDMA systems, operational systems, Wireless networking, design issues in personal wireless systems

TEXTBOOKS

1. S. Rappaport, Wireless digital communications: Principles and practice, Prentice Hall, NJ, 1996.
2. Schiller, Mobile Communications; Pearson Education Asia Ltd., 2000.

REFERENCES

1. Feher, Wireless digital communications, PHI, New Delhi, 1999.
2. C. Y. Lee, Mobile communications engineering: Theory and Applications, Second Edition, McGraw Hill, New York, 1998.

COURSE OUTCOMES

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

1. Explain the principles of wireless communication, cellular architecture, propagation models, modulation techniques, and mobile network technologies.
2. Apply multiple access, modulation, coding, and propagation concepts to analyze wireless communication systems.
3. Analyze wireless channel behavior, system capacity, interference, and mobile radio performance using appropriate communication models.
4. Evaluate cellular communication technologies, wireless networking, and design trade-offs based on efficiency, reliability, and performance.
5. Design wireless communication solutions by integrating cellular concepts, multiple access techniques, modulation, coding, and modern mobile technologies.

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

25ITPE307	VIRTUALIZATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Familiarize with virtualization fundamentals, VM architectures, and hypervisor types.
- Configure server partitioning, network virtualization, and SAN/storage solutions.
- Analyze and compare hypervisor types, server, and storage architectures.
- Assess virtualization strategies and enterprise tools like VMware, Hyper-V, and Xen.
- Design integrated virtualization solutions for enterprise environments.

UNIT I Introduction to Virtualization

System Architectures – Virtual Machine Basics – Process Virtual Machines – System Virtual Machines – Taxonomy of Virtual Machines – Emulation: Basic Interpretation – Threaded Interpretation – Pre-Coded & Direct Interpretation – Binary Translation – Full and Para Virtualization – Types of Hypervisors – Types of Virtualization.

UNIT II Server Virtualization

Server Virtualization – Partitioning Techniques – Hardware Virtualization – Virtual Hardware – Types of Server Virtualization – Business Cases for Server Virtualization – Uses of Virtual Server Consolidation – Selecting Server Virtualization Platform.

UNIT III Network Virtualization

Design of Scalable Enterprise Networks – Virtualizing the Campus – WAN Design – WAN Architecture – WAN virtualization – Virtual Enterprise Transport Virtualization – VLANs and Scalability – Theory Network Device Virtualization Layer 2 – VLANs Layer 3 VRF Instances Layer 2 – VFI's Virtual Firewall Contexts Network Device Virtualization – Datapath Virtualization Layer 2: 802.1q – Trunking Generic Routing Encapsulation – IPsec L2TPv3 Label Switched Paths – Control-Plane Virtualization – Routing Protocols – VRF- Aware Routing – Multi-Topology Routing.

UNIT IV Storage Virtualization

Hardware Devices – SCSI – SCSI Communication – Using SCSI Buses – Fiber Channel – Fiber Channel Cables – Fiber Channel Hardware Devices – iSCSI Architecture – Securing iSCSI SAN Backup & Recovery Techniques – RAID – Classic Storage Model – SNIA Shared Storage Model-Host-based Architecture – Storage-based Architecture – Network-based Architecture – Fault tolerance to SAN – Performing Backups – Virtual Tape Libraries.

UNIT V Applying Virtualization

Comparison of Virtualization Technologies: Guest OS, Host OS, Hypervisor, Emulation, Kernel Level – Shared Kernel – Enterprise Solutions: VMware Server, ESXi, Citrix Xen Server, Microsoft Virtual PC, Microsoft Hyper-V, Virtual Box – Server Virtualization: Configuring Server with Server Virtualization, Adjusting & Tuning Virtual Servers, VM Backup and Migration – Desktop Virtualization: Terminal Services, Hosted Desktop, Web Based Solutions, Localized Virtualized Desktop – Network and Storage Virtualization: VPN, VLAN, SAN and VSAN, NAS.

TEXTBOOKS

1. Chris Wolf, Erick M. Halter, "Virtualization: From the Desktop to the Enterprise", APress, 2005.
2. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
3. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach Publications, 2006.

REFERENCES

1. William von Hagen, "Professional Xen Virtualization", Wrox Publications, January 2008.
2. Kumar Reddy, Victor Moreno, "Network Virtualization", Cisco Press, July, 2006.
3. Amy Newman, Kenneth Hess, "Practical Virtualization Solutions: Virtualization from the Trenches", Prentice Hall, October 2009.

COURSE OUTCOMES

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

1. Describe virtualization fundamentals, VM architectures, hypervisor types, and server/network/storage virtualization concepts along with enterprise platforms.
2. Configure server partitioning, VLAN/WAN network virtualization, SAN/iSCSI storage, and desktop virtualization solutions.
3. Analyze and compare hypervisor types, server consolidation techniques, network device virtualization, and storage architectures.
4. Assess business cases, evaluate network/storage virtualization strategies, and judge enterprise virtualization tools (VMware, Hyper-V, Xen).
5. Design and build integrated servers, network, storage, and desktop virtualization solutions for enterprise environments.

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

25ITPE307	ROBOTIC PROCESS AUTOMATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To illustrate the fundamental concepts of Robotic Process Automation.
- To examine different workflow models used in RPA development.
- To design data manipulation and automation processes using RPA tools.
- To evaluate applications, integrations, and plugins in RPA platforms.
- To deploy, monitor, and maintain software bots in enterprise environments.

UNIT I Introduction to Robotics

Robotic Process Automation: What is RPA: Benefits of RPA –Components of RPA –Recorder –Development Studio –Extensions and Plugins –Bot Runner –Control Center. RPA Platforms: Automation Anywhere –UiPath –Blue Prism –Work Fusion. UiPath: UiPath Robot –UiPath Orchestrator.

UNIT II Types of Workflows

Sequences – Flowcharts –State Machines.Variables: Managing Variables –Naming Best Practices.The Variables Panel: Types of Variables. Arguments: Managing Arguments –Naming Best Practices, The Arguments Panel -Using Arguments. Control Flow: Control Flow Activities -The Assign Activity –The Delay Activity –The While Activity –The Do while Activity –The For each Activity –The If Activity. TaskRecorder: Advanced UI interactions –Input Methods –Output Methods.

UNIT III Data Manipulation

Variables and scope: Collections –Arguments – Purpose and Use –Data Table Usage –Building a Data Table. File operation: Read Cell –Write Cell –Read Range –Write Range –Append Range.Taking

Control: Finding the Control – Anchor Base – Element Exists – Element Scope – Find Relative Element – Mouse

Activities – Send Hotkey. Working with UiExplorer: Handling Events – Element Triggering Events – Hotkey Trigger. RevisitRecorder: Basic Recording – Desktop Recording.

UNIT IV Application with Plugins

Terminal plugin: SAP automation – How SAP Automation affects data. Examples of SAP automation. Java plugin: JAVA plugin with UiPath Studio. Citrix automation: Citrix environment work – Mail Plugin – PDF

Plugin – Web Integration – Word Plugins – Excel Plugin – Word Plugin – Credential Management. Events and Assistant Bots: What are Assistant Bots – Event Triggers – Hotkey Trigger – Mouse Trigger – System Trigger.

UNIT V Deploying and Maintaining the Bot

Publishing using the Publish utility: workflow in UiPath, Orchestration Server: Queues – Assets – Process – Deploying a process. Server to Control Bots: Robot Statuses – Editing the Robot – Deleting the Robot – Displaying logs for a robot. Server to deploy bots: Connecting a Robot to Orchestrator – Deploy the Robot to Orchestrator. License management: Activating and uploading a license to Orchestrator. Publishing and Managing Updates: Packages – Managing Packages

TEXTBOOKS

1. Tom Taulli, “The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems”, 2020.
2. Nandan Mullakara, “Robotic Process Automation Projects: Build real-world RPA solutions using UiPath and Automation Anywhere”, 2020.
3. Gerardus Blokdyk, “RPA: Robotic Process Automation”, Second Edition, Paperback, 2018.
4. Craig, J. J., “Introduction to Robotics: Mechanics and Control”, Pearson, New Delhi, 2009.
5. Mark W. Spong, Seth Hutchinson, and M. Vidyasagar, “Robot Modelling and Control”, John Wiley and Sons Inc, 2005.

REFERENCES

1. Niku Saeed B., “Introduction to Robotics: Analysis, Systems, Applications”, PHI, New Delhi. 2007.
2. Ghosal, A, “Robotics”, Oxford Press, New Delhi, 2006.
3. Mittal R.K. and Nagrath I.J., “Robotics and Control”, Tata McGraw Hill, 2003.
4. Steve Heath, “Embedded System Design”, 2nd Edition, Newnes, Burlington, 2003.
5. Mukherjee S., “Robotics and Automation”, Khanna Publishing House, Delhi.

WEB RESOURCES

1. <https://www.laserfiche.com/ecmblog/what-is-robotic-process-automation-rpa/>
2. <https://piazza.com/class/j641h48teqh6ba>
3. https://developer.mozilla.org/en-US/docs/Plugins/Guide/Plug-in_Basics
4. <https://www.edx.org/>

COURSE OUTCOMES

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

1. Explain the principles of Robotic Process Automation, workflow models, data manipulation, application integration, and bot deployment using industry-standard RPA platforms.
2. Apply workflow design, data handling, automation activities, plugins, and orchestration techniques to develop efficient software bots.
3. Analyze RPA workflows, data operations, application integrations, event handling, and deployment strategies to improve automation performance.
4. Evaluate RPA solutions by assessing workflow efficiency, plugin integration, bot orchestration, licensing, and maintenance for enterprise automation.

- Design and deploy scalable RPA solutions by integrating workflows, data processing, application plugins, orchestration, and bot lifecycle management.

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

25ITPE307	COGNITIVE SCIENCE				L	T	P	C
					3	0	0	3

COURSE OBJECTIVES

- Provide a strong foundation in cognitive science, human cognition, and cognitive modeling paradigms.
- Introduce computational models of memory, language, and psycholinguistics used in cognitive systems.
- Develop knowledge of reasoning, learning, decision-making, and cognitive modeling techniques.
- Familiarize students with inductive reasoning, cognitive development, and artificial cognitive architectures.
- Enable students to understand and build cognitive computing applications using modern cognitive computing frameworks and architectures.

UNIT I Introduction to Cognitive Science

Understanding Cognition, IBM's Watson, Design for Human Cognition, Augmented Intelligence, Cognition Modeling Paradigms: Declarative/ logic-based computational cognitive modeling, connectionist models of cognition, Bayesian models of cognition, a dynamical systems approach to cognition.

UNIT II Models

Cognitive Models of memory and language, computational models of episodic and semantic memory, modeling psycholinguistics.

UNIT III Cognitive Modeling

Modeling the interaction of language, memory, and learning; modeling selects aspects of cognition; classical models of rationality, symbolic reasoning, and decision-making.

UNIT IV Inductive Generalization

Formal models of inductive generalization, causality, categorization and similarity, the role of analogy in problem solving, cognitive development, child concept acquisition. Cognition and Artificial cognitive architectures such as ACT-R, SOAR, OpenCog, CopyCat, Memory Networks.

UNIT V Application

DeepQA Architecture, Unstructured Information Management Architecture (UIMA), Structured Knowledge, Business Implications, Building Cognitive Applications, Application of Cognitive CO5 Computing and Systems

REFERENCES

1. Emmanuel M. Pothos, Andy J. Wills, "Formal Approaches in Categorization", Cambridge University Press, 2012.
2. Bernard J. Bears, Nicole M. Gage, "Cognition, Brain and Consciousness: Introduction to Cognitive Neuroscience", Academic Press, 2013.
3. Hurwitz, Kaufman, and Bowles, "Cognitive Computing and Big Data Analytics", Wiley, 2012.
4. Ron Sun, "The Cambridge Handbook of Computational Psychology", Cambridge University Press, 2008.

COURSE OUTCOMES

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

1. Understand the principles of cognitive science, human cognition, augmented intelligence, and cognitive modeling paradigms.
2. Analyze computational models of memory, language, episodic memory, semantic memory, and psycholinguistic systems.
3. Apply cognitive modeling techniques to solve problems involving learning, reasoning, memory, language interaction, and decision-making.
4. Evaluate inductive reasoning, categorization, analogy, cognitive development, and artificial cognitive architectures for intelligent systems.
5. Design cognitive computing applications using DeepQA, UIMA, structured knowledge, and modern cognitive computing technologies to address real-world challenges.

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

25ITPE307	ETHICAL HACKING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Develop a fundamental understanding of ethical hacking concepts, security principles, vulnerabilities, threats, attacks, and the phases of hacking.
- Acquire knowledge of reconnaissance, footprinting, port scanning, and enumeration techniques for identifying system and network vulnerabilities.
- Understand system hacking techniques, password attacks, sniffing, spoofing, and security assessment methodologies used in ethical hacking.
- Analyze web application vulnerabilities, session hijacking techniques, and security mechanisms to evaluate the security of web services.
- Enable students to design and implement appropriate security measures for wireless networks and apply ethical hacking tools to secure modern computing environments.

UNIT I Ethical Hacking Overview & Vulnerabilities

Understanding the importance of security - Concept of ethical hacking and essential terminologies: Threat - Attack, Vulnerabilities, Target of Evaluation, Exploit. Phases involved in hacking

UNIT II Footprinting & Port Scanning

Footprinting - Introduction to footprinting, Understanding the information-gathering methodology of the hackers, Tools used for the reconnaissance phase, Port Scanning - Introduction, using port scanning tools, ping sweeps, Scripting Enumeration - Introduction, Enumerating Windows OS & Linux OS

UNIT III System Hacking

Aspects of remote password guessing, Role of eavesdropping, Various methods of password cracking, Keystroke Loggers, Understanding Sniffers, Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing.

UNIT IV Hacking Web Services & Session Hijacking

Web application vulnerabilities, application coding errors, SQL injection into Back-end Databases, cross-site scripting, cross-site request forgery, authentication bypass, web services and related flaws, protective HTTP headers. Understanding Session Hijacking, Phases involved in Session Hijacking, Types of Session Hijacking, Session Hijacking Tools

UNIT V Hacking Wireless Networks

Introduction to 802.11, Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless DOS attacks, WLAN Scanners, WLAN Sniffers, Hacking Tools, Securing Wireless Network

REFERENCES

1. Kimberly Graves, "Certified Ethical Hacker", Wiley India Pvt Ltd, 2010
2. Michael T. Simpson, "Hands-on Ethical Hacking & Network Defense", Course Technology, 2010
3. RajatKhare, "Network Security and Ethical Hacking", Luniver Press, 2006
4. Ramachandran V, "BackTrack 5 Wireless Penetration Testing Beginner's Guide", 3rd Edition, Packt Publishing, 2011
5. Thomas Mathew, "Ethical Hacking", OSB Publishers, 2003
6. Matthew Hickey, Jennifer Arcuri, "Hands-on Hacking: Become an Expert at Next Gen Penetration Testing and Purple Teaming", 1st Edition, Wiley, 2020.
7. Jon Ericson, Hacking: The Art of Exploitation, 2nd Edition, No Starch Press, 2008.

COURSE OUTCOMES

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

1. Understand the concepts of ethical hacking, information security, threats, vulnerabilities, exploits, and the phases of ethical hacking.
2. Analyze network reconnaissance techniques, including footprinting, port scanning, and enumeration, to identify potential security weaknesses
3. Apply ethical hacking techniques to assess system security through password auditing, sniffing, spoofing, and system hacking methodologies.
4. Evaluate web application vulnerabilities, session hijacking attacks, and security controls to recommend appropriate countermeasures.
5. Design secure wireless network solutions by utilizing ethical hacking tools, wireless security techniques, and best security practices.

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

PROFESSIONAL ELECTIVES – II

25ITPE407	INTRODUCTION TO MACHINE LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand ML fundamentals, types, and linear/decision tree models.
- Study supervised learning: regression, classification, and SVMs.
- Explore unsupervised learning: clustering, ensembles, dimensionality reduction.
- Learn neural network architecture, training, and optimization.
- Understand reinforcement learning and graphical models.

UNIT I

Machine Learning: Machine Learning Foundations - Overview - Applications - Types of machine learning - Basic concepts in machine learning - Examples of Machine Learning – Applications. Linear Models for Regression: Linear Basis Function Models - The Bias-Variance Decomposition. Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees.

UNIT II

Supervised Learning: Linear Regression models, least squares, single & multiple variables, Decision trees, Naïve Bayes. Bayesian linear regression, gradient descent. Linear classification Models: Discriminant function, Perceptron algorithm. RBF Network – Curse of dimensionality - Interpolation and Basis functions – Support Vector Machines.

UNIT III

Unsupervised Learning: Combining multiple learners: Model combination schemes, voting. Ensemble learning – bagging, boosting, stacking. Unsupervised learning: Clustering - K-means - Instance-based learning: KNN, EM - Mixtures of Gaussians - The EM Algorithm Gaussian mixture models - Dimensionality Reduction – linear discriminant analysis - Principal Component Analysis – Factor Analysis - Independent components analysis.

UNIT IV

Neural networks: Multilayer perceptron -going forwards and backwards – activation functions, network training, gradient descent optimization – stochastic gradient descent, Feedforward Network Functions – error backpropagation – from shallow networks to deep networks – ReLU, hyperparameter tuning, Batch normalization.

UNIT V

Reinforcement Learning – overview - Examples - Markov Random Fields - Inference in Graphical Models - Markov Models - Hidden Markov Models - Inference - Learning - Markov Random Fields – Markov Chain Monte Carlo- Graphical models – Tracking method.

TEXTBOOKS

1. Ethem Alpaydin, “Introduction to Machine Learning”, MIT, Fourth Edition, 2020.
2. Stephen Marsland, “Machine Learning –An Algorithmic Perspective”, Second Edition, CRC Press, 2014.
3. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.

REFERENCES

1. Tom Mitchell, “Machine Learning”, McGraw-Hill, 1997.
2. Hastie, Tibshirani, Friedman, “The Elements of Statistical Learning”, Second Edition, Springer, 2008.
3. Sebastian Raschka, Vahid Mir Jalili, “Python Machine Learning”, Packt Publishing, 3rd Edition, 2019.

COURSE OUTCOMES

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

1. List key concepts in ML types, models, trees, classifiers, clustering, neural networks, and RL/graphical models.
2. Explain principles of regression, classifiers, unsupervised learning, neural network training, and Markov models.
3. Implement regression, trees, classifiers, clustering/PCA, neural networks, and HMMs on real problems.
4. Compare bias-variance tradeoffs, classifiers, ensemble/clustering methods, network architectures, and inference models.
5. Design and evaluate ML solutions across regression, classification, unsupervised learning, deep networks, and RL frameworks.

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

25ITPE407	CYBER-PHYSICAL SYSTEMS										L	T	P	C
											3	0	0	3

COURSE OBJECTIVES

- Demonstrate a comprehensive understanding of the scope, architecture, models, and applications of Cyber-Physical Systems (CPS).
- Apply appropriate CPS modelling, simulation, and system-design methodologies to address complex real-world challenges.
- Critically analyze CPS models, hybrid systems, and functional behaviours across Medical, Energy, and Agriculture domains.
- Evaluate CPS architecture and solutions based on performance, reliability, scalability, and application-specific requirements.
- Design and develop innovative, application-oriented CPS solutions integrating cyber, physical, modelling, and simulation techniques.

UNIT I Introduction and Design Principles of Cyber-Physical Systems

Cyber-Physical Systems Concepts – Internet of Things (IoT), Industrial IoT implications - Industry 4.0 - Design Challenges – Cyber-Physical System Controls - Mobile Cyber-Physical Systems – Cyber-Physical System Security.

UNIT II Cyber-Physical System Components

Wireless Sensors and Actuators - Networks for Cyber-Physical Systems - CPS Drivers - Community Sensing - Wireless Embedded Microsystems Architecture – CPS SW stack - The Application of Machine Learning in CPS.

UNIT III Real-Time Systems

Introduction to Real-Time Systems, RTS tasks (WCET), RTS Scheduling (Feedback Scheduling), Fault Tolerance and Robustness (RTS and Control), Hybrid Systems

UNIT IV Security Issues in Cyber-Physical Systems

Analysis of Security Attacks in Cyber-Physical Systems – Generalized Framework based on Trust with Privacy - Secure Local Communication – Internet-Wide Secure Communication –

Intrusion Detection, Prevention, and Privacy of Big Data for Cyber-Physical Systems – Security and Privacy for Cloud-Based CPSs – Securely Processing CPS Data in the Cloud – Safety Measures.

UNIT V Medical, Energy and Agriculture Cyber-Physical Systems

Emergence of CPS in different applications – Motivation for Medical CPS – System Description and Operational Scenarios – Key Design Drivers and Quality Attributes – Practitioners’ Implications – Motivation for Energy CPS - System Description and Operational Scenarios – Key Design Drivers and Quality Attributes – Cyber Paradigm for Sustainable SEES. Motivation for Agriculture CPS - System Description and Operational Scenarios, CPS in Aerospace, Biometric CPS, - Case studies.

TEXTBOOKS

1. Raj Rajkumar, Dionisio de Niz and Mark Klein, “Cyber Physical Systems”, 2017, Pearson Education, Inc, ISBN-13: 978-0-321-92696-8.
2. Houbing Song, Gleena A. Fink and Sabina Jeschke, “Security and Privacy in Cyber-Physical Systems, Foundations, Principles, and Applications”, 2018, John Wiley, ISBN: 2017012503.
3. Fei Hu, “Cyber-Physical Systems, Integrated Computing and Engineering Design”, 2013, Taylor and Francis Group, ISBN -13: 978-1-4665-7701-5.
4. Gaddadevara Matt Siddesh, Ganesh Chandra Deka et al., “Cyber-Physical Systems, A computational Perspective”, 2016, Taylor and Francis Group, ISBN-13: 978-14822-5975-

REFERENCES

1. E. A. Lee and S. A. Seshia, “Introduction to Embedded Systems: A Cyber-Physical Systems Approach”, 2017, MIT Press.
2. R. Alur, “Principles of Cyber-Physical Systems,” 2015, MIT Press.
3. P. Tabuada, “Verification and control of hybrid systems: a symbolic approach”, 2009, Springer-Verlag.

COURSE OUTCOMES

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

1. Explain CPS concepts, process models, real-time scheduling, networking, security, and application domains.
2. Utilize modelling, scheduling, networking, and cybersecurity techniques to formulate effective CPS solutions.
3. Examine CPS architecture, scheduling strategies, communication frameworks, security challenges, and functional behaviour across diverse applications.
4. Critically assess CPS solutions for performance, reliability, interoperability, safety, and security.
5. Develop innovative CPS solutions through integrated modeling and scheduling.

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

25ITPE407	3D PRINTING AND DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand the fundamentals and applications of 3D printing (Additive Manufacturing).
- Select suitable materials and 3D printing techniques for different engineering applications.
- Develop functional products using additive manufacturing in an Industry 4.0 environment

UNIT I

3D Printing (Additive Manufacturing) - Introduction, Process, Classification, Advantages, Additive V/s Conventional Manufacturing processes, Applications.

CAD for Additive Manufacturing - CAD Data formats, Data translation, Data loss, STL format.

UNIT II

Additive Manufacturing Techniques - Stereolithography, LOM, FDM, SLS, SLM, Binder Jet technology - Process, Parameters, Process Selection for various applications - Additive Manufacturing Application Domains: Aerospace, Electronics, Health Care, Defence, Automotive, Construction, Food Processing, Machine Tools

UNIT III

Materials - Polymers, Metals, Non-Metals, Ceramics - Various forms of raw material- Liquid, Solid, Wire, Powder Preparation and their desired properties, Polymers and their properties. Support Materials

UNIT IV

Additive Manufacturing Equipment -Process Equipment- Design and process parameters- Governing Bonding Mechanism- Common faults and troubleshooting - Process Design

UNIT V

Post-processing: Requirements and Techniques - Product quality- Inspection and testing - Defects and their causes

TEXTBOOKS

1. Lan Gibson, David W. Rosen and Brent Stucker, "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.
2. Andreas Gebhardt, "Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing", Hanser Publisher, 2011.
3. Khanna Editorial, "3D Printing and Design", Khanna Publishing House, Delhi.

REFERENCES

1. CK Chua, Kah Fai Leong, "3D Printing and Rapid Prototyping- Principles and Applications", World Scientific, 2017.
2. J.D. Majumdar and I. Manna, "Laser-Assisted Fabrication of Materials", Springer Series in Materials Science, 2013.
3. L. Lu, J. Fuh and Y.S. Wong, "Laser-Induced Materials and Processes for Rapid Prototyping", Kluwer Academic Press, 2001.
4. Zhiqiang Fan and Frank Liou, "Numerical Modelling of the Additive Manufacturing (AM) Processes of Titanium Alloy", InTech, 2012.

COURSE OUTCOMES

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

1. Explain the fundamentals, CAD concepts, and applications of 3D printing.
2. Compare and select appropriate additive manufacturing processes for engineering applications.
3. Choose suitable materials for additive manufacturing based on application requirements.
4. Analyze additive manufacturing equipment, process parameters, and common manufacturing defects.

5. Produce and evaluate a 3D printed product using appropriate post-processing and quality inspection techniques.

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

25ITPE407	MOBILE AD HOC AND WIRELESS SENSOR NETWORKS											L	T	P	C
												3	0	0	3

COURSE OBJECTIVES

- To introduce the basics of routing in cellular and ad hoc networks. 0 0
- To impart knowledge about quality of service, QoS solutions, QoS routing protocols.
- To enable the students to understand the importance of Energy Management schemes in Mobile ad hoc and wireless sensor networks.
- To describe sensor networks, their architecture and Standards.
- To expose the students to hybrid wireless networks.

UNIT I

Routing: Cellular and Ad hoc wireless networks – Issues of MAC layer and Routing – Proactive, Reactive and Hybrid Routing protocols – Multicast Routing – Tree-based and mesh-based protocols – Multicast with Quality-of-Service Provision.

UNIT II

Quality of Service: Real-time traffic support – Issues and challenges in providing QoS – Classification of QoS Solutions – MAC layer classifications – QoS Aware Routing Protocols – Ticket-based and Predictive location-based QoS Routing Protocols.

UNIT III

Energy Management: Need for Energy Management – Classification of Energy Management Schemes – Battery Management and Transmission Power Management Schemes – Network Layer and Data Link Layer Solutions – System power Management schemes.

UNIT IV

Sensor Networks: Introduction – Sensor Network Architecture-Data Dissemination – Data Gathering – MAC Protocols for sensor Networks – Location discovery – Quality of Sensor Networks – Evolving Standards – Other Issues – Recent trends in Infrastructureless Networks.

UNIT V

Hybrid Wireless Networks: Introduction – Next Generation Hybrid Wireless Architectures – Routing in Hybrid Wireless Networks – Pricing in Multi-Hop Wireless Networks – Power Control Schemes in Hybrid Wireless Networks – Load Balancing in Hybrid Wireless Networks

TEXTBOOKS

1. C. Siva Ram Murthy and B.S. Manoj, “Ad hoc Wireless Networks – Architectures and Protocols”, 1st Edition, Pearson Education, 2006.
2. Feng Zhao and Leonidas Guibas, “Wireless Sensor Networks – An Information Processing Approach”, 1st Edition, Morgan Kaufmann Publishers, 2004.

REFERENCES

1. C.K. Toh, “Ad hoc Mobile Wireless Networks: Protocols and Systems”, Pearson Education, 2002.
2. Thomas Krag and SebastinBuettrich, “Wireless Mesh Networking”, O’Reilly Publishers, 2007.
3. Carlos De Moraes Cordeiro, Dharma Prakash Agarwal, “Ad hoc and Sensor Networks: Theory and Applications”, World Scientific Publishing Company Private Limited, 2006.

COURSE OUTCOMES

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

1. Classify routing protocols in cellular and ad hoc wireless networks.
2. Apply QoS-aware routing protocols for real-time traffic support.
3. Analyze energy management schemes in wireless networks.
4. Analyze sensor network architecture and protocols.
5. Evaluate routing and resource management strategies in hybrid wireless networks

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

25ITPE407	UI AND UX DESIGN					L	T	P	C
						3	0	0	3

COURSE OBJECTIVES

- Understand the principles of User Experience (UX), user-centered design, and the UX design process.
- Apply UX research methods, information architecture, wireframing, and prototyping techniques to design effective interfaces.
- Analyze user needs, business requirements, and usability findings to enhance user experience.
- Evaluate UX designs using usability testing, user feedback, and design principles to improve product quality.
- Design user-centered UX solutions by integrating research, design, prototyping, testing, and iterative refinement.

UNIT I

UX Introduction: User Interaction with products, applications, and services, Cognitive Model/Mental Model; Necessity of User Experience Design; Definition of User Experience (UX) Design.

Elements of UX Design: Core elements of User Experience, working of elements, UX Design Process: Defining the UX Design Process and Methodology.

UNIT II

UX Design Process: Research and define the importance of research, Research methods and tools, Understanding the user needs and goals, Understanding the business goals, Deliverables of the research and define phase-Insight on User goals and business goals, Hands-on assignments and Quiz.

UNIT III

UX Design Process: IDEATE/DESIGN - Visual design principles, Information design and data, Visualization: Interaction design, Information architecture, Wireframing and storyboarding, UI elements and widgets, Screen design and layouts, Hands-on assignments and quizzes.

UNIT IV

UX Design Process: PROTOTYPE and TEST: Necessity of testing your design, Usability testing, Types of usability testing, Usability testing process, Plan for the usability tests, Prototype your design to test, Introduction of prototyping tools, Conducting and preparation of usability test results.

UNIT V

UX Design Process: iterate/improve: Understanding the Usability test findings, applying the Usability test feedback in improving the design. UX Design Process: Communication with implementation team; UX Deliverables to be given to the implementation team.

TEXTBOOKS

1. Jesse James Garrett, “The Elements of User Experience: User-Centered Design for the Web and Beyond”, New Riders Publishing, 2nd Edition, 2002.
2. Steve Krug, “Don't Make Me Think, Revisited: A Commonsense Approach to Web Usability”, 3rd Edition, 2014.
3. Thomas Tullis, William Albert, “Measuring the User Experience: Collecting, Analyzing, and Presenting Usability Metrics”, Morgan Kaufman, 1st Edition, 2008.

REFERENCES

1. Jeff Gothelf, Josh Seiden, “Lean UX: Applying Lean Principles to Improve User Experience”, O'Reilly, 1st Edition, 2013.
2. Kevin Mullet, Darrell Sano, “Designing Visual Interfaces: Communication Oriented Techniques”, Soft Press, 1995.
3. Wilbert O. Galitz, “The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques”, Wiley, 2002.

COURSE OUTCOMES

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

1. Explain UX principles, user-centered design, research methods, prototyping, usability testing, and iterative design.
2. Apply UX research, information architecture, wireframing, prototyping, and usability testing to develop user-centered solutions.
3. Analyze user needs, business goals, interface designs, and usability findings to improve user experience.
4. Evaluate UX solutions using design principles, usability testing, user feedback, and performance metrics.
5. Design and develop end-to-end UX solutions by integrating research, ideation, prototyping, testing, and continuous improvement.

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

25ITPE407	SOFTWARE DEFINED NETWORKS										L	T	P	C
											3	0	0	3

COURSE OBJECTIVES:

- To understand the fundamentals and architecture of Software Defined Networking (SDN).
- To study OpenFlow protocols and SDN controller frameworks.
- To explore data center networking and virtualization technologies.
- To learn SDN programming and Network Functions Virtualization (NFV).
- To understand SDN frameworks, orchestration, and real-world applications

UNIT I

INTRODUCTION: History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Why SDN – Evolution of SDN – How SDN Works – Centralized and Distributed Control and Data Planes

UNIT II

OPENFLOW & SDN CONTROLLERS: OpenFlow Specification – Drawbacks of Open SDN, SDN via APIs, PIs, SDN via Hypervisor-Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts

UNIT III

DATA CENTERS: Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE

UNIT IV

SDN PROGRAMMING: Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications

UNIT V

SDN: Juniper SDN Framework – IETF SDN Framework – OpenDaylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration

TEXTBOOKS

1. Paul Goransson and Chuck Black, Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014.
2. Thomas D. Nadeau, Ken Gray, SDN: Software Defined Networks, O'Reilly Media, 2013.

REFERENCES

1. Siamak Azodolmolky, Software Defined Networking with OpenFlow, Packet Publishing, 2013.
2. Vivek Tiwari, SDN and OpenFlow for Beginners, Amazon Digital Services, Inc., 2013.

3. Fei Hu, Editor, Network Innovation through OpenFlow and SDN: Principles and Design, CRC Press, 2014.

COURSE OUTCOMES

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

1. Analyze the evolution and architecture of Software Defined Networking (SDN).
2. Explain the components, controllers, and OpenFlow protocols of SDN.
3. Investigate the role of SDN, virtualization, and NFV in modern networking.
4. Design and develop SDN-based applications using programming frameworks and controllers.
5. Perform data center orchestration using SDN tools and virtualization technologies.

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

25ITPE407	SOFTWARE TESTING AND QUALITY ASSURANCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the fundamentals of software testing and SQA.
- To learn software testing techniques and test management.
- To study software quality assurance frameworks and standards.
- To understand software quality planning and assurance processes.
- To apply software testing and quality assurance in software development.

UNIT I

Phases of Software project – Quality, Quality assurance and quality control – Testing, Verification and Validation – White box testing – Static testing – Structural testing – Black box testing – Definition, need for black box testing – Black box testing techniques – Requirements based testing, Positive and Negative testing, Boundary Value Analysis, Decision Tables, Equivalence Partitioning, Graph based Testing, Compatibility Testing, Domain Testing.

UNIT II

Integration testing – Integration testing as a type of testing – Integration testing as a phase of testing – Scenario testing – Defect bash – System and Acceptance testing – System testing overview – Need for System testing – Functional system testing – Non-functional testing – Acceptance testing.

UNIT III

Performance testing – Factors governing performance testing – Methodology for performance testing – Tools for performance testing – Process for performance testing – Regression testing – Types of Regression testing – When and how to do Regression testing – Test planning – Test management – Test process – Test reporting.

UNIT IV

Software quality – definition – Software quality assurance-definition and objectives – Software quality assurance and software engineering – Software quality factors – The components of the

software quality assurance system – The SQA system – SQA architecture Pre-project components – Software project life cycle components – Infrastructure components for error prevention and improvement – Management SQA components – SQA standards, system certification, and assessment components – Organizing for SQA – The human components – Considerations guiding construction of an organization's SQA system.

UNIT V

Development plan and quality plan objectives – Elements of the development plan – Elements of the quality plan – Development and quality plans for small projects and for internal projects – Integrating quality activities in the project life cycle-Classic and other software development methodologies – Factors affecting intensity of quality assurance activities in the development process – Verification, validation and qualification – A model for SQA defect removal effectiveness and cost.

TEXTBOOKS

1. Srinivasan Desikan, Gopalaswamy Ramesh, "Software Testing: Principles and Practices", Pearson Education India, 1st Edition, 2005.
2. Daniel Galin, "Software quality assurance-from theory to implementation", Pearson Education India, 1st Edition, 2009.

REFERENCES

1. Aditya Mathur, "Foundations of software testing", Pearson Education, 1st Edition, 2008.
2. Ron Patton, "Software Testing", Pearson Education, 2nd Edition, 2007.
3. William E. Perry, "Effective Methods for Software Testing: Includes Complete Guidelines, Checklists, and Templates", Wiley Publishing, 3rd Edition, 2006.
4. Alan C Gillies, "Software Quality Theory and Management", Cengage Learning, 2nd Edition, 2003.
5. Yogesh Singh, "Software Testing", University Press.
6. Chauhan, "Software Testing Principles and Practices", Oxford University Press.

COURSE OUTCOMES

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

1. Explain the concepts of software testing, quality, and Software Quality Assurance (SQA).
2. Apply software testing techniques, verification, validation, and quality assurance practices.
3. Analyze testing strategies, SQA frameworks, and software quality processes.
4. Evaluate software quality, testing methods, and quality plans for software projects.
5. Design and develop effective software testing and quality assurance solutions.

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

25ITPE407	INFORMATION CODING THEORY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the fundamentals of information theory and entropy.
- To learn error control coding techniques and decoding methods.

- To study source coding and data compression techniques.
- To understand audio, speech, image, and video coding standards.
- To apply coding and compression techniques in multimedia communication systems.

UNIT I

Information theory: Information – Entropy, Information rate, classification of codes, Kraft-McMillan inequality, Source coding theorem, Shannon-Fano coding, Huffman coding, Extended Huffman coding – Joint and conditional entropies, Mutual information – Discrete memoryless channels – Binary Symmetric Channel – Channel capacity, Shannon limit.

UNIT II

Error control coding: block codes: Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding – Single parity codes, Hamming codes, Repetition codes – Linear block codes, Cyclic codes – Syndrome calculation, Encoder and decoder.

UNIT III

Error control coding: convolutional codes: Convolutional codes – code tree, trellis, state diagram – Encoding – Decoding: Sequential search and Viterbi algorithm – Principle of Turbo coding.

UNIT IV

Source coding: text, audio and speech: Text: Adaptive Huffman Coding, Arithmetic Coding, LZW algorithm – Audio: Perceptual coding, Masking techniques, Psychoacoustic model, MEG Audio layers I, II, III, Dolby AC3 – Speech: Channel Vocoder, Linear Predictive Coding.

UNIT V

Source coding: image and video: Image and Video Formats – GIF, TIFF, SIF, CIF, QCIF – Image compression: Read, JPEG – Video Compression: Principles– I, B, P frames, Motion estimation, Motion compensation, H.26, MPEG standard.

TEXTBOOKS

1. R. Bose, “Information Theory, Coding and Cryptography”, TMH 2007.
2. Fred Halsall, “Multimedia Communications: Applications, Networks, Protocols and Standards”, Pearson Education Asia, 2002.

REFERENCES

1. K. Sayood, “Introduction to Data Compression” 3/e, Elsevier, 2006.
2. S. Gravano, “Introduction to Error Control Codes”, Oxford University Press, 2007.
3. Amitabha Bhattacharya, “Digital Communication”, TMH, 2006.

COURSE OUTCOMES

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

1. Explain the principles of information theory, error control coding, and source coding.
2. Apply coding techniques and compression algorithms for reliable data communication.
3. Analyze error control codes and multimedia compression methods.
4. Evaluate coding schemes and compression standards for communication systems.
5. Design and implement efficient coding and compression solutions for multimedia applications.

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

PROFESSIONAL ELECTIVES – III

25ITPE505	MOBILE COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand mobile computing fundamentals, generations, and multiple access techniques.
- Study GSM, GPRS, and UMTS architecture, protocols, and security.
- Explore Mobile IP, Ad hoc routing protocols, and vehicular networks.
- Learn mobile transport layer and WAP-based application protocols.
- Analyze mobile OS platforms, SDKs, m-commerce, and payment security

UNIT I Introduction

Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA

UNIT II Mobile Telecommunication System

Introduction to Cellular Systems - GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS- UMTS – Architecture – Handover - Security

UNIT III Mobile Network Layer

Mobile IP – DHCP – Ad Hoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV, Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) – MANET vs VANET – Security.

UNIT IV Mobile Transport and Application Layer

Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML

UNIT V Mobile Platforms and Applications

Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues

TEXTBOOKS

1. Jochen Schiller, Mobile Communications, PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, —Fundamentals of Mobile Computingl, PHI Learning Pvt.Ltd, New Delhi – 2012

REFERENCES

1. Dharma Prakash Agarwal, Qing and An Zeng, “Introduction to Wireless and Mobile Systems”, Thomson Asia Pvt Ltd, 2005.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, 2003.
3. William C.Y. Lee, “Mobile Cellular Telecommunications - Analog and Digital Systems”, Second Edition, Tata McGraw-Hill Edition, 2006.
4. C. K. Toh, “Ad Hoc Mobile Wireless Networks”, First Edition, Pearson Education, 2002.
5. Android Developers: <http://developer.android.com/index.html>
6. Apple Developer: <https://developer.apple.com/>
7. Windows Phone DevCenter: <http://developer.windowsphone.com>
8. BlackBerry Developer: <http://developer.blackberry.com>

COURSE OUTCOMES

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

1. Explain multiple access techniques, GSM/GPRS/UMTS, Mobile IP/routing protocols, WAP/transport layer, and mobile OS/SDK/m-commerce concepts.

2. Apply multiplexing, frequency allocation/handover, ad-hoc/vehicular routing, WAP/WML development, and mobile SDKs to build solutions.
3. Compare and analyze performance, security vulnerabilities, and trade-offs across access techniques, cellular systems, routing protocols, WAP, and mobile platforms.
4. Assess and justify technologies, network designs, routing solutions, and mobile platforms for performance/security.
5. Design mobile applications, ad-hoc/vehicular routing schemes, and secure m-commerce/mobile payment systems.

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

25ITPE505	IMAGE AND VIDEO ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand digital image/video representation, sampling, and pixel relationships.
- Study spatial, frequency, and wavelet-domain image/video enhancement and restoration.
- Learn lossless image compression techniques and coding schemes.
- Understand video compression standards and coding techniques.
- Explore feature detection, description, and image segmentation methods

UNIT I Introduction to Digital Image and Video Processing

Digital image representation, Sampling and Quantization, Types of Images, Basic Relations between Pixels - Neighbours, Connectivity, Distance Measures between Pixels, Linear and Non-Linear Operations, Introduction to Digital Video, Sampled Video, Video Transmission. Gray-Level Processing: Image Histogram, Linear and Non-linear point operations on Images, Arithmetic Operations between Images, Geometric Image Operations. Binary Image Processing: Image Thresholding, Region labelling, Binary Image Morphology

UNIT II Image and Video Enhancement and Restoration

Spatial domain - Linear and Non-linear Filtering, Morphological filtering, Frequency domain – Homomorphic Filtering, Blotch Detection and Removal - Blotch Detection, Motion Vector Repair and Interpolating Corrupted Intensities, Intensity Flicker Correction - Flicker Parameter Estimation, Brief introduction to Wavelets, Wavelet-based image denoising, Basic methods for image restoration using deconvolution filters

UNIT III Image Analysis

Image Compression: Huffman coding, Run-length coding, LZW coding, Lossless Coding, Wavelet-based image compression

UNIT IV Video Analysis

Video Compression: Basic Concepts and Techniques of Video Coding and the H.264 Standard, MPEG-1 and MPEG-2 Video Standards

UNIT V Feature Detection and Description

Introduction to feature detectors, descriptors, matching and tracking, Basic edge detectors – Canny, Sobel, Prewitt, etc., Image Segmentation – Region-based Segmentation – Region Growing and Region Splitting and Merging, Thresholding – Basic global thresholding, optimum global thresholding using Otsu's method

TEXTBOOKS

1. Alan Bovik, “Handbook of Image and Video Processing”, Second Edition, Academic Press, 2005.
2. Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2008.
3. Richard Szeliski, “Computer Vision – Algorithms and Applications”, Springer, 2011

REFERENCES

1. Anil K Jain, “Fundamentals of Digital Image Processing”, PHI, 2011.
2. Oge Marques, “Practical Image and Video Processing Using MATLAB”, Wiley, 2011.
3. John W. Woods, “Multidimensional Signal, Image, Video Processing and Coding”, Academic Press, 2006

COURSE OUTCOMES

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

1. Explain pixel relationships, gray-level/binary processing, filtering/restoration, compression coding, video coding standards, and feature detection/segmentation concepts.
2. Apply sampling, quantization, morphological operations, filtering/wavelet-based restoration,
3. Compare and analyze image processing operations, restoration techniques, compression efficiency, video coding standards, and segmentation/feature-matching performance.
4. Assess and justify image/video processing, restoration, compression, and segmentation techniques for application requirements.
5. Design image/video processing pipelines, compression schemes, video coding modules, and feature-based segmentation/tracking

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

25ITPE505	PARALLEL COMPUTING	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

At the end of the course, the student shall be able to

- Understand parallel computer architecture classifications, CPU architecture, and memory/cache organization.
- Study GPU architecture, interconnect networks, and parallel programming models.
- Learn parallel performance analysis models, metrics, and evaluation laws.
- Understand parallel program design steps, decomposition techniques, and scheduling strategies.
- Explore the CUDA programming model and GPU memory management techniques.

UNIT-I

An Introduction to Parallel Computer Architecture: Parallel Organization, SISD: Single Instruction, Single Data, SIMD: Single Instruction, Multiple Data, MIMD: Multiple Instruction, Multiple Data, MISD: Multiple Instruction, Single Data, System Architecture, CPU Architecture, Memory and Cache.

UNIT-II

GPU Architecture: Interconnect Architecture, Routing, Links, Types and Quality of Networks, Torus Network, Hypercube Network, Crossbar Network, Shuffle-Exchange Network, Clos Network, Tree Network, Network Comparison. Parallel Programming Models: Distributed-Memory Programming Model, Shared Memory Programming Model, Task Graph Model, Variants of Task Parallelism.

UNIT-III

Parallel Performance Analysis: Simple Parallel Model, Bulk-Synchronous Parallel Model, BSP Computation Time, BSP Example, PRAM Model, PRAM Computation Time, PRAM Example, Parallel Performance Evaluation, Latency and Throughput, Speed-up, Cost, Efficiency, Scalability, Iso-efficiency, Parallel Work, Brent's Work-Time Scheduling Principle, Amdahl's Law, Gustafson's Law, Karp–Flatt Metric.

UNIT-IV

Parallel Program Design: Design Steps, Granularity, Communication, Synchronization, Load Balance, Task Decomposition, Domain Decomposition, Functional Decomposition, Task Graph Metrics, Task Execution, Preliminary Task Mapping, Task Scheduling Framework, Centralized Push Scheduling Strategy, Distributed Push Scheduling, Pull Scheduling, Input/Output, Debugging and Profiling.

UNIT-V

CUDA: Programming Model, CPU–GPU Memory Transfer, Concurrent Kernels, CUDA Synchronization, CUDA Shared Memory, CUDA Parallel Memory Access.

COURSE OUTCOMES

At the end of the course, the student shall be able to

1. Explain architecture classifications, interconnect networks/programming models, performance metrics, program design/scheduling, and CUDA fundamentals.
2. Apply architecture/memory concepts, interconnect networks, performance laws, task/domain decomposition/scheduling, and CUDA constructs for GPU programming.
3. Analyze architecture/memory trade-offs, compare networks/programming models, evaluate performance metrics, and examine scheduling and CUDA memory/synchronization efficiency.
4. Assess and justify architecture, network/programming model, performance analysis, program design, and CUDA optimization choices.
5. Design parallel system configurations, communication schemes, performance-optimized algorithms, task-decomposed programs, and CUDA-based GPU applications.

TEXTBOOKS

1. Subodh Kumar, “Introduction to Parallel Programming”, 1st Edition, Cambridge University Press, 2023.

REFERENCES

1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, "Introduction to Parallel Computing", 2nd Edition, Addison-Wesley Professional, 2003.
2. An introduction to parallel programming by Peter S Pacheco. 2011. I Edition, Morgan Kaufmann Publishers

WEB REFERENCES

1. <https://nptel.ac.in/courses/106102114>
2. <https://www.cs.purdue.edu/homes/ayg/book/Slides/>

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

25ITPE505	NETWORK MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand network management standards, models, and design issues for network projects.
- Study SNMP-based network management functions and fault management techniques.
- Learn SNMP v3 security models, accounting, and performance management.
- Understand network management architecture and organizational models.
- Explore RMON-based monitoring and open-source network management tools.

UNIT I Network Management Architectures & Applications

Management Standards and Models, Network Design Issues for the Project, Network Management Functions – Configuration, Configuration Management & Auto-discovery, Configuration Database & Reports, Abstract Syntax Notation One (ASN.1)

UNIT II Network management and functions

Introduction- Basic Concepts and task: functional areas, SNMP, Client Pull & Server Push, Ports & UDP, Parts of SNMP, Nodes, SNMP Agents, Proxy & Gateway Agents, Basic Operations, Languages of SNMP, SNMP Data Types, Managed "Objects" & MIBs, Commercial SNMP Applications, SNMP & Windows services

Network Management Functions – Fault Management, Fault Identification and Isolation, Event Correlation Techniques, Simple Network Management Protocol - SNMP v2, Protocol Specification, Version 2 MIB Enhancements, MIB-II, Case Diagrams

UNIT III Simple Network Management Protocol - SNMP v3

Version 3 Protocol & MIB, Simple Network Management Protocol - SNMP v3, User-Based Security Model, View-Based Access Model, Network Management Functions - Accounting & Performance, Accounting Management, Performance Management, Network Usage, Metrics and Quotas

UNIT IV Network Management Architectures & Applications

Management Standards and Models, NM Standards - International standard (ISO/OSI), Internet model, TMN Architecture, Organization Model, 2&3 tier models, Information Model, Communication Model

UNIT V Remote Network Monitoring RMON 1

Statistics Collection, Alarms and Filters, Remote Network Monitoring RMON 2, Monitoring. Network Protocol Traffic, Application-Layer Visibility. Management Open-Source Tools OpenNMS, NMIS, op5, Nagios Contemporary issues

TEXTBOOK

1. Verma, Dinesh Chandra, "Principles of Computer Systems and Network Management", Springer, 2010

REFERENCES

1. Mani Subramanian, "Network Management Principles and Practice", Addison-Wesley, New York, 2010.
2. Ghislain Hachey, "Instant OpenNMS Starter", Packt, June 2013

COURSE OUTCOMES

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

1. Explain configuration management, ASN.1, SNMP, agents, MIBs, fault management, SNMPv3 security, NM architectures, and RMON tools.
2. Apply configuration management, auto-discovery, SNMP operations, SNMPv3 security, and RMON/open-source tools for network monitoring and fault identification.
3. Analyze configuration issues, fault management, event correlation, SNMPv3 security, NM architecture, and RMON traffic statistics.
4. Assess configuration and SNMP-based fault management strategies, SNMPv3 security approaches, NM architecture, and RMON/open-source tools.
5. Design configuration systems, auto-discovery mechanisms, SNMP-based fault management solutions, SNMPv3 security frameworks, and RMON-based monitoring solutions.

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

25ITPE505	OBJECT-ORIENTED ANALYSIS AND DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand object-oriented system development methodology and the unified approach.
- Study object-oriented methodologies, modelling, and UML.
- Learn to use case-driven object-oriented analysis techniques.
- Understand object-oriented design process, axioms, and class design.
- Explore applications in data acquisition, frameworks, and client/server computing.

UNIT I

Overview of Object-Oriented System Development: Introduction – Object-Oriented System Development Methodology – Overview of Unified Approach – Object Basics – Systems Development Life Cycle-Unified Approach.

UNIT II

Methodology and Modelling: Introduction –Rumbaugh et al.'s Object Modelling Technique - Booch Methodology – Jacobson et al. Methodologies – Patterns –Framework – Unified approach – Unified Modelling Language.

UNIT III

Object-Oriented Analysis: Use Case-Driven Object-Oriented Analysis; Object-Oriented Analysis: Classification Noun Phrase Approach – Common Class Patterns Approach – Object Relationship Analysis.

UNIT IV

Object-Oriented Design: Object-Oriented Design Process – Object-Oriented Design Axioms – Corollaries – Designing Classes: Defining Attributes and methods –Object Store and Access layer – Designing the View Layer Classes.

UNIT V

Applications: Data Acquisition: Weather Monitoring Station – Frameworks: Foundation Class Library – Client/Server Computing: Inventory Tracking.

TEXTBOOKS

1. Ali Bahrami, "Object-Oriented Systems Development using the Unified Modelling Language", Tata McGraw Hill, 1st Edition, 2008.
2. Grady Booch, "Object-Oriented Analysis and Design with Applications", Pearson Education, Inc, Second Edition, 2008.

REFERENCES

1. John Deacon, "Object-Oriented Analysis and Design", Addison Wesley, 1st Edition, 2005.
2. Pinson L. and Wiener R., "Application of Object-Oriented Programming", Addison Wesley Publishing Company, 1990.
3. Taylor D., "Object Oriented Information Systems", John Wiley and Sons, 1992.

COURSE OUTCOMES

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

1. Explain object basics, SDLC, unified approach, OMT/Booch/Jacobson methodologies, UML, use case analysis, and design axioms.
2. Apply the unified approach and UML to model systems; use analysis approaches for use cases and design axioms for classes/layers.
3. Analyze development approaches, methodologies, patterns, and frameworks; examine use case analysis and design structures for consistency.
4. Assess and justify methodology, modelling approach, and design solutions; evaluate analysis outcomes and design effectiveness.
5. Design UML-based system models and develop object-oriented solutions/applications (e.g., monitoring, inventory systems).

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

25ITPE505	SOCIAL NETWORK INFORMATION ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Introduce the foundations of the semantic web, social web, and social network analysis.
- Equip learners with knowledge representation techniques such as RDF and OWL for social data.
- Provide skills to identify, evaluate, and analyze communities in social networks.
- Familiarize learners with behaviour prediction, privacy, and trust models in social networks.
- Build competence in graph theory and visualization methods for social networks.

UNIT I

Introduction – Development of Semantic Web – Emergence of the Social Web – Social Network Analysis: Development of Social Network Analysis – Key concepts and measures in network analysis – Electronic sources for network analysis: Electronic discussion networks, blogs, and online communities – Web-based networks – Applications of Social Network Analysis

UNIT II

Ontology-based knowledge Representation –Resource Description Framework – Web Ontology Language–Modeling and aggregating social network data: State-of-the-art in network data representation – Ontological representation of social individuals – Ontological representation of social relationships – Aggregating and reasoning with social network data – Advanced representations.

UNIT III

Extracting evolution of Web Community from a Series of Web Archive–Detecting communities in social networks – Evaluating communities – Methods for community detection and mining – Applications of community mining algorithms – Tools for detecting communities in social network infrastructures and communities – Decentralized online social networks

UNIT IV

Understanding and predicting human behaviour for social communities – User data management – Inference and Distribution – Enabling new human experiences – Reality mining – Context – Awareness – Privacy in online social networks – Trust models based on subjective logic – Trust network analysis – Trust transitivity analysis – Combining trust and reputation – Trust derivation based on trust comparisons – Attack spectrum and countermeasures.

UNIT V

Graph theory – Centrality – Clustering –Node–Edge Diagrams – Matrix representation – Visualizing online social networks, Visualizing social networks with matrix-based representations –

Matrix and Node–Link Diagrams – Hybrid representations – Applications – Cover networks – Community welfare–Collaboration networks – Co–Citation networks.

TEXTBOOKS

1. Borko Furht, “Handbook of Social Network Technologies and Applications”, Springer, 1st Edition, 2010.
2. Peter Mika, “Social Networks and the Semantic Web”, Springer, First Edition, 2007.

REFERENCES

1. Guandong Xu, Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and applications”, Springer, First Edition, 2011.
2. Dion Goh and Schubert Foo, “Social Information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively”, IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé–Dupuy, “Collaborative and Social Information Retrieval and Access: Techniques for Improved User Modelling”, IGI Global Snippet, 2009.
4. John G Breslin, Alexander Passant and Stefan Decker, “The Social Semantic Web”, Springer, 2009.

COURSE OUTCOMES

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

1. Explain social network analysis, ontology-based representation, community detection, trust/privacy models, and graph theory/visualization concepts.
2. Apply network analysis measures, RDF/OWL representation, community detection algorithms, trust models, and graph-based visualization techniques.
3. Analyze network structures, examine community detection effectiveness, evaluate trust/privacy models, and compare visualization techniques.
4. Assess and justify representation approaches, community detection methods, trust frameworks, and visualization techniques.
5. Design ontology-based models, community detection solutions, trust/privacy frameworks, and visualization solutions for social networks.

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

25ITPE505	BUSINESS INTELLIGENCE										L	T	P	C
											3	0	0	3

COURSE OBJECTIVES

- Introduce the fundamentals of business intelligence, BI processes, and infrastructure evaluation.
- Build skills in BI project planning, requirements gathering, and data analysis.
- Provide knowledge of metadata repository design and ETL processes.
- Develop competence in BI application development using OLAP and data mining tools.

- Familiarize learners with modern BI technologies, ethical issues, and BI team management.

UNIT I Introduction

Definition, BI process - Private and Public intelligence, BI Decision Support Initiatives, Business Drivers, Cost- Benefit analysis, Risk Assessment, Enterprise Infrastructure Evaluation- Technical and Non-technical.

UNIT II Project Planning and Data Analysis

BI Project planning, Requirements definition and gathering, deliverables, business-focused data analysis, top-down logical data modeling, Bottom-up source data analysis, data cleansing, Prototyping.

UNIT III Metadata Repository Analysis and Design

Metadata models, Analysis, Database design, Extract/ Transform / Load (ETL) design, metadata design, ETL development.

UNIT IV Application Development

OLAP tools, Multidimensional analysis factors, architecture, Data mining, Risks, metadata repository development, Implementation, Release evaluation.

UNIT V Modern Information Technology and Its Business Opportunities

Business intelligence software, BI on the web, Ethical and legal limits, Industrial espionage, BI software, modern techniques of crypto analysis, managing and organizing for an effective BI Team.

COURSE OUTCOMES

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

1. Identify and summarize BI concepts, project planning approaches, metadata/ETL fundamentals, OLAP and data mining basics, and modern BI trends.
2. Use cost-benefit and risk assessment methods, perform data analysis and modeling, build ETL processes, and implement OLAP-based BI solutions.
3. Examine enterprise infrastructure, data analysis approaches, metadata/ETL designs, and BI application risks and issues.
4. Critique BI initiatives, project plans, metadata/ETL efficiency, and BI applications for organizational fitness.
5. Formulate BI project plans, metadata/ETL solutions, OLAP-based applications, and strategies for managing effective BI teams.

TEXTBOOKS

1. Larissa T. Moss and Shaku Atre, Business Intelligence Roadmap: The Complete Project Lifecycle for Decision Support Applications, Addison Wesley, 2003.
2. Efraim Turban, Ramesh Sharda, Jay E. Aronson and David King, Business Intelligence, Prentice Hall, 2008.

REFERENCES

1. Elizabeth Vitt, Michael Luckevich, Stacia Misner, Business Intelligence, Microsoft, 2002.
2. Michalewicz Z., Schmidt M., Michalewicz M and Chiriac C, Adaptive Business Intelligence, Springer – Verlag, 2006.
3. Galit Shmueli, Nitin R. Patel and Peter C. Bruce, Data Mining for Business Intelligence – Concepts, Techniques and Applications, Wiley, India, 2007.

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

25ITPE505	MODERN CRYPTOGRAPHY										L	T	P	C
											3	0	0	3

COURSE OBJECTIVES

- Lay a foundation in number theory relevant to cryptography.
- Present core security services and classical-to-modern encryption schemes.
- Examine block ciphers and hash functions for data protection.
- Investigate asymmetric encryption and key-sharing protocols.
- Address digital signatures and network security threats.

UNIT 1

Basics of Algebra and Number Theory: Integer Arithmetic-Modular Arithmetic- Algebraic structures – Prime Numbers -Fermat's and Euler's Theorem – Factorization –Chinese Remainder Theorem - Linear and Quadratic Congruence -Discrete Logarithms

UNIT II

Security services - Confidentiality, Integrity, Authentication, Non-repudiation, Access control – Security Mechanisms (Data Integrity, Digital Signature, Authentication, Access control) - Security Principles- Introduction to Cryptography: Classification of Cryptosystems - Cryptanalytic attacks- Cipher Properties (Confusion, Diffusion) - Traditional Secret Key Ciphers: Substitution Ciphers (monoalphabetic ciphers, polyalphabetic ciphers)-TranspositionCiphers-Stream and Block Ciphers. Modern Secret Key Ciphers: Substitution Box-Permutation Box-Product Ciphers

UNIT III

Data Encryption Standard (DES) (Feistel and Non-Feistel Ciphers, Structure of DES, DES Attacks, 2-DES, 3-DES) - Advanced Encryption Standard (AES) (Structure, Analysis)-Cryptographic Hash Functions– Properties - Secure HashAlgorithm-Message Authentication Code (MAC)

UNIT IV

Public Key Cryptosystems (PKC): - Types of PKC –Trapdoor - one-way functions -RSA Cryptosystem (Integer Factorization Trapdoor, Key Generation, Encryption, Decryption) - ElGamal Cryptosystem (Discrete Logarithm Trapdoor, Key Generation, Encryption, Decryption) - Diffie-Hellman Key Exchange Protocol, Man-in-the-Middle attack on Diffie-Hellman Protocol

UNIT V

Digital Signature: Signing – Verification - Digital signature forgery (Existential forgery, Selective forgery, Universal forgery) - RSA Digital Signature Scheme - ElGamal Signature Scheme - IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload-Intruders, Intrusion Detection, Distributed Denial of Service attacks

TEXTBOOKS

1. Behrouz A. Forouzan and Debdeep Mukhopadhyay, “Cryptography & Network Security”, Second Edition, Tata McGraw Hill, New Delhi, 2010
2. Douglas R. Stinson, “Cryptography: Theory and Practice”, Third Edition, CRC Press.
3. William Stallings, “Cryptography and Network Security – Principles and Practices”, Pearson Education, Fourth Edition, 2006.

REFERENCES

1. Atul Kahate, “Cryptography and Network Security”, 2nd Edition, Tata McGraw Hill, 2003.
2. Bernard Menezes, “Network Security and Cryptography”, Cengage Learning India, 2011
3. Bruce Schneier, “Applied Cryptography: Protocols, Algorithms, and Source Code in C”, Second Edition, John Wiley and Sons Inc, 2001.
4. Thomas Mowbray, “Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions”, John Wiley, 2013
5. Wenbo Mao, “Modern Cryptography: Theory & Practice”, Pearson Education, 2006.

COURSE OUTCOMES

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

1. State number theory concepts, security goals, DES/AES basics, public key terminology, and signature/attack types.
2. Solve number-theoretic problems, apply classical/modern ciphers, execute RSA/ ElGamal/ Diffie-Hellman operations, and generate digital signatures.
3. Examine cryptanalytic techniques, cipher/hash weaknesses, and signature forgery/intrusion methods.
4. Assess cryptographic algorithm strength, protocol resilience, and security architecture effectiveness.
5. Formulate encryption/authentication schemes and countermeasures against network attacks.

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

PROFESSIONAL ELECTIVES – IV

25ITPE604	DISTRIBUTED COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce the computation and communication models of distributed systems.
- To illustrate the issues of synchronization and information collection in distributed systems.
- To describe distributed mutual exclusion and distributed deadlock detection techniques.
- To elucidate agreement protocols and fault tolerance mechanisms in distributed systems.
- To explain cloud computing models and their underlying concepts.

UNIT I Introduction

Introduction: Definition-Relation to Computer System Components – Motivation – Message – Passing Systems versus Shared Memory Systems – Primitives for Distributed Communication – Synchronous versus Asynchronous Executions – Design Issues and Challenges; A Model of Distributed Computations: A Distributed Program – A Model of Distributed Executions – Models of Communication Networks – Global State of a Distributed System.

UNIT II Logical Time and Global State

Logical Time: Physical Clock Synchronization: NTP – A Framework for a System of Logical Clocks – Scalar Time – Vector Time; Message Ordering and Group Communication: Message Ordering Paradigms – Asynchronous Execution with Synchronous Communication – Synchronous Program Order on Asynchronous System – Group Communication – Causal Order – Total Order; Global State and Snapshot Recording Algorithms: Introduction – System Model and Definitions – Snapshot Algorithms for FIFO Channels.

UNIT III Distributed Mutex and Deadlock

Distributed Mutual Exclusion Algorithms: Introduction – Preliminaries – Lamport's algorithm – Ricart-Agrawala's Algorithm – Token-Based Algorithms – Suzuki-Kasami's Broadcast Algorithm; Deadlock Detection in Distributed Systems: Introduction – System Model – Preliminaries – Models of Deadlocks – Chandy-Misra-Haas Algorithm for the AND model and OR Model.

UNIT IV Consensus and Recovery

Consensus and Agreement Algorithms: Problem Definition – Overview of Results – Agreement in a Failure-Free System (Synchronous and Asynchronous) – Agreement in Synchronous Systems with Failures; Checkpointing and Rollback Recovery: Introduction – Background and Definitions – Issues in Failure Recovery – Checkpoint-based Recovery – Coordinated Checkpointing Algorithm – Algorithm for Asynchronous Checkpointing and Recovery.

UNIT V Cloud Computing

Definition of Cloud Computing – Characteristics of Cloud – Cloud Deployment Models – Cloud Service Models – Driving Factors and Challenges of Cloud – Virtualization – Load Balancing – Scalability and Elasticity – Replication – Monitoring – Cloud Services and Platforms: Compute Services – Storage Services – Application Services.

TEXTBOOKS

1. Kshemkalyani Ajay D, Mukesh Singhal, "Distributed Computing: Principles, Algorithms and Systems", Cambridge Press, 2011.
2. Mukesh Singhal, Niranjana G Shivaratri, "Advanced Concepts in Operating Systems", McGraw Hill Publishers, 1994.

REFERENCES

1. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012.
2. Pradeep L Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.

3. Tanenbaum A S, Van Steen M, “Distributed Systems: Principles and Paradigms”, Pearson Education, 2007.
4. Liu M L, “Distributed Computing: Principles and Applications”, Pearson Education, 2004.
5. Nancy A Lynch, “Distributed Algorithms”, Morgan Kaufmann Publishers, 2003.
6. Arshdeep Bagga, Vijay Madiseti, “Cloud Computing: A Hands-On Approach”, Universities Press, 2014.

COURSE OUTCOMES

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

1. Describe the concepts of distributed computing, synchronization, consensus, recovery, and cloud computing.
2. Utilize distributed algorithms, communication models, and cloud services for distributed systems.
3. Examine synchronization, deadlocks, fault tolerance, and cloud architectures in distributed environments.
4. Assess distributed system performance, recovery mechanisms, and cloud deployment strategies.
5. Develop scalable and reliable distributed solutions using cloud computing technologies.

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

25ITPE604	SOFT COMPUTING				L	T	P	C
					3	0	0	3

COURSE OBJECTIVES

- Learn the various soft computing frameworks.
- Be familiar with the design of various Neural Networks.
- Be exposed to Fuzzy Logic.
- Learn Genetic Programming and Hybrid Systems.

UNIT I

Artificial neural network: Introduction, characteristics– learning methods – taxonomy – Evolution of neural networks– basic models – important technologies – Applications. Fuzzy logic: Introduction – Crisp sets– Fuzzy sets – Crisp relations and Fuzzy relations: Cartesian product of relation – Classical relation, Fuzzy relations, Tolerance and Equivalence relations, Non-iterative fuzzy sets. Genetic algorithm– Introduction – Biological background – Traditional optimization and Search techniques – Genetic basic concepts.

UNIT II

ANS and BPN: Network inputs and outputs – Feedback interconnections and network stability – Feedforward networks – Adaptive networks – Supervised and Unsupervised learning – Backpropagation network – Approach – Operation – Generalized Delta Rule-Update of output layer weights – Updates of hidden layer weights – Training data – Network sizing – Weights and Learning Parameters – BPN Applications – Data compression.

UNIT III

Membership functions: Features, Fuzzification, methods of membership value assignments–Defuzzification: Lambda cuts – Methods – Fuzzy arithmetic and fuzzy measures: Fuzzy arithmetic – Extension principle-Fuzzy measures – Measures of fuzziness –Fuzzy integrals – Fuzzy rule base and approximate reasoning: Truth values and tables, Fuzzy propositions, formation of rules–Decomposition of rules, Aggregation of fuzzy rules, Fuzzy reasoning–Fuzzy inference systems–Overview of fuzzy expert system–Fuzzy decision making.

UNIT IV

Genetic algorithm: Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, crossover, inversion & deletion, mutation operator, Bitwise operator, Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional methods.

UNIT V

Neuro–fuzzy hybrid systems – Genetic Neuro Hybrid systems – Genetic fuzzy hybrid and Fuzzy genetic hybrid systems – Simplified fuzzy ARTMAP – Applications: A fusion approach of Multispectral images with SAR, Optimization of Traveling Salesman Problem using Genetic Algorithm approach, Soft computing based hybrid fuzzy controllers.

TEXTBOOKS

1. J.S.R. Jang, C.T. Sun and E. Mizutani, “Neuro–Fuzzy and Soft Computing”, PHI/Pearson Education 2004.
2. S.N. Sivanandam and S.N. Deepa, “Principles of Soft Computing”, Wiley India Pvt. Ltd., 2011.

REFERENCES

1. S. Rajasekaran and G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications", Prentice-Hall of India Pvt. Ltd., 2006.
2. David E. Goldberg, “Genetic Algorithm in Search, Optimization and Machine Learning”, Pearson Education India, 2013.
3. James A. Freeman, David M. Skapura, “Neural Networks: Algorithms, Applications, and Programming Techniques, Pearson Education India, 1991.
4. George J. Klir, Ute St. Clair, Bo Yuan, “Fuzzy Set Theory: Foundations and Applications”, Prentice Hall, 1997.
5. Simon Haykin, “Neural Networks: A Comprehensive Foundation”, Second Edition, Pearson Education, 2005.

COURSE OUTCOMES

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

1. Describe the fundamentals of neural networks, fuzzy logic, genetic algorithms, and hybrid soft computing techniques.
2. Utilize neural networks, fuzzy systems, genetic algorithms, and hybrid models to solve computational problems.
3. Examine learning methods, fuzzy inference, optimization techniques, and hybrid architectures in soft computing.
4. Assess the performance of neural, fuzzy, genetic, and hybrid approaches for intelligent problem solving.
5. Develop intelligent solutions by integrating neural networks, fuzzy logic, genetic algorithms, and hybrid computing techniques.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Program Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
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CO4	2	3	2	2	3	-	1	-	-	1	2	2	2	2
CO5	2	2	3	2	3	1	1	1	1	2	3	3	3	2

25ITPE604	CYBER LAW AND ETHICS										L	T	P	C
											3	0	0	3

COURSE OBJECTIVES

- Define key terms in cybercrime, cyber law, and cyber ethics.
- Explain the technical, legal, and social aspects of cybercrime and the significance of cyber ethics.
- Apply cyber laws and ethical principles to real-world cybercrime scenarios.
- Analyze how technical, legal, and social factors contribute to cybercrime and unethical behavior online.
- Evaluate the effectiveness of cyber laws and ethics in addressing cybercrime through case studies.

UNIT I Fundamentals of Cyber Crime

Definition and Origin of the Word, Cyber Crime and Information Security, identifying Cyber Criminals, Classification of Cybercrimes, E-mail Spoofing, Spamming, Cyber Defamation, Internet Time Theft, Salami Attack, Salami technique Data Diddling, Forgery, Web Jacking, Newsgroup Spam, Industrial Spying, Hacking, Online Frauds, Pornographic Offenders, Software Piracy, Computer Sabotage, Email Bombing, Password Sniffing, Credit Card Frauds, Identity Theft

UNIT II Attacks and Techniques used in Cyber Crime

Keyloggers and Spyware, Viruses and Worms, Trojan and backdoors, Steganography, DOS and DDoS attacks, SQL injection, Buffer overflow. Phishing, working of Phishing, Methods & techniques of Phishing, Types of Phishing scams, Phishing countermeasures, Identity theft types and techniques of identity theft and its countermeasures

UNIT III Cyber Law & Related Legislation

Introduction to cyber law, Patent law, Trademark law, Copyright, software Copyright or patent, Domain names and Copyright disputes, electronic database and its protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedure Code

UNIT IV IT ACT and Offenses

Overview of IT Act, 2000, Amendments and limitations of IT Act, Digital signatures, Cryptographic algorithm, Public cryptography, Private cryptography, Electronic governance, Legal recognition of electronic records, Legal recognition of Digital signature, certifying authorities, cybercrime and offences, Network service providers' liability, Cyber regulations, appellate tribunal, penalties and adjudication

UNIT V Cyber Ethics

The Importance of Cyber Law, Significance of cyber ethics, need for cyber regulations and ethics. Ethics in Information society, Introduction to artificial intelligence ethics: Ethical issues in AI and core principles, Introduction to blockchain ethics

REFERENCES

1. Nina Godbole and Sunit Belpure, "Cyber Security - Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley
2. Kumar K, "Cyber Laws: Intellectual Property & E-Commerce, Security", Dominant Publisher
3. Christoph Stuckelberger, Pavan Duggal, Globethic, "Cyber Ethics 4.0, Information Security Policy & Implementation Issues, NIIT | PHI
4. Verma S, K, Mittal Raman, "Legal Dimensions of Cyber Space", Indian Law Institute
5. Sudhir Naib, "The Information Technology Act, 2005: A Handbook", OUP
6. S. R. Bhansali, "Information Technology Act, 2000", University Book House Pvt. Ltd
7. Vasu Deva, "Cyber Crimes and Law Enforcement", Commonwealth Publishers

COURSE OUTCOMES

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

1. Outline the concepts of cybercrime, cyber law, IT Act, cyber ethics, and information security.
2. Demonstrate the application of cybersecurity practices, legal provisions, and ethical principles in addressing cybercrimes.
3. Investigate cyber attacks, cyber laws, digital evidence, and ethical issues in cyberspace.
4. Critique cybersecurity measures, legal frameworks, IT Act provisions, and ethical standards for secure digital environments.
5. Formulate secure and ethical solutions by integrating cyber laws, IT regulations, and cybersecurity practices.

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

25ITPE604	PATTERN RECOGNITION AND VISUAL RECOGNITION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To help students understand basic mathematical and statistical techniques commonly used in pattern recognition.
- To introduce students to a variety of pattern recognition algorithms.
- To understand the concepts of visual recognition.
- To develop real-world applications with pattern recognition and visual recognition algorithms.

UNIT I Introduction and mathematical Preliminaries

Principles of pattern recognition: Uses, mathematics, Classification and Bayesian rules, Clustering vs classification, Basics of linear algebra and vector spaces, eigenvalues and eigenvectors, Rank of a matrix and SVD

UNIT II Pattern Recognition basics

Bayesian decision theory, Classifiers, Discriminant functions, Decision surfaces, Parameter estimation methods, Hidden Markov models, dimension reduction methods, Fisher discriminant analysis, Principal component analysis, non-parametric techniques for density estimation, nonmetric methods for pattern classification, unsupervised learning, algorithms for clustering: K-means, Hierarchical and other methods

UNIT III Feature Selection and Extraction

Problem statement and uses, Branch and bound algorithm, Sequential forward and backward selection, Cauchy-Schwarz inequality, Feature selection criteria function: Probabilistic separability based and Interclass distance based, Feature Extraction: principles

UNIT IV Visual Recognition

Human visual recognition system, Recognition methods: Low-level modelling (e.g. features), Mid-level abstraction (e.g. segmentation), High-level reasoning (e.g. scene understanding); Detection/Segmentation methods; Context and scenes, Importance and saliency, Large-scale search and recognition, Egocentric vision, Human-in-the-loop interactive systems, 3D scene understanding.

UNIT V Recent advancements in Pattern Recognition

Comparison between performance of classifiers, Basics of statistics, covariance and their properties, Data condensation, feature clustering, Data visualization, Probability density estimation, Visualization and Aggregation, FCM and soft-computing techniques, Examples of real-life datasets.

TEXTBOOK

1. Christopher M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.

REFERENCES

1. Richard O. Duda, Peter E. Hart, David G. Stork, “Pattern Classification”, Wiley, 2006.

WEB RESOURCE

<https://nptel.ac.in/courses/106/106/106106046/>

COURSE OUTCOMES

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

1. Summarize the fundamentals of pattern recognition, feature engineering, visual recognition, and recent advances.
2. Implement classification, clustering, feature extraction, and dimensionality reduction techniques.
3. Differentiate recognition models, classifiers, and feature selection methods.
4. Justify recognition techniques based on performance, accuracy, and application needs.
5. Construct intelligent solutions using pattern recognition and machine learning techniques.

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

25ITPE604	BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the Analytics Life Cycle.
- To comprehend the process of acquiring Business Intelligence.
- To understand various types of analytics for Business Forecasting.
- To model supply chain management for Analytics.
- To apply analytics for different functions of a business.

UNIT I Introduction to Business Analytics

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration

UNIT II Business Intelligence

Data Warehouses and Data Mart - Knowledge Management – Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence – OLAP –Analytic functions

UNIT III Business Forecasting

Introduction to Business Forecasting and Predictive analytics - Logic and Data-Driven Models – Data Mining and Predictive Analysis Modeling – Machine Learning for Predictive analytics.

UNIT IV Hr & Supply Chain Analytics

Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain

UNIT V Marketing & Sales Analytics

Marketing Strategy, Marketing Mix, Customer Behavior – Selling Process – Sales Planning – Analytics applications in Marketing and Sales

REFERENCES

1. R. Evans James, “Business Analytics”, 2017
2. R N Prasad, Seema Acharya, “Fundamentals of Business Analytics”, 2016
3. Philip Kotler and Kevin Keller, “Marketing Management”, 15th edition, PHI, 2016
4. VSP RAO, “Human Resource Management”, 3rd Edition, Excel Books, 2010.
5. Mahadevan B, “Operations Management -Theory and Practice”, 3rd Edition, Pearson Education, 2018.

COURSE OUTCOMES

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

1. Summarize the concepts of analytics, business intelligence, forecasting, supply chain, and marketing analytics.
2. Demonstrate analytics techniques for business intelligence, forecasting, and functional business applications.
3. Differentiate analytical models, forecasting methods, and business decision-making approaches.
4. Justify the use of analytics tools and strategies for business performance and decision support.
5. Formulate analytics-driven solutions for business, supply chain, HR, and marketing applications.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Program Specific Outcomes (PSOs)														
	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	3	-	-	-	-	1	2	2	3	2
CO3	2	3	2	3	2	-	-	-	-	1	2	2	3	2
CO4	2	2	2	2	2	1	1	-	-	2	2	1	2	3
CO5	2	2	3	2	3	1	1	1	1	3	3	2	3	3

25ITPE604	GAME THEORY					L	T	P	C
						3	0	0	3

COURSE OBJECTIVES

- To study the fundamental concepts and rules of game theory.
- To understand bargaining and repeat games with perfect information.
- To develop knowledge of games with imperfect information and strategic behavior.
- To understand coalition games and solution concepts.
- To explore evolutionary game theory and stability concepts.

UNIT I Introduction

Introduction – Rules of the game - Strategic games – Introduction to zero-sum games – Nash Equilibrium – Bayesian game - Mixed Strategic Nash Equilibrium.

UNIT II Extensive Game with Perfect Information

Extensive game with perfect information – Bargaining games – repeated games – subgame-perfect equilibrium.

UNIT III Extensive Game with Imperfect Information

Extensive game with Imperfect Information – Equivalence of Extensive games – mixed strategy – strategy as a machine.

UNIT IV Coalition Game Theory

Coalition Game with transferable payoff - Exchange economy – Stable Set Bargaining – Shapley Value.

UNIT V Evolutionary Game Theory

Evolutionary theory – stability – Dynamic structure – Stochastic stability.

TEXTBOOKS

1. Osborne, Martin J., “An Introduction to Game Theory”, Oxford University Press, 2003.
2. Martin J. Osborne, Ariel Rubinstein, “A course in Game Theory”, MIT press, 1984.

REFERENCES

1. Eric Rasmusen, “Games and Information: An Introduction to game theory”, MIT press.
2. Joel Watson, “Strategy: An Introduction to Game Theory”, W.W. Norton & Company – 2001.

COURSE OUTCOMES

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

1. Outline the principles of strategic games, Nash equilibrium, bargaining, coalition, and evolutionary game theory.
2. Demonstrate game-theoretic models for strategic decision-making under perfect and imperfect information.

- Investigate bargaining, repeated, coalition, and evolutionary games to interpret strategic interactions.
- Critique game-theoretic solution concepts based on equilibrium, cooperation, and stability.
- Formulate strategic solutions by integrating bargaining, coalition, and evolutionary game models.

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

25ITPE604	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES				L	T	P	C
					3	0	0	3

COURSE OBJECTIVES

- To understand the concepts and architecture of blockchain technology.
- To study Ethereum and blockchain transaction mechanisms.
- To develop smart contracts using Solidity and deployment tools.
- To understand smart contract security and blockchain vulnerabilities.
- To explore cryptocurrencies and consensus mechanisms.

UNIT I Blockchain Concepts

Blockchain definitions: How are blockchains different from databases? Versions of blockchain. Characteristics of blockchain: public blockchain (permissionless), private blockchain (permissioned), consortium blockchain. Layers of blockchain. Block attributes. Structure of the block. Block header. Linking blocks. Cryptography in blockchain. Classical cryptography. Cryptographic primitives. Symmetric key cryptography. Hashing in blockchain. Linking blocks in a blockchain. Nash Equilibrium. Prisoner's Dilemma. Byzantine Generals' Problem. Zero-Sum Games.

UNIT II Ethereum Blockchain

Overview of Ethereum. Ethereum accounts Transactions Consensus Timestamp Nonce Block time Forking Genesis block Ether denominations Ethereum virtual machine Gas Peer discovery Whisper and Swarm Geth Installing geth Connecting to the mainnet network Creating a private network Creating accounts Mining Fast synchronization Ethereum Wallet Mist Sybil attack Serenity. Consensus Mechanism. Proof of Work. Proof of Stake. Delegated Proof of Stake.

UNIT III Smart Contract with Solidity

What Is a Smart Contract? Life Cycle of a Smart Contract. Solidity. The Ethereum Contract ABI. Smart contract templates. Oracles. Types of blockchain oracles. Deploying smart contracts. Statements and Expressions in Solidity. Data Types of Solidity. Tokens. Mining Ether. Truffle Suite.Ganache. Deploying using Ganache. Private Ethereum Blockchain with Geth.

UNIT IV Smart Contract Security

Smart Contract Vulnerability. Preventative Techniques. PoWHC and Batch Transfer Overflow. Unexpected Ether. Parity Multisig Wallet. PRNG Contracts. Reentrancy Honey Pot. Short Address/Parameter Attack. Etherpot. Race Conditions/Front Running. Denial of Service (DoS). Wallet Cyberattacks. Blockchain network attacks. Platform attacks. Phishing Attack. Online Wallet Phishing-Malware Attacks. Double Spending or 51 Per cent Attack. Credential Attacks.

UNIT V Cryptocurrency

About Cryptocurrency: Bitcoin - Bitcoin public addresses - Bitcoin Transaction output - Bitcoin Transaction input - Bitcoin Transaction verification - Mining and consensus Mining: a block Verification of transactions - Key management Wallet balance. Altcoins. Proof of Storage. Proof of Stake (PoS). Proof of coinage. Proof of Deposit. Stellar (XLM). Binance Coin (BNB). Cardano (ADA). Dogecoin (DOGE). XRP (XRP). Litecoin (LTC)

TEXTBOOKS

1. Bikramaditya Singhal, Gautam Dhameja and Priyansu Sekhar Panda, "Beginning Blockchain", Apress, 2018
2. Andreas M. Antonopoulos and Dr Gavin Wood, "Mastering Ethereum", O'Reilly Media, 2018
3. Chris Dannen, "Introducing Ethereum and Solidity", Apress, 2017
4. Elad Elrom, "The Blockchain Developer", Apress, 2019

REFERENCES

1. Mayukh Mukhopadhyay, "Ethereum Smart Contract Development", Packt Publishing, 2018
2. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Second Edition, Packt Publishing, 2018.

COURSE OUTCOMES

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

1. Outline the concepts of blockchain architecture, cryptography, consensus mechanisms, Ethereum, and cryptocurrencies.
2. Demonstrate blockchain transactions, Ethereum operations, and smart contract development using Solidity.
3. Investigate blockchain platforms, consensus protocols, smart contract deployment, and security challenges.
4. Critique blockchain frameworks, smart contract security, and cryptocurrency mechanisms for secure decentralized applications.
5. Formulate blockchain-based solutions by integrating Ethereum, smart contracts, security practices, and cryptocurrency technologies.

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

25ITPE604	COMPUTER VISION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To review image processing techniques for computer vision.
- To understand shape and region analysis.
- To understand Hough Transform and its applications for detecting lines, circles, and ellipses.
- To understand three-dimensional image analysis techniques and motion analysis.

- To study selected applications of computer vision algorithms.

UNIT I Image Processing Foundations

Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture.

UNIT II Shapes and Regions

Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.

UNIT III Hough Transform

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation.

UNIT IV 3d Vision and Motion

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion.

UNIT V Applications

Application: Photo album – Face detection – Face recognition – Eigenfaces – Active appearance and 3D shape models of faces. Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis. Application: In-vehicle vision system - locating roadway – road markings – identifying road signs – locating pedestrians.

TEXTBOOKS

1. Baggio D L et al., Mastering OpenCV with Practical Computer Vision Projects, Packt Publishing, 2012.

REFERENCES

1. E. R. Davies, “Computer & Machine Vision”, Fourth Edition, Academic Press, 2012.
2. Jan Erik Solem, “Programming Computer Vision with Python: Tools and Algorithms for Analysing Images”, O'Reilly Media, 2012.
3. Mark Nixon and Alberto S. Aquado, “Feature Extraction & Image Processing for Computer Vision”, Third Edition, Academic Press, 2012.
4. R. Szeliski, “Computer Vision: Algorithms and Applications”, Springer, 2011.
5. Simon J. D. Prince, “Computer Vision: Models, Learning, and Inference”, Cambridge University Press, 2012.

COURSE OUTCOMES

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

1. Explain computer vision principles involving image processing, feature extraction, shape analysis, object detection, motion estimation, and vision-based applications.
2. Employ image analysis techniques to extract features, identify objects, estimate motion, and interpret visual information from digital images.
3. Investigate shape representation, Hough Transform, three-dimensional vision, and motion analysis techniques for solving image interpretation problems.
4. Assess feature extraction methods, object recognition algorithms, motion estimation models, and vision techniques for real-world image analysis tasks.

5. Develop computer vision solutions by integrating image processing, object detection, three-dimensional reconstruction, motion analysis, and application-oriented vision algorithms.

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

PROFESSIONAL ELECTIVES –V

25ITPE605	ANALYSIS AND DESIGN OF SERVICE ORIENTED ARCHITECTURE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To illustrate the foundational principles and architectural paradigms of Service-Oriented Architecture (SOA).
- To interpret service engineering methodologies, web service technologies, and RESTful architectural frameworks.
- To apply service modeling, orchestration, and composition techniques for enterprise service development.
- To examine governance models, interoperability mechanisms, and quality attributes of service-oriented systems.
- To design scalable and maintainable service-oriented applications using SOA principles and lifecycle management.

UNIT I Introduction to Service-Oriented Architecture

Introduction to Service Orientation- Comparing SOA with Client-Server and Distributed architectures - Needs and effects of Service Orientation on the Enterprise – Characteristics of SOA - Types of SOA.

UNIT II SOA Project and Lifecycle Stages

Methodology and Project Delivery Strategies-SOA Project Stages-SOA Adoption Planning-Service Inventory Analysis-Service Modeling-Service Oriented Design -Service Logic Design-Service Development- Service Testing-Service Deployment and Maintenance-Service Usage and Monitoring - Service Discovery-Service Versioning and Retirement - Project Stages and Organizational Roles, Case Study: Apply the concepts of SOA Lifecycle to an appropriate use case.

UNIT III Web Services and Service Layering

Web services – Service descriptions – Messaging with SOAP –Message exchange Patterns – Coordination –Atomic Transactions – Business activities – Orchestration – Choreography - Service layer abstraction – Application Service Layer – Business Service Layer – Orchestration Service Layer.

UNIT IV SOA Analysis and Design

Service-oriented analysis – Business-centric SOA – Deriving business services- service modeling - Service Oriented Design – Service Modelling -WSDL basics – SOAP basics – SOA composition – Entity-centric business service design – Application service design – Task-centric business service design- Design standards and guidelines - Composition – WSBPEL – WS-Coordination – WS-Policy – WS-Security.

UNIT V Analysis and Modelling Use Case

Analysis and Modeling with web services and Microservices - Analysis and Modeling with REST Services and Microservices - Service API and Contract Versioning with Web Services and REST Services – Versioning - Versioning Strategies - Case Study - Implement an application using web services and REST services.

TEXTBOOK

1. Thomas Erl. “Service-Oriented Architecture: Analysis and Design for Services and Microservices”, Second Edition, Prentice Hall, 2016

REFERENCES

1. H. Howell-Barber and James P. Lawler, “Service-Oriented Architecture: SOA Strategy, Methodology, and Technology”, Auerbach Publications, 2007.
2. Ron Schmelzer et al., “XML and Web Services”, Pearson Education, 2002.
3. Sandeep Chatterjee and James Webber, “Developing Enterprise Web Services: An Architect's Guide”, Prentice Hall, 2004.

4. Thomas Erl, "Next Generation SOA: A Concise Introduction to Service Technology & Service-Oriented", PHI, 2014
5. <https://www.ibm.com/developerworks/library/ws-soad1/>.

COURSE OUTCOMES

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

1. Explain the foundational paradigms, architectural principles, service lifecycle, engineering methodologies, web service technologies, and RESTful frameworks underpinning enterprise SOA solutions.
2. Apply service modeling techniques, orchestration mechanisms, SOAP/REST technologies, composition strategies, and lifecycle practices to construct interoperable service-oriented applications.
3. Analyze service-oriented ecosystems by investigating interoperability, governance frameworks, orchestration workflows, quality attributes, and architectural abstractions for enterprise integration.
4. Evaluate alternative SOA solutions by assessing composition strategies, versioning mechanisms, governance models, lifecycle practices, and architectural trade-offs to optimize enterprise services.
5. Design resilient, scalable, and interoperable service-oriented systems by synthesizing SOA principles, service engineering methodologies, RESTful architectures, orchestration strategies, and lifecycle management practices.

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

25ITPE605	DIGITAL AND MOBILE FORENSICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To illustrate the principles and challenges of digital and mobile forensics.
- To interpret wireless technologies and mobile forensic methodologies.
- To apply forensic techniques for digital evidence acquisition and analysis.
- To examine digital artifacts, evidence integrity, and forensic investigation processes.
- To design secure and reliable digital forensic investigation frameworks.

UNIT I Introduction to Wireless Technologies

Overview of wireless technologies and security: Personal Area Networks, Wireless Local Area Networks, Metropolitan Area Networks, Wide Area Networks. Wireless threats, vulnerabilities, and security: Wireless LANs, War Driving, War Chalking, War Flying, Common Wi-fi security recommendations, PDA Security, Cell Phones and Security, Wireless DoS attacks, GPS Jamming, Identity theft.

UNIT II Security Framework for Mobile Systems

CIA triad in mobile phones-Voice, SMS, and Identification data interception in GSM: Introduction, practical setup and tools, implementation - Software and hardware. Mobile phone tricks: Netmonitor, GSM network service codes, mobile phone codes, catalog tricks, and AT command set-SMS security issues.

UNIT III Mobile Phone Forensics

Crime and mobile phones, evidence, forensic procedures, files present in SIM card, device data, external memory dump, evidence in memory card, operator's systems - Android forensics: Procedures for handling an Android device, imaging Android USB mass storage devices, logical and physical techniques.

UNIT – IV Introduction to Digital Forensics

Digital forensics: Introduction – Evidential potential of digital devices: closed vs. open systems, evaluating digital evidence potential - Device handling: seizure issues, device identification, networked devices and contamination.

UNIT - V Analysis of Digital Forensic Techniques

Digital forensics examination principles: Previewing, imaging, continuity, hashing and evidence locations - Seven element security model - developmental model of digital systems - audit and logs - Evidence interpretation: Data content and context.

TEXTBOOKS

1. Gregory Kipper, "Wireless Crime and Forensic Investigation", Auerbach Publications, 2007.
2. Iosif I. Androulidakis, "Mobile phone security and forensics: A practical approach", Springer publications, 2012.

REFERENCES

1. Andrew Hoog, "Android Forensics: Investigation, Analysis and Mobile Security for Google Android", Elsevier publications, 2011.
2. Angus M. Marshall, "Digital forensics: Digital evidence in criminal investigation", John Wiley and Sons, 2008.

COURSE OUTCOMES

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

1. Explain the fundamental principles, wireless technologies, forensic methodologies, mobile security mechanisms, evidence acquisition techniques, and investigative procedures underpinning digital and mobile forensic investigations.
2. Apply forensic acquisition, preservation, recovery, imaging, and analytical techniques to examine digital and mobile devices while maintaining evidence integrity and investigative reliability.
3. Analyze digital artifacts, wireless communications, mobile operating systems, forensic evidence, and investigative workflows to identify security incidents and reconstruct cybercrime scenarios.
4. Evaluate forensic tools, acquisition methodologies, evidence validation techniques, and investigative procedures to ensure the authenticity, admissibility, and reliability of digital evidence.
5. Design comprehensive digital and mobile forensic investigation frameworks by integrating evidence acquisition, forensic analysis, mobile security, reporting methodologies, and legal compliance for cybercrime investigations.

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

25ITPE605	BIO INFORMATICS										L	T	P	C
											3	0	0	3

COURSE OBJECTIVES

- Define key concepts, technologies, and terminology used in Bioinformatics.
- Explain the principles and applications of Bioinformatics in biological research.
- Apply Bioinformatics methods and tools to analyze biological data.
- Analyze computational techniques used for biological data integration and management.
- Evaluate the effectiveness of predictive models and computational approaches in solving biological problems.

UNIT I

Introduction: Need for Bioinformatics technologies – Overview of Bioinformatics technologies
Structural bioinformatics – Data format and processing – Secondary resources and applications – Role of Structural bioinformatics – Biological Data Integration System.

UNIT II

Data warehousing and data mining in bioinformatics: Bioinformatics data – Data warehousing architecture – Data quality – Biomedical data analysis – DNA data analysis – Protein data analysis – Machine learning –Neural network architecture and applications in bioinformatics.

UNIT III

Modeling for bioinformatics: Hidden Markov modelling for biological data analysis – Sequence identification – Sequence classification–multiple alignment generation – Comparative modeling – Protein modeling – genomic modeling –Probabilistic modeling – Bayesian networks – Boolean networks–Molecular modeling – Computer programs for molecular modeling.

UNIT IV

Pattern matching and visualization: Gene regulation –motif recognition –motif detection – strategies for motif detection –Visualization –Fractal analysis –DNA walk models–one dimension – two dimension –higher dimension –Game representation of biological sequences –DNA, Protein, Amino acid sequences.

UNIT V

Microarray analysis: Microarray technology for genome expression study –image analysis for data extraction –preprocessing –segmentation –gridding –spot extraction –normalization, filtering – cluster analysis –gene network analysis –Comparative Evaluation of Scientific Data Management Systems –Cost Matrix –Evaluation model –Benchmark –Tradeoffs.

TEXTBOOKS

1. Yi-Ping Phoebe Chen (Ed), "BioInformatics Technologies", First Indian Reprint, Springer Verlag, 2007.
2. Arthur M. Lesk, "Introduction to Bioinformatics", First Edition, Oxford University Press, 2002.

REFERENCES

1. Bryan Bergeron, "Bioinformatics Computing", Second Edition, Pearson Education, 2003.
2. Arthur M Lesk, "Introduction to Bioinformatics", Second Edition, Oxford University Press, 2005.
3. Dan E. Krane, Michael L. Raymer, "Fundamental Concepts of Bioinformatics", First Edition, 2002.

COURSE OUTCOMES

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

1. Explain Bioinformatics concepts by relating biological data processing, integration, analysis, visualization, and management techniques.
2. Utilize computational methods to process biological datasets, perform sequence analysis, and develop predictive biological models.
3. Differentiate suitable analytical, modeling, and visualization techniques for extracting meaningful information from biological data.
4. Assess Bioinformatics frameworks, mining strategies, and data management approaches for solving biological research problems.
5. Develop integrated Bioinformatics solutions using computational models, visualization methods, and biological data management techniques.

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

25ITPE605	GIS AND REMOTE SENSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the fundamentals of electromagnetic radiation and its interaction with the atmosphere and earth materials.
- To gain knowledge of remote sensing platforms, sensors, and their payload characteristics.
- To acquire skills in image interpretation and digital image processing techniques for multispectral data analysis.
- To understand the fundamental concepts, components, and data types used in Geographic Information Systems.

- To develop competence in spatial data modeling, entry, storage, and analysis for real-world GIS applications.

UNIT I

EMR and its Interaction with Atmosphere & Earth Material: Definition of remote sensing and its components – Electromagnetic spectrum – wavelength regions important to remote sensing – Wave theory, Particle theory, Stefan–Boltzmann and Wien's Displacement Law – Atmospheric scattering, absorption – Atmospheric windows – spectral signature concepts – typical spectral reflective characteristics of water, vegetation and soil.

UNIT II

Platforms and Sensors: Types of platforms – orbit types, Sun–synchronous and Geosynchronous – Passive and Active sensors – resolution concept – payload description of important Earth Resources and Meteorological satellites – Airborne and spaceborne TIR and microwave sensors.

UNIT III

Image Interpretation and Analysis: Types of Data Products – types of image interpretation – basic elements of image interpretation – visual interpretation keys – Digital Image Processing – Pre-processing – image enhancement techniques – multispectral image classification – Supervised and unsupervised.

UNIT IV

Geographic Information System: Introduction – Maps – Definitions – Map projections – types of map projections – map analysis – GIS definition – basic components of GIS – standard GIS software – Data Type - Spatial and Non-spatial (attribute) data – measurement scales – Database Management Systems (DBMS).

UNIT V

Data Entry, Storage and Analysis: Data models – vector and raster data – data compression – data input by digitization and scanning – attribute data analysis – integrated data analysis – Modeling in GIS Highway alignment studies – Land Information System.

TEXTBOOKS

1. Lillesand, T.M., Kiefer, R.W. and J.W. Chipman. “Remote Sensing and Image Interpretation” 5th Edition. John Wiley and Sons Asia Pvt. Ltd., New Delhi, 2004.
2. Anji Reddy, M. “Textbook of Remote Sensing and Geographical Information System” 2nd edition. BS Publications, Hyderabad, 2001.

REFERENCES

1. Lo. C.P. and A.K.W. Yeung, “Concepts and Techniques of Geographic Information Systems”, Prentice Hall of India Pvt. Ltd., New Delhi, 2002
2. Peter A. Burrough, Rachael A. McDonnell, “Principles of GIS”, Oxford University Press, 2000.
3. Ian Heywood, “An Introduction to GIS”, Pearson Education Asia, 2000.

COURSE OUTCOMES:

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

1. Explain the principles of electromagnetic radiation, atmospheric interactions, and spectral signatures of Earth surface features.
2. Apply knowledge of remote sensing platforms, sensors, and resolution concepts to select appropriate systems for Earth observation tasks.
3. Analyze remotely sensed imagery using visual and digital interpretation techniques, including image enhancement and multispectral classification methods.
4. Apply GIS concepts, map projections, and data models to represent and organize spatial and non-spatial information.
5. Design and evaluate integrated GIS-based data analysis and modeling solutions for applications such as highway alignment and land information systems.

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

25ITPE605	TEXT AND SPEECH ANALYSIS										L	T	P	C
											3	0	0	3

COURSE OBJECTIVES

- To understand the fundamentals of text processing, language modeling, and probabilistic classification techniques.
- To gain knowledge of lexical and vector semantics for representing and analyzing word meaning.
- To acquire skills in information extraction techniques including relation extraction, word sense disambiguation, and sentiment analysis.
- To understand the principles of information retrieval, question answering, and dialogue system design.
- To develop competence in phonetics, speech signal processing, and automatic speech recognition and synthesis techniques.

UNIT I

Regular Expressions – Words – Corpora - Text Normalization - Minimum Edit Distance - N-Grams - Evaluating Language Models - Generalization and Zeros – Smoothing - Kneser-Ney Smoothing - Huge Language Models and Stupid Backoff - Naive Bayes Classifiers - Training the Naive Bayes Classifier - Optimizing for Sentiment Analysis - Naive Bayes for other text classification tasks - Naive Bayes as a Language Model.

UNIT II

Lexical Semantics - Vector Semantics - Words and Vectors - Cosine for measuring similarity - TF-IDF: Weighing terms in the vector - Pointwise Mutual Information (PMI) - Applications of the tf-idf or PPMI vector models - Word2vec - Visualizing Embeddings - Semantic properties of embeddings - Bias and Embeddings - Evaluating Vector Models - English Word Classes - Part-of-Speech Tagging - Named Entities and Named Entity Tagging - HMM Part-of-Speech Tagging - Conditional Random Fields (CRFs) - Evaluation of Named Entity Recognition.

UNIT III

Information Extraction: Relation Extraction - Relation Extraction Algorithms - Extracting Times - Extracting Events and their Times - Template Filling - Word Senses - Relations Between Senses - WordNet: A Database of Lexical Relations - Word Sense Disambiguation - Semantic Roles - Diathesis Alternations - The Proposition Bank - FrameNet- Semantic Role Labeling- Selectional Restrictions - Available Sentiment and Affect Lexicons - Creating Affect Lexicons by Human Labeling- Semi-supervised Induction of Affect Lexicons - Supervised Learning of Word Sentiment - Using Lexicons for Sentiment Recognition.

UNIT IV

Information Retrieval: IR-based Factoid Question Answering - Entity Linking- Knowledge-based Question Answering - Using Language Models to do QA - Classic QA Models. Chatbots - Simple Frame-based Dialogue Systems - The Dialogue-State Architecture - Evaluating Dialogue Systems - Dialogue System Design.

UNIT V

Phonetics: Speech Sounds and Phonetics - Articulatory Phonetics - Prosody - Acoustic Phonetics and Signals. Automatic Speech Recognition and Text-to-Speech: The Automatic Speech Recognition Task - Feature Extraction for ASR - Speech Recognition Architecture - CTC - ASR Evaluation: Word Error Rate – TTS - Other Speech Tasks.

TEXTBOOKS

1. Dan Jurafsky and James H. Martin, “Speech and Language Processing”, 3rd edition, Pearson, 2020.
2. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 4th edition, Pearson, 2020

REFERENCES

1. Steven Bird, Ewan Klein, Edward Loper, “Natural Language Processing with Python – Analyzing Text with the Natural Language Toolkit”, O'Reilly Media, First edition, 2009
2. Daniel de Kok, Harm Brouwer, “Natural Language Processing for the Working Programmer”, nlpwp.org, 2011

COURSE OUTCOMES

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

1. Acquire the knowledge of the basic characteristics of text, language models and the naïve Bayes classifier.
2. Implement various steps of text analysis tasks.
3. Apply information extraction algorithms and perform sentiment analysis
4. Develop information retrieval and question answering systems
5. Understand phonetics and various speech analysis methods.

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

25ITPE605	CYBER FORENSICS AND INFORMATION SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand network and transport layer security protocols along with firewall and e-mail security concepts.
- To gain knowledge of digital forensics fundamentals and investigation preparation procedures.
- To acquire skills in digital evidence acquisition, validation, and storage using appropriate forensic tools.
- To understand techniques for forensic data analysis, validation, and handling of data hiding methods.

- To develop competence in investigating e-mail crimes and conducting social media and mobile device forensics.

UNIT I Network Layer and Transport Layer Security

Introduction, Network layer security: IPSec protocol – Authentication header – Key management protocol, Transport layer security: SSL and TLS, Introduction to E-mail security, Introduction to firewalls: Terminology – Types of firewalls.

UNIT II Understanding Digital Forensics and Investigation

Overview of digital forensics, Preparation for digital investigation, Professional conduct, preparing a digital forensics investigation, conducting an investigation, Procedures for private sector investigations.

UNIT III Data Acquisition and Processing

Understanding storage formats, determining acquisition methods, Contingency planning, using acquisition tools and validating, identifying and collecting digital evidence, preparing for a search, storing digital evidence.

UNIT IV Digital Forensics Analysis and Validation

Determining the data to collect and analyze, validating forensic data, addressing data hiding techniques, performing live acquisition.

UNIT V E-Mail and Social Media Investigation

Introduction, Role of client and server in E-Mail, Investigating E-mail crimes: Understanding forensics linguistics – Examining E-mail headers and messages – Tracing E-mail files, social media forensics on mobile devices: Forensics tools for social media investigations.

TEXTBOOK

1. Man Young Rhee, Internet Security: Cryptographic Principles, Algorithms and Protocols, Wiley Publications, 2003.

REFERENCES

1. Nelson, Phillips, Enfinger, Steuart, “Computer Forensics and Investigations”, Cengage Learning, India Edition, 2008.
2. John R. Vacca, “Computer Forensics”, Cengage Learning, 2005.
3. Richard E. Smith, “Internet Cryptography”, 3rd Edition, Pearson Education, 2008.
4. MarjieT.Britz, “Computer Forensics and Cyber Crime: An Introduction”, 3rd Edition, Prentice Hall, 2013.
5. Peterson, Gilbert, and Sujeet Sheno, “Advances in Digital Forensics”, IX, Vol. 410, Springer, 2013.

COURSE OUTCOMES

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

1. Explain network layer, transport layer, and e-mail security mechanisms along with firewall types for securing communication systems.
2. Apply digital forensics principles and investigation preparation procedures to plan and conduct forensic investigations professionally.
3. Apply appropriate data acquisition methods and tools to identify, collect, and store digital evidence securely.
4. Analyze and validate forensic data, address data hiding techniques and perform live acquisition for investigative purposes.
5. Investigate and evaluate e-mail and social media-related cybercrimes using forensic linguistics, header analysis, and mobile forensic tools.

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

25ITPE605	SOCIAL NETWORK SECURITY										L	T	P	C
											3	0	0	3

COURSE OBJECTIVES

- To describe the significance of security in online social networks.
- To outline the trust management policies for secure online social networking.
- To gain knowledge of information sharing and identity management actions.
- To handle and manage digital identity in online social networks.
- To analyze privacy and terrorism issues in online social networks.

UNIT I Online Social Networks and Security Issues

Introduction- Social Networks: The Meaning of Community –Evolution of Online Social Networks – Trust Management – Controlled Information Sharing – Identity Management

UNIT II Trust Management in Online Social Networks

Trust, Policies and Reputation Systems – Trust properties – Trust Components – Social trust and Social Capital – Trust Evaluation Model

UNIT III Information Sharing in Online Social Networks

Access control in Data Management System – Access control Models – Relationship-based Access control – Privacy settings in Commercial Online Social Networks – Existing Access control approaches

UNIT IV Identity Management in Online Social Networks

Digital Identity – Identity Management Models – Self-Presentation – Identity Disclosure – Identity Theft

UNIT V Network Analysis, Privacy and Terrorism

Privacy in Online Social Networks – Privacy Threats and Defenses – Terrorism Threats and Defenses

REFERENCES

1. Barbara Carminati, Elena Ferrari, Marco Viviani, “Security and Trust in Online Social Networks”, Morgan & Claypool, 2013.
2. Richard Chbeir, Bechara Al Bouna, “Security and Privacy Preserving in Social Networks”, Springer- VerlagWein, 2013.
3. YanivAltshuler, Yuval Elovici, Armin B. Cremers, Nadav Aharony, Alex Pentland, “Security and Privacy in Social Networks”, Springer Science Business Media, New York, 2013.

COURSE OUTCOMES

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

1. Explain the concepts of online social network security, trust management, information sharing, identity management, privacy, and cyber threat mitigation.
2. Utilize trust models, access control mechanisms, and identity management techniques to strengthen secure communication in online social networks.
3. Examine social network architectures, privacy-preserving methods, and information-sharing strategies to identify potential security and trust issues.
4. Assess digital identity, privacy threats, access control policies, and social network security mechanisms for reliable protection of online communities.
5. Develop secure social networking solutions by integrating trust frameworks, identity management, privacy controls, and cyber defense strategies.

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

25ITPE605	HUMAN COMPUTER INTERACTION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Illustrate the principles of human-computer interaction, interaction design, and usability in interactive systems.
- Employ user-centered design, interface development, and evaluation techniques to create usable interfaces.
- Examine interface models, dialogue design, and interaction methodologies for effective human-computer communication.
- Assess experimental design, statistical analysis, and usability evaluation methods to improve interface performance.
- Construct intelligent interactive systems by integrating HCI principles, evaluation methods, interface models, and emerging interaction technologies.

UNIT I Design Process

Humans – Information Process – Computer – Information Process – Differences and Similarities between them – Need for Interaction – Models – Ergonomics – Style – Context – Paradigms – Designing of Interactive Systems – Usability – Paradigm Shift – Interaction Design Basics – Design Process – Scenarios – Users Need –Complexity of Design.

UNIT II Design and Evaluation of Interactive Systems

Software Process – Usability Engineering – Issue-based Information Systems – Iterative Design Practices – Design Rules – Maximum Usability – Principles – Standards and Guidelines – Design Patterns – Programming Tools – Windowing Systems – Interaction Toolkit – User Interface Management System – Evaluation Techniques – Evaluation Design – Evaluating Implementations – Observational Methods.

UNIT III Modelling Interfaces

Universal Design Principles – Multimodal Systems – User Support – Presentation and Implementation Issues – Types – Requirements – Approaches – Cognitive Model – Hierarchical

Model – Linguistic Model – Physical and Device Models – Socio-Technical Models – Communication and Collaboration Models – Task Models – Task Analysis and Design Dialogue Notations And Design – Dialogue Need – Dialogue Design Notations – Graphical – Textual – Representing Dialogue – Formal Descriptions – Dialogue Analysis – System Models – Interaction Models – Relationship with Dialogue – Formalisms – Formal Notations – Interstitial Behavior.

UNIT IV Experimental Design and Statistical Analysis of HCI

Basic Design Structure – Single Independent Variable – Multiple Independent Variables – Factorial Design – Split-Plot Design – Random Errors – Experimental Procedure – Statistical Analysis – T Tests – Analysis of Variance Test – Regression – Chi-Square Test – Survey – Probabilistic Sampling – Non-Probabilistic Sampling – Developing Survey Questions.

UNIT V Current Trends

Virtual Reality – Modeling Rich Interaction – Status Event Analysis – Properties – Rich Contexts – Sensor-Based Systems – Groupware – Applications – Ubiquitous Computing – Virtual Reality – Wearable User Interfaces – User Interfaces For MR Applications.

TEXTBOOKS

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, Third Edition, Prentice Hall, 2004.
2. Preece, J., Sharp, H., Rogers, Y., “Interaction Design: Beyond Human-Computer Interaction”, Fourth Edition, Wiley, 2015.

REFERENCES

1. Jonathan Lazar, Jinjuan Heidi Feng, Harry Hochheiser, “Research Methods in Human-Computer Interaction”, Wiley, 2010.
2. Ben Shneiderman, Catherine Plaisant, “Designing the User Interface: Strategies for Effective Human-Computer Interaction”, Fifth Edition, Addison-Wesley, 2009.
3. Jeff Johnson, “Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Rules”, Second Edition, Morgan Kaufmann, 2014.

COURSE OUTCOMES

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

1. Interpret the concepts of interaction design, usability engineering, interface modelling, experimental evaluation, and emerging HCI technologies in designing interactive systems.
2. Utilize user-centered design principles, interface development techniques, modelling approaches, evaluation methods, and modern interaction technologies to develop effective interactive systems.
3. Investigate the relationships among interaction design, usability engineering, interface modelling, experimental analysis, and advanced HCI paradigms to address diverse user requirements.
4. Appraise interactive systems by selecting appropriate design methodologies, interface models, evaluation techniques, statistical analyses, and emerging technologies to enhance usability and user experience.
5. Formulate innovative human-computer interaction solutions by integrating interaction design, interface modelling, usability evaluation, experimental methods, and current HCI technologies for real-world applications.

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

PROFESSIONAL ELECTIVES – VI

25ITPE704	CLOUD AND EDGE COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To provide students with a sound foundation in Cloud Computing for adopting cloud services and tools in real-life scenarios.
- To enable students to explore cloud computing-driven commercial systems and applications.
- To discuss cloud and edge computing for cyber-physical systems, including design, implementation, and evaluation.
- To familiarize students with edge computing applications in cyber-physical systems and practical knowledge in the field.
- To develop a comprehensive understanding of edge computing and its role in emerging cyber-physical systems.

UNIT I Introduction

Roots of cloud computing, Cloud characteristics, Deployment models: private – public - hybrid - community, Service models: SaaS – PaaS – IaaS, Challenges of cloud computing, security risks and threats, Microservices, Service Level Agreement, Private Cloud architecture.

UNIT II Virtualization

Basics of Virtualization, Virtual Machine and its applications, Types of virtualizations: Application – Network – Desktop – Storage – Server and Data, Types of Hypervisors, VM Migration: Cold and Live, Live Migration Techniques and advantages over WAN, VM Provisioning and manageability, Study on virtualization softwares: XEN – KVM - Hyper-v and Virtualbox.

UNIT III Edge Cloud Platform

Edge computing role, Hierarchy of Edge Computing, Benefits, Key Techniques: Virtual machine and Container - Software Defined Network - Content Delivery Networks - Mobile Data centers, Resource management: Kubernetes - Containers - Dockers, Edge to Cloud Protocols, Edge computing challenges.

UNIT IV Edge Analytics

Centralized cloud: Parallel processing - MapReduce programming paradigm in cloud, Potential of Edge Analytics, IoT and Edge Architecture, Sensors and Endpoints, Edge Servers, Edge Gateways, Edge Devices and Management, Edge computing in IIoT.

UNIT V Edge Cloud Services

Amazon AWS, Microsoft Windows Azure, Google App Engine, OpenStack, Azure IoT Edge, iFogSim, Eclipse ioFog, Data analytics on high potential applications.

TEXTBOOKS

1. Rajkumar Buyya, James Broberg and Andrzej Goscinski, "Cloud Computing: Principles and Paradigms", Wiley, USA, 2017.
2. Jie Cao, Quan Zhang, Weisong Shi, "Edge Computing: A Primer", Springer, Detroit, USA, 2018.

REFERENCES

1. Dac-Nhuong Le, Raghvendra Kumar, Gia Nhu Nguyen, Jyotir Moy Chatterjee, "Cloud Computing and Virtualization", Wiley, USA, 2018.
2. K. Anitha Kumari, G. Sudha Sadasivam, D. Dharani, M. Niranjanamurthy, "Edge Computing: Fundamentals, Advances and Applications", CRC Press, 2021.
3. Rajkumar Buyya, Satish Narayana Srirama, "Fog and Edge Computing: Principles and Paradigms", Wiley, USA, 2019.

COURSE OUTCOMES

1. Explain the principles of cloud and edge computing, virtualization, distributed architectures, resource management, and cloud service models.

- Utilize cloud platforms, virtualization techniques, and edge computing frameworks to deploy scalable and efficient computing solutions.
- Investigate cloud infrastructures, edge architectures, orchestration methods, and distributed applications for solving modern computing challenges.
- Assess cloud services, virtualization strategies, resource allocation methods, and edge computing technologies for diverse application environments.
- Develop integrated cloud and edge computing solutions by combining virtualization, orchestration, distributed processing, and intelligent service deployment.

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

25ITPE704	RECOMMENDER SYSTEMS										L	T	P	C
											3	0	0	3

COURSE OBJECTIVES

To impart knowledge on

- To impart knowledge on neighbourhood models and collaborative filtering.
- To study content-based recommender systems.
- To understand evaluation of recommender systems.
- To study time-aware recommender systems.
- To know about structural recommender systems in networks.

UNIT I Neighbourhood and Model-Based Collaborative Filtering

Introduction to Recommender Systems – NEIGHBOURHOOD-BASED – Cluster-based Model – Regression-based Model – Graph Model – Model-based collaborative filtering – Decision – Regression tree – Rule-based – Latent factor models – Matrix Factorization – Singular Value Decomposition

UNIT II Content-Based and Hybrid Systems

CONTENT BASED – Components of content-based– Pre-processing and Feature Extraction – Learning user profiles and filtering – Nearest neighbour – Bayes – Rule-based – Regression-based– ENSEMBLE AND HYBRID – Weighted – Switching – Cascade – Feature augmentation – Feature combination– Meta-level hybrids – CONTEXT SENSITIVE recommender systems – Contextual modelling

UNIT III Evaluating Recommender Systems

Measuring accuracy and rating prediction – Evaluation paradigms – Evaluation design – Accuracy – coverage – confidence – trust – novelty – serendipity – diversity

UNIT IV Time and Location Sensitive Systems

Temporal collaborative filtering – recency-based – handling periodic context – Time-SVD++ model–Discrete Temporal Model – Markovian–Sequential pattern mining – Location-aware –

Preference and travel locality– Measuring accuracy and rating prediction – Evaluation paradigms – Evaluation design – Accuracy – coverage – confidence – trust – novelty – serendipity – diversity

UNIT V Structural Recommendations in Networks

Ranking algorithm – PageRank; Recommending Friends – link prediction – Neighbourhood – Katz measure – random walk based – Matrix factorization; Social Influence analysis – Linear Threshold – Independent cascade –Influence function evaluation – Recommendation using Deep Neural Networks – Softmax model – Softmax Training – Case Studies

TEXTBOOK

1. Charu C. Aggarwal, “Recommender Systems”, Springer, 2016

REFERENCES

1. Ricci, F, Rokach, L., Shapira, B., Kantor, “Recommender Systems Handbook”, Springer, First Edition, 2011
2. C. Manning, P. Raghavan, and H. Schütze, “Introduction to Information Retrieval”, Cambridge University Press, 2008
3. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, “Information Retrieval: Implementing and Evaluating Search Engines”, The MIT Press, 2010
4. Bing Liu, “Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data (Data-Centric Systems and Applications)”, Springer, 2nd Edition, 2009

EXTENSIVE READING

- <https://developers.google.com/machine-learning/recommendation/dnn/softmax>
- <https://www.analyticssteps.com/blogs/what-are-recommendation-systems-machine-learning>
- <https://www.kdnuggets.com/2019/09/machine-learning-recommender-systems.html>
- <https://medium.com/recombee-blog/machine-learning-for-recommender-systems-part-1-algorithm-evaluation-and-cold-start-6f696683d0ed>

COURSE OUTCOMES

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

1. Describe the fundamentals of recommender systems, filtering techniques, evaluation methods, temporal models, and network-based recommendation strategies.
2. Construct personalized recommendation models using collaborative, content-based, hybrid, context-sensitive, and time-aware recommendation techniques.
3. Compare recommendation algorithms, prediction models, and structural network approaches to improve recommendation relevance and effectiveness.
4. Validate recommendation performance through ranking measures, accuracy metrics, contextual analysis, and quality assessment techniques.
5. Integrate recommendation frameworks, temporal information, contextual knowledge, and network structures to deliver efficient personalized recommendation solutions.

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

25ITPE704	NEXT GENERATION NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To learn the fundamentals of 5G internet.
- To understand the concept of small cells in 5G mobile networks.
- To learn about mobile clouds in the 5G network context.
- To understand the role of cognitive radios in 5G networks.
- To learn the security issues in 5G networks.

UNIT I Pervasive Connected World and 5g Internet

Historical Trend of Wireless Communications – Evolution of LTE Technology to Beyond 4G – 5G Roadmap – Ten Pillars of 5G – Internet of Things and Context Awareness – Network Reconfiguration and Virtualization Support – Mobility – Quality of Service Control – Emerging Approach for Resource Over-Provisioning.

UNIT II Small Cells for 5g Mobile Networks

Introduction to Small Cells – Capacity Limits and Achievable Gains with Densification – Mobile Data Demand – Demand vs. Capacity – Small Cell Challenges.

UNIT III Cooperation for Next Generation Wireless Networks

Introduction – Cooperative Diversity and Relaying Strategies: Cooperation and Network Coding, Cooperative ARQ MAC Protocols – PHY Layer Impact on MAC Protocol Analysis: Impact of Fast Fading and Shadowing on Packet Reception for QoS Guarantee, Impact of Shadowing Spatial Correlation – Study: NCCARQ, PHY Layer Impact.

UNIT IV Mobile Clouds and Cognitive Radio

Introduction – The Mobile Cloud – Mobile Cloud Enablers – Network Coding – Overview of Cognitive Radio Technology in 5G Wireless – Spectrum Optimization using Cognitive Radio – Relevant Spectrum Optimization Literature in 5G – Cognitive Radio and Carrier Aggregation – Energy Efficient Cognitive Radio Technology.

UNIT V Security and Self-Organising Networks

Overview of Potential 5G Communications System Architecture – Security Issues and Challenges in 5G Communications Systems – Self-Organising Networks: Introduction, Self-Organising Networks in UMTS and LTE, The Need for Self-Organising Networks in 5G, Evolution towards Small Cell Dominant HetNets.

TEXTBOOK

1. Jonathan Rodriguez, “Fundamentals of 5G Mobile Networks”, Wiley, 2015.

REFERENCES

1. Yin Zhang, Min Chen, “Cloud-Based 5G Wireless Networks – Springer Briefs in Computer Science”, Springer, 2016.
2. Athanasios G. Kanatas, Konstantina S. Nikita, Panagiotis (Takis) Mathiopoulos, “New Directions in Wireless Communications Systems: From Mobile to 5G”, CRC Press, 2017.

COURSE OUTCOMES

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

1. Describe the architecture, evolution, enabling technologies, mobile cloud concepts, cognitive radio, and security aspects of next-generation networks.
2. Implement 5G networking techniques by utilizing small cells, virtualization, mobility management, and advanced wireless communication mechanisms.
3. Examine network coding, cooperative communication, spectrum utilization, and cognitive radio techniques to enhance wireless network performance.
4. Validate the efficiency of 5G architectures, mobile cloud services, spectrum management strategies, and security mechanisms in diverse communication environments.
5. Formulate reliable next-generation networking solutions by integrating 5G technologies, cognitive radio, mobile cloud computing, and secure communication practices.

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

25ITPE704	STORAGE TECHNOLOGIES					L	T	P	C
						3	0	0	3

COURSE OBJECTIVES

- To provide a better understanding of storage system environments.
- To provide insight into data protection and intelligent storage systems.
- To impart knowledge in direct-attached storage.
- To understand storage area networks.
- To understand the concept of network-attached storage.

UNIT I Introduction to Information Storage and Management

Information storage, Evolution of storage technology and architecture, Data center infrastructure, Key challenges in managing information, Information lifecycle, storage system environment, components of a storage system environment, Disk drive components, Disk drive performance and fundamental laws governing disk performance, logical components of the Host, Application requirements and disk performance

UNIT II Data Protection using RAID

RAID and its implementation aspects, RAID array components, RAID levels and comparison, RAID impact on disk performance, Hot spares, Intelligent Storage System Components of an intelligent storage system, intelligent storage array, Concepts in practice

UNIT III Direct-attached storage and introduction to SCSI

Benefits, limitations and types of direct-attached storage (DAS), Disk drive interfaces, Introduction to SCSI and its command model.

UNIT IV Storage Area Networks

Fiber Channel, Evolution and components of SAN, Fiber Channel (FC), connectivity, FC ports and architecture, Zoning, FC login types, FC topologies.

UNIT V Network-attached storage

General purpose servers versus network attached storage (NAS) devices, NAS file I/O, NAS components and implementation, NAS file-sharing protocols and I/O operations, Factors affecting NAS performance and availability, contemporary issues.

TEXTBOOK

1. Somasundaram Gnanasundaram, Alok Shrivastava, "Information Storage and Management", Wiley Publishing Inc, 2nd Edition, 2012.

REFERENCES

1. Nigel Poulton, "Data Storage Networking: Real World Skills for the CompTIA Storage and Certification and Beyond", John Wiley & Sons, 2014.
2. Ulf Troppens, Rainer Erkens, Wolfgang Muller-Friedt, Rainer Wolafka, Nils Haustein, "Storage Networks Explained", John Wiley & Sons, 24-Aug-2011
3. Himanshu Dwivedi, "Securing Storage: A Practical Guide to SAN and NAS Security", Prentice Hall, 2012.

COURSE OUTCOMES

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

1. Outline the concepts of storage architecture, information management, data protection, intelligent storage systems, and enterprise storage networks.
2. Execute storage management techniques using RAID, direct-attached storage, storage area networks, and network-attached storage solutions.
3. Distinguish storage architectures, protection mechanisms, connectivity models, and storage protocols for efficient information management.
4. Verify the effectiveness of RAID configurations, SAN infrastructures, NAS services, and intelligent storage components in enterprise environments.
5. Integrate storage technologies, data protection strategies, storage networks, and management practices to establish reliable enterprise storage solutions.

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

25ITPE704	DEV OPS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To learn the basic concepts and terminology of DevOps.
- To gain knowledge of DevOps platforms.
- To understand building and deployment of code.
- To become familiar with DevOps automation tools.
- To learn the basics of MLOps.

UNIT I

Software Engineering - traditional and Agile process models - DevOps -Definition - Practices - DevOps life cycle process - need for DevOps –Barriers

UNIT II

Cloud as a platform - IaaS, PaaS, SaaS - Virtualization - Containers – Supporting Multiple Data Centers - Operation Services - Hardware provisioning- software Provisioning - IT services - SLA - capacity planning - security - Service Transition - Service Operation Concepts.

UNIT III

Microservices architecture - coordination model - building and testing - Deployment pipeline - Development and Pre-commit Testing - Build and Integration Testing - continuous integration - monitoring - security - Resources to Be Protected - Identity Management

UNIT IV

Infrastructure Automation - Configuration Management - Deployment Automation - Performance Management - Log Management -Monitoring.

UNIT V

MLOps - Definition – Challenges - Developing Models - Deploying to Production - Model Governance - Real-world examples

REFERENCES

1. Len Bass, Ingo Weber and Liming Zhu, “DevOps: A Software Architect’s Perspective”, Pearson Education, 2016
2. Joakim Verona - “Practical DevOps” - Packet Publishing, 2016
3. Viktor Farcic, “The DevOps 2.1 Toolkit: Docker Swarm” - Packet Publishing, 2017
4. Mark Treveil and the Dataiku Team, “Introducing MLOps” - O’Reilly Media, 2020

COURSE OUTCOMES

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

1. Summarize the principles of DevOps, cloud platforms, automation practices, deployment workflows, infrastructure management, and MLOps concepts.
2. Implement DevOps practices using version control, containerization, orchestration, continuous integration, and deployment automation techniques.
3. Differentiate software provisioning, infrastructure automation, monitoring strategies, and deployment models for efficient application delivery.
4. Measure the effectiveness of DevOps pipelines, configuration management, deployment automation, logging, monitoring, and MLOps workflows.
5. Establish reliable DevOps solutions by integrating automation tools, cloud services, deployment pipelines, infrastructure management, and MLOps practices.

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

25ITPE704	GAME DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To know the basics of 2D and 3D graphics for game development.
- To know the stages of game development.
- To understand the basics of game engines.
- To survey the game development environment and toolkits.
- To learn and develop simple games using Pygame.

UNIT I 3D Graphics for Game Programming

Game – Definition – Genres of Games, Basics of 2D and 3D Graphics, Game Object Design – 2D and 3D Transformations – Projections – Colour Models – Illumination and Shader Models – Animation – Controller-based Animation.

UNIT II Game Design Principles

Character Development, Storyboard Development for Gaming – Script Design – Script Narration – Game Balancing – Core Mechanics – Principles of Level Design – Proposals – Writing for Pre-production, Production and Post-Production.

UNIT III Game Engine Design

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine – Collision Detection – Game Logic – Game AI – Path Finding.

UNIT IV Overview of Gaming Platforms and Frameworks

Pygame Game development – Unity – Unity Scripts – Mobile Gaming, Game Studio, Unity – Single-player and Multi-Player games.

UNIT V Game Development Using Pygame

Developing 2D and 3D Interactive Games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating Music and Sound – Asset Creation – Game Physics Algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile-Based Games – Overview of Puzzle Games.

TEXTBOOK

1. Sanjay Madhav, “Game Programming Algorithms and Techniques: A Platform Agnostic Approach”, Addison-Wesley Professional, 2013.

REFERENCES

1. Will McGugan, “Beginning Game Development with Python and Pygame: From Novice to Professional”, Apress Publishers, 2007.
2. Paul Craven, “Python Arcade Games”, Apress Publishers, 2016.
3. David H. Eberly, “3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics”, Second Edition, CRC Press, 2006.
4. Jung Hyun Han, “3D Graphics for Game Programming”, Chapman and Hall/CRC, 2011.

COURSE OUTCOMES

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

1. Describe the fundamentals of game development, graphics programming, game engines, rendering techniques, frameworks, and game design principles.
2. Construct interactive games using Pygame, game development frameworks, rendering methods, and object-oriented programming techniques.
3. Explore game design strategies, rendering algorithms, animation methods, physics concepts, and gameplay mechanics for engaging game experiences.
4. Verify game performance by examining rendering efficiency, framework capabilities, game physics, asset integration, and user interaction techniques.
5. Create functional game applications by combining game engines, graphics programming, Pygame libraries, rendering techniques, and gameplay design concepts.

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

25ITPE704	FUNDAMENTALS OF VR / AR / MR	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To explore the evolution of spatial computing and interaction design.
- To understand the principles of VR/AR/MR hardware and computer vision algorithms.
- To learn virtual reality animation and 3D art optimization techniques.
- To demonstrate virtual reality development concepts and applications.
- To introduce the design of visualization tools for immersive environments.

UNIT I

How Humans interact with Computers: Common term definitions, introduction, modalities through the ages (pre - 20th century, through World War II, post-World War II, the rise of personal computing, computer miniaturization), why did we just go over all of this? types of common HCI modalities, new modalities, the current state of modalities for spatial computing devices, current controllers for immersive computing systems, a note on hand tracking and hand pose recognition.

Designing for our Senses, not our Devices: Envisioning a future, sensory technology explained, who are we building this future for? Sensory design, five sensory principles, Adobe's AR story.

UNIT II

Virtual Reality for Art: A more natural way of making 3D art, VR for animation.

3D art optimization: Introduction, draw calls, using VR tools for creating 3D art, acquiring 3D models vs making them from scratch.

How the computer vision that makes augmented reality possible works: Who are we? A brief history of AR, how and why to select an AR platform, mapping, platforms, other development considerations, the AR cloud.

UNIT III

Virtual reality and augmented reality: cross-platform theory: Why cross-platform? The role of game engines, understanding 3D graphics, portability lessons from video game design, simplifying the controller input.

Virtual reality toolkit: open-source framework for the community: What is VRTK and why do people use it? The history of VRTK, welcome to the SteamVR Unity Toolkit, VRTK v4, the future of VRTK, success of VRTK.

Three virtual reality and augmented reality development practices: Developing for virtual reality and augmented reality, handling locomotion, effective use of audio, common interaction paradigms.

UNIT IV

Data and machine learning visualization design and development in spatial computing: Introduction, understanding data visualization, principles for data and machine learning visualization design and development in spatial computing, why data and machine learning visualization works in spatial computing, 2D data visualization vs 3D data visualization in spatial computing, interactivity in data visualizations and in spatial computing, animation, failures in data visualization, good data visualization design optimize 3D spaces, data representations, info graphics, and interactions, defining distinctions in data visualization and big data for machine, how to create data visualization: data visualization creation pipeline, webXR, data visualization challenges in XR, data visualization industry use case examples of data visualization, 3D reconstruction and direct manipulation of real world data, data visualization is for everyone, hands on tutorials, how to create data visualization, resources.

UNIT V

Character AI and Behaviors: Introduction, behaviors, current practice: Reactive AI, more intelligence in the system, Deliberative AI, machine learning.

The virtual and augmented reality health technology ecosystem: VR/AR health technology application design, standard UX isn't intuitive, tutorial: insight Parkinson's experiment, companies, case studies from leading Academic institutions.

TEXTBOOK

1. Erin Pangilinan, Steve Lukas, and Vasanth Mohan, "Creating Augmented & Virtual Realities", 1st edition, O'REILLY, 2019.

REFERENCE

1. Steve Aukstakalnis, "Practical Augmented Reality", Pearson Education, 2017.

COURSE OUTCOMES

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

1. Describe the concepts of spatial computing, immersive technologies, computer vision, interaction design, visualization, and virtual reality development practices.
2. Construct immersive VR, AR, and MR applications using cross-platform frameworks, development toolkits, computer vision, and interaction techniques.
3. Examine visualization methods, 3D content optimization, virtual environments, and intelligent interaction models for enhanced user experiences.
4. Validate immersive systems by analyzing visualization designs, interaction paradigms, AI behaviors, usability principles, and real-world application scenarios.
5. Integrate VR, AR, and MR technologies with visualization, artificial intelligence, and computer vision to deliver effective immersive solutions across diverse domains.

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

25ITPE704	ENGINEERING SECURE SOFTWARE SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To demonstrate the ability to manage software projects through planning, scheduling, risk assessment, and management.
- To understand proper software documentation and software requirement specifications.
- To illustrate distributed system architectures and application architectures.
- To identify reusable software design components for secure software development.
- To demonstrate proficiency in secure software development cost estimation.

UNIT I

Security and software issues: introduction, the problem, Software Assurance and Software Security, Threats to software security, Sources of software insecurity, Benefits of Detecting Software Security. What Makes Software Secure: Properties of Secure Software, Influencing the security properties of software, Asserting and specifying the desired security properties?

UNIT II

Requirements Engineering for secure software: Introduction, the SQUARE process Model, Requirements elicitation and prioritization

UNIT III

Secure Software Architecture and Design: Introduction, software security practices for architecture and design: architectural risk analysis, software security knowledge for architecture and design: security principles, security guidelines and attack patterns. Secure Coding and Testing: Code analysis, Software Security testing, Security testing considerations throughout the SDLC

UNIT IV

Security and Complexity: System Assembly Challenges: introduction, security failures, functional and attacker perspectives for security analysis, system complexity drivers and security

UNIT V

Governance and Managing for More Secure Software: Governance and security, adopting an enterprise software security framework, how much security is enough? Security and project management, Maturity of Practice

TEXTBOOK

1. Julia H. Allen, "Software Security Engineering", Pearson Education

REFERENCES

1. Jason Grembi, "Developing Secure Software", Cengage Learning
2. Richard Sinn, "Software Security", Cengage Learning
3. Theodor Richardson, Charles N Thies, "Secure Software Design", Jones & Bartlett, 2013.
4. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, "Enterprise Software Security: A Confluence of Disciplines", Addison Wesley, 2014.
5. William R. Simpson, "Enterprise-level security: Securing Information Systems in an Uncertain World", 1st edition, CRC Press, 2016.
6. 4. Qing Li, Gregory Clark, "Security Intelligence: A Practitioner's Guide to Solving Enterprise Security Challenges", Wiley, 2010.

COURSE OUTCOMES

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

1. Describe secure software engineering principles, requirements analysis, software architecture, security testing, governance, and project management practices.
2. Implement secure software development practices by applying architectural guidelines, coding standards, risk assessment, and software assurance techniques.
3. Examine software vulnerabilities, security threats, design patterns, and testing strategies to improve the reliability of software systems.
4. Validate software security through architecture evaluation, secure coding practices, governance frameworks, and complexity management techniques.
5. Formulate secure software solutions by integrating security engineering, software assurance, governance policies, and lifecycle management practices.

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

PROFESSIONAL ELECTIVES – VII

25ITPE705	DEEP LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To illustrate the fundamental concepts, architecture, and working principles of artificial neural networks.
- To apply training techniques and optimization algorithms for developing artificial neural network models.
- To design artificial neural networks for solving classification problems using appropriate learning strategies.
- To develop and deploy deep learning models for solving real-world machine learning applications.

UNIT I

Artificial Neural Networks- The Neuron-Expressing Linear Perceptrons as Neurons-Feed-Forward Neural Networks- Linear Neurons and Their Limitations –Sigmoid – Tanh – and ReLU Neurons -Softmax Output Layers – Training Feed-Forward Neural Networks

UNIT II

Gradient Descent-Delta Rule and Learning Rates- Gradient Descent with Sigmoidal Neurons-The Backpropagation Algorithm - Stochastic and Mini-batch Gradient Descent – Test Sets – Validation Sets – and Overfitting- Preventing Overfitting in Deep Neural Networks – Implementing Neural Networks in TensorFlow.

UNIT III

Local Minima in the Error Surfaces of Deep Networks - Model Identifiability - Spurious Local Minima in Deep Networks - Flat Regions in the Error Surface – Momentum-Based Optimization – Learning Rate Adaptation.

UNIT IV

Convolutional Neural Networks (CNN) – Architecture -Accelerating Training with Batch Normalization- Building a Convolutional Network using TensorFlow- Visualizing Learning in Convolutional Networks – Embedding and Representation Learning.

UNIT V

Autoencoder Architecture-Implementing an Autoencoder in TensorFlow –Denoising Sparsity in Autoencoder Models for Sequence Analysis – Recurrent Neural Networks- Vanishing GradientsLong Short-Term Memory (LSTM) Units- TensorFlow Primitives for RNN Models-Augmenting Recurrent Networks with Attention.

TEXTBOOK

1. Nikhil Buduma, “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithm”, O’Reilly, 2017.
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, “Deep Learning”, MIT Press, 2016.

REFERENCE

1. Aurélien Géron, “Hands-On Machine Learning with Scikit - Learn and TensorFlow”, O’Reilly, 2017.
2. Nikhil Ketkar, “Deep Learning with Python: A Hands-on Introduction”, Apress, 2017.

COURSE OUTCOMES

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

1. Explain the principles of neural networks, deep learning architectures, optimization techniques, and sequence models for intelligent systems.
2. Apply neural network training algorithms, TensorFlow frameworks, and deep learning models to solve machine learning problems.

3. Analyze optimization methods, network performance, and learning strategies to improve deep learning model effectiveness.
4. Evaluate suitable deep learning architectures and optimization techniques for classification and predictive applications.
5. Design and implement deep learning solutions using CNNs, autoencoders, RNNs, LSTMs, attention mechanisms, and TensorFlow.

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

25ITPE705	QUANTUM COMPUTING										L	T	P	C
											3	0	0	3

COURSE OBJECTIVES

- To illustrate the foundations of classical and quantum computing paradigms.
- To explain the fundamental principles and computational concepts of quantum computing.
- To examine the relationship between quantum mechanics and computer science.
- To analyze the hardware and mathematical models used in quantum computation.
- To interpret the principles and applications of quantum information theory.

UNIT I Fundamental Concepts

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

UNIT II Quantum Mechanics and Overview of Computational Models

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

UNIT III Quantum Computation

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

UNIT IV Quantum Information

Quantum Noise and Quantum Operations: Classical Noise and Markov processes – Quantum Operations – Examples – Applications – Distance Measures for Quantum Information – Quantum Error Correction – Entropy

UNIT V Quantum Information Theory

Quantum States and Accessible Information – Data Compression – Classical Information Over Noisy Quantum Channels – Quantum Information Over Noisy Quantum Channels – Entanglement as a Physical Resource – Quantum Cryptography.

TEXTBOOK

1. Michael A. Nielsen, Issac L. Chuang, “Quantum Computation and Quantum Information”, Tenth Edition, Cambridge University Press, 2010.

REFERENCES

1. Scott Aaronson, “Quantum Computing Since Democritus”, Cambridge University Press, 2013.
2. N. David Mermin, “Quantum Computer Science: An Introduction”, Cambridge University Press, 2007.

COURSE OUTCOMES

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

1. Explain the principles of quantum computing, quantum mechanics, computational models, and quantum information theory.
2. Apply quantum gates, circuits, algorithms, and computational models to solve quantum computing problems.
3. Analyze quantum computation, error correction, noise models, and information processing techniques for efficient quantum systems.
4. Evaluate quantum algorithms, communication protocols, and information-theoretic models for secure and reliable quantum computing.
5. Design quantum computing solutions by integrating quantum circuits, information theory, cryptographic techniques, and computational models for real-world applications.

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

25ITPE705	SECURITY AND PRIVACY IN CLOUD	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To illustrate the security challenges from cloud provider and user perspectives.
- To apply security mechanisms for protecting private and public cloud environments.
- To develop secure cloud-based solutions using appropriate security protocols and standards.
- To analyze cloud security risks and mitigation strategies.
- To interpret security management practices for cloud service models and data protection.

UNIT-I INTRODUCTION

Review of cloud platforms and architectures - Security issues from the cloud provider's perspective, user's perspective - Understanding security and privacy - Cloud Computing risk issues.

UNIT-II SECURING THE CLOUD

Security challenges - Security requirements for the architecture - Securing private and public clouds - Security patterns - Cloud security architecture - Infrastructure security.

UNIT-III SECURITY PROTOCOLS AND STANDARDS

Host security, Compromise response, Security standards, Message Level Security (MLS), Transport Level Security, OAuth, OpenID, eXtensible Access Control Markup Language (XACML), and Security Assertion Markup Language (SAML).

UNIT-IV STRATEGIES AND PRACTICES

Strategies and best practices - Security controls: limits, best practices, monitoring - Security criteria - Assessing risk factors in Clouds.

UNIT-V SECURITY MANAGEMENT IN THE CLOUD

Security management in the cloud: SaaS, PaaS, IaaS – Availability management - Security as a service - Trust Management for Security - Data Security and Storage, Privacy in Cloud

TEXTBOOKS

1. Ronald L. Krutz, Russell Dean Vines, “Cloud Security: A Comprehensive Guide to Secure Cloud Computing”, Wiley 2010.
2. Vic J R, “Securing the Cloud: Cloud Computer Security Techniques and Tactics”, Winkler, Elsevier, 2011

REFERENCES

1. Ben Halpert, “Auditing Cloud Computing: A Security and Privacy Guide”, John Wiley & Sons, 2011.
2. Ianlim, E. Coleen Coolidge, Paul Hourani, “Securing Cloud and Mobility: A Practitioner's Guide”, Auerbach Publications, Feb 2013.
3. Pethuru Raj, “Cloud Enterprise Architecture”, CRC Press, 2013

COURSE OUTCOMES

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

1. Explain cloud security concepts, architectures, service models, security challenges, and privacy requirements in cloud environments.
2. Apply cloud security mechanisms, protocols, standards, and best practices to secure cloud infrastructures and applications.
3. Analyze cloud security risks, vulnerabilities, and threat mitigation strategies to enhance secure cloud operations.
4. Evaluate cloud security architectures, authentication protocols, and security management frameworks for reliable cloud services.
5. Design secure cloud solutions by integrating security controls, trust management, data protection, and privacy-preserving techniques across cloud platforms.

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

25ITPE705	SATELLITE COMMUNICATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To explain the fundamental concepts and orbital principles of satellite communication.
- To illustrate the architecture and functions of satellite and earth segments.
- To analyze satellite access techniques and communication link performance.
- To interpret the applications of satellite communication in modern communication systems.

UNIT I Introduction to Satellite Communication

Historical background, Basic concepts of Satellite Communications, Communication Networks and Services, Comparison of Network Transmission technologies, Orbital and Spacecraft problems, Growth of Satellite communications.

UNIT II Satellite Orbits

Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geostationary and non-geostationary orbits – look angle determination- limits of visibility – eclipse-sub-satellite point – Sun transit outage - Launching Procedures – launch vehicles and propulsion.

UNIT III The Space Link

Introduction, Equivalent Isotropic Radiated Power, Transmission Losses, Free-space transmission, Feeder losses, Antenna misalignment losses, Fixed atmospheric and ionospheric losses, The Link-Power Budget Equation, System Noise, Carrier-to-Noise Ratio, The Uplink, Saturation flux density, Input backoff, Downlink, Output back-off, Combined Uplink and Downlink C/N Ratio.

UNIT IV Earth Segment

Introduction – Receive – Only home TV systems – Outdoor unit – Indoor unit for analog (FM) TV – Master antenna TV system – Community antenna TV system – Transmit – Receive earth stations – Problems – Equivalent isotropic radiated power – Transmission losses – Free-space transmission – Feeder losses – Antenna misalignment losses – Fixed atmospheric and ionospheric losses – Link power budget equation – System noise – Antenna noise – Amplifier noise temperature – Amplifiers in cascade – Noise factor – Noise temperature of absorptive networks – Overall system noise temperature – Carrier to- Noise ratio – Uplink – Saturation flux density – Input back off – The earth station – HPA – Downlink – Output back off – Satellite TWTA output – Effects of rain – Uplink rain – Fade margin – Downlink rain – Fade margin – Combined uplink and downlink C/N ratio – Inter modulation noise.

UNIT V Satellite Applications

INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. Direct Broadcast satellites (DBS) - Direct-to-home Broadcast (DTH), Digital audio broadcast (DAB) - World space services, Business TV(BTV), GRAMSAT, Specialized services – E-mail, Video conferencing, Internet.

TEXTBOOKS

1. Dennis Roddy, "Satellite Communication", 4th Edition, McGraw Hill International, 2006.
2. Wilbur L Pritchard, Hendri G. Snyderhoud, Robert A. Nelson, "Satellite Communication Systems Engineering", Prentice Hall/Pearson, 2007.

REFERENCES

1. N. Agarwal, "Design of Geosynchronous Space Craft", Prentice Hall, 1986.
2. Bruce R. Elbert, "The Satellite Communication Applications", Handbook, Artech House, Boston, London, 1997.
3. Tri T. Ha, "Digital Satellite Communication", II nd edition, 1990.
4. Emanuel Fthenakis, "Manual of Satellite Communications", McGraw-Hill Book Co., 1984.
5. Robert G. Winch, "Telecommunication Transmission Systems", McGraw-Hill Book Co., 1983.

6. Brian Ackroyd, "World Satellite Communication and Earth Station Design", BSP Professional Books, 1990.
7. G.B. Bleazard, "Introducing Satellite Communications ", NCC Publication, 1985.
8. M. Richharia, "Satellite Communication Systems - Design Principles", Macmillan, 2003.

COURSE OUTCOMES

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

1. Explain the principles of satellite communication, orbital mechanics, space links, earth stations, and satellite-based communication services.
2. Apply orbital parameters, link budget analysis, and earth segment concepts to evaluate satellite communication systems.
3. Analyze satellite orbits, transmission characteristics, propagation losses, and system performance for reliable communication.
4. Evaluate satellite communication architectures, access methods, and navigation technologies for diverse communication applications.
5. Design satellite communication solutions by integrating orbital analysis, link design, earth segment components, and satellite applications for real-world communication networks.

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

25ITPE705	EXPLORATORY DATA ANALYSIS					L	T	P	C
						3	0	0	3

COURSE OBJECTIVES

- To illustrate the fundamental concepts and significance of Exploratory Data Analysis (EDA).
- To explain the theoretical foundations and preprocessing techniques for data analysis.
- To apply statistical methods and data transformation techniques for meaningful insights.
- To analyze time-series data and develop predictive models using EDA techniques.
- To evaluate data quality and machine learning workflows for effective data-driven decision-making.

UNIT I Introduction to Exploratory Data Analysis

Exploratory Data Analysis Fundamentals - Understanding data science - The significance of EDA - Making sense of data - Comparing EDA with classical and Bayesian analysis - Software tools available for EDA - Visual aids for EDA – Types of Charts

UNIT II Data Transformation

EDA with personal Email - Loading the dataset - Data transformation - Data Analysis - Merging database-style data frames - Transformation techniques - Benefits of Transformation

UNIT III Descriptive Statistics, Grouping Datasets

Understanding statistics - Measures of central tendency - Measures of dispersion - Grouping Datasets - Understanding groupby() - Data aggregation - Pivot tables and cross-tabulations - Correlation - Types of analysis - multivariate analysis using the Titanic dataset

UNIT IV Time Series Analysis, Model Development and Evaluation

Understanding time series - Time Series Analysis with Open Power System - Hypothesis Testing and Regression - Hypothesis testing - p-hacking - Understanding regression - Model development and evaluation

UNIT V Machine Learning, EDA on Wine Quality Data Analysis

Types of machine learning - Supervised learning - Unsupervised learning - Reinforcement Learning - Unified machine learning workflow - Disclosing the wine quality dataset - Analyzing red wine - Analyzing white wine – Model Development and Evaluation

TEXTBOOK

1. Suresh Kumar Mukhiya, Usman Ahmed, “Hands-On Exploratory Data Analysis with Python: Perform EDA techniques to understand, summarize, and investigate your data”, First Edition, Packt Publishing, 2020.

REFERENCE BOOKS

1. Allen B. Downey, “Think Stats: Exploratory Data Analysis”, Second Edition, O'Reilly Publications, 2014.
2. Glenn J. Myatt and Wayne P. Johnson, “Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining”, Second Edition, Wiley Publications, 2014.
3. Glenn J. Myatt and Wayne P. Johnson, “Making Sense of Data II: A Practical Guide to Data Visualization, Advanced Data Mining Methods and Applications”, Wiley Publications, 2009.

COURSE OUTCOMES

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

1. Explain the concepts of exploratory data analysis, data transformation, statistical measures, time-series analysis, and machine learning workflows.
2. Apply data preprocessing, transformation, statistical analysis, and visualization techniques to explore and interpret datasets effectively.
3. Analyze datasets using descriptive statistics, correlation, grouping methods, time-series analysis, and regression techniques to extract meaningful insights.
4. Evaluate data quality, machine learning models, and analytical methods to support reliable and informed decision-making.
5. Design data-driven solutions by integrating exploratory data analysis, statistical techniques, predictive modeling, and machine learning for real-world applications.

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

25ITPE705	PENETRATION TESTING METHODOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To explain the fundamentals of Linux and penetration testing methodologies.
- To illustrate the phases and techniques involved in penetration testing.

- To analyze web application security mechanisms and vulnerabilities.
- To apply exploit development and vulnerability assessment techniques.
- To interpret hardware-based attacks and security testing tools for ethical hacking.

UNIT I

Kali Linux Fundamentals: History, Tool Categories, Linux Fundamentals, Installing, Configuring and Updating services, Types of Penetration testing, Security testing methodologies, Penetration Testing Execution Standard, General penetration testing framework

UNIT II

Phases of Penetration Testing: Target Scoping, Information Gathering, Target Discovery, Enumerating Target, Vulnerability Mapping, Social Engineering, Target Exploitation, Privilege Escalation, Maintaining Access, Documentation and Reporting, Enumeration Techniques.

UNIT III

Web Application Security: Core Defense Mechanisms - Handling User Access, Handling User Input, Handling Attackers, Managing the Application.

Web Application Hacker's Methodology: Map the Application's Content, Analyze the Application, Client-Side Controls, Authentication Mechanism, Session Management Mechanism, Access Controls, Input-Based Vulnerabilities, Function-Specific Input Vulnerabilities, Logic Flaws, Shared Hosting Vulnerabilities, Application Server Vulnerabilities.

UNIT IV

Exploit writing/analysis: Basics of exploit writing, Buffer overflow attacks, generating shellcode with Metasploit, shellcode analysis, working with public exploits, bypassing antivirus software, File transfers with netcat, working with exploit writing.

UNIT V

Hardware-based attacks: Hardware-based malware, Ducky scripts - Throwstarlaptop pro, LAN turtle, Bash bunny, Wifi pineapple.

Tools essential: Website Copier, The Harvester, Google-fu, Whois, SET, netcat, ncat, Wireshark, Tcpdump, Email harvesting, DNS, SMTP, SNMP, SMB, Metasploit, Shodan, Exploit-db, Nmap, Nikto, Password attacks.

REFERENCES

1. Raphaël Hertzog, Jim O'Gorman, Mati Aharoni, "Kali Linux Revealed - Mastering the Penetration Testing Distribution", OFFSEC Press, 1st Edition, 2017.
2. Lee Allen, Tedi Heriyanto, Shakeel Ali, "Kali Linux – Assuring Security by Penetration Testing", PACT Publishers, Second Edition, 2014.
3. Patrick Engebretson, The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy, Syngress; 2nd edition, 2013
4. Dafydd Stuttard, Marcus Pinto, "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws", Wiley, Second edition, 2011.
5. OWASP Top 10, URL: https://www.owasp.org/index.php/Top_10_2017-Top_10
6. Exploit Database, URL: <https://www.exploit-db.com/>
7. SecurityFocus, URL: <http://www.securityfocus.com/>
8. Packetstormsecurity, URL: <https://packetstormsecurity.com/>
9. Basic Linux Privilege Escalation, URL: <http://blog.g0tmilk.com/2011/08/basic-linuxprivilege-escalation/>
10. Windows Privilege Escalation Fundamentals,
Url:<http://www.fuzzysecurity.com/tutorials/16.html>
11. Capture the Flag, URL: <https://ctftime.org/>

COURSE OUTCOMES

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

1. Explain the principles of penetration testing, Linux fundamentals, web application security, exploit analysis, and hardware-based attack methodologies.

2. Apply penetration testing methodologies, security assessment tools, and vulnerability analysis techniques to identify system weaknesses.
3. Analyze web applications, network services, exploits, and hardware vulnerabilities to assess security risks and attack surfaces.
4. Evaluate security mechanisms, penetration testing frameworks, and mitigation strategies to enhance system and application security.
5. Design ethical penetration testing solutions by integrating reconnaissance, exploitation, reporting, and security assessment tools for real-world cybersecurity environments.

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

25ITPE705	CLOUD SERVICE MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To explain the fundamental concepts and architectures of cloud computing.
- To analyze cloud deployment strategies and application hosting over cloud infrastructure.
- To illustrate storage virtualization technologies and their business benefits.
- To interpret business continuity, backup, and recovery solutions in cloud environments.

UNIT I

Introduction: Distributed Computing and Enabling Technologies, Cloud Fundamentals: Cloud Definition, Evolution, Architecture, Applications, Deployment models and service models.

Virtualization: Issues with virtualization, Virtualization technologies and architectures, Internals of virtual machine monitors/hypervisors, Virtualization of data centers and Issues with Multi-tenancy.

UNIT II

Implementation: Study of Cloud computing Systems like Amazon EC2 and S3, Google App Engine and Microsoft Azure, Build Private/Hybrid Cloud using open-source tools, Deployment of Web Services from inside and outside a Cloud Architecture, MapReduce and its extensions to Cloud Computing, HDFS and GFS.

UNIT III

Storage virtualization: Fixed Content and Archives, Types, Features, Benefits, CAS Architecture, Object storage and retrieval, Examples: Storage Virtualization - forms of virtualization, SNIA Taxonomy – Storage virtualization configurations, Challenges, Types of storage virtualization – Business Continuity- Overview of emerging technologies such as Cloud storage, Virtual provisioning, Unified Storage, FCOE, FAST.

UNIT IV

Business Continuity and Recovery: Information Availability, BC Terminology, Life cycle, Failure analysis: Backup and Recovery- Backup purpose, considerations, Backup Granularity,

Recovery considerations- Backup methods, Process, backup and restore operations, Overview of emerging technologies: Duplication, Off-site backup.

UNIT V

Storage security and Management: Storage security framework, securing the storage infrastructure, Risk triad: Managing the storage infrastructure, monitoring the storage infrastructure, identifying key parameters and components to monitor in a storage infrastructure, List key management activities and examples, define storage management standards and initiatives, industry trend.

TEXTBOOKS

1. Rajkumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing Principles and Paradigms, Wiley Publishers, 2011.
2. Barrie Sosinsky, Cloud Computing Bible, Wiley Publishers, 2010.
3. Tim Mather, Subra Kumaraswamy, Shahed Latif, Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, O'Reilly, 2010.
4. EMC Corporation, Information Storage and Management, 1st Edition, Wiley India, 2009.

REFERENCES

1. Rajkumar Buyya, Christian Vacchiola, S ThamaraiSelvi, Mastering Cloud Computing, McGraw Hill, 2013
2. Michael Miller, Cloud Computing: Web-based Applications that change the way you work and collaborate online, Pearson Education, 2008
3. IBM, Introduction to Storage Area Networks and System Networking, 5th Edition, November 2012.
4. Robert Spalding, Storage Networks: The Complete Reference, Tata McGraw Hill, Osborne, 6th reprint, 2003.
5. Marc Farley, Building Storage Networks, Tata McGraw Hill, Osborne, 1st Edition, 2001.

COURSE OUTCOMES

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

1. Explain cloud computing concepts, virtualization, deployment models, storage technologies, and business continuity principles.
2. Apply cloud platforms, virtualization techniques, distributed storage, and cloud services to implement scalable cloud solutions.
3. Analyze cloud architecture, storage virtualization, backup strategies, and recovery mechanisms for efficient cloud management.
4. Evaluate cloud service models, storage security frameworks, and business continuity solutions to ensure reliable cloud operations.
5. Design secure and resilient cloud service management solutions by integrating virtualization, storage management, security, and disaster recovery techniques.

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

25ITPE705	FUNDAMENTALS OF REVERSIBLE AND QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To explain the fundamentals of Boolean algebra and logic functions.
- To illustrate the principles of reversible logic and reversible circuit design.
- To apply linear algebra concepts in quantum computing.
- To interpret the fundamentals of quantum computing and qubit operations.
- To analyze quantum algorithms for computational problem solving.

UNIT I Boolean Algebra and Group Theory

Boolean Functions of One, Two Variables, n Variables, Minterm and Maxterm Expansion, Reed–Muller Expansion, Minimal ESOP Expansion, Linear Functions, Affine Linear Functions, Monotonic Functions, Boolean Derivative, Boolean Decompositions.

UNIT II Reversible Circuits

Conservative Circuits, Monotonic Circuits, Linear Circuits, Affine Linear Circuits, Exchange Gates, SWAP Gates, Affine Exchange Gates, Control Gates, Sylow Circuits, Gate Cost and Logic Depth, Methods of Synthesis, Cosets, Double Cosets, The Synthesis Algorithm, Variable Ordering, Linear Synthesis Algorithm, Preset Bits and Garbage Bits, Duplicating Circuit, Controlled NOT, Full Adder.

UNIT III Basic Linear Algebra

Vector spaces, Basis and dimension, Inner products, Orthonormality, Gram-Schmidt orthogonalization, Bra-Ket formalization, Hilbert spaces, Products, Tensor products, Matrices, Complex spaces, Hadamard Matrices, Fourier matrices, Pauli matrices, Hermitian, Unitary, and normal operators.

UNIT IV Introduction to Quantum Computing

Doubly Stochastic Matrices, System of Qubits, Qubits and measurement, Entanglement, single-qubit gates, controlled gates, Gate decomposition.

UNIT V Quantum Algorithms

Deutsch algorithm, Deutsch - Jozsa algorithm, Simon algorithm, Shor algorithm, Grover algorithm.

TEXTBOOK

1. Alexis De Vos, Reversible Computing: Fundamentals, Quantum computing with applications, Wiley-VCH VerlagGmbH & Co. KGaA, 2010.

REFERENCES

1. David McMahon, Quantum computing explained, Wiley-Interscience, John Wiley & Sons, Inc., 2008.
2. Vincent Moret-Bonillo, Adventures in computer science: From classical bits to quantum bits, Springer, 2017.
3. Richard Lipton and Kenneth W Regan, Quantum algorithms via linear algebra, MIT Press, 2014.
4. Scott Anderson, Quantum computing since Democritus, Cambridge University Press, 2013.
5. Kalyan S. Perumalla, Introduction to Reversible Computing, CRC Press, 2014.

COURSE OUTCOMES

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

1. Explain the principles of Boolean algebra, reversible logic, linear algebra, quantum computing, and quantum algorithms.
2. Apply reversible logic circuits, linear algebra techniques, and quantum gates to solve quantum computing problems.
3. Analyze reversible circuit synthesis, quantum states, entanglement, and gate operations for efficient quantum computation.

4. Evaluate reversible circuit designs and quantum algorithms to address computational challenges in quantum systems.
5. Design reversible and quantum computing solutions by integrating logic synthesis, quantum gates, and quantum algorithms for advanced computing applications.

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

PROFESSIONAL ELECTIVE – VIII

25ITPE801	FREE AND OPEN-SOURCE SOFTWARE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To illustrate the concepts, licenses, and applications of Free and Open-Source Software.
- To apply MySQL for database creation, querying, and management.
- To develop web applications using PHP and database connectivity.
- To implement programming solutions using Python and object-oriented concepts.
- To configure web servers and utilize open-source technologies for application deployment.

UNIT I

Introduction to open source – Need for Open Source – Advantages of Open Source – Application of Open Source. Open-source operating systems: LINUX: Introduction – General Overview – Kernel Mode and user mode-Process – Advanced Concepts – Scheduling – Personalities – Cloning – Signals – Development with Linux.

UNIT II

MySQL: Introduction – Setting up an account – Starting, terminating and writing your own SQL programs – Record selection Technology – Working with strings – Date and Time – Sorting Query Results – Generating Summary – Working with metadata – Using sequences – MySQL and Web.

UNIT III

PHP: Introduction – Programming in web environment – variables – constants – data types – operators – Statements – Functions – Arrays – OOP – String Manipulation and regular expressions – File handling and data storage – PHP and SQL database – PHP and LDAP – PHP Connectivity – Sending and receiving E-mails – Debugging and error handling – Security – Templates.

UNIT IV

PYTHON: Syntax and Style-Python Objects – Numbers – Sequences – Strings – Lists and Tuples – Dictionaries – Conditionals and Loops – Files – Input and Output – Errors and Exceptions – Functions – Modules – Classes and OOP – Execution Environment.

UNIT V

Web Server: Apache Web server – Working with Web Server – Configuring and Using Apache web services. MDA: Introduction to MDA – Genesis of MDA – Meta Object Facility – UML – UML Profiles – MDA Applications.

TEXTBOOKS

1. Steve Suchring, “MySQL Bible”, John Wiley, 2002.
2. Rasmus Lerdorf and Levin Tatroe, “Programming PHP”, O’Reilly, 2002.

REFERENCES

1. Remy Card, Eric Dumas and Frank Mevel, “The Linux Kernel Book”, Wiley Publications, 2003.
2. Wesley J. Chun, “Core Python Programming”, Prentice Hall, 2001.
3. Peter Wainwright, “Professional Apache”, Wrox Press, 2002.
4. Stephen J. Mellor, Marc Balces, “Executable UMS: A foundation for MDA”, Addison Wesley, 2002.

COURSE OUTCOMES

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

1. Explain the principles of Free and Open-Source Software, Linux, MySQL, PHP, Python, and web server technologies.
2. Apply open-source tools, database management, programming, and web technologies to develop software applications.

3. Analyze operating system features, database operations, programming constructs, and web server configurations for effective software solutions.
4. Evaluate open-source platforms, application architectures, database connectivity, and deployment strategies based on performance and security.
5. Design and implement integrated software solutions using Linux, MySQL, PHP, Python, and Apache web server technologies.

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

25ITPE801	DATA ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To illustrate the fundamental concepts, techniques, and tools of data analytics.
- To apply statistical methods, R programming, and machine learning techniques for data analysis.
- To develop parallel data processing solutions using Hadoop and MapReduce.
- To examine data visualization and documentation techniques for effective communication.
- To analyze real-world datasets using modern data analytics tools and methodologies.

UNIT I

Introduction: Data science process – roles, stages in data science project – State of the practice in analytics – Role of data scientists – Key roles for successful analytic project – Main phases of life cycle-Working with data from files – Exploring data – Managing data – Cleaning and sampling for modeling and validation – Challenges of conventional systems – Web data – Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting – Modern data analytic tools. Introduction to Big Data Platform – Big Data and its importance, Five Vs. Drivers for Big Data, Big Data analytics, Big Data applications.

UNIT II

R Programming: R basics – Reading and getting data into R – Ordered and unordered factors – Arrays and matrices – Lists and data frames – Reading data from files – Probability distributions – Statistical models in R – Manipulating objects – Data distribution – Simple programs using R.

UNIT III

MapReduce: Introduction – Distributed file system – Algorithms using MapReduce, Matrix–Vector Multiplication by MapReduce-Hadoop – Understanding the MapReduce architecture - Writing Hadoop MapReduce Programs – Loading data into HDFS – Executing the Map Phase-Shuffling and sorting – Reducing phase execution.

UNIT IV

Data Analysis Techniques: Linear and logistic regression modeling – Naïve Bayes classifier – Support vector machine-Neural networks – Principal component analysis – Linear Discriminant Analysis – Decision Trees – Fuzzy logic – Clustering Techniques: Hierarchical, agglomerative, K-Means – Associative Rule Mining.

Case Studies: Social Network Analysis – Text analysis –Marketing analysis.

UNIT V

Data Visualization: Documentation and deployment – Producing effective presentations – Introduction to graphical analysis – plot() function – Displaying multivariate data – Matrix plots – Multiple plots in one window – Exporting graph – Using graphics parameters – Visualizations – Visual data analysis techniques, interaction techniques; Systems and applications.

TEXTBOOKS

1. Nina Zumel, John Mount, “Practical Data Science with R”, Manning Publications, 2014.
2. Chris Eaton, Dirk De Rooij et al, “Understanding Big Data”, McGraw Hill, 2012.

REFERENCES

1. Mark Gardener, “Beginning R – The Statistical Programming Language”, John Wiley & Sons, Inc., 2012.
2. Boris Lubinsky, Kevin T. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, 2015.
3. David Hand, Heikki Mannila, Padhria Smyth, “Principles of Data Mining”, PHI 2013.
4. Nathan Yau, “Visualize This: The Flowing Data Guide to Design, Visualization, and Statistics”, Wiley, 2011.
5. Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, “Practical Data Science Cookbook”, Packt Publishing Ltd., 2014.
6. V.K. Jain, “Big Data and Hadoop”, Khanna Publishing House.
7. V.K. Jain, “Data Science and Analytics”, Khanna Publishing House.

COURSE OUTCOMES

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

1. Describe the concepts of data analytics, statistical techniques, R programming, Hadoop, machine learning, and data visualization.
2. Utilize data preprocessing, statistical methods, R programming, MapReduce, and visualization tools to address analytical problems.
3. Examine large datasets using classification, clustering, Hadoop, and machine learning techniques to derive meaningful insights.
4. Assess analytical models, big data processing frameworks, visualization methods, and predictive techniques for effective decision-making.
5. Develop comprehensive data analytics solutions by integrating R programming, Hadoop, machine learning algorithms, and visualization techniques.

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

25ITPE801	5G WIRELESS NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To illustrate the advancements and benefits of 5G wireless technology.
- To examine the RF, PHY, MAC, and air interface enhancements supporting 5G networks.
- To analyze device-to-device and millimeter-wave communication technologies.
- To develop solutions using emerging 5G communication techniques.
- To evaluate interference, mobility, and security mechanisms in 5G networks.

UNIT I

Overview of 5G Broadband Wireless Communications: Evaluation of mobile technologies 1G to 4G (LTE, LTEA, LTEA Pro), An Overview of 5G requirements, Regulations for 5G, Spectrum Analysis and sharing for 5G.

UNIT II

The 5G wireless Propagation Channels: Channel modeling requirements, propagation scenarios and challenges in 5G modeling, Channel Models for mmWave MIMO Systems.

UNIT III

Transmission and Design Techniques for 5G: Basic requirements of transmission over 5G, Modulation Techniques – Orthogonal frequency division multiplexing (OFDM), generalized frequency division multiplexing (GFDM), filter bank multi-carriers (FBMC) and universal filtered multi-carrier (UFMC), multiple access techniques – orthogonal frequency division multiple access (OFDMA), generalized frequency division multiple access (GFDMA), nonorthogonal multiple access (NOMA).

UNIT IV

Device-to-device (D2D) and machine-to-machine (M2M) type communications – Extension of 4G D2D standardization to 5G, radio resource management for mobile broadband D2D, multihop and multi-operator D2D communications.

UNIT V

Millimeter-wave Communications – spectrum regulations, deployment scenarios, beamforming, physical layer techniques, interference and mobility management, Massive MIMO propagation channel models, Channel Estimation in Massive MIMO, Massive MIMO with Imperfect CSI, Multi-Cell Massive MIMO, Pilot Contamination, Spatial Modulation (SM)

TEXTBOOKS

1. Martin Sauter, “From GSM to LTE–Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband”, Wiley-Blackwell.
2. Afif Osseiran, Jose F. Monserrat, Patrick Marsch, “Fundamentals of 5G Mobile Networks”, Cambridge University Press.
3. Athanasios G. Kanatos, Konstantina S. Nikita, Panagiotis Mathiopoulos, “New Directions in Wireless Communication Systems from Mobile to 5G”, CRC Press.
4. Theodore S. Rappaport, Robert W. Heath, Robert C. Daniels, James N. Murdock, “Millimeter Wave Wireless Communications”, Prentice Hall Communications.

REFERENCES

1. Jonathan Rodriguez, “Fundamentals of 5G Mobile Networks”, John Wiley & Sons.
2. Amitabha Ghosh and Rapeepat Ratasuk, “Essentials of LTE and LTE-A”, Cambridge University Press.

COURSE OUTCOMES

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

1. Describe the architecture, technologies, propagation models, transmission techniques, and communication paradigms of 5G wireless networks.

2. Apply 5G transmission, multiple access, device-to-device communication, and millimeter-wave technologies to modern wireless systems.
3. Analyze propagation characteristics, resource management, Massive MIMO, and communication techniques for efficient 5G network performance.
4. Assess 5G network architectures, interference mitigation, mobility management, security mechanisms, and spectrum utilization strategies.
5. Develop reliable 5G wireless network solutions by integrating advanced transmission, multiple access, Massive MIMO, and millimeter-wave communication technologies.

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

25ITPE801	OPTICAL COMMUNICATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To illustrate the fundamentals of optical fiber transmission, fiber structures, and propagation modes.
- To examine optical sources, laser diodes, LEDs, and optical amplification techniques.
- To analyze optical receivers, photodetectors, and signal degradation mechanisms.
- To evaluate optical communication links, receiver performance, and transmission characteristics.
- To investigate WDM technologies, optical components, and modern optical communication systems.

UNIT I

Motivation –optical spectral bands –key elements of optical fiber systems – optical fibers –basic optical laws and definitions –optical fiber modes and configurations –mode theory for circular wave guides –single mode fibers –graded-index fiber structure –fiber materials –photonic crystal fibers – fiber fabrication –fiber optic cables.

UNIT II

Light emitting diodes (LED): structures –materials –quantum efficiency –LED power – modulation of an LED –Laser diodes: modes –threshold conditions –laser diode rate equations –external quantum efficiency –resonant frequencies –structure and radiation patterns –single mode lasers – modulation of laser diodes – power launching and coupling –source to fiber power launching –fiber of fiber joints –LED coupling to single mode fibers –fiber splicing –optical fiber connectors.

UNIT III

pin photo detector – avalanche photodiodes – photo detector noise –detector response time-avalanche multiplication noise-signal degradation in optical fibers –attenuation –UNIT s –absorption –

scattering losses –bending losses – core and cladding losses –signal distortion in fibers –overview of distortion origin –modal delay –factors contributing to delay –group delay – material dispersion – wave guide dispersion –polarization – mode dispersion – characteristics of single mode fibers.

UNIT IV

Fundamental receiver operation – digital receiver performance-eye diagrams –coherent detection – homodyne and heterodyne- burst-mode receiver – analog receivers. Digital links – point-to-point links – link power budget – rise time budget –power penalties – Analog links – overview of analog links – carrier-to-noise ratio – multichannel transmission techniques.

UNIT V

Wavelength division multiplexing (WDM) concepts – operational principles of WDM – passive optical star coupler – isolators – circulators –active optical components – MEM Stechnology – variable optical attenuators – tunable optical filters – dynamic gain equalizers – polarization controller – chromatic dispersion compensators – Optical amplifiers – basic applications and types of optical amplifiers – Erbium Doped Fiber Amplifiers(EDFA) –amplification mechanism – architecture-power conversion efficiency and gain – Amplifier noise-optical SNR – system applications.

TEXTBOOKS

1. Gerd Keiser, “Optical Fiber Communication”, McGraw Hill International, Singapore, 3rd ed., 2000.
2. Govind P. Agrawal, “Fiber–optic communication Systems”, Third Edition, John Wiley & Sons, 2004.

REFERENCES

1. J. Senior, “Optical Communication, Principles and Practice”, Prentice Hall of India, -994.
2. J. Gower, “Optical Communication System”, Prentice Hall of India, 200-.
3. R.P. Khare, “Fiber Optics and Optoelectronics”, Oxford University Press, 2007.

COURSE OUTCOMES

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

1. Describe the principles of optical fiber communication, fiber structures, optical sources, receivers, transmission links, and WDM technologies.
2. Apply optical sources, photodetectors, fiber coupling, splicing, amplification, and communication link design techniques in optical systems.
3. Examine signal attenuation, dispersion, receiver characteristics, optical amplification, and transmission performance to enhance communication efficiency.
4. Assess optical communication systems by evaluating receiver performance, link budgets, WDM components, and signal quality parameters.
5. Develop optical communication solutions by integrating fiber transmission, optical devices, amplification techniques, and wavelength division multiplexing technologies.

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

25ITPE801	DRONE TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To illustrate the fundamentals and evolution of Unmanned Aerial Vehicles (UAVs).
- To examine the operating principles and architecture of drone systems.
- To apply drone technologies for engineering and scientific applications.
- To evaluate drone payloads, communication protocols, and emerging technologies.
- To design and assemble drone components for practical deployment.

UNIT I Introduction to Unmanned Aerial Vehicles

History of UAS - Introduction to fixed-wing UAVs, Introduction – Classification of UAVs, unmanned aircraft system elements. Case study of Predator C: Avenger - Advantages and disadvantages of UAV's - Applications of UAVs

UNIT II Drone Protocols

Basic drone protocols for collecting data - Collect, process, control, clean up, and import Drone and Acoustic Doppler Profiler - Classify drone imagery in ArcGIS- discerning water from other habitat and land use categories.

UNIT III Working Principle

Main controller- main sensor- electronic speed controller- receiver - motor-GPS-optical flow - ground station - safety.

UNIT IV Types and Payload

Drone Technology: Types, Payloads - Applications, Frequency Spectrum Issues and Future Development

UNIT V Building the Drone

Basic drone terminology - choosing the drone frame-motor - propeller – propulsion - flight controller - putting it all together.

TEXTBOOK

1. Ben Rupert, “Drones - the Ultimate Guide: How They Work, Learning to Fly, How to Fly, Building”, CreateSpace Independent Publishing Platform, 2017.

REFERENCES

1. Bart Custers, “The Future of Drone Use: Opportunities and Threats from Ethical and Legal Perspectives”, 2016.
2. Douglas M. Marshall, Richard K. Barnhart, Eric Shappee, Michael Thomas Most. “Introduction to Unmanned Aircraft Systems”, CRC Press, 2016.
3. Grégoire Chamayou, “Drone Theory”, Penguin, 2015.
4. Michael J. Boyle, “Legal and Ethical Implications of Drone Warfare”, Routledge, 2017.
5. Daisuke Nakazawa, David W. Wang, Farid Kendoul, Kenzo Nonami, and Satoshi Suzuki, “Autonomous Flying Robots: Unmanned Aerial Vehicles and Micro Aerial Vehicles”, Springer, 2010.

COURSE OUTCOMES

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

1. Describe the concepts of unmanned aerial vehicles, drone architecture, communication protocols, operational principles, payloads, and system components.
2. Apply drone technologies, sensing systems, communication protocols, and control mechanisms for engineering and scientific applications.
3. Examine UAV architecture, flight control systems, payload integration, navigation techniques, and operational performance in drone-based solutions.
4. Assess drone platforms, payload configurations, communication methods, and deployment strategies based on application requirements and performance.

5. Develop functional drone systems by integrating airframe design, propulsion, flight control, navigation, and payload technologies.

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

25ITPE801	E-LEARNING TECHNIQUES				L	T	P	C
					3	0	0	3

COURSE OBJECTIVES

- To illustrate various E-learning approaches and their components.
- To examine design thinking concepts for E-learning development.
- To analyze instructional design models for effective E-learning courses.
- To develop interactive courseware using E-learning authoring tools.
- To evaluate and manage E-learning platforms and course delivery strategies.

UNIT I Introduction

Need for E-Learning – Approaches of E-Learning – Components of E-Learning – Synchronous and Asynchronous Modes of Learning – Quality of E-Learning – Blended Learning: Activities, Team and Technology – Workflow to Produce and Deliver E-Learning Content – Design Thinking: Introduction – Actionable Strategy – Act to Learn – Leading Teams to Win.

UNIT II Designing E-Learning Course Content

Design Models of E-Learning – Identifying and Organizing E-Learning Course Content: Needs Analysis – Analyzing the Target Audience – Identifying Course Content – Defining Learning Objectives – Defining the Course Sequence – Defining Instructional Methods – Defining Evaluation and Delivery Strategies – Case Study.

UNIT III Creating Interactive Content

Preparing Content: Tips for Content Development and Language Style – Creating Storyboards: Structure of an Interactive E-Lesson – Techniques for Presenting Content – Adding Examples – Integrating Multimedia Elements – Adding Examples – Developing Practice and Assessment Tests – Adding Additional Resources– Courseware Development – Authoring Tools – Types of Authoring Tools – Selecting an Authoring Tool.

UNIT IV Learning Platforms

Types of Learning Platforms – Proprietary Vs. Open-Source LMS – LMS Vs LCMS – Internally Handled and Hosted LMS – LMS Solutions – Functional Areas of LMS.

UNIT V Course Delivery and Evaluation

Components of an Instructor-Led or Facilitated Course – Planning and Documenting Activities – Facilitating Learners Activities – E-Learning Methods and Delivery Formats – Using Communication Tools for E-Learning – Course Evaluation.

TEXTBOOK

1. Clark, R. C., Mayer, R. E., “E-Learning and the Science of Instruction”, Third Edition, 2011.

REFERENCES

1. Crews, T. B., Sheth, S. N., Horne, T. M., “Understanding the Learning Personalities of Successful Online Students”, Educause Review, 2014.
2. Johnny Schneider, “Understanding Design Thinking, Lean and Agile”, O’Reilly Media, 2017.
3. Madhuri Dubey, “Effective E-learning Design, Development and Delivery”, University Press, 2011.

COURSE OUTCOMES

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

1. Describe the concepts of E-learning approaches, instructional design models, authoring tools, learning platforms, and course delivery methods.
2. Apply instructional design principles, content organization, multimedia integration, and authoring tools to develop E-learning solutions.
3. Examine E-learning models, interactive courseware, learning management systems, and delivery strategies to enhance learning effectiveness.
4. Assess E-learning platforms, instructional methods, course evaluation techniques, and management strategies for quality learning experiences.
5. Develop comprehensive E-learning solutions by integrating instructional design, multimedia content, learning platforms, and evaluation methodologies.

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

25ITPE801	UNIX INTERNALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To illustrate the architecture and design principles of the UNIX operating system.
- To examine kernel data structures and low-level algorithms used in UNIX.
- To analyze the UNIX file system and system call mechanisms.
- To evaluate process management, scheduling, and inter-process communication.
- To investigate memory management and I/O subsystem operations in UNIX.

UNIT I Overview

General Overview of the System: History – System Structure – User Perspective – Operating System Services – Assumptions about Hardware – Introduction to the Kernel Architecture of the UNIX Operating System – Introduction to System Concept – The Buffer Cache – Buffer headers – Structure of the Buffer Pool – Scenarios for Retrieval of a Buffer– Reading and Writing Disk Blocks – Advantages and Disadvantages of the Buffer Cache.

UNIT II File Subsystem

Internal Representation of Files: inodes – Structure of a Regular File – Directories – Conversion of a Path Name to an Inode – Super Block – Inode Assignment to a New File – Allocation of Disk Blocks.

UNIT III System Calls for the File System

Open – Read – Write – File and Record Locking – Adjusting the Position of File I/O – lseek – Close – File Creation – Creation of Special Files – Changing Directory – Root – Owner – Mode – stat and fstat – Pipes – dup – Mounting and Unmounting File Systems – link – unlink.

UNIT IV Processes

Process States and Transitions – Layout of System Memory – The Context of a Process – Saving the Context of a Process – Manipulation of the Process Address Space – Process Control – Process Creation – Signals – Process Termination – Awaiting Process Termination – Invoking other programs – User Id of a Process – Changing the Size of a Process – Shell – System Boot and the INIT Process – Process Scheduling.

UNIT V Memory Management and I/O

Memory Management Policies – Swapping – Demand Paging – The I/O Subsystem: Driver Interface – Disk Drivers – Terminal Drivers.

TEXTBOOK

1. Maurice J. Bach, “The Design of the Unix Operating System”, Pearson Education, 1986.

REFERENCES

1. B. Goodheart, J. Cox, “The Magic Garden Explained”, Prentice Hall of India, 1986.
2. S. J. Leffler, M. K. McKusick, M. J. Karels, J. S. Quarterman, “The Design and Implementation of the 4.3 BSD Unix Operating System”, Addison Wesley, 1998.
3. Robert Love, “Linux Kernel Development”, Third Edition, Addison Wesley, 2010.

COURSE OUTCOMES

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

1. Describe the architecture, kernel organization, file system, process management, memory management, and I/O mechanisms of the UNIX operating system.
2. Apply UNIX system calls, file operations, process control, and memory management concepts to solve operating system problems.
3. Examine kernel data structures, file subsystems, process scheduling, memory allocation, and I/O operations to analyze system behavior.
4. Assess UNIX kernel components, scheduling policies, file management techniques, and memory handling strategies for efficient system performance.
5. Develop operating system solutions by integrating kernel architecture, file systems, process management, memory management, and I/O subsystem concepts.

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

25ITPE801	SUPPLY CHAIN MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To illustrate the significance of major decisions in supply chain management.
- To examine supply chain strategies and their role in organizational competitiveness.
- To analyze sourcing, distribution, and network design decisions.
- To evaluate forecasting, inventory, and uncertainty management in supply chains.
- To investigate current trends and emerging practices in supply chain management.

UNIT I

Supply Chain – Fundamentals –Evolution– Role in Economy – Importance-Decision Phases – Supplier– Manufacturer–Customer chain – Enablers/ Drivers of Supply Chain Performance –Supply chain strategy – Supply Chain Performance Measures.

UNIT II

Outsourcing – Make vs buy – Identifying core processes – Market vs hierarchy – Make vs buy continuum – Sourcing strategy: Portfolio Approach – Reconfiguration of the Supply Base –Impact of the internet on Sourcing Strategy.

UNIT III

Distribution Network Design – Role-Factors Influencing Distribution Network Design – Design Option for a Distribution Network – E-Business and the Distribution Network – Network Design in Supply Chain – Role-Factors Influencing Network Design Decisions – Framework for Network Design Decisions – Impact of uncertainty on Network Design.

UNIT IV

Demand Forecasting in a Supply Chain – The Role of Forecasting in a Supply Chain – Characteristics – Components – Risk Management in Forecasting – Managing Economies of Scale in a Supply Chain – Role of Economies of Scale to Exploit Fixed Costs – Estimating Cycle Inventory– Managing supply chain cycle inventory – Uncertainty in the supply chain.

UNIT V

Supply Chain Integration – Building partnership and trust in SC. Value of Information: Bullwhip Effect – Effective forecasting – Coordinating the supply chain – SC Restructuring – SC Mapping – SC process restructuring, Postpone the point of differentiation – IT in Supply Chain – Agile Supply Chains –Reverse Supply chain – Agro Supply Chains.

TEXTBOOKS

1. Janat Shah, “Supply Chain Management – Text and Cases”, Pearson Education, 2009.
2. Sunil Chopra and Peter Meindl, “Supply Chain Management–Strategy, Planning and Operation”, PHI Learning / Pearson Education, 2007.

REFERENCES

1. Ballou, Ronald H, “Business Logistics and Supply Chain Management”, Pearson Education, 5th Edition, 2007.
2. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, “Designing and Managing the Supply Chain: Concepts, Strategies, and Cases”, Tata McGraw-Hill, 2005.
3. Altekhar Rahul V, “Supply Chain Management–Concept and Cases”, PHI, 2005.
4. Shapiro, Jeremy F, “Modeling the Supply Chain”, Thomson Learning, Second Edition, 2006.
5. Joel D. Wisner, G. Keong Leong, Keah-Choon Tan, “Principles of Supply Chain Management– A Balanced Approach”, South-Western, Cengage Learning, 2008.

COURSE OUTCOMES

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

1. Describe the principles of supply chain management, sourcing strategies, distribution networks, demand forecasting, and supply chain integration.

2. Apply supply chain strategies, sourcing approaches, forecasting techniques, and network design concepts to improve operational efficiency.
3. Examine supply chain performance, inventory management, distribution systems, demand uncertainty, and coordination mechanisms to enhance organizational effectiveness.
4. Assess supply chain models, forecasting methods, integration strategies, information systems, and emerging trends for better decision-making.
5. Develop efficient supply chain solutions by integrating sourcing, distribution, forecasting, inventory management, and information technology practices.

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

PROFESSIONAL ELECTIVE – IX

25ITPE802	E-COMMERCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To illustrate the components and applications of e-commerce infrastructure.
- To examine e-commerce technologies and web-based business models.
- To analyze electronic payment systems and Electronic Data Interchange (EDI).
- To evaluate digital information systems, libraries, and online marketing concepts.
- To investigate on-demand education and software agent technologies.

UNIT I

E-Commerce Infrastructure: E-Commerce framework – Media Convergence-Anatomy of E-Commerce Applications – Consumer and Organization Applications – Market forces influencing the I-way – Components of the I-way – Network Access Equipment – Distribution Networks – Issues – Internet Terminology – NSFNET – Research and Education Network – Internet Governance.

UNIT II

E-Commerce and Web: Architecture framework for E-Commerce - WWW as the architecture-Hypertext publishing – Technology and Security on Web – Consumer Oriented Applications – Mercantile Process Model – Mercantile Models from the perspective of Consumer and merchants.

UNIT III

Electronic Payment Systems and EDI: Types of Electronic payment systems – Digital token-based system – Smart cards – Credit card-based system – Risk factors – Designing Electronic payment systems. EDI – EDI Applications in business – Legal, Security, and Privacy issues – Standardization in EDI – EDI software implementation – EDI envelope-VANs – Internet-based EDI.

UNIT IV

Inter-organizational E-Commerce and Marketing: Internal Information Systems – Macro forces and Internal Commerce-Work-flow automation – Customization – SCM – Corporate Digital Library: Dimensions, Making a business case, Types of Digital Documents – Advertising on Internet – Charting the online marketing process – Market Research.

UNIT V

On-Demand Education and Software Agents: Computer-based Education and Training – Technological Components – Digital Copyrights and E-Commerce-History of software agents – Characteristics and Properties of Agents – Technology behind the Agents – Telescript Agent Language-Safe-Tcl – Software Agents in action – SGML.

TEXTBOOKS

1. Ravi Kalakota, Andrew B. Whinston, “Frontiers of Electronic Commerce”, Paperback – Addison-Wesley Publishing Company, 1996.
2. Kenneth C. Laudon, “E-Commerce: Business, Technology”, Society– 2016 Edition 10.

REFERENCES

1. Dave Chaffey, “E-Business and E-Commerce Management: Strategy, Implementation and Practice”, 2013.
2. Tharam Dillon, Elizabeth Chang, “E-Commerce: Fundamentals and Applications”, Wiley Publication, 2007.
3. David Whiteley, “E-Commerce: Strategy, Technologies and Applications”, Tata McGraw-Hill, 2001.

COURSE OUTCOMES

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

1. Describe the concepts of e-commerce infrastructure, web technologies, electronic payment systems, digital information systems, and software agents.

2. Apply e-commerce frameworks, payment technologies, EDI standards, and web-based solutions to support electronic business operations.
3. Examine e-commerce architectures, digital payment mechanisms, information systems, online marketing, and software agent technologies for business applications.
4. Assess e-commerce models, payment systems, digital commerce strategies, security aspects, and emerging technologies for effective business decision-making.
5. Develop integrated e-commerce solutions by combining web technologies, electronic payment systems, digital information management, and software agent applications.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Program Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
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CO2	2	3	3	2	3	1	1	2	2	2	2	3	3	2
CO3	2	3	2	3	3	1	1	2	2	2	2	3	3	2
CO4	2	3	2	3	3	2	2	2	2	3	2	2	3	3
CO5	3	3	3	3	3	2	2	3	3	3	3	3	3	3

25ITPE802	ENTERPRISE RESOURCE PLANNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To illustrate the fundamentals and implementation concepts of Enterprise Resource Planning (ERP).
- To examine ERP implementation strategies and associated challenges.
- To analyze the functional business modules of ERP systems.
- To evaluate leading ERP solutions and enterprise applications.
- To investigate emerging trends and future developments in ERP.

UNIT I

ERP: Enterprise-An Overview – Basic ERP Concepts – Risks of ERP – Benefits of ERP – ERP and Related Technologies – Business Intelligence (BI) – Business Process Reengineering (BPR) – Data Warehousing – Data Mining – OLAP – SCM.

UNIT II

Implementation Challenges – Implementation Strategies – ERP Implementation Lifecycle-Implementation Methodologies – Vendors and Consultants – Contracts with Vendors – Consultants and Employees – Project Management and Monitoring – Post Implementation Activities.

UNIT III

Business Modules of an ERP Package-Finance, Manufacturing – Human Resources – Plant Maintenance-Materials Management – Quality Management – Marketing – Sales and Distribution.

UNIT IV

ERP Marketplace and Marketplace Dynamics – SAP AG – PeopleSoft – JD Edwards – Oracle Corporation – QAD Inc – QAD Analytics – QAD Open Technology – SSA Global – Lawson Software – Intuitive-ERP UNIT s.

UNIT V

Turbo Charge the ERP System – Limitations of ERP Systems – Enterprise Application Integration (EAI) – ERP and E-Business – ERP, Internet and WWW – ERP and Total Quality Management – Future Directions and Trends in ERP.

TEXTBOOKS

1. Alexis Leon, “ERP Demystified”, Tata McGraw Hill, New Delhi, 2008.
2. Mary Sumner, “Enterprise Resource Planning”, Pearson Education, 2007.

REFERENCES

1. Joseph A Brady, Ellen F Monk, Bret Wagner, “Concepts in Enterprise Resource Planning”, Thomson Course Technology, USA, 2012.
2. Vinod Kumar Garg and Venkitakrishnan N K, “Enterprise Resource Planning – Concepts and Practice”, PHI, New Delhi, 2003.
3. K. Ganesh, Sanjay Mohapatra, S. P. Anbuudayasankar, P. Sivakumar, “Enterprise Resource Planning: Fundamentals of Design and Implementation”, Springer, 2014.

COURSE OUTCOMES

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

1. Describe the concepts of ERP systems, implementation methodologies, business modules, enterprise applications, and emerging ERP technologies.
2. Apply ERP implementation strategies, project management practices, and business modules to support enterprise operations.
3. Examine ERP architecture, implementation challenges, business processes, vendor solutions, and enterprise integration techniques.
4. Assess ERP implementation approaches, enterprise applications, system integration, and organizational performance for effective decision-making.
5. Develop ERP-based enterprise solutions by integrating business processes, implementation methodologies, enterprise applications, and emerging ERP technologies.

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

25ITPE802	ENTREPRENEURSHIP AND START-UPS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To illustrate the fundamentals of entrepreneurship and venture creation.
- To examine entrepreneurial skills and business development practices.
- To analyze business planning, feasibility, and financial requirements for start-ups.
- To evaluate institutional support and funding mechanisms for entrepreneurs.
- To develop managerial competencies for establishing and sustaining start-up enterprises.

UNIT I

Introduction to Entrepreneurship: Concept, Significance, Theories and Models of Entrepreneurship Development - Traits and Characteristics, Functions, Types - Entrepreneurial Processes - Problems - Capacity building - Risk Analysis - Scope of Entrepreneurship in India.

UNIT II

Entrepreneurial Environment for Start-up Enterprises: Significance - Internal and External Environment forces - Entrepreneurial Culture and Society - EDP: Objectives, Features, Steps and Issues in EDP Process - Role of Institutions and Government in EDP.

UNIT III

Developing Start-up Enterprises: Developing a Business Idea: Opportunity, Methods, and Creativity - Deciding to set up a Start-up Enterprise: Effectual Reasoning, Forms, Size and Location - Entrepreneurial skills and Competences - Feasibility Study: Market Survey, Techno-Economic feasibility and Preparing Project Report - Financial Requirements.

UNIT IV

Steps in Promoting Start-up Micro-Enterprises: Entrepreneurial Success in Rural Areas - Establishing Entrepreneurial System - Assistance and Support - Institutions Supporting and providing Financial Assistance: SSI, KVIC, MSME-DO, NSIC, NIESBUD, IIE, SIDC, SDIs, DICs, NGOs, Industry Association, SIDBI and SFCs - Self-help Groups - Technological Up-gradation - Challenges.

UNIT V

Managing a New or Start-up Enterprise: Management - HRM, Marketing, Financial Management, Production and Operations Management in a New or Start-up Enterprise.

REFERENCES:

1. Saravanavel, P. (2020): Entrepreneurial Development, Margham Publication, Chennai.
2. Prasanna Chandra (2019): Protect Preparation, Appraisal, Implementation, Tata McGraw Hill. New Delhi.
3. Srinivasan, N.P. & Gupta, C.B. (2017): Entrepreneurial Development, Sultan Chand & Sons
4. Barringer, Bruce R. (2008): Entrepreneurship: Successfully launching new ventures, Pearson Education, India.
5. Drucker, Peter F., and Peter Ferdinand Drucker (2007): Innovation and Entrepreneurship: Practice and Principles, Routledge.

COURSE OUTCOMES

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

1. Describe the concepts of entrepreneurship, start-up ecosystems, business planning, institutional support, and enterprise management.
2. Apply entrepreneurial skills, feasibility analysis, business planning, and financial strategies to establish start-up ventures.
3. Examine entrepreneurial opportunities, business environments, support systems, and operational challenges in developing new enterprises.
4. Assess start-up strategies, funding options, government initiatives, and management practices for sustainable business growth.
5. Develop innovative start-up solutions by integrating entrepreneurial principles, business planning, financial management, and organizational practices.

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

25ITPE802	INFORMATION ETHICS					L	T	P	C
						3	0	0	3

COURSE OBJECTIVES

- To illustrate the principles and theories of information ethics.
- To examine privacy, intellectual property, and ethical issues in information technology.
- To analyze computer security threats, cyberattacks, and security policies.
- To evaluate professional ethics and responsibilities in computing.
- To investigate cyber laws and emerging ethical challenges in the digital world.

UNIT I Ethical Theories and Concepts

Definition of ethics, Ethics in the business world: Corporate social responsibility – Improving corporate ethics – Creating an ethical work environment, Ethical considerations in decision-making, Ethics in information technology. Ethical Theories: Utilitarianism, Intrinsic and instrumental value, Acts Vs. rules, Critique of utilitarianism, Deontological theory, Rights, Rights and social contract theory, Virtue ethics, Analogical reasoning in computer ethics.

UNIT II Privacy and Intellectual Property

Key privacy and anonymity issues: Data breaches – Electronic discovery – Consumer profiling – Workplace monitoring – Advanced surveillance technology. Intellectual Property: Copyrights, patents, Trade secrets, Key intellectual issues, Ethics of IT organizations: Key ethical issues for organization - Contingent workers – Outsourcing – Whistleblowing.

UNIT III Computer and Internet Crime

IT security incidents: Types of exploits – Types of perpetrators – Federal laws for prosecuting computer attacks, implementing trustworthy computing: Risk assessment – Establishing a security policy – Educating employees and contract workers – Prevention – Detection – Response.

UNIT IV Professional Ethics in Computing

Scenarios, sorting out computing: Mastery knowledge – Formal organization – Autonomy – Codes of ethics – The culture of computing, Professional relationships: Employer-employee – Client-professional – Other stakeholders-professional – Professional-professional – Conflicting responsibilities, A legal perspective on professionalism in computing: Licensing – Selling software.

UNIT V New Frontiers for Information Ethics

Federal laws for prosecuting computer attacks, Implementing trustworthy computing: Risk assessment - Establishing a security policy – Educating employees and contract workers – Prevention - Detection- Response Automation and Employment, workplace changes, globalization, The Digital

Divide, Artificial Intelligence and Ethics, Virtual Reality and Ethics, Cyberspace and Ethics, Cyberbullying.

TEXTBOOKS

1. George Reynolds, "Ethics in Information Technology", Cengage Learning, United States, 2019.
2. Deborah G Johnson, "Computer Ethics", Yale University Press, United Kingdom, 2020.

REFERENCES

1. Joseph MiggaKizza, "Ethical and Social Issues in the Information Age, Springer International Publishing, Germany, 2017.
2. John Weckert, "Computer Ethics", Taylor & Francis Group, United Kingdom, 2019.
3. Michael J. Quinn, "Ethics for the Information Age", Seventh Edition, Pearson Education, New Delhi, 2017.
4. Anthony F. Bainbridge, "Ethics for Engineers - A Brief Introduction", CRC Press, United States, 2021

COURSE OUTCOMES

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

1. Describe the principles of information ethics, privacy, intellectual property, cybersecurity, professional ethics, and cyber laws.
2. Apply ethical theories, security practices, privacy principles, and professional standards to address information technology issues.
3. Examine cyber threats, intellectual property rights, organizational ethics, security policies, and legal frameworks in computing environments.
4. Assess ethical practices, cybersecurity measures, professional responsibilities, and emerging technologies to support responsible decision-making.
5. Develop ethical and secure computing solutions by integrating information ethics, legal compliance, cybersecurity, and professional standards.

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

25ITPE802	E-BUSINESS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To illustrate the technical and business foundations of electronic business.
- To examine the evolution and applications of E-Business technologies.
- To analyze secure electronic transactions and payment mechanisms.
- To evaluate authentication, authorization, and web security techniques.
- To develop strategies for establishing and managing E-Business websites.

UNIT I Electronic Commerce Environment and Opportunities

Background – The Electronic commerce environment – Electronic marketplace technologies – Modes of Electronic Commerce: Overview – Electronic Data Interchange – Migration to open EDI – Electronic commerce with WWW / Internet – Commerce net advocacy – Web commerce going forward.

UNIT II Approaches to Safe Electronic Commerce

Overview – Secure Transport Protocols – Secure transactions – Secure Electronic Payment Protocol (SEPP) – Secure Electronic Transaction (SET) – Certificates for authentication – Security on Web Servers and enterprise networks – Electronic cash and electronic payment schemes: Internet Monetary payment and security requirements – Payment and purchase order process - Online electronic cash.

UNIT III Internet / Intranet Security Issues and Solutions

The need for computer security – Specific intruder approaches – Security strategies – Security tools – Encryption – Enterprise networking and Access to the Internet – Antivirus programs – Security Teams.

UNIT IV Mastercard/Visa Secure Electronic Transaction

Introduction – Business requirements – Concepts – Payment processing – E-mail and secure e-mail technologies for electronic commerce. Introduction – The Means of Distribution – A model for message handling – Working of email. MIME: Multipurpose Internet Mail Extensions. S/MIME: Secure Multipurpose Internet Mail Extensions – MOSS: Message Object Security Services.

UNIT V Internet and Website Establishment

Introduction – Technologies for web servers – Internet tools relevant to commerce – Internet applications for commerce – Internet charges – Internet access and architecture – Searching the Internet – Case study.

TEXTBOOKS

1. Daniel Minoli and Emma Minoli, “Web Commerce Technology Handbook”, Tata McGraw-Hill, 2017.
2. Elias M. Awad, “Electronic Commerce from Vision to Fulfilment”, PHI, Feb-2003.
3. Bharat Bhaskar, “Electronic Commerce – Framework, Technology and Application”, TMH, 2003.

REFERENCES

1. Bruce C. Brown, “How to Use the Internet to Advertise, Promote and Market Your Business or Website nd with Little or No Money”, Atlantic Publishing Company, 2nd Edition, 2011.
2. Andrew B. Whinston, Ravi Kalakota, K. Bajaj and D. Nag, “Frontiers of Electronic Commerce”, Tata McGraw-Hill, 2004.
3. Kamalesh K. Bajaj, “E-Commerce: The Cutting Edge & Business”, Tata McGraw-Hill, 2003.
4. Brenda Kennan, “Managing your E-Commerce Business”, PHI, 2001.
5. Jim A Carter, “Developing E-Commerce Systems”, PHI, 2001.

WEB RESOURCES

1. <https://nptel.ac.in/courses/110/105/110105083/>
2. <https://www.tutorialspoint.com/listtutorial/INTRODUCTION-TO-E-BUSINESS/6549>.
3. https://en.wikipedia.org/wiki/Electronic_business

COURSE OUTCOMES

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

1. Describe the concepts of E-Business, electronic commerce, secure transactions, Internet security, and web-based business technologies.
2. Apply electronic commerce frameworks, security protocols, payment systems, and Internet technologies to support online business operations.
3. Examine electronic payment mechanisms, web security solutions, authentication methods, and Internet-based business applications.

4. Assess E-Business models, secure communication techniques, website technologies, and online transaction mechanisms for effective business operations.
5. Develop secure E-Business solutions by integrating electronic commerce technologies, payment systems, Internet security, and web applications.

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

25ITPE802	SYSTEM MODELING AND SIMULATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To illustrate the fundamental concepts of systems and simulation.
- To examine modeling techniques for static and dynamic systems.
- To analyze statistical and simulation models for system behavior.
- To evaluate simulation models using validation and performance analysis.
- To develop simulation solutions using appropriate tools and methodologies.

UNIT I

Introduction – Simulation Terminologies– Application areas – Model Classification – Types of Simulation – Steps in a Simulation study– Concepts in Discrete Event Simulation – Monte Carlo Simulation – Simulation Examples.

UNIT II

Statistical Models – Concepts – Discrete Distribution– Continuous Distribution – Poisson Process– Empirical Distributions– Queueing Models – Characteristics– Notation – Queueing Systems – Markovian Models– Properties of random numbers– Generation of Pseudo-Random numbers– Techniques for generating random numbers–Testing random number generators– Generating Random Variables – Inverse Transform technique- Acceptance-Rejection technique - Composition and Convolution Method.

UNIT III

Input Modeling – Data collection – Assessing sample independence - Hypothesizing distribution family with data – Parameter Estimation – Goodness-of-fit tests – Selecting input models in absence of data– Output analysis for a Single system – Terminating Simulations – Steady-state simulations.

UNIT IV

Model Building – Verification of Simulation Models – Calibration and Validation of Models – Validation of Model Assumptions – Validating Input – Output Transformations.

UNIT V

Simulation Tools – Model Input – High-level computer system simulation – CPU – Memory Simulation – Comparison of systems via simulation – Simulation Programming techniques – Development of Simulation models – Simulation Project Management.

TEXTBOOKS

1. Banks, J and John Carson, “Discrete Event System Simulation”, Pearson Education, 2010.
2. Geoffrey Gordon, “System Simulation”, Second Edition, PHI, 2006.

REFERENCES

1. Kelton, W. D., Sadowski, R, Zupick, Simulation with Arena, McGraw–Hill, 2014.
2. Frank L. Severance, “System Modeling and Simulation”, Wiley, 2001.
3. Averill M. Law and W. David Kelton, “Simulation Modeling and Analysis, Third Edition, McGraw-Hill, 2006.
4. Jerry Banks, “Handbook of Simulation: Principles, Methodology, Advances, Applications and Practice”, Wiley, 1998.
5. Altiock, T., Melamed, B, Simulation Modeling and Analysis with Arena, Academic Press, 2007.

COURSE OUTCOMES

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

1. Describe the concepts of system modeling, simulation techniques, statistical models, input analysis, and simulation tools.
2. Apply modeling, random number generation, statistical analysis, and simulation methods to represent real-world systems.
3. Examine input models, output analysis, validation techniques, and simulation processes to evaluate system performance.
4. Assess simulation models, verification methods, statistical techniques, and simulation tools for effective decision-making.
5. Develop simulation-based solutions by integrating system modeling, statistical methods, validation techniques, and simulation software.

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

25ITPE802	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To illustrate the fundamentals of Intellectual Property Rights (IPR).
- To examine trademarks, trade secrets, and geographical indications.
- To analyze copyrights, patents, and industrial designs.
- To evaluate the management and legal protection of intellectual property.

- To investigate cyber laws and information technology regulations related to IPR.

UNIT I

Introduction to Intellectual Property: IPR - Definition - Types of IPR: Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications, IP as a factor in R&D; Few Case Studies. WTO - Definition - Functions - Forms of IPR Protection.

UNIT II

Trademarks: Purpose and function of trademarks, Acquisition of trademark rights, transfer of rights, selecting and evaluating trademarks, registration of trademarks, claims. Trade Secrets: Trade secret law, determination of trade secret status, liability for misappropriation of trade secrets, trade secret litigation. Geographical Indication of Goods: Basic aspects and need for the registration.

UNIT III

Copyrights: Fundamentals of copyright law, originality of material, right of reproduction, right to perform the work publicly, copyright ownership issues, notice of copyright. Patents: Foundation of patent law, patent searching process, Basic Criteria of Patentability. Industrial Designs: Kind of protection provided in Industrial design.

UNIT IV

Managing IP Rights: Acquiring IP Rights: letters of instruction, collaboration agreement. Protecting IP Rights: nondisclosure agreement, cease and desist letter, settlement memorandum. Transferring IP Rights: Assignment contract, license agreement, deed of assignment.

UNIT V

Introduction to Cyber law: Information Technology Act, cybercrime and e-commerce, data security, confidentiality, privacy, international aspects of computer and online crime.

REFERENCES

1. Bare Act, The Indian Patent Act, 1970 and the Patent Rules, Universal Law Publishing Co. Pvt. Ltd., 2007.
2. Mittal D.P., Indian Patents Law. Taxmann Allied Services (p) Ltd., 1999.
3. Deborah E Bouchoux, Intellectual Property: Right: The Law of Trademarks, Copyrights, Patents and Trade Secrets, 2012.
4. Gerald R. Ferrara, Cyber Law: Text and Cases, South-Western Cengage Learning, 2012.
5. N.K Acharya, Intellectual Property Rights, Scandinavian Languages Edition, 2021.
6. Kompal Bansal, Fundamentals of Intellectual Property for Engineers, BS Publications, 2013.
7. P. Radhakrishna, Intellectual Property Rights: Text and Cases, Excel Books, 2008.

COURSE OUTCOMES

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

1. Describe the concepts of intellectual property rights, trademarks, copyrights, patents, industrial designs, and cyber laws.
2. Apply legal principles, registration procedures, and protection mechanisms to safeguard intellectual property assets.
3. Examine intellectual property laws, trade secrets, geographical indications, licensing, and cyber regulations in practical scenarios.
4. Assess intellectual property management strategies, legal frameworks, technology protection, and regulatory compliance for organizational needs.
5. Develop effective intellectual property management solutions by integrating legal provisions, protection strategies, licensing practices, and cyber law principles.

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

25ITPE802	MOBILE APPLICATION DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To illustrate the system requirements for mobile applications.
- To examine mobile application design using development frameworks.
- To develop user-friendly mobile application interfaces.
- To implement mobile applications using Android and iOS technologies.
- To deploy mobile applications for distribution through application marketplaces.

UNIT I Introduction to Mobile Applications

Web vs. Mobile App – Cost of Development – Myths - Mobile Applications – Marketing - Mobile User Interface Design - Effective Use of Screen – Mobile Users – Mobile Information Design - Mobile Platforms - Tools of Mobile Interface Design

UNIT II Android User Interface Design

Android Architecture – Android SDK Tools - Application Components - Intents – Content Providers - Broadcast Receivers – Services - User Interface Design - Views - View Groups –Layouts - Event Handling – Listeners – Adapters – Menus - Action Bars – Notifications - Android Localization

UNIT III Android Data Storage

Content Providers – URI - CRUD access –Browser – CallLog – Contacts – Media Store – Data Access and Storage - Shared Preferences - External Storage - Network Connection – SQLite Databases

UNIT IV Android Native Capabilities

Camera – Audio - Sensors and Bluetooth - Playing audio/video - Media recording - Sensors - Listening to sensor readings – Bluetooth - Android Communications – GPS - Working with Location Manager, Working with Google Maps extensions - Maps via intent - Map Activity- Location-based Services - Location Updates - Location Providers - Selecting a LocationProvider - Finding Location

UNIT V iOS Design

iPhone Craze – iOS Features – iOS Tools - iOS Project – Objective-C Basics – Building iOS App– Actions and Outlets – Delegates - User Interface Elements – Accelerometer –Location Handling - SQLite Database

REFERENCES

1. Jeff McWherter and Scott Gowell, “Professional Mobile Application Development”, Wrox, 2012.
2. Reto Meier, “Professional Android 4 Development”, John Wiley and Sons, 2012.

- David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, “Beginning iOS Development: Exploring the iOS SDK”, Apress, 2013.

COURSE OUTCOMES

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

- Describe the concepts of mobile application development, user interface design, Android architecture, data storage, and iOS development.
- Apply mobile development frameworks, interface design principles, data management, and native capabilities to build mobile applications.
- Examine Android components, data storage techniques, communication services, location-based features, and iOS application development.
- Assess mobile application architectures, native device capabilities, database integration, and deployment strategies for effective mobile solutions.
- Develop cross-platform mobile applications by integrating user interfaces, data storage, native services, and deployment practices.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Program Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
C01	3	2	1	1	2	–	–	–	1	–	2	3	2	–
C02	3	3	3	2	3	–	–	2	2	2	2	3	3	1
C03	3	3	2	3	3	–	–	2	2	1	2	3	3	1
C04	2	3	2	3	3	1	1	2	2	2	2	3	3	2
C05	3	3	3	3	3	1	1	2	2	2	3	3	3	2

OPEN ELECTIVES – I

25ITOE506	CYBER SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand cyber threats, vulnerabilities, safeguards, intrusion detection, and cyber laws/forensics.
- Examine attack scenarios and mitigation, analyze safeguards, evaluate intrusion prevention, and link to legal frameworks.
- Distinguish Systems/Network Security and cryptography, analyze intrusion detection techniques, and interpret forensic procedures.
- Analyze threats to critical infrastructure, evaluate vulnerabilities and safeguards, assess intrusion systems, and evaluate legal/forensic frameworks.

UNIT I Introduction to Cyber Security

Overview of Cyber Security, Cyber Threats & Crime, Cyber Espionage, Internet Governance, Challenges and Constraints, necessity for a Comprehensive Cyber Security Policy, necessity for a Nodal Authority, necessity for an international convention on Cyberspace.

UNIT II Security Threats and Vulnerabilities

Overview, vulnerabilities in software, Intrusion, Physical Theft, Abuse of Privileges, Malware infection, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Poor Cyber Security Awareness.

UNIT III Security Practices & Security Safeguards

Security Practices: Security Management, Security Policy, Risk Management, Information Classification Process, Security Procedures and Guidelines, Business Continuity and Disaster Recovery.

Security Safeguards: Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Denial of Service Filters, Ethical Hacking, Firewalls, Intrusion Detection Systems, Response, Scanning, anti-Malware software.

UNIT IV Intrusion Detection & Securing Web

Intrusion detection and Prevention Techniques, Basic security for HTTP Applications and Services, Basic Security for SOAP Services, Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges, Network based Intrusion detection & Prevention Systems.

UNIT V Security Laws, Standards & Forensics

Security Laws & Standards: Cyber Security Regulations, Roles of International Law, the state and private sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cybersecurity Policy, Cyber Forensics: Overview, Handling Preliminary Investigations, Controlling an Investigation

TEXTBOOKS

1. Micki Krause, Harold F. Tipton, “Handbook of Information Security Management”, Vol 1-3, CRC Press LLC, 2004.

REFERENCES

1. Bill Nelson, “Computer Forensics and Investigations”, Cengage Learning, India Edition, 2016.
2. Matt Bishop, “Computer Security Art and Science”, Pearson/PHI, 2002.

COURSE OUTCOMES

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

1. Describe cyber threats and policies, vulnerabilities, safeguards, intrusion detection, laws/forensics.
2. Understand stakeholder roles, analyze vulnerabilities, examine safeguards, assess intrusion systems, and relate to regulations.

3. Apply security policies, analyze vulnerabilities, implement safeguards, apply intrusion detection, interpret standards.
4. Analyze security across technical/legal/social views, evaluate intrusion strategies, assess laws and standards.
5. Evaluate cyber regulations and national policy, apply knowledge of threats, vulnerabilities, safeguards, and intrusion detection to forensic investigations.

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

25ITOE506	INDUSTRY 4.0				L	T	P	C
					3	0	0	3

COURSE OBJECTIVES

- Understand the fundamentals of Industrial IoT and Industry 4.0 systems.
- Apply IoT sensing and communication techniques to industrial applications.
- Analyze Industry 4.0 systems and data for engineering decision-making.
- Evaluate Industrial IoT solutions for various application domains.
- Design Industrial IoT systems for real-world industrial applications.

UNIT I Introduction to Industrial IoT (IIoT) Systems

The Various Industrial Revolutions, Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT) in Industry, Industry 4.0 revolutions, Support System for Industry 4.0, Smart Factories.

UNIT II Implementation systems for IIoT

Sensors and Actuators for Industrial Processes, Sensor networks, Process automation and Data Acquisition on IoT Platform, Microcontrollers and Embedded PC roles in IIoT, Wireless Sensor nodes with Bluetooth, WiFi, and LoRa Protocols, and IoT Hub systems

UNIT III IIoT Data Monitoring & Control

IoT gateway, IoT Edge Systems and its Programming, Cloud computing, Real-Time Dashboard for Data Monitoring, Data Analytics and Predictive Maintenance with IIoT technology.

UNIT IV Cyber Physical Systems

Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis

UNIT V

Industrial IoT- Applications: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management

Case Studies of IIoT Systems: IIoT application development with Embedded PC based development boards, Development of a mini project on a new version of operating systems and an edge development board. That project should also address the current societal needs

TEXTBOOK

1. Industry 4.0: The Industrial Internet of Things. Alasdair Gilchrist. Publications: Apress

REFERENCES

3. Concept Industry 4.0: An Empirical Analysis of Technologies and Applications in Production Logistics. Authors: Bartodziej, Christoph Jan Springer: Publication in the field of economic science.
4. Embedded System: Architecture, Programming and Design by Rajkamal, TMH3.
5. Dr Ovidiu Vermesan, Dr Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers

COURSE OUTCOMES

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

1. Explain the theoretical foundations, architecture, and components of Industrial IoT systems.
2. Formulate engineering problems related to Industrial IoT sensing, networking, and communication protocols.
3. Analyze Industrial IoT data and communication techniques to derive engineering solutions.
4. Implement Industrial IoT-enabled solutions to address real-field industrial application problems.
5. Design complete Industrial IoT systems for diverse industrial applications.

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

25ITOE506	ROBOTICS SIMULATION FOR MANUFACTURING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Provide Knowledge of Robot Fundamentals, Kinematics, Sensors, Programming, and Motion Planning.
- Develop An Understanding of Robot Architectures, Control, Sensing Technologies, Programming Methods, and Path Planning Techniques.
- Enable The Application of Robotics Principles, Programming, Sensing, and Motion Planning for Engineering Problems.
- Develop Analytical Skills for Evaluating Robot Kinematics, Control Strategies, Sensor Integration, and Motion Planning Algorithms.
- Equip Students to Design, Evaluate, and Implement Robotic Systems for Industrial and Intelligent Automation Applications.

UNIT I Introduction to Robotics

Components, Classification, Characteristics, and Applications of Robots. Material transfer, Machineloading/unloading, Processing operation, Assembly and Inspection, Feature Application.

UNIT II Drive Systems, Actuators and Sensors

Actuators: Characteristics of Actuating Systems, Actuating Devices and Control. Sensors: Sensor characteristics, Description of Different Sensors, Touch sensors, Tactile sensor, Proximity and range sensors, Robotic vision sensor, Force sensor, Light sensors, Pressure sensors.

UNIT III Basic Concepts of Artificial Intelligence

Concepts of AI, AI Problems, techniques, Characteristics & Applications, AI versus Natural Intelligence, Problem representation in AI, Problem-solution Techniques. Elements of Knowledge Representation: Logic, Production Systems, Semantic Networks, Expert Systems. Defining the Problem as State Space Search, Production Systems, Issues in the Design of Search Programs, DFS & BFS Techniques.

UNIT IV Intelligent Agents and Multi-agent system

Design of intelligent agents - reasoning agents, agents as reactive systems; hybrid agents; layered agents. Multi-Agent Systems: Classifying multi-agent interactions - cooperative versus non-cooperative; zero-sum and other interactions; Cooperation, Prisoner's dilemma and Axelrod's experiments; interactions between self-interested agents: auctions & voting systems: negotiation; Interactions between benevolent agents: cooperative distributed problem solving, partial global planning; coherence and coordination; Interaction languages and protocols: speech acts, KQML/KIF, the FIPA framework.

UNIT V Multi-robot representations and Task Planning

Task-Level Programming, Uncertainty, Configuration Space, Gross-Motion Planning, Grasp Planning, Fine Motion Planning, and Task Planning Problem: control architectures, simulation environments, and testbeds. Integration of assorted sensors (IR, Potentiometer, strain gauges, etc.), microcontrollers, and ROS (Robot Operating System) in a robotic system.

TEXTBOOKS

1. Introduction to Robotics: Analysis, Systems, Applications by Saeed B Niku, Prentice Hall, 2nd Edition, 2001.
2. Fundamentals of Robotics: Analysis and Control, Robert J Schilling, PHI, 5th Edition, 2003.

REFERENCES

1. An Introduction to MultiAgent Systems - Second Edition. Michael Wooldridge, Wiley, latest Edition.
2. Mikell P Groover, Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, "Industrial Robotics: Technology, Programming, and Applications", McGraw Hill, 2nd Edition, 2017.
3. Craig J. J. "Introduction to Robotics: Mechanics and Control", Addison- Wesley, 3rd edition, 2004.

COURSE OUTCOMES

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

1. Explain the fundamentals, components, and programming of robotic systems.
2. Apply robot kinematics, sensors, actuators, and control principles in robotic systems.
3. Analyze robot control, trajectory planning, and intelligent robotic systems.
4. Evaluate autonomous robots and multi-agent systems for real-world applications.
5. Design intelligent robotic solutions for industrial, medical, and space applications.

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

25ITOE506	SMART ENERGY GRID										L	T	P	C
											3	0	0	3

COURSE OBJECTIVES

- To understand smart grid technologies, IT enablers, decision-support tools, analytics, and market structures across all units
- To apply communication protocols, operational techniques, computational intelligence, and new technology integration to grid scenarios
- To analyze grid architectures, control/analytics methods, and integration challenges for their performance and limitations
- To evaluate smart grid technologies, analytics techniques, and market mechanisms for real-world suitability
- To create solutions integrating IT enablers, analytics, new technologies, and market models for smart grid systems

UNIT I Smart Grid Technology Overview

Initial Overview of various smart grid measurement and communication technologies, smart grid protocols - IT Enablers for Smart Grid Technology: Overview of Multi-agent Systems, Distributed Intelligence, Big Data Analysis, Cloud Computing, Software-Defined Networks (SDN)

UNIT II Smart Grid Decision Support and Operational Technology

Concepts of Visualization, Self-Healing, Congestion Management, Dynamic OPF, Security Assessment, Contingency Analysis, Dynamic State estimation, Stability Analysis, Intelligent Fault Management, Feeder Reconfiguration, Short Circuit Analysis, Topology Processing, Power Quality, Voltage VAR Control, advanced control of generators, improved FACTS devices

UNIT III Smart Analytics

Computational Intelligence, Wide Area Monitoring and Control Techniques, Demand Response Management, Predictive Asset Management, Forecasting Techniques

UNIT IV New Technology Integration

Renewable Integration, Plug-in Electric Vehicle, Smart home and Smart City concepts, Cooperative grids

UNIT V Smart Grid Market and Economics

Energy market overview, Role of System Operators, DSO, and TSO under the smart grid, Transactive Energy

TEXTBOOKS

1. Lars T. Berger and Krzysztof Iniewski, “Smart Grid Applications, Communications, And Security,” Wiley, New Delhi, Aug 2015
2. Buchholz, Bernd M., Styczynski, Zbigniew, “Smart Grids – Fundamentals and Technologies in Electricity Networks”, Springer, 2014

3. Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, and NickJenkins, "Smart Grid: Technology and Applications," Wiley, New Delhi, Aug 2015

REFERENCES

1. James Momoh, "Smart Grid: Fundamentals of Design and Analysis," (IEEE Power Engineering Series) – Wiley-Blackwell, Apr 2012
2. Takuro Sato, Daniel M. Kammen, Bin Duan, Martin Macuha, Zhenyu Zhou, and Jun Wu, "Smart Grid Standards: Specifications, Requirements, and Technologies," Wiley- Blackwell, Apr 2015.
3. Chen-Ching Liu, Stephen McArthur, Seung-Jae Lee, "Smart Grid Handbook", 3 Volume Set, Wiley, USA, 2016

COURSE OUTCOMES

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

1. Describe smart grid communication/IT enablers, decision-support concepts, analytics techniques, technology integration, and market structures.
2. Apply smart grid protocols, state estimation & VAR control, forecasting & demand-response, renewable/EV integration, and transactive energy models to grid scenarios.
3. Analyze IT-enabled grid architectures, self-healing mechanisms, wide-area monitoring techniques, smart city integration, and system operator roles.
4. Evaluate smart grid technologies, control strategies, predictive analytics, technology integration methods, and market mechanisms for real-world suitability.
5. Design a smart grid solution integrating distributed intelligence, fault management, predictive analytics, renewable/smart city integration, and transactive energy models.

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

25ITOE506	AUGMENTED & VIRTUAL REALITY DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To gain knowledge of historical and modern overviews and perspectives on virtual reality.
- To learn the fundamentals of sensation, perception, and perceptual training.
- To understand the scientific, technical, and engineering aspects of augmented and virtual reality systems.
- To learn the evaluation of virtual reality through the lens of design.
- To learn the technology of augmented reality and implement it to gain practical knowledge.

UNIT I Introduction

Introduction to Augmented, Virtual, and Mixed Reality, Taxonomy, technology and features of augmented reality, difference between AR, VR and MR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality.

UNIT II VR systems

VR as a discipline, Basic features of VR systems, Architecture of VR systems, VR hardware: VR input hardware: tracking systems, motion capture systems, data gloves, VR output hardware: visual displays.

UNIT III Stereoscopic Vision & Haptic Rendering

Fundamentals of the human visual system, Depth cues, Stereopsis, Retinal disparity, Haptic sense, Haptic devices, Algorithms for haptic rendering and parallax, Synthesis of stereo pairs, Pipeline for stereo images.

UNIT IV VR software development

Challenges in VR software development, Master/slave and Client/server architectures, Cluster rendering, Game Engines and available SDKs to develop VR applications for different hardware (HTC VIVE, Oculus, Google VR). Application of VR in Digital Entertainment: VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR.

UNIT V 3D interaction techniques

3D Manipulation tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D Manipulation. AR software development: AR software, Camera parameters and camera calibration, Marker-based augmented reality, AR Toolkit.

REFERENCES

1. George Mather, "Foundations of Sensation and Perception", Psychology Press; 2nd Edition, 2009.
2. Jason Jerald, "The VR Book: Human-Centered Design for Virtual Reality".
3. Tony Parisi, "Learning Virtual Reality", O' Reilly
4. Burdea, G. C. and P. Coffet, "Virtual Reality Technology", Second Edition. Wiley-IEEE Press, 2003/2006.
5. Alan B. Craig, "Understanding Augmented Reality, Concepts and Applications", Morgan Kaufmann, 2013.
6. Alan Craig, William Sherman and Jeffrey Will, "Developing Virtual Reality Applications", Foundations of Effective Design, Morgan Kaufmann, 2009.

E-RESOURCES

1. <http://msl.cs.uiuc.edu/vr/>

COURSE OUTCOMES

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

1. Identify, examine, and develop software that reflects fundamental techniques for the design and deployment of VR and AR experiences.
2. Describe how VR and AR systems work.
3. Choose, develop, explain, and defend the use of designs for AR and VR experiences.
4. Evaluate the benefits and drawbacks of specific AR and VR techniques on the human body.
5. Identify and examine state-of-the-art AR and VR design problems and solutions from industry and academia.

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

OPEN ELECTIVES – II

25ITOE606	FULL STACK DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To become knowledgeable about the latest web development technologies.
- To understand the design of two-tier and three-tier web application architectures.
- To design and analyze real-time web applications.
- To construct efficient client-side and server-side applications.
- To learn the core concepts of front-end and back-end development.

UNIT I

Web Development Basics: Web development Basics - HTML & Web servers. Shell - UNIX CLI - Version control - Git & GitHub- HTML, CSS

UNIT II

Frontend Development: JavaScript basics, OOPS Aspects of JavaScript, Memory usage and Functions in JS, AJAX for data exchange with server, jQuery framework, jQuery events, UI components, etc. JSON data format.

UNIT III

REACT JS: Introduction to React, React Router and Single Page Applications, React Forms, Flow Architecture and Introduction to Redux, More Redux and Client-Server Communication

UNIT IV

Java Web Development: JAVA PROGRAMMING BASICS, Model-View-Controller (MVC) Pattern, MVC Architecture using Spring, RESTful API using Spring Framework, Building an application using Maven

UNIT V

Databases & Deployment: Relational schemas and normalization, Structured Query Language (SQL), Data persistence using Spring JDBC, Agile development principles, and deploying applications in the cloud.

TEXTBOOKS

1. Web Design with HTML, CSS, JavaScript and JQuery Set Book by Jon Duckett; Professional JavaScript for Web Developers Book by Nicholas C. Zakas
2. Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-by-Step Guide to Creating Dynamic Websites by Robin Nixon
3. Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB. Copyright © 2015

REFERENCES

1. Full-Stack JavaScript Development by Eric Bush.
2. Mastering Full Stack React Web Development Paperback – April 28, 2017, by Tomasz Dyl, Kamil Przeorski, Maciej Czarnecki

COURSE OUTCOMES

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

1. Describe the principles of web development, frontend technologies, backend frameworks, databases, version control, and cloud deployment.
2. Construct dynamic web applications using HTML, CSS, JavaScript, React, Spring Framework, and relational database technologies.
3. Demonstrate client-server communication, RESTful service integration, state management, and database connectivity for scalable web applications.
4. Validate web application performance through API integration, database operations, deployment strategies, and software development practices.

5. Integrate frontend interfaces, backend services, databases, and cloud platforms to deliver reliable and scalable full-stack applications.

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

25ITOE606	CLOUD ESSENTIALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce cloud computing concepts and the MapReduce programming model.
- To provide knowledge of cloud operations and management for implementing large-scale systems.
- To develop the ability to design cloud infrastructures that satisfy business and customer requirements.

UNIT I Foundations of cloud

Inception and need for cloud computing: Motivations from distributed computing predecessors - Evolution - Characteristics - Business Benefits – Challenges in cloud computing - Exploring the Cloud Computing Stack - Fundamental Cloud Architectures – Advanced Cloud Architectures - Specialized Cloud Architectures

UNIT II Service Delivery and Deployment Models

Service Models (XaaS): Infrastructure as a Service (IaaS) - Platform as a Service (PaaS) - Software as a Service (SaaS) - Deployment Models: Types of cloud - Public cloud - Private cloud - Hybrid cloud – Service level agreements - Types of SLA – Lifecycle of SLA- SLA Management

UNIT III Cloud Resource Virtualization

Virtualization as Foundation of Cloud – Understanding Hypervisors – Understanding Machine Image and Instances - Managing Instances – Virtual Machine Provisioning and Service Migrations Cloud Computing: Applications and Paradigms Existing Cloud Applications and Opportunities for New Applications - Architectural Styles for Cloud Applications - Workflows: Coordination of Multiple Activities - Coordination Based on a State Machine Model: The ZooKeeper - The MapReduce Programming Model - A Case Study: The GrepTheWeb Application

UNIT IV Resource Management and Scheduling in Cloud

Policies and Mechanisms for Resource Management – Stability of a Two-Level Resource Allocation Architecture- Feedback Control Based on Dynamic Thresholds - Coordination of Specialized Autonomic Performance Managers - A Utility-Based Model for Cloud-Based Web Services - Resource Bundling: Combinatorial Auctions for Cloud Resources – Scheduling Algorithms for Computing Clouds - Resource Management and Dynamic Application Scaling

UNIT V Cloud Platforms and Application Development

Comparing Amazon Web Services, Google App Engine, Microsoft Azure from the perspective of architecture (Compute, Storage, Communication) services and cost models. Cloud application development using third-party APIs - Working with EC2 API – Google App Engine API - Facebook API, Twitter API. Advances in Cloud Media Clouds - Security Clouds - Computing Clouds - Mobile Clouds – Federated Clouds – Hybrid Clouds

TEXTBOOKS

1. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley, 1st Edition, 2013.
2. Sosinsk, Barrie, Cloud Computing Bible, John Wiley & Sons, 1st Edition, 2011.

REFERENCES

1. Marinescu, Dan C. Cloud Computing: Theory and Practice. Morgan Kaufmann, 2017.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing: A Practical Approach, McGraw-Hill Education, 1st Edition, 2017.
3. Buyya, Rajkumar, Christian Vecchiola, and S. ThamaraiSelvi. Mastering Cloud Computing: Foundations and Applications Programming, Tata McGraw-Hill, 1st Edition, 2017.

COURSE OUTCOMES

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

1. Outline the fundamentals of cloud computing, service models, deployment architectures, virtualization, resource management, and cloud application platforms.
2. Implement cloud solutions using virtualization, MapReduce, resource scheduling, cloud APIs, and application deployment techniques.
3. Compare cloud service models, deployment strategies, virtualization approaches, and resource allocation mechanisms for diverse computing environments.
4. Measure the efficiency of cloud infrastructures through SLA management, scheduling policies, scalability techniques, and platform performance analysis.
5. Formulate cloud-based applications by integrating virtualization, resource management, cloud platforms, third-party APIs, and emerging cloud technologies.

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

25ITOE606	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The student should be able to:

- To understand the role of Grid computing in solving large-scale scientific problems.
- To gain knowledge of virtualization concepts fundamental to cloud computing.
- To learn Grid and Cloud programming techniques.
- To understand security issues in Grid and Cloud environments.

UNIT I

Evolution of distributed computing: Scalable computing over the Internet –Technologies for network-based systems – clusters of cooperative computers – Grid computing Infrastructures– cloud computing – service-oriented architecture - Introduction to Grid Architecture and standards–Elements of Grid – Overview of Grid Architecture.

UNIT II

Introduction to Open Grid Services Architecture (OGSA) – Motivation – Functionality Requirements – Practical & Detailed view of OGSA/OGSI – Data-intensive grid service models – OGSA services.

UNIT III

Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software–Pros and Cons of cloud computing– Implementation levels of virtualization–virtualization structure–Virtualization of CPU, Memory and I/O devices – virtual clusters and Resource Management – Virtualization for data center automation.

UNIT IV

Open-source grid middleware packages – Globus Toolkit (GT4) Architecture, Configuration – Usage of Globus – Main components and Programming model –Introduction to Hadoop Framework – Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job – Design of Hadoop file system, HDFS concepts, command line and java interface, dataflow of File read & File write.

UNIT V

Trust models for Grid security environment – Authentication and Authorization methods – Grid security infrastructure–Cloud Infrastructure security: network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud, Key privacy issues in the cloud.

TEXTBOOKS

1. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, “Distributed and Cloud Computing: Clusters, Grids, Clouds and the Future of Internet”, First Edition, Morgan Kaufmann Publisher, an Imprint of Elsevier, 2012.
2. Jason Venner, “Pro Hadoop– Build Scalable, Distributed Applications in the Cloud”, A Press, 2009.

REFERENCES

1. Tom White, “Hadoop: The Definitive Guide”, First Edition. O’Reilly, 2009
2. Bart Jacob (Editor), “Introduction to Grid Computing”, IBM Red Books, Vervante, 2005
3. Ian Foster, Carl Kesselman, “The Grid: Blueprint for a New Computing Infrastructure”, 2nd Edition, Morgan Kaufmann.
4. Frederic Magoules and Jie Pan, “Introduction to Grid Computing”, CRC Press, 2009.
5. Daniel Minoli, “A Networking Approach to Grid Computing”, John Wiley Publication, 2005.
6. Barry Wilkinson, “Grid Computing: Techniques and Applications”, Chapman and Hall, CRC, Taylor and Francis Group, 2010.

COURSE OUTCOMES

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

1. Explain the fundamentals of distributed computing, grid architectures, cloud services, virtualization, middleware, and cloud security concepts.
2. Implement grid and cloud computing solutions using virtualization, Hadoop, MapReduce, distributed resource management, and service-oriented architectures.
3. Distinguish cloud deployment models, grid frameworks, virtualization techniques, and middleware services for scalable distributed applications.
4. Assess the effectiveness of resource management, Hadoop ecosystems, virtualization platforms, and security mechanisms in distributed computing environments.

- Integrate grid technologies, cloud platforms, virtualization, distributed programming, and security practices to deliver reliable computing solutions.

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

25ITOE606	BIG DATA ANALYTICS										L	T	P	C
											3	0	0	3

COURSE OBJECTIVES

- To learn the characteristics of Big Data and technologies for Big Data analytics.
- To recognize the concepts of the Hadoop framework and develop MapReduce applications.
- To understand Hadoop ecosystem components for data storage, analysis, and processing.
- To analyze Big Data case studies and develop sample Big Data projects.

UNIT I

Fundamentals of Big Data – Big Data Types – Basics of Distributed Computing – Big Data Technology Components – MapReduce Fundamentals - Defining Big Data Analytics – A Brief History of Hadoop - The Hadoop Foundation and Ecosystem.

UNIT II

The Hadoop Distributed File System: The Design of HDFS - HDFS Concepts - The Command - Line Interface - Hadoop Filesystems - The Java Interface - Data Flow. Setting Up a Hadoop Cluster: Cluster Specification - Cluster Setup and Installation - SSH Configuration - Hadoop Configuration - YARN Configuration

UNIT III

MapReduce: Analyzing the Data with Hadoop - Scaling Out - Hadoop Streaming - Hadoop Pipes. Developing a MapReduce Application: The Configuration API - Configuring the Development Environment - Writing a Unit Test - Running Locally on Test Data - Running on a Cluster - Tuning a Job - MapReduce Workflow - Anatomy of a MapReduce Job Run - Failures - Job Scheduling - Shuffle and Sort -Task Execution

UNIT IV

Pig: Installing and Running - An Example - Pig Latin - User-Defined Functions - Pig in Practice. Hive: Installing Hive - An Example - Running Hive - Comparison with Traditional Databases - HiveQL - Tables - Querying Data - User-Defined Functions - HBase: Basics - Concepts - Installation - Clients – Example

UNIT V

ZooKeeper: Installing and Running ZooKeeper - An Example - The ZooKeeper Service - Building Applications with ZooKeeper - Sqoop: Getting Sqoop - A Sample Import - Generated Code - Database Imports - Working with Imported Data - Importing Large Objects - Performing an Export. - Case Studies: Hadoop Usage at Last.fm - Hadoop and Hive at Facebook - Nutch Search Engine - Log Processing at Rackspace

TEXTBOOKS

1. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'reilly, 2012.
2. Judith Hurwitz, Alan Nugent, Fern Halper, and Marcia Kaufman, "Big Data for Dummies", First Edition, 2013.

REFERENCES

1. Boris Lubinsky, Kevin T. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, 2015.
2. Borko Furht and Flavio Villanustre, "Big Data Technologies and Applications", First Edition, Springer Publishing Company, Incorporated, 2016

COURSE OUTCOMES

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

1. Explain the concepts of Big Data, distributed computing, Hadoop architecture, MapReduce, ecosystem components, and data analytics techniques.
2. Build Big Data applications using Hadoop, HDFS, MapReduce, YARN, and cluster configuration for efficient data processing.
3. Examine Hadoop ecosystem tools, including Pig, Hive, HBase, ZooKeeper, and Sqoop, for managing and analyzing large datasets.
4. Verify the performance of Big Data solutions through workflow optimization, job scheduling, data processing, and ecosystem integration techniques.
5. Formulate scalable Big Data solutions by integrating Hadoop technologies, analytics tools, distributed storage, and real-world data processing practices.

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

25ITOE606	DATA SCIENCE FOR ENGINEERS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Recall key descriptive methods, statistical measures, and terminology used in data analysis.
- Explain frameworks for selecting appropriate descriptive methods based on data characteristics.
- Apply estimation, hypothesis testing, and statistical modeling techniques to support decision-making.
- Analyze distributions, patterns, and relationships within real-time data.
- Evaluate the appropriateness and reliability of statistical models and methods used for a given dataset.

UNIT I Introduction to Statistics

Introduction to statistics and data analysis-Measures of central tendency –Measures of variability - Moments-Skewness-Kurtosis (Concepts only). Random variables: Introduction - random variables-Probability mass Function, distribution and density functions - joint Probability distribution and joint density functions- Marginal, conditional distribution and density functions - Mathematical expectation and its properties - Covariance, moment generating function – characteristic function.

UNIT II Correlation and regression

Correlation and Regression – Rank Correlation - Partial and Multiple correlation - Multiple regression.

Probability Distributions: Binomial and Poisson distributions – Normal distribution – Gamma distribution – Exponential distribution – Weibull distribution.

UNIT III Hypothesis Testing I

Testing of hypothesis – Introduction - Types of errors, critical region, procedure of testing hypothesis - large sample tests - Z test for Single Proportion, Difference of proportions, mean and difference of means.

UNIT IV Hypothesis Testing II

Small sample tests- Student's t-test, F-test - chi-square test - goodness of fit - independence of attributes- Design of Experiments - Analysis of variance – one - and two-way classifications – CRD - RBD - LSD.

UNIT V Reliability

Basic concepts - Hazard Function - Reliabilities of series and parallel systems – System Reliability – Maintainability - Preventive and repair maintenance - Availability. Contemporary Issues

TEXTBOOKS

1. R.E. Walpole, R.H. Myers, S.L. Myers and K. Ye, “Probability and Statistics for engineers and scientists”, 9th Edition, Pearson Education (2012).
2. Douglas C. Montgomery, George C. Runger, “Applied Statistics and Probability for Engineers”, 6th Edition, John Wiley & Sons (2016).

REFERENCES

1. E. Balagurusamy, “Reliability Engineering”, Tata McGraw Hill, Tenth reprint, 2017.
2. J. L. Devore, “Probability and Statistics”, 8th Edition, Brooks/Cole, Cengage Learning (2012).
3. R. A. Johnson, Miller Freund, “Probability and Statistics for Engineers”, 8th edition, Prentice Hall India (2011).
4. Bilal M. Ayyub and Richard H. McCuen, “Probability, Statistics and Reliability for Engineers and Scientists”, 3rd edition, CRC Press (2011).

COURSE OUTCOMES

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

1. Explain the fundamentals of probability, statistics, data distributions, correlation, regression, hypothesis testing, and reliability analysis.
2. Apply statistical methods to analyze data distributions, estimate parameters, evaluate relationships, and support engineering decision-making.
3. Differentiate probability models, regression techniques, hypothesis tests, and experimental designs for solving engineering data analysis problems.
4. Validate statistical inferences using estimation methods, significance tests, analysis of variance, and reliability measures.
5. Formulate data-driven solutions by integrating statistical modeling, probability distributions, hypothesis testing, reliability analysis, and engineering data interpretation.

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

OPEN ELECTIVES – III

25ITOE706	BLOCKCHAIN TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To explain the fundamentals of blockchain technology and cryptocurrencies.
- To illustrate the architecture and functionality of blockchain systems.
- To apply cryptographic techniques for secure blockchain transactions.
- To analyze blockchain applications, mining mechanisms, and security challenges.
- To interpret emerging blockchain platforms, smart contracts, and regulatory aspects.

UNIT I Introduction to Cryptography and Cryptocurrencies

Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, and A Simple Cryptocurrency.

UNIT II How Blockchain Achieves and How to Store and Use

Decentralization - Centralization vs. Decentralization - Distributed consensus, Consensus without identity using a blockchain, Incentives and proof of work. Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets.

UNIT III Mechanics of Bitcoin

Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, the Bitcoin network, Limitations and improvements.

UNIT IV Bitcoin Mining

The task of Bitcoin miners, Mining Hardware, Energy consumption and ecology, Mining pools, Mining incentives and strategies, Bitcoin and Anonymity, Anonymity Basics, How to De-anonymize Bitcoin, Mixing, Decentralized Mixing, Zerocoin and Zerocash.

UNIT V Community, Politics, and Regulation

Consensus in Bitcoin, Bitcoin Core Software, Stakeholders: Who's in Charge, Roots of Bitcoin, Governments Notice on Bitcoin, Anti-Money Laundering Regulation, New York's Bit License Proposal. Bitcoin as a Platform: Bitcoin as an Append-only Log, Bitcoins as Smart Property, Secure Multi-Party Lotteries in Bitcoin, Bitcoin as Public Randomness, Source – Prediction Markets, and Real-World Data Feeds.

Altcoins and the Cryptocurrency Ecosystem: Altcoins: History and Motivation, A Few Altcoins in Detail, Relationship Between Bitcoin and Altcoins, Merge Mining - Atomic Crosschain Swaps, Bitcoin-Backed Altcoins, Side Chains, Ethereum and Smart Contracts.

TEXTBOOK

1. Narayanan, A., Bonneau, J., Felten, E., Miller, A., and Goldfeder, S. (2016). Bitcoin and cryptocurrency technologies: A comprehensive introduction. Princeton University Press.

REFERENCES

1. Antonopoulos, A. M. (2014). Mastering Bitcoin: Unlocking Digital Cryptocurrencies. O'Reilly Media, Inc.
2. Franco, P. (2014). Understanding Bitcoin: Cryptography, engineering and economics. JohnWiley and Sons.

COURSE OUTCOMES

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

1. Explain the principles of blockchain, cryptocurrencies, cryptographic techniques, consensus mechanisms, and decentralized systems.
2. Apply blockchain protocols, cryptographic methods, and transaction mechanisms to develop secure decentralized applications.

3. Analyze blockchain architectures, Bitcoin operations, mining strategies, and security mechanisms to assess system performance.
4. Evaluate blockchain platforms, smart contracts, cryptocurrencies, and regulatory frameworks for diverse real-world applications.
5. Design blockchain-based solutions by integrating cryptographic techniques, decentralized consensus, smart contracts, and emerging blockchain technologies.

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

25ITOE706	FRONT-END INFORMATION TECHNOLOGY WITH REACT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To explain the fundamentals of computer hardware, networking, and communication technologies.
- To illustrate web development concepts using HTML5, CSS3, and JavaScript.
- To apply Python and ReactJS for developing interactive front-end applications.
- To develop back-end services using Node.js and Express.
- To interpret mobile communication technologies and information system applications.

UNIT I Hardware and Network Essentials

Basics of Computer System - Motherboard – Network Cards – Graphics Card – Processors – Hard Drive – USB Port – Monitor Ports – Servers – Types of Servers – Web Server – Database Server – Communication Medium – Fundamentals of Computer Networking – Types of Computer Networks – Network Topologies – Network Standards: OSI Model, TCP/IP Model - Network Components.

UNIT II Web and Scripting Essentials

Internet Basics – Browser Fundamentals – Introduction to HTML5 – HTML5 Tags – HTML5 Forms – Cascading Style Sheets (CSS3) Fundamentals - Introduction to JavaScript - Variables and Assignments – Writing Functions – Built-in functions and methods - JavaScript Loops – Events.

UNIT III Front- End Essentials

Introduction to Python – Datatypes – Flow Control – Functions & Modules – GUI in Python using wxPython - React Introduction - React Render HTML - React with JSX – React Components – Communication between components.

UNIT IV Back-End Scripting Essentials

Introduction to Node.js - Node.js Module System - Node Package Manager – Asynchronous Node.js - Node.js EventEmitter - Frameworks for Node.js – Promises in Node.js – Introduction to Express – Route Parameters - Express REST APIs - HTTP Methods as Actions – JSON.

UNIT V Mobile and Application Essentials

Introduction to Mobile Communication – Generations of Cellular Networks – GSM - Creation of Simple Interactive Applications – Simple Database Applications – Introduction to Information

TEXTBOOK

1. James Kurose and Keith Ross, “Computer Networking: A Top-Down Approach”, Eighth Edition, 2021.
2. Niederst Robbins, Jennifer, “Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics”, Fifth Edition, O'Reilly Media, 2018.
3. Mark Lutz, “Learning Python”, Fifth Edition, O’ Reilly, 2013.
4. Greg Lim, Beginning MERN Stack: Build and Deploy a Full Stack MongoDB, Express, React, Node.js App, 2021.

REFERENCES

1. Douglas E. Comer, “Computer Networks and Internets”, Sixth Edition, Prentice Hall, 2015.
2. Steven Holzner, “PHP: The Complete Reference”, Fifth Edition, McGraw-Hill, 2017.
3. Laura Lemay, Rafe Colburn, Jennifer Kyrnin, “Mastering HTML, CSS & JavaScript, Web Publishing”, BPB Publications, 2016.
4. Jochen Schiller, “Mobile Communications”, Pearson Education, 2012.
5. R. Kelly Rainer, Casey G. Cegielski, Brad Prince, “Introduction to Information Systems”, Fifth Edition, Wiley Publication, 2014.
6. Nabendu Biswas, MERN Projects for Beginners: Create Five Social Web Apps Using MongoDB, Express.js, React, and Node, Apress, 2021.

COURSE OUTCOMES

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

1. Explain the concepts of computer hardware, networking, web technologies, React, Node.js, and mobile communication systems.
2. Apply HTML5, CSS3, JavaScript, Python, React, and Node.js to develop interactive web applications.
3. Analyze front-end and back-end architectures, communication mechanisms, and application workflows for efficient web development.
4. Evaluate modern web frameworks, networking technologies, and information systems to build scalable and reliable applications.
5. Design full-stack web applications by integrating React, Node.js, Express, Python, databases, and mobile communication technologies.

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

25ITOE706	BIG DATA	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To explain the fundamentals of Big Data and its applications.

- To illustrate Hadoop architecture, HDFS, and MapReduce programming.
- To apply BigInsights and Hadoop ecosystem tools for Big Data processing.
- To analyze distributed data processing frameworks and cluster management.
- To develop Big Data solutions for real-world applications.

UNIT I

Big Data - Big Data Applications – IBM Big Data Platform – Big Data solutions and the cloud.

UNIT II

Hadoop – Hadoop architecture – Terminologies – HDFS – MapReduce – Types of Nodes – Topology – Hands-on lab.

UNIT III

BigInsights – Working with InfoSphere – Setting up a Hadoop cluster -MapReduce – Map, Reduce operations – Job submission – Distributed Mergesort Engine –Fundamental data types – Fault tolerance – Scheduling and Task execution – Hands-on lab

UNIT IV

BigInsights Web Console – Hands-on lab - Ecosystem Tools – Pig, Hive, Jaql – Hands-on lab.

UNIT V

Data Flume – Architecture – Modes – Single Node, Pseudo-Distributed, Fully Distributed nodes– Event Data Model – Hands-on lab

REFERENCES

1. Paul C. Zikopoulos, Chris Eaton, “Understanding Big Data”, McGraw-Hill, 2012 (eBook from IBM)
2. <http://bigdatauniversity.com/bdu-wp/bdu-course/big-data-fundamentals>

COURSE OUTCOMES

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

1. Explain the concepts of Big Data, Hadoop architecture, HDFS, MapReduce, and Hadoop ecosystem tools.
2. Apply Hadoop, MapReduce, BigInsights, Pig, Hive, Jaql, and Flume to process large-scale datasets.
3. Analyze distributed computing architectures, data processing workflows, and cluster performance for Big Data applications.
4. Evaluate Hadoop ecosystem components and data management techniques to support scalable Big Data solutions.
5. Design Big Data applications by integrating Hadoop, MapReduce, ecosystem tools, and distributed processing frameworks for real-world analytics.

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

25ITOE706	DATA ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Recall techniques and tools used for data extraction, cleaning, and storage.
- Explain the processes involved in extracting and cleaning raw data.
- Apply data transformation, storage, and visualization techniques to analyze data.
- Analyze data quality issues and inconsistencies during the cleaning and transformation process.
- Evaluate the effectiveness of different visualization and storage techniques in supporting data analysis.

UNIT I

Data Science: Data Analysis Sequence, Data Acquisition Pipeline, Report Structure

Files and Working with Text Data: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, The Pickle Module, Reading and Writing CSV Files, Python os and os. Path Modules. Working with Text Data: JSON and XML in Python

UNIT II

Working with Text Data: Processing HTML Files, Processing Texts in Natural Languages

Regular Expression Operations: Using Special Characters, Regular Expression Methods, Named Groups in Python Regular Expressions, Regular Expression with *glob* Module

UNIT III

Working with Databases: Setting Up a MySQL Database, using a MySQL Database Command Line, using a MySQL Database, Taming Document Stores: MongoDB

Working with Tabular Numeric Data (NumPy with Python): NumPy Arrays Creation Using *array()* Function, Array Attributes, NumPy Arrays Creation with Initial Placeholder Content, Integer Indexing, Array Indexing, Boolean Array Indexing, Slicing and Iterating in Arrays, Basic Arithmetic Operations on NumPy Arrays, Mathematical Functions in NumPy, Changing the Shape of an Array, Stacking and Splitting of Arrays, Broadcasting in Arrays.

UNIT IV

Working with Data Series and Frames: Pandas Data Structures, Reshaping Data, Handling Missing Data, Combining Data, Ordering and Describing Data, Transforming Data, Taming Pandas File I/O

UNIT V

Plotting: Basic Plotting with PyPlot, Getting to Know Other Plot Types, Mastering Embellishments, Plotting with Pandas

TEXTBOOKS

1. Data Science Essentials in Python: Collect, Organize, Explore, Predict, Value. Dmitry Zinoriev, The Pragmatic Programmers LLC, 2016
2. Introduction to Python Programming. Gowrishankar S., Veena A., CRC Press, Taylor & Francis Group, 2019

REFERENCES

1. Python for Everybody: Exploring Data Using Python 3. Charles R Severance, 2016
2. Python Data Analytics – Data Analysis and Science using Pandas, matplotlib and the Python Programming Language. Fabio Nelli, Apress, 2015
3. Website Scraping with Python. Using BeautifulSoup and Scrapy. Apress, 2018
4. Machine Learning with Python Cookbook: Practical Solutions from Preprocessing to Deep Learning. Chris Albon, O'Reilly, 2018

COURSE OUTCOMES

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

1. Explain data acquisition, data preprocessing, file handling, databases, and data visualization techniques used in data engineering.
2. Apply Python, SQL, MongoDB, NumPy, Pandas, and visualization libraries to process and manage structured and unstructured data.
3. Analyze datasets using data transformation, statistical operations, and data manipulation techniques to derive meaningful insights.
4. Evaluate data processing methods, storage technologies, and visualization techniques for effective data-driven decision-making.
5. Design end-to-end data engineering workflows by integrating data extraction, transformation, storage, analysis, and visualization tools.

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

25ITOE706	DATA SCIENCE FOUNDATION					L	T	P	C
						3	0	0	0

COURSE OBJECTIVES

- To explain the fundamentals and workflow of data science.
- To illustrate statistical methods for describing and analyzing data.
- To analyze relationships among data using statistical techniques.
- To apply Python libraries for data wrangling and preprocessing.
- To interpret data effectively using visualization techniques.

UNIT I Introduction

Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model–presenting findings and building applications - Data Mining - Data Warehousing – Basic Statistical descriptions of Data

UNIT II Describing Data

Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores

UNIT III Describing Relationships

Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r^2 –multiple regression equations –regression towards the mean

UNIT IV Python Libraries for Data Wrangling

Basics of NumPy arrays –aggregations –computations on arrays –comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables

UNIT V Data Visualization

Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three-dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

TEXTBOOKS

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.
2. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.
3. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016.

REFERENCES

1. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014.

COURSE OUTCOMES

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

1. Explain the fundamentals of data science, statistical concepts, data relationships, data wrangling, and visualization techniques.
2. Apply statistical methods, Python libraries, and data preprocessing techniques to analyze and manage datasets effectively.
3. Analyze data distributions, correlations, regression models, and transformed datasets to extract meaningful insights.
4. Evaluate data analysis methods and visualization techniques to support accurate interpretation and decision-making.
5. Design data-driven solutions by integrating statistical analysis, Python-based data wrangling, and visualization tools for real-world applications

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

HONOURS ELECTIVES

25ITHESCN	INFORMATION SYSTEM AUDIT	L	T	P	C
		3	0	0	4

COURSE OBJECTIVES

- To recall the fundamentals of Information Systems auditing and its process.
- To explain management control frameworks, including systems development, security, and quality assurance controls.
- To apply boundary, input, processing, database, and output controls to real application systems.
- To analyze audit evidence using software tools, code review, and testing techniques.
- To evaluate the planning, organizing, and controlling functions of managing an IS audit.

UNIT I Overview of Information System

Auditing-Conducting an Information Systems Audit - Overview & steps in an Audit.

UNIT II The Management Control Framework

Introduction - Systems Development Management Controls - Approaches to Auditing Systems Development - Normative Models of the Systems Development Process - Evaluating the Major phases in the Systems Development Process. Security Management Controls - Operations management Controls - Quality assurance Management Controls.

UNIT III The Application Control Framework

Boundary Controls - Input Controls- Processing Controls - Database Controls - Output Controls.

UNIT IV Evidence Collection and Evaluation

Audit Software - Code Review - Test Data and Code Comparison - Concurrent Auditing techniques – Interviews -Questionnaires - Control Flowcharts- Performance Management tools. Evaluating Asset Safeguarding and Data Integrity - Evaluating System Effectiveness - Evaluating System Efficiency.

UNIT V Information Systems Audit and Management

Managing the Information Systems Audit Function - Planning Function - Organizing Function - Staffing Function - Leading Function - Controlling Function - Some Features of Information Systems Auditing – Troubleshooting the Audit Service.

TEXTBOOK

1. CA. Manoj Agarwal, Information Systems Control and Audit, Fifth Edition, Bharat Law House, 2017

REFERENCES

1. David L Cannon, Timothy S Beigmann, Brandy Pamplin, Certified Information Systems Auditor Study Guide, Wiley Publications, 2011.
2. James A. Hall, Information Technology Auditing and Assurance, Fourth Edition, SouthWestern College Pub, 2015.

COURSE OUTCOMES

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

1. Illustrate the steps and overview of conducting an Information Systems audit.
2. Describe management control approaches and models used in systems development and security.
3. Implement appropriate application controls (boundary, input, processing, database, output) in system design.
4. Examine audit evidence collection methods to assess system integrity, effectiveness, and efficiency.
5. Assess and manage the IS audit function, including troubleshooting audit services.

25ITHESCN	GENERATIVE AI	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To remember the fundamentals of generative AI, deep neural networks, and probability-based generation techniques.
- To understand and explain the working of RBMs and DBNs for digit/image generation.
- To apply GAN architecture and deepfake techniques for image generation.
- To analyze LSTM-based models for text and music generation.
- To evaluate reinforcement learning approaches and generative AI applications across domains

UNIT I Introduction

Applications of AI - The rules of probability - Why use generative models? - Style transfer and image transformation - Challenges of generative models. DEEP NEURAL NETWORKS: Perceptron - Multi-layer perceptron and back-propagation - Varieties of networks: Convolution and Recursive - Networks for sequence data - Building a better optimizer.

UNIT II Digits Generation

The MNIST database - Restricted Boltzmann Machines: generating pixels with statistical mechanics - Stacking Restricted Boltzmann Machines to generate images: the Deep Belief Network. Creating RBM and DBN.

UNIT III Image Generation

The taxonomy of generative models - Generative adversarial networks - Vanilla GAN - Improved GANs - Progressive GAN - Challenges. DEEPFAKES WITH GANs: Overview - Modes of operation - Key feature set - High-level workflow - Replacement using auto-encoders - Re-enactment - Challenges.

UNIT IV Text Generation

Representing text - Text generation and LSTMs - LSTM variants and convolutions for text. COMPOSING MUSIC: Music generation - Music generation using LSTMs - Music generation using GANs

UNIT V Video Games with Generative AI

Reinforcement learning: Actions, agents, spaces, policies, and rewards. APPLICATIONS: Introduction - Finding new drugs - Solving partial differential equations - Creating videos from images - Generating recipes.

TEXTBOOKS

1. Joseph Babcock; Raghav Bali, Generative AI with Python and TensorFlow 2: Create images, text, and music with VAEs, GANs, LSTMs, Transformer models, Packt Publishing, 2021.
2. Foster, David. Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play. Germany, O'Reilly Media, 2022.

REFERENCES

1. Priyanka Singh, Hariom Singh, Generative AI Essentials: Unlocking creativity and innovation with generative AI, Bpb Publications, 2025.
2. David M. Patel, Artificial Intelligence & Generative AI for Beginners: The Complete Guide, Independently Published, 2023.

COURSE OUTCOMES

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

1. Recall core concepts of generative models and deep neural network architectures.
2. Describe how Restricted Boltzmann Machines and Deep Belief Networks generate images.
3. Build GAN-based models, including deepfakes, for image generation tasks.
4. Examine LSTM variants for generating text and composing music.
5. Assess reinforcement learning techniques and real-world applications of generative AI

25ITHESCN	PREDICTIVE ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Recall data product strategy concepts and Python-based techniques for reading, filtering, and processing data.
- Explain the working principles of Python libraries and gradient descent methods used in data processing.
- Apply Python libraries such as NumPy, Matplotlib, and BeautifulSoup for hands-on data processing and visualization.
- Analyze predictive models using regression and classification diagnostics.
- Evaluate the performance and accuracy of predictive models through practical implementation.

UNIT I Introduction

Data Product, Data Product Examples in Enterprise, Developing a Data Product Strategy

UNIT II Reading Data in Python

Reading CSV & JSON Files, Processing Structured Data in Python, Live-Coding: JSON, Extracting Simple Statistics from Datasets, Data Processing in Python -Data Filtering and Cleaning, Processing Text and Strings in Python, Processing Times and Dates in Python

UNIT III Python Libraries and Toolkits

Matrix Processing and NumPy, Introduction to Data Visualization, Introduction to Matplotlib, urllib and BeautifulSoup

UNIT IV Gradient Descent

Classification in Python, Introduction to Training and Testing, Gradient Descent in Python, Gradient Descent in TensorFlow

UNIT V Diagnostics for Data

Meaningful Predictive modelling, Regression Diagnostic, Over- and Under-Fitting, Classification Diagnostics: Accuracy and Error, Classification Diagnostics: Precision and Recall. Codebase for Evaluation and Validation, Model Complexity and Regularization, Evaluating Classifiers for Ranking.

LABORATORY/ PRACTICALS

1. Hands-on with data processing (dates, time, strings) in Python.
2. Hands-on with different Python libraries used for data visualization.
3. Hands-on with TensorFlow to understand deep neural networks.
4. Hands-on with regression diagnostics using Python.
5. Hands-on with classification diagnostics using Python.

TEXTBOOKS/SUGGESTED REFERENCES

1. <https://www.coursera.org/learn/basic-data-processing-visualization-python>
2. <https://www.coursera.org/learn/design-thinking-predictive-analytics-data-products>
3. <https://www.coursera.org/learn/meaningful-predictive-modeling>
4. Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst, Dean Abbott, 2014, Wiley.
5. Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking, Tom Fawcett, O'Reilly, 1st edition, 2013.

COURSE OUTCOMES

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

1. Explain data product development strategies and Python-based methods for reading, cleaning, and processing structured data.
2. Implement Python toolkits for data visualization and gradient descent-based classification through hands-on practicals.

3. Analyze regression and classification models to identify patterns in accuracy, precision, and recall.
4. Evaluate predictive model performance through lab exercises using diagnostic metrics such as accuracy, precision, and recall.
5. Design and develop a complete predictive modeling workflow, integrating data processing, visualization, and classification techniques to solve a real-world problem.

25ITHESCN	HETEROGENEOUS COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To recall fundamentals of parallel computing, hardware architecture, and Flynn's classification.
- To explain shared memory programming concepts using OpenMP directives and synchronization.
- To apply CUDA basics to develop GPU programs using threads, blocks, and memory handling.
- To analyze parallel patterns and algorithms implemented using CUDA.
- To evaluate alternative GPU programming platforms and heterogeneous cluster computing approaches.

UNIT I Parallel Computing Basics

Importance of Parallelism – Processes, Tasks and Threads – Modifications to Von-Neumann model – ILP – TLP – Parallel Hardware – Flynn's Classification – Shared Memory and Distributed Memory Architectures – Cache Coherence – Parallel Software – Performance – Speedup and Scalability – Massive Parallelism – GPUs – GPGPUs.

UNIT II Shared Memory Programming with OpenMP

OpenMP Program Structure – OpenMP Clauses and Directives – Scheduling Primitives – Synchronization Primitives – Performance Issues with Caches – Case Study – Tree Search.

UNIT III Programming GPUs

GPU Architectures – Data Parallelism – CUDA Basics – CUDA Program Structure – Threads, Blocks, Grids – Memory Handling.

UNIT IV Programming with CUDA

Parallel Patterns – Convolution – Prefix Sum – Sparse matrix – Vector Multiplication – Imaging Case Study.

UNIT V Other GPU Programming Platforms

Introduction to OpenCL – OpenACC – C++AMP – Thrust – Programming Heterogeneous Clusters – CUDA and MPI.

TEXTBOOKS:

1. Peter Pacheco, "Introduction to Parallel Programming", Morgan Kauffman, 2011.
2. David B. Kirk, Wen-mei W. Hwu, "Programming Massively Parallel Processors", Third Edition, Morgan Kauffman, 2016.

REFERENCES:

1. Shane Cook, "CUDA Programming – A Developer's Guide to Parallel Computing with GPUs", Morgan Kauffman, 2013.
2. B.R. Gaster, L. Howes, D.R. Kaeli, P. Mistry, D. Schaa, "Heterogeneous Computing with OpenCL 2.0", Morgan Kauffman, 2015.

COURSE OUTCOMES

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

1. List key concepts of parallelism, von-Neumann modifications, and parallel hardware types.
2. Illustrate OpenMP program structure and synchronization for shared memory systems.
3. Write CUDA programs handling threads, blocks, grids, and memory.

4. Compare parallel algorithm implementations (convolution, prefix sum, sparse matrix) on GPUs.
5. Justify the choice of GPU platforms (OpenCL, OpenACC, C++AMP, Thrust) for heterogeneous cluster computing.

25ITHESCN	AGILE SOFTWARE DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To recall iterative, evolutionary, and adaptive software development concepts.
- To explain agile manifesto principles and agile project management practices.
- To apply Scrum and Extreme Programming methodologies to software projects.
- To analyze various agile methodologies (Crystal, DSDM, FDD, Lean) to select suitable processes.
- To evaluate agile roles and testing practices, including TDD and refactoring, for quality assurance.

UNIT I Introduction

Software is new product development – Iterative development – Risk-Driven and client-driven iterative planning – Time-boxed iterative development – During the iteration, no changes from external stakeholders – Evolutionary and adaptive development - Evolutionary requirements analysis – Early “Top Ten” high-level requirements and skilful analysis – Evolutionary and adaptive planning – Incremental delivery – Evolutionary delivery – The most common mistake – Specific iterative and Evolutionary methods.

UNIT II Agile Processes

Agile development – Classification of methods – The agile manifesto and principles – Agile project management – Embrace communication and feedback – Simple practices and project tools – Empirical Vs defined and prescriptive process – Principle-based versus Rule-Based – Sustainable discipline: The human touch – Team as a complex adaptive system – Agile hype – Specific agile methods. The facts of change on software projects – Key motivations for iterative development – Meeting the requirements challenge iteratively – Problems with the waterfall.

UNIT III Agile Methodologies I

SCRUM and Extreme Programming: Method overview, Lifecycle, Work products, Roles and practices, values, Common mistakes and misunderstandings – Sample projects – Process mixtures – Adoption strategies – Fact versus fantasy – Strengths versus “Other” history.

UNIT IV Agile Methodologies II

Crystal – Dynamic Systems Development method – Feature Driven Development– Lean Development–Unified Process – EVO – How to choose a process.

UNIT V Agile Roles and Testing

Deep dive into Scrum roles - Roles in other methodologies - Testing: Creating a quality-focused culture, TDD- Refactored code: Refactoring example, Complex Test cases, Comparison of test cases, Manual, automated, Customer testing.

TEXTBOOKS

1. Craig Larman, Agile and Iterative Development – A Manager’s Guide, Pearson Education – 2004. (Unit 1, 2, 3, 4)
2. Sondra Ashmore, Kristin Runyan, Introduction to Agile Methods, Addison-Wesley. (Unit 4, 5)

REFERENCES

1. Alistair Cockburn, Agile Software Development series, 2001.
2. www.agileintro.wordpress.com/2008.
3. Elisabeth Hendrickson, Agile Testing Quality Tree Software Inc 2008.
4. Jim Highsmith, Agile Project Management, Addison-Wesley Professional, 2004.

COURSE OUTCOMES

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

1. List the principles of iterative, risk-driven, and evolutionary development.
2. Summarize the agile manifesto, principles, and agile project management practices.
3. Practice Scrum and Extreme Programming lifecycles, roles, and work products in projects.
4. Differentiate agile methodologies (Crystal, DSDM, FDD, Lean, Unified Process) to choose an appropriate approach.
5. Judge agile testing practices, including TDD and refactoring, to build a quality-focused culture.

25ITHESCN	IoT BASED SMART SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To recall IoT fundamentals, architecture, and enabling technologies.
- To explain IoT access technologies, network protocols, and 6LoWPAN concepts.
- To apply routing and application layer protocols (RPL, CoAP, MQTT) to connect IoT devices to the cloud.
- To analyze cloud, fog, and data analytics frameworks for processing IoT data.
- To evaluate smart system architectures for real-world applications like smart cities and transportation.
- To build IoT-based smart systems.

UNIT I FUNDAMENTALS OF IoT

Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT Models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT – Functional Blocks of an IoT Ecosystem – Sensors, Actuators, and Smart Objects – Open Hardware Platforms for IoT.

Suggested Activities:

- Survey of different real-world IoT applications.
- Assignments on operational principles of sensors and actuators.
- Mini project on building a smart system - Identify the sensors required for the system, connect sensors (such as temperature, pressure, light) to a suitable IoT hardware platform and take measurements.

Suggested Evaluation Methods:

- Evaluation of survey for breadth and depth - pairwise comparison.
- Quiz on sensors and actuators.
- Demonstration of practical setup on connecting sensors.

UNIT II IoT Protocols - I

IoT Access Technologies: Physical and MAC Layers, Topology and Security of IEEE 802.15.4, 1901.2a, 802.11ah and LoRaWAN – Network Layer: Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo.

Suggested Activities:

- Assignment on access technologies (a simulator could be used).
- Flipped classroom on 6LoWPAN.
- Mini project on building a smart system - Choose appropriate access technology and connect the hardware to the Internet.

Suggested Evaluation Methods:

- Quiz on access technologies.
- Quiz on 6LoWPAN.
- Demonstration of practical setup on connecting to the Internet.

UNIT III IoT Protocols - II

Routing over Low Power and Lossy Networks (RPL) – Application Transport Methods: Application Layer Not Present, Supervisory Control and Data Acquisition (SCADA) – Application Layer Protocols: CoAP and MQTT – Service discovery – mDNS.

Suggested Activities:

- Assignment on RPL (simulator could be used).
- Mini project on building a smart system - Choose appropriate application protocol and connect to the cloud using available open platforms (such as IBM Bluemix).

Suggested Evaluation Methods:

- Quiz on RPL for different topologies.
- Demonstration of practical setup on connecting to the cloud.

UNIT IV Cloud, Fog and Data Analytics Frameworks

Cloud and Fog Topologies – Cloud Services Model – Fog Computing – Structured versus Unstructured Data and Data in Motion Vs Data at Rest – Role of Machine Learning – NoSQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Security in IoT – CISCO IoT System – IBM Watson IoT Platform.

Suggested Activities:

- Use a simulator such as FogSim to study the characteristics of fog computing.
- Mini project on building a smart system - Choose appropriate analytics mechanisms to analyze the data collected and build the application.

Suggested Evaluation Methods:

- Quiz on fog characteristics.
- Demonstration of applications with analytics.

UNIT V Applications

Smart and Connected Cities: Street Layer, City Layer, Data Center Layer and Services Layer, Street Lighting, Smart Parking Architecture and Smart Traffic Control – Smart Transportation – Connected Cars.

Suggested Activities:

- Design the architecture and use cases for various smart systems (eg., agriculture, home automation, smart campus, smart hostel).
- Mini project on building a smart system - Enhance the system with additional smart features.

Suggested Evaluation Methods:

- Report and presentation on architecture solutions.
- Demonstration of complete smart system.

TEXTBOOK

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things”, CISCO Press, 2017.

REFERENCES

1. Perry Lea, “Internet of things for architects”, Packt, 2018.
2. Jan Ho“ller, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, “From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence”, Elsevier, 2014.
3. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things – Key Applications and Protocols”, Wiley, 2012.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
5. Arshdeep Bahga, Vijay Madiseti, “Internet of Things – A hands-on approach”, Universities Press, 2015

6. <https://www.arduino.cc/>
7. https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet

COURSE OUTCOMES

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

1. List IoT enabling technologies and core architectural models (oneM2M, IoTWF).
2. Illustrate IoT access technologies and 6LoWPAN-based network optimization.
3. Implement RPL routing and CoAP/MQTT protocols to connect devices to the cloud.
4. Compare cloud and fog computing frameworks for IoT data analytics.
5. Design smart system solutions for applications like smart cities, parking, and transportation.

MINOR ENGINEERING ELECTIVES

25ITMISCN	INTRODUCTION TO INFORMATION TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce and identify the fundamentals of programming languages, operating systems, and database terminology.
- To describe the basics of information technology, its role, present scenario, and multimedia concepts.
- To demonstrate the use of network concepts, internet tools, and search engines.
- To examine emerging technologies and future trends in information technology.

UNIT I

Classification of computers, computer architecture and Memory. Computer Basics-Introduction, Evolution of Computers, Generations of Computers, Classification of Computers, The Computer System, Applications of Computers. Computer organization and Architecture - Introduction, Central Processing Unit, Types of Number Systems. Computer Memory and Storage - Introduction, Memory Hierarchy. Input/Output Media - Introduction.

UNIT II

The generations of programming languages, operating systems, and Database basics. Computer Programming and Languages - Introduction, Algorithm, Programming Paradigms, characteristics of a good program, programming Languages, generations of programming Languages, Features of a Good Programming Language. Operating System - Introduction, Operating System Definition, Evolution of Operating System, Types of Operating Systems. Database Fundamentals - Introduction, database definition.

UNIT III

Information Technology and Multimedia Basics. Information Technology Basics - Introduction, Information, Technology, Information Technology, Present scenario, Role of Information Technology, Information Technology and the Internet. Multimedia: Introduction, Multimedia - definition, Multimedia Applications.

UNIT IV

The Basics of Networks, Internet and Internet Tools. Computer Networks -Computer Network, Network Topologies, Network Devices. Internet - Introduction, Evolution of Internet, Basic Internet Terms, and Getting connected to the Internet, Internet Applications. Internet Tools - Introduction, Web Browser, Browsing the Internet using Internet Explorer, E-mail Address Structure, Search engines.

UNIT V

Know the Future Trends in IT. Current and Future Trends in IT - Introduction, Electronic commerce, Electronic data interchange, Smart card, Internet protocol television, Blogging, Radio frequency identification, Emerging Technologies.

TEXTBOOKS

1. "Introduction to Information Technology", ITL Education Solutions Limited, PEARSON.

REFERENCES

1. Alexis Leon, Mathews Leon, "Fundamentals of Information Technology", Second edition, (Leon VIKAS)

COURSE OUTCOMES

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

1. List hardware, programming/DB/OS terms, IT's strategic role, data communication, and IT applications across sectors.

2. Explain hardware, programming/DB/OS basics, IT's strategic importance, data communication, and sector-wise IT applications.
3. Use hardware, apply programming/DB/OS operations and data communication tools, and solve sector-specific IT problems.
4. Analyze hardware/system setups, compare programming/DB/OS approaches, IT's strategic role, and data communication across sectors.
5. Evaluate hardware/system choices, programming/DB/OS decisions, IT's strategic value, and emerging IT trends across sectors.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Program Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	—	—	1	—	—	—	1	—	1	2	1	—
CO2	3	2	—	—	1	—	—	—	1	—	1	2	1	—
CO3	2	2	2	—	3	—	—	1	1	—	1	3	2	—
CO4	2	3	2	2	2	1	—	1	1	—	2	2	3	1
CO5	2	2	3	2	3	1	—	1	2	1	2	3	3	1

25ITMISCN	FUNDAMENTALS OF OBJECT-ORIENTED PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce the fundamental concepts of object-oriented programming.
- To describe object-oriented programming using C++ and its core features.
- To demonstrate the implementation of object-oriented concepts through C++ programs.
- To examine the challenges and design considerations involved in developing object-oriented programs.

UNIT I

Introduction: Evolution of programming methodologies - Disadvantages of conventional programming-programming paradigms.

Object-oriented programming concepts – objects – classes – methods and messages – abstraction and encapsulation – inheritance – abstract classes – polymorphism.

UNIT II

C++ Program Elements: Limitations of C – Introduction to C++ – Structure of the C++ program – Tokens - Expressions - Data types - variables - dynamic initialization - scope and lifetime of variables

Control structures: Decision-making statements – jump statement – switch case statement – looping statements.

UNIT III

Functions: Passing arguments – LValues and RValues – return by reference – default arguments – Inline functions – function overloading– const and volatile functions – static members - data hiding or encapsulation.

Classes and objects: Defining member functions, function and data members – objects and memory – static object – array of objects – objects as function arguments, friend functions, member functions and non-member functions – overloading member functions.

UNIT IV

Constructors & Destructor – default constructor – Parameterized constructors – Constructor with dynamic allocation – copy constructor – destructors.

Overloading Functions: Overloading unary operators – overloading binary operators – overloading with friend functions.

Inheritance: Introduction – public, private, and protected derivations -Types of Inheritance

UNIT V

Polymorphism and Virtual Functions: Binding in C++ –Virtual functions - Runtime polymorphism –Pure virtual functions –Abstract classes – Virtual functions in derived classes – Constructors and virtual functions – Virtual destructors – Destructors and virtual functions.

Exception Handling: Fundamentals of Exception Handling – Using Multiple catch statements – Catching All Exceptions – Rethrowing Exception – Specifying Exception - controlling uncaught Exceptions.

TEXTBOOKS

1. Ashok N. Kamthane, “Object Oriented Programming with ANSI and Turbo C++”, Pearson Edition
2. Deitel&Deitel, “C++ How to Program”, Prentice Hall, Eighth Edition, 2011.

REFERENCES

1. Eric Nagler, “Learning C++: A Hands-on Approach”, Jaiho Publishing House.
2. E Balagurusamy, “Object Oriented Programming with C++”, Tata McGraw Hill, 2nd Edition.
3. Sotter A Nicholas and Kleper J Scott, “Professional C++”, Wiley Publishing Inc.

COURSE OUTCOMES

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

1. List OOP concepts, C++ syntax, class/object terms, inheritance/polymorphism keywords, and file-handling/STL functions.
2. Explain OOP features, classes/objects, inheritance/polymorphism, templates/exceptions, and file handling/STL.
3. Implement C++ programs using classes, inheritance, polymorphism, exception handling, and file/STL operations.
4. Analyze OOP-based problems, class designs, inheritance/polymorphism strategies, and file/STL-based structures.
5. Design and develop C++ programs for real-time applications using OOP principles, exception handling, and file/STL solutions.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Program Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	—	—	1	—	—	—	1	—	1	2	1	—
CO2	3	2	—	—	1	—	—	—	1	—	1	2	1	—
CO3	2	2	2	—	3	—	—	1	1	—	1	3	2	—
CO4	2	3	2	1	2	—	—	1	1	—	2	2	3	1
CO5	2	2	3	1	3	—	—	1	2	1	2	3	3	1

25ITMISCN	DATA COMMUNICATION AND COMPUTER NETWORKS	L	T	P	C
		3	0	0	4

COURSE OBJECTIVES

- Introduce fundamental concepts, basic taxonomy, and terminology of computer networking.
- Familiarize students with layered architecture and layer functionality.
- Demonstrate information flows across nodes by selecting layer functionalities for a given application.
- Examine advanced networking concepts for higher-level study.
- Develop expertise in designing and maintaining individual networks.

UNIT I

Introduction: Introduction to Networks and Communication Media: History of Computer Networking and the Internet-Need for Networking- Uses – Network Hardware- Network Software – Reference Models – Example Networks – Network Standardization.

Basis for data communication - Transmission media – Wireless Transmission – Telephone Systems – Satellite Communication.

UNIT II

Data link layer: Layer Services– Framing - Error correction and detection – Link-level flow control – Medium Access – Ethernet – Token Ring –FDDI – Wireless LAN – Bridges and Switches.

UNIT III

Network layer: Network Layer design issues – Circuit Switching - Packet Switching - Virtual Circuit Switching – IP – ARP – DHCP – ICMP – Routing –RIP – OSPF – Subnetting – CIDR – Inter-domain Routing – BGP – IPV6 Basic Features Routing algorithms – Congestion - Control algorithms.

UNIT IV

Transport Layer: Transport Layer Services – Multiplexing and Demultiplexing – Internet Transport Protocols- UDP – Reliable Data Transfer –Connection-Oriented Transport: TCP – TCP Structure.

UNIT V

Application Layer: DNS – Namespace – Resource records – name servers – e-mail - Message Formats - Message Transfer - Final Delivery – WWW - Static Web Pages - Dynamic Web Pages and Web Applications - HTTP – Network Security-Basic Cryptography - DES - RSA.

TEXTBOOKS

1. Andrew S. Tanenbaum, “Computer Networks”, Prentice Hall of India Private Limited, (4th Edition), 2003.
2. Larry L. Peterson and Bruce S. Davie, “Computer Networks: A Systems Approach”, Elsevier, Fourth edition, 2007.

REFERENCES

1. Leon Garcia and Widjaja, Communication Networks - Fundamental concepts and key architecture, Tata McGraw Hill, 2001.
2. William Stallings, Data and Computer Communication, Sixth Edition, Pearson Education, 2000.
3. Behrouz A. Forouzan, Data Communication and Networking, Tata McGraw-Hill, 2004.

COURSE OUTCOMES

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

1. List data communication, layered architecture, data link/network/transport concepts, and application layer protocols (DNS/Email).
2. Explain data communication and layered architecture, data link error handling, network addressing, transport functions, and application layer services.
3. Apply layered architecture, data link protocols, subnet design, transport protocols, and application layer protocols for internet services.

- Analyze layer interactions, data link error control, routing-based packet flow, transport performance, and application layer security.
- Evaluate data links, assess protocol reliability, design subnetting/routing, evaluate transport efficiency, and design application layer protocols for security, Email, and DNS.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Program Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	—	—	1	—	—	—	1	—	1	2	1	—
CO2	3	2	—	—	1	—	—	—	1	—	1	2	1	—
CO3	2	2	2	—	3	—	—	1	1	—	1	3	2	—
CO4	2	3	2	2	2	1	—	1	1	—	2	2	3	1
CO5	2	2	3	2	3	1	—	1	2	1	2	3	3	1

25ITMISCN	BASICS OF COMPUTER GRAPHICS AND MULTIMEDIA					L	T	P	C
						3	0	0	3

COURSE OBJECTIVES

- To introduce the fundamental concepts and terminology of Computer Graphics, Animation, and Multimedia.
- To describe input/output devices, computing fundamentals, and general mathematical transformations used in graphics.
- To demonstrate various algorithms for drawing and filling primitive shapes.
- To examine 2D/3D transformations, clipping, and viewing techniques in computer graphics.

UNIT I

Pixel, frame, buffer, applications of computer graphics, Raster Graphics fundamentals. Display Devices– Random Scan, Raster Scan Monitors, Color CRT Monitor, DVST and Plasma Panel.

UNIT II

Graphics Primitives: Algorithms for line Generation, circle generation, Polygon generation and polygon filling algorithm, Antialiasing. 2D Transformation: Translation, Scaling, Rotation, Reflection, Homogeneous Coordinates.

UNIT III

3-D Transformation: Translation, Scaling, Rotation, windowing & clipping windows, viewport, line clipping, polygon clipping, windows & viewport transformation. Display file, Segment table, Segment creation, deletion, rename.

UNIT IV

Multimedia: Text – Font, Faces, animating Text, Hyper Text. Sound: MIDI, Digital audio basics, audio file formats, audio editing, MCI–Multimedia Control Interface. Image – Bitmap, Vector drawing, color palate, concept of 3D Modeling, Image file formats (BMP, JPG). Animation: principle of animation, cell animation, kinematics, Morphing.

UNIT V

Video – Broadcast video standards (NTSC, PAL), integrating computer and Television, video capture board, video, color, shooting and editing video, video hardware resolution, video compression (JPEG, MPEG). Hard copy devices: Printers & plotters. Input devices: mouse, Trackball, Light pen, Scanner, Digital Camera.

TEXTBOOKS

1. Rogers, "Procedural Elements of Computer Graphics", Tata McGraw Hill
2. Donald Hearn and M.P. Becker, "Computer Graphics", Pearson Pub.
3. Parekh, "Principles of Multimedia", Tata McGraw Hill

REFERENCES

1. Maurya, "Computer Graphics with Virtual Reality System", Wiley India
2. Pakhira, "Computer Graphics, Multimedia & Animation", PHI Learning
3. Andleigh, Thakral, "Multimedia System Design", PHI Learning

COURSE OUTCOMES

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

1. List hardware components, programming/DB/OS terms, IT's strategic role, and data communication and application terminology.
2. Explain hardware functions, programming/DB/OS basics, IT's strategic importance, and data communication concepts.
3. Use hardware, apply programming/DB/OS operations, and use data communication/internet tools for tasks.
4. Analyze hardware/system setups, compare programming/DB/OS approaches, and examine IT's strategic role and communication technologies.
5. Evaluate hardware/system choices, programming/DB/OS decisions, and emerging IT applications/trends across sectors.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Program Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	—	—	1	—	—	—	1	—	1	2	1	—
CO2	3	2	—	—	1	—	—	—	1	—	1	2	1	—
CO3	2	2	1	—	3	—	—	1	1	—	1	3	2	1
CO4	2	3	2	1	2	—	—	1	1	—	2	2	3	1
CO5	2	2	3	1	3	1	—	1	2	1	3	2	3	2

25ITMISCN	INFORMATION SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce various information security concerns, vulnerabilities, and terminology.
- To describe protection and authentication mechanisms and database security issues.
- To demonstrate the use of protection methods against different network threats.
- To examine and manage security risks in a network.

UNIT I

Introduction: Security - Threats - Harm - Attacks - Computer criminals - Methods of defence.
Program Security: Secure Programs - Non-malicious program errors - Viruses and other malicious code - Targeted malicious code - Controls against program threats

UNIT II

Operating System Security: Protected objects and methods of protection - Memory address protection - Control of access to general objects - File protection mechanism - Authentication: Authentication basics - Password - Challenge-response - Biometrics

UNIT III

Database Security: Security Requirements - Reliability and integrity - Sensitive data – Interface - Multilevel database - Proposals for multilevel security

UNIT IV

Security in Networks: Threats in networks - Network security control - Firewalls - Intrusion detection systems - Secure e - mail - Networks and cryptography - Example protocols: PEM - SSL - IPsec.

UNIT V

Management and Incidents: Security planning - Risk analysis - Organizational security policies - Physical security - Legal - Privacy - Ethical Issues in Computer Security - Protecting programs and data - Information and law - Rights of employees and employers - Software failures - Computer crime - Privacy - Ethical issues in computer society - Case studies of ethics.

TEXTBOOKS

1. C. P. Pfleeger and S. L. Pfleeger, “Security in Computing”, Pearson Education, 5th Edition, 2015.
2. Matt Bishop, “Computer Security: Art and Science”, Pearson Education, 2005

REFERENCES

1. Stallings, “Cryptography and Network Security: Principles and Practice”, 5th Edition, 2011.
2. Kaufman, Perlman, and Speciner, “Network Security”, Prentice Hall, 3rd Edition, 2005.
3. Eric Maiwald, “Network Security: A Beginner’s Guide”, TMH, 1999.
4. Macro Pistoia, “Java Network Security”, Pearson Education, 2nd Edition, 1999.
5. Whitman, Mattord, “Principles of information security”, Thomson, 2nd Edition, 2005

COURSE OUTCOMES

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

1. List security concerns, vulnerabilities, attack types, database security issues, network threats, and organizational risk factors.
2. Explain security vulnerabilities, system attacks, database security concepts, network threats, and risk management principles.
3. Apply protection against system attacks, secure databases, mitigate network threats, and implement risk management practices.
4. Analyze attack patterns, database security weaknesses, network threats, and organizational risk exposure.
5. Evaluate security measures, design secure databases, assess network strategies, and develop organizational risk management plans.

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

25ITMISCN	FUNDAMENTALS OF DATA MINING	L	T	P	C
		3	0	0	4

COURSE OBJECTIVES

- List data mining basics, preprocessing, similarity/dissimilarity measures, association rules, and classification/clustering terms.
- Explain data mining fundamentals, preprocessing needs, similarity techniques, association rules, and classification/clustering approaches.
- Apply preprocessing methods, similarity measures, association rule mining, and classification/clustering algorithms.
- Analyze preprocessing effectiveness, similarity techniques, association rule algorithms, and classification/clustering performance.
- Evaluate preprocessing strategies, similarity-based solutions, association rule algorithms, and classification/clustering models.

UNIT I

Introduction: Why Data Mining? What Is Data Mining? What Kinds of Data Can Be Mined? What Kinds of Patterns Can Be Mined? Which Technologies Are Used? Which Kinds of Applications Are Targeted? Major Issues in Data Mining. Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity

UNIT II

Data Preprocessing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization

UNIT III

Classification: Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Working of Decision Tree, building a decision tree, methods for expressing attribute test conditions, measures for selecting the best split, Algorithm for decision tree induction. Alternative Techniques, Bayes' Theorem, Naïve Bayesian Classification, Bayesian Belief Networks

UNIT IV

Association Analysis: Basic Concepts and Algorithms: Problem Definition, Frequent Item Set generation, Rule generation, compact representation of frequent item sets, FP-Growth Algorithm. (Tan & Vipin)

UNIT V

Cluster Analysis: Basic Concepts and Algorithms: Overview: What Is Cluster Analysis? Different Types of Clustering, Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means Additional Issues, Bisecting K-means, Strengths and Weaknesses; Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm; DBSCAN: Traditional Density Center-Based Approach, DBSCAN Algorithm, Strengths and Weaknesses. (Tan & Vipin)

TEXTBOOKS

1. Pang-Ning Tan & Michael Steinbach, Vipin Kumar, "Introduction to Data Mining", Pearson.
2. Jiawei Han, Michel Kamber, "Data Mining: Concepts and Techniques", 3rd Edition, Elsevier.

REFERENCES

1. Hongbo Du, "The Data Mining Techniques and Applications: An Introduction", Cengage Learning.
2. Vikram Pudi and P. Radha Krishna, "Data Mining", Oxford.
3. Mohammed J. Zaki, Wagner Meira, "Data Mining and Analysis – Fundamental Concepts and Algorithms", Oxford
4. Alex Berson, Stephen Smith, "Data Warehousing Data Mining & OLAP", TMH.

COURSE OUTCOMES

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

1. Recall data mining basics, preprocessing, similarity/dissimilarity measures, association rules, and classification/clustering terms.
2. Explain data mining fundamentals, preprocessing needs, similarity techniques, association rules, and classification/clustering methods.
3. Implement preprocessing techniques, similarity measures, association rule mining, and classification/clustering algorithms.
4. Compare preprocessing effectiveness, similarity techniques, and association rule/classification/clustering algorithm performance.
5. Assess preprocessing strategies, and design/evaluate similarity-based, association rule, and classification/clustering solutions.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Program Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	—	—	1	—	—	—	1	—	1	1	2	—
CO2	3	2	—	1	1	—	—	—	1	—	1	1	2	—
CO3	2	2	2	2	3	—	—	1	1	—	1	2	3	—
CO4	2	3	2	3	2	—	—	1	1	—	2	2	3	1
CO5	2	2	3	3	3	1	—	1	2	1	2	2	3	1

ONE CREDIT COURSES

25ITOCSCN	OFFICE AUTOMATION TOOLS LAB	L	T	P	C
		0	1	0	1

COURSE OBJECTIVES

- Understand the concepts, features, and applications of MS Word, MS Excel, and MS PowerPoint for documentation, data processing, and presentations.
- Use Microsoft Office tools to create, format, analyze, and present information effectively.
- Analyze documents, spreadsheets, and presentations using appropriate tools, functions, and design techniques.
- Evaluate the quality and effectiveness of documents, spreadsheets, and presentations using standard practices.
- Design professional documents, analytical spreadsheets, and multimedia presentations using advanced Microsoft Office features.

LIST OF EXPERIMENTS

MS WORD

1. Create and format a document
2. Working with tables
3. Working with Bullets and Lists
4. Working with styles, shapes, smart art, charts
5. Inserting objects, charts and importing objects from other office tools
6. Creating and using document templates
7. Inserting equations, symbols and special characters
8. Working with Table of Contents and References, citations
9. Insert and review comments
10. Create bookmarks, hyperlinks, endnotes, footnotes
11. Viewing documents in different modes
12. Working with document protection and security
13. Inspect document for accessibility
14. Mail merge

MS EXCEL

1. Create worksheets, insert and format data
2. Work with different types of data: text, currency, date, numeric, etc.
3. Split, validate, consolidate, and convert data
4. Sort and filter data
5. Perform calculations and use functions (Statistical, Logical, Mathematical, Date, Time, etc.)
6. Work with Lookup and reference formulae
7. Create and work with different types of charts
8. Use pivot tables to summarize and analyse data
9. Perform data analysis using own formulae and functions
10. Combine data from multiple worksheets using own formulae and built-in functions to generate results
11. Export data and sheets to other file formats
12. Working with macros
13. Protecting data and securing the workbook

MS POWERPOINT

1. Select slide templates, layout and themes
2. Formatting slide content and using bullets and numbering
3. Insert and format images, SmartArt, tables, charts
4. Using Slide master, notes and handout master
5. Working with animation and transitions

6. Organize and Group slides
7. Import or create and use media objects: audio, video, animation
8. Perform slideshow recording, narration and creating presentable videos

COURSE OUTCOMES

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

1. Create and format professional documents using MS Word.
2. Analyze and visualize data using MS Excel.
3. Design effective multimedia presentations using MS PowerPoint.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Program Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	–	3	–	–	–	3	–	1	2	2	–
CO2	2	2	2	1	3	–	–	–	2	–	1	2	3	–
CO3	2	1	2	–	3	–	–	1	3	1	1	2	2	1

25ITOCSCN	SOCIALLY RELEVANT PROJECT LAB				L	T	P	C
					0	1	0	1

COURSE OBJECTIVES

- Understand software engineering concepts, development, testing, and modern technologies.
- Apply software engineering principles to develop software solutions.
- Analyze requirements, design, implementation, and testing strategies.
- Evaluate software solutions for quality, usability, and societal impact.
- Design and implement innovative software solutions for real-world problems.

Students are expected to take up problems that would directly benefit society and design and implement an IT-based solution for the problem, based on the courses undertaken up to that semester. The domains of the problems may reach out to sectors like, but not limited to, Energy, Education, Material, Environment, Telecommunications, Defence, Healthcare, Entertainment and Agriculture. The societal value of the project is to be evaluated based on the need of the hour and requests from stakeholders. The evaluation of the project would be based on the usefulness of the problem statement, formulation of the problem, stakeholders' needs, and the usage statistics of the solution and the technical merit of the solution.

The project design, development and testing phases can be as shown below:

REQUIREMENTS ENGINEERING PHASE:

- Problem identification.
- Feasibility study of the domain.
- Requirement elicitation and analysis.

DESIGN PHASE:

- Architectural design.
- UI design.
- Component Design.
- Database design.

IMPLEMENTATION PHASE:

- Coding in a suitable language using necessary platforms and tools.

TESTING AND VALIDATION PHASE:

- Component Testing

- System Testing
- Acceptance Testing

REFERENCES:

1. <https://www.niti.gov.in/>.
2. <https://www.sih.gov.in/>.

COURSE OUTCOMES

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

1. Analyze societal problems and identify appropriate technical solutions.
2. Design, develop, and implement software solutions for societal needs.
3. Design and implement software solutions using software engineering methodologies to address real-world societal problems.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Program Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	2	2	2	3	2	1	1	–	2	2	2	2
CO2	3	2	3	2	3	2	1	2	1	1	2	3	3	2
CO3	3	3	3	3	3	2	2	2	2	2	2	3	3	3

25ITOCSCN	PROFESSIONAL COMMUNICATION	L	T	P	C
		0	1	0	1

COURSE OBJECTIVES

- Understand employability, communication, aptitude, and professional skills.
- Apply communication, interpersonal, and professional skills in workplace scenarios.
- Analyze career opportunities, workplace situations, and personal strengths.
- Evaluate professional performance and interview strategies for improvement.
- Develop a career plan using employability and leadership skills.

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. Globe Arena 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. Orient Blackswan: Hyderabad, 2016.
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. S. Hariharan et al. Soft Skills. MJP Publishers: Chennai, 2010.

COURSE OUTCOMES

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

1. Explain the fundamentals of verbal and non-verbal communication, presentation techniques, and workplace soft skills.
2. Deliver effective presentations using appropriate content structuring, body language, and audio-visual aids.
3. Participate confidently and analyze group dynamics during group discussions to build consensus and leadership.
4. Demonstrate successful interview skills through resume preparation, self-introduction, and structured responses to interview questions.
5. Apply essential workplace soft skills such as teamwork, time management, and professional etiquette, and evaluate their relevance to career readiness.

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

25ITOCSCN	WEB AND SOCIAL MEDIA ANALYTICS LAB	L	T	P	C
		0	1	0	1

COURSE OBJECTIVES

- Understand the concepts, techniques, and applications of web and social media analytics.
- Apply web and social media analytics tools and techniques to collect and process data.
- Analyze web and social media data to identify trends, patterns, and user behavior.
- Evaluate analytical methods and results to support effective decision-making.
- Design analytics-based solutions for extracting meaningful insights from web and social media data.

LIST OF EXPERIMENTS

1. Preprocessing text documents using NLTK in Python
 - a. Stopword elimination
 - b. Stemming
 - c. Lemmatization
 - d. POS tagging
 - e. Lexical analysis

2. Sentiment analysis on customer reviews of products
3. Web analytics
 - a. Web usage data (web server log data, clickstream analysis)
 - b. Hyperlink data
4. Search engine optimization- implement spamdexing
5. Use Google Analytics to implement the following
 - a. Conversion Statistics
 - b. Visitor Profiles
6. Use Google Analytics tools to implement the Traffic Sources.

RESOURCES

1. Stanford core NLP package
2. GOOGLE.COM/ANALYTICS

TEXTBOOKS:

1. Ramesh Sharda, Dursun Delen, Efraim Turban, “Business Intelligence and Analytics: Systems for decision support”, Pearson Education.

REFERENCE BOOKS:

1. Rajiv Sabherwal, Irma Becerra- Fernandez,” Business Intelligence –Practice, Technologies and Management”, John Wiley, 2011.
2. Lariss T. Moss, Shaku Atre, “Business Intelligence Roadmap”, Addison-Wesley IT Service.
3. Yuli Vasiliev, “Oracle Business Intelligence: The Condensed Guide to Analysis and Reporting”, SPD Shroff, 2012.

COURSE OUTCOMES

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

1. Apply NLP techniques for text analytics.
2. Analyze sentiment using social media analytics.
3. Apply SEO and web analytics techniques.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Program Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	–	–	–	1	–	2	3	3	–
CO2	2	3	2	2	3	–	–	–	1	–	2	3	3	–
CO3	2	2	2	1	3	–	–	–	1	–	2	2	3	1

25ITOCSCN	HARDWARE AND TROUBLESHOOTING LAB	L	T	P	C
		0	1	0	1

COURSE OBJECTIVES

- Recognize computer components, storage devices, operating systems, and administration concepts.
- Perform system configuration, software installation, and maintenance tasks.
- Diagnose hardware, software, and system-related issues.
- Assess system performance and select suitable troubleshooting methods.
- Configure and maintain reliable computer systems using appropriate tools.

LIST OF EXPERIMENTS

1. (a) Recognition of all external connections of a computer
(b) Tools needed to open and clean the computer cabinet

2. (a) Preassembling the computer
(b) Replacing the various components of the computer
3. Preassembling and cleaning the keyboard
4. Changing the BIOS setup
5. (a) Understanding the physical and logical organization of HDD
(b) Replacing and installing the HDD
6. Partition and format the hard disk in Windows
7. Hardware Installation on a PC
8. (a) Installation of operating system
(b) Installation of antivirus software
(c) Installation of software

COURSE OUTCOMES

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

1. Describe computer hardware, storage, and system components.
2. Troubleshoot, repair, and maintain computer systems.
3. Configure operating systems, software, and network connectivity.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Program Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	2	–	–	–	1	–	2	3	2	–
CO2	3	3	2	2	3	1	–	1	1	–	2	3	3	–
CO3	3	2	3	1	3	1	–	1	1	–	2	3	3	1

25ITOCSCN	ADOBE EXPERIENCE MANAGER LAB	L	T	P	C
		0	1	0	1

COURSE OBJECTIVES

- Understand the concepts and features of Adobe Flash, Illustrator, Photoshop, Dreamweaver, and InDesign.
- Apply Adobe tools to create animations, graphics, image edits, web pages, and publications.
- Analyze design requirements to select appropriate Adobe tools and techniques.
- Evaluate digital designs based on quality, usability, creativity, and visual appeal.
- Design professional multimedia, graphics, web pages, and print publications using Adobe applications.

LIST OF EXPERIMENTS

FLASH ANIMATION

1. The Flash Screen
2. Creating Animations
3. Animating Along a Path
4. Creating a Bouncing Ball
5. Creating Orbits
6. Fixed Point Animations
7. Shape Tweening
8. Using Masks
9. Movie Clips
10. Invisible Buttons

COMPUTER GRAPHICS

1. Using Drawing Tools

2. Editing Objects
3. Adding Text to Designs
4. Formatting Text in Designs
5. Creating an Office Design
6. Creating a Backyard Design
7. Creating a House Plan

PHOTO EDITING

1. Selecting Parts of Images
2. Displaying Just the Car
3. Adjusting Image Sizes
4. Saving Files for the Web
5. Aligned Cloning
6. Unaligned Cloning
7. The Red Eye Effect
8. Enhancing Skin Complexion
9. Sharpening the Eyes
10. Creating a Brick Wall
11. Adding Distorted Text
12. Adding Three-Dimensional Effects
13. Adding a Custom Shape

WEBPAGE AUTHORIZING

1. Creating a Home Page
2. Using Tables
3. Creating a Template
4. Creating Pages from the Template
5. Linking Pages
6. Creating Forms
7. Email and Other Site Links
8. Anchor Links
9. Enhancing Web Pages
10. More Detailed Page Layouts

DESKTOP PUBLISHING

1. Creating a Flyer
2. Creating a Greeting Card
3. Creating Restaurant Menus
4. Creating Tables
5. Creating Newsletters
6. Publicity Pamphlets

COURSE OUTCOMES

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

1. Create animations and graphics using Adobe Flash and Illustrator.
2. Edit and enhance digital content using Adobe Photoshop.
3. Develop web pages and desktop publications using Adobe Dreamweaver and InDesign.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Program Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	1	3	—	—	1	2	—	2	2	3	—
CO2	2	2	2	1	3	—	—	—	1	—	2	2	3	—
CO3	2	2	3	2	3	1	—	1	2	1	2	3	3	1

25ITOCSCN	MOBILE APPLICATION DEVELOPMENT LAB	L	T	P	C
		0	1	0	1

COURSE OBJECTIVES

- Understand mobile platforms, tools, architectures, and development concepts.
- Apply programming skills and SDK tools to develop mobile applications.
- Analyze mobile application requirements, designs, and development approaches.
- Evaluate mobile applications for performance, usability, and compatibility.
- Design and develop mobile applications using modern frameworks and technologies.

LIST OF EXPERIMENTS

1. Survey of Mobile Application Development Tools.
2. Form design for mobile applications using a layout manager.
3. Develop mobile Applications using GUI controls.
4. Graphical and Multimedia applications.
5. Data retrieval applications.
6. Networking applications.
7. Develop a native application that uses GPS location information.
8. Gaming applications. (Perform the experiments from 2 to 7 in J2ME and Android SDK framework)
9. Micro browser-based applications using WAP, WML and WML scripts. (Perform experiments in 8 using Sun Java Wireless toolkit)
10. Create a mobile application development tool
11. Develop the gaming Applications by use of Forms, Controls, Graphical and multimedia, Data retrieval Applications.

REFERENCES

1. Prof. C. Mallika, "Mobile Application Development Laboratory Manual"
2. Reto Meier, "Professional Android 4 Application Development", 3rd Edition
3. Zigurd Mennieks, "Programming Android Java Programming for the New Generation of Mobile Devices"
4. <https://developer.android.com/guide/>
5. <https://www.tutorialspoint.com/android/>

COURSE OUTCOMES

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

1. Understand mobile platforms, architectures, tools, and development concepts.
2. Develop Android applications using SDK, layouts, multimedia, and data handling techniques.
3. Analyze mobile application design, requirements, and performance aspects.
4. Evaluate mobile applications based on usability, functionality, and compatibility.
5. Design and implement mobile, games, GPS, and data-driven applications.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Program Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	2	–	–	–	1	–	2	3	2	–
CO2	3	2	3	1	3	–	–	1	1	–	2	3	3	1
CO3	2	3	2	2	3	–	–	–	1	–	2	3	3	–

VALUE ADDED COURSES

25EINTVAC01	WEB DEVELOPMENT	L	T	P	C
		3	0	0	0

COURSE OBJECTIVES

- To understand the fundamentals of web technologies, Internet concepts, and web design principles.
- To develop responsive web pages using HTML, CSS, and styling techniques.
- To apply JavaScript and XML to build interactive and dynamic web applications.
- To utilize PHP for server-side scripting, form processing, and session management.
- To design and implement database-driven web applications using PHP and MySQL

UNIT I

Introduction: Concept of WWW, Internet and WWW, HTTP Protocol: Request and Response, Web browser and Web servers, Features of latest version of Web.

Web Design: Concepts of effective web design, Web design issues including Browser, Bandwidth and Cache, Display resolution, Look and Feel of the Website, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing effective navigation.

UNIT II

HTML: Basics of HTML, formatting and fonts, commenting code, color, hyperlink, lists, tables, images, forms, XHTML, Meta tags, Character entities, frames and frame sets, Browser architecture and website structure. Overview and features of the latest version of HTML.

Style sheets: Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating text, using fonts, borders and boxes, margins, padding, lists, positioning using CSS, CSS2, Overview and features of the latest version of CSS.

UNIT III

JavaScript: Client-side scripting with JavaScript, variables, functions, conditions, loops and repetition, pop-up boxes, Advanced JavaScript: JavaScript and objects, JavaScript own objects, the DOM and web browser environments, Manipulation using DOM, forms and validations, DHTML: Combining HTML, CSS and JavaScript, Events and buttons.

UNIT IV

XML: Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, using XML with applications. Transforming XML using XSL and XSLT.

PHP: Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, strings, Form processing, Files, advanced features: Cookies and Sessions

UNIT V

HP and MySQL: Basic commands with PHP examples, Connection to server, creating a database, selecting a database, listing databases, listing table names, creating a table, inserting data, altering tables, queries, deleting a database, deleting data and tables, phpMyAdmin and database bugs.

TEXTBOOKS

1. Ralph Moseley and M. T. Savaliya, Developing Web Applications, Wiley-India Private Limited, 2011.
2. Robert W. Sebesta, Programming the World Wide Web, 7th edition, Pearson Education, 2013.

REFERENCES

1. Kogent Learning Solutions Inc., Web Technologies Black Book, Dreamtech Press, 2009.
2. Joel Sklar, Principles of Web Design, Cengage Learning, 6th Edition, 2015.
3. B. M. Harwani, Developing Web Applications in PHP and AJAX, Tata McGraw-Hill, 2010.
4. Internet and World Wide Web: How to Program, Paul J. Deitel, Harvey M. Deitel, and Abbey Deitel, 5th Edition, Pearson Education, 2011.

COURSE OUTCOMES

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

1. Explain the concepts of web technologies, web design, scripting, XML, and database management.
2. Apply HTML, CSS, JavaScript, PHP, XML, and MySQL to build dynamic web applications.
3. Analyze web design principles, scripting techniques, and database interactions for web development.
4. Evaluate web applications based on usability, performance, security, and validation techniques.
5. Design and develop secure, interactive, and database-driven web applications using modern web technologies.

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

25EINTVAC02	MOBILE APPLICATION DEVELOPMENT					L	T	P	C
						3	0	0	0

COURSE OBJECTIVES

- To understand the fundamentals of mobile application development and Android architecture.
- To develop mobile applications using Android frameworks and UI design principles.
- To apply databases, cloud services, and mobile technologies in application development.
- To implement Android applications using device features and development tools.
- To deploy mobile applications using modern testing, debugging, and publishing techniques.

UNIT I Introduction

Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications

UNIT II Basic Design

Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software-related – Architecting mobile applications – User interfaces for mobile applications – Touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability.

UNIT III Advanced Design

Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

UNIT IV Technology I - Android

Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server-side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.

UNIT V Work, Development and Deployment

Work with Android system Text-to-Speech, Camera, Taking Picture with Camera, Manage Bluetooth Connection, Monitor and Manage Wi-Fi, Accelerometer Sensor & Gyroscope. Delvik Debug Tool, Logcat, Emulator Control, Device Control, Work with ADB, Connect Real Devices, Execute Application on Real Device, Publish your application.

REFERENCES

1. <http://developer.android.com/develop/index.html>
2. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012
3. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", DreamTech, 2012
4. James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012
5. Pradeep Kothari, "Android Application Development Black Book", DreamTech
6. Wei Meng Lee, "Beginning Android 4 Application Development", Wrox
7. Lauren Darcey, Shane Conder, "Android Wireless Application Development", Pearson U

COURSE OUTCOMES

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

1. Explain the concepts of mobile application development, Android architecture, design principles, and deployment methods.
2. Apply Android frameworks, UI design, databases, and mobile technologies to develop applications.
3. Analyze mobile application requirements, architecture, integration techniques, and deployment strategies.
4. Evaluate mobile applications based on performance, usability, security, and quality constraints.
5. Design, develop, and deploy Android mobile applications using modern frameworks and device technologies.

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

25EINTVAC03	BIG DATA TECHNOLOGIES	L	T	P	C
		3	0	0	0

COURSE OBJECTIVES

- To understand the fundamentals of mobile application development.
- To develop mobile applications using Android frameworks.
- To apply UI design and mobile technologies.
- To implement Android applications using device features.
- To deploy mobile applications using modern tools

UNIT I

Fundamentals of Big Data – Big Data Types – Basics of Distributed Computing – Big Data Technology Components – MapReduce Fundamentals - Defining Big Data Analytics – A Brief History of Hadoop - The Hadoop Foundation and Ecosystem.

UNIT II

The Hadoop Distributed File System: The Design of HDFS - HDFS Concepts - The Command-Line Interface - Hadoop Filesystems - The Java Interface - Data Flow. Setting Up a Hadoop Cluster: Cluster Specification - Cluster Setup and Installation - SSH Configuration - Hadoop Configuration - YARN Configuration

UNIT III

MapReduce: Analyzing the Data with Hadoop - Scaling Out - Hadoop Streaming - Hadoop Pipes. Developing a MapReduce Application: The Configuration API - Configuring the Development Environment - Writing a Unit Test - Running Locally on Test Data - Running on a Cluster - Tuning a Job - MapReduce Workflow - Anatomy of a MapReduce Job Run - Failures - Job Scheduling - Shuffle and Sort -Task Execution

UNIT IV

Pig: Installing and Running - An Example - Pig Latin - User-Defined Functions - Pig in Practice. Hive - Installing Hive - An Example - Running Hive - Comparison with Traditional Databases. HiveQL - Tables - Querying Data - User-Defined Functions- HBase: Basics - Concepts - Installation - Clients – Example

UNIT V

ZooKeeper: Installing and Running ZooKeeper - An Example - The ZooKeeper Service - Building Applications with ZooKeeper

Sqoop: Getting Sqoop - A Sample Import - Generated Code - Database Imports - Working with Imported Data - Importing Large Objects - Performing an Export.

Case Studies: Hadoop Usage at Last.fm - Hadoop and Hive at Facebook - Nutch Search Engine - Log Processing at Rackspace

TEXTBOOKS

1. Tom White, “Hadoop: The Definitive Guide”, 3rd Edition, O’reilly, 2012.
2. Judith Hurwitz, Alan Nugent, Fern Halper, and Marcia Kaufman, *Big Data for Dummies, First Edition*, For Dummies, 2013.

REFERENCES

1. Boris Lubinsky, Kevin T. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, 2015.
2. Borko Furht and Flavio Villanustre, “*Big Data Technologies and Applications*”, First Edition, Springer Publishing Company, Incorporated, 2016

COURSE OUTCOMES

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

1. Explain mobile application development concepts, design principles, and deployment strategies.
2. Apply Android frameworks and development tools to build mobile applications.
3. Analyze mobile application design, user interfaces, and integration techniques.
4. Evaluate mobile applications based on performance, usability, security, and deployment.
5. Design and develop Android mobile applications using modern frameworks and technologies.

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

25EINTVAC04	FOUNDATION OF DATA SCIENCE	L	T	P	C
		3	0	0	0

COURSE OBJECTIVES

- To understand the fundamentals of data science and data analytics.
- To apply SQL, NoSQL, and data preprocessing techniques for data analysis.
- To analyze data using text mining and natural language processing techniques.
- To utilize Python libraries for data analysis and visualization.
- To develop data-driven solutions using modern analytics and visualization tools.

UNIT I

Need for Data Science – What is Data Science - Data Science Process – Business Intelligence and Data Science – Prerequisites for a Data Scientist – Tools and Skills required.

UNIT II

Structured Query Language (SQL): Basic Statistics, Data Munging, Filtering, Joins, Aggregation, Window Functions, Ordered Data, preparing No-SQL: Document Databases, Wide-column Databases and Graph Databases. Analytics for Data Science – Examples of Data Analytics – Data Analytics Lifecycle: Data Discovery, Data Preparation, Model Planning, Model Building, Communicate Results.

UNIT III

Major Text Mining Areas – Information Retrieval – Data Mining – Natural Language Processing (NLP) – Text analytics tasks: Cleaning and Parsing, Searching, Retrieval, Text Mining, Part-of-Speech Tagging, Stemming, Text Analytics Pipeline. NLP: Major components of NLP, stages of NLP, and NLP applications.

UNIT IV

Python for Data Science –Python Libraries – Data Frame Manipulation with NumPy and pandas – Exploratory Data Analysis – Time Series Dataset – Clustering with Python – Dimensionality Reduction. Python Integrated Development Environments (IDE) for Data Science.

UNIT V

Handling Vectors and Matrices: Multiplication, Transpose, Random Matrix creation, Eigenvectors and Eigenvalues, Determinants. Arithmetic Operations – Set Operations – Plotting Data. Tableau Introduction – Dimensions, Measures, Descriptive Statistics, Basic Charts, Dashboard Design Principles, Special Chart Types, Integrate Tableau with Google Sheets.

TEXTBOOK

1. Sanjeev Wagh, Manisha Bhende, Anuradha Thakare, Fundamentals of Data Science, CRC Press, 1st Edition, 2022.

REFERENCES

1. Avrim Blum, John Hopcroft, Ravindran Kannan, “Foundations of Data Science”, Cambridge University Press, First Edition, 2020.
2. Joel Grus, “Data Science from Scratch: First Principles with Python”, O’Reilly Media, 1st Edition, 2015.
3. Ani Adhikari and John DeNero, Computational and Inferential Thinking: The Foundations of Data Science, GitBook, 2019.

COURSE OUTCOMES

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

1. Explain the principles of data science, analytics, text mining, Python, and data visualization techniques.
2. Apply SQL, NoSQL, Python libraries, analytical methods, and visualization tools to process and analyze data.
3. Analyze data science workflows, text analytics, machine learning techniques, and data visualization for effective decision-making.
4. Evaluate data processing methods, analytical models, and visualization techniques using modern data science tools.
5. Design and develop data-driven solutions using SQL, Python, analytics, and visualization techniques.

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

25EINTVAC05	INTRODUCTION TO CYBER SECURITY	L	T	P	C
		3	0	0	0

COURSE OBJECTIVES

- To understand the fundamentals of network security and cybersecurity concepts.
- To apply security principles, cryptography, and threat detection techniques.
- To analyze attacker techniques, fraud methods, and system vulnerability.
- To utilize security mechanisms for protecting networked systems.
- To develop secure network solutions using modern security practices and mitigation techniques

UNIT I

Network and Security Concepts: Information Assurance Fundamentals- Authentication, Authorization, Nonrepudiation, Confidentiality, Integrity, Availability.

UNIT II

Attacker Techniques and Motivations: How Hackers Cover Their Tracks (Antiforensics), Tunneling Techniques - HTTP, DNS, ICMP, Intermediaries, Steganography and Other Concepts, Detection and Prevention

UNIT III

Basic Cryptography, Symmetric Encryption, Public Key Encryption, Firewalls. Microsoft Windows Security Principles: Windows Tokens, Windows Messaging, Windows Program Execution.

UNIT IV

Fraud Techniques and Threat Infrastructure: Phishing, Smishing, Vishing, Mobile, Malicious Code, Rogue Antivirus, Click Fraud, Botnets, Fast-Flux, Advanced Fast-Flux.

UNIT V

Exploitation Techniques to Gain a Foothold: Shellcode, Integer Overflow Vulnerabilities, Stack-Based Buffer Overflows, Format String Vulnerabilities, SQL Injection, Malicious PDF Files, Race Conditions.

TEXTBOOK

1. James Graham, Richard Howard, Ryan Olson, "CYBER SECURITY ESSENTIALS", CRC Press, Taylor & Francis Group, 2011.

REFERENCES

1. MarttiLehto, PekkaNeittaanmäki, "Cyber Security: Analytics, Technology and Automation",
2. Springer-Intelligent Systems, Control and Automation: Science and Engineering-Volume 78, 2015.

WEB REFERENCES

1. <https://www.coursera.org/learn/intro-cyber-security-business>

COURSE OUTCOMES

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

1. Explain the fundamentals of network security, cryptography, cyber threats, and system vulnerabilities.
2. Apply security principles, cryptographic techniques, and threat detection methods to secure networked systems.
3. Analyze attacker techniques, fraud methods, vulnerabilities, and exploitation techniques to assess security risks.
4. Evaluate security mechanisms, defense strategies, and vulnerability mitigation techniques for secure systems.
5. Design and implement secure network solutions using modern security practices and threat mitigation techniques

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