VELAMMAL

COLLEGE OF ENGINEERING AND TECHNOLOGY, MADURAI – 625009.
(Autonomous)

(Accredited by NAAC with 'A' Grade and by NBA for 6 UG Programmes)

(Approved by AICTE and affiliated to Anna University, Chennai)

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

REGULATIONS – 2025

CURRICULUM and SYLLABUS

SEMESTER – I - IV

VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY, MADURAI-625009

(Autonomous)

REGULATIONS - 2025

B.Tech.- ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

CURRICULUM FOR SEMESTERS I TO IV

SEMESTER – I

Sl. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1.	IP25C01	Induction Programme *(Common to all B.E./B.Tech. Programmes)*	-	0	0	0	0
THEORY							
2.	EN25C01	Technical English *(Common to all B.E./B.Tech. Programmes)*	HSMC	3	0	0	3
3.	MA25C01	Linear Algebra and Calculus *(Common to B. Tech. AI&DS & B. E. CSE(CS))*	BSC	3	1	0	4
4.	PH25C01	Engineering Physics *(Common to B.Tech. AI&DS, IT and B.E. CSE, CSE(CS), ECE, EEE, VLSI and Civil)*	BSC	3	0	0	3
5.	CH25C01	Engineering Chemistry *(Common to all B.E./B.Tech. Programmes)*	BSC	3	0	0	3
6.	CS25C01	Problem solving using C programming *(Common to B.Tech. AI&DS, IT and B.E. CSE, CSE(CS), ECE, EEE,VLSI and Civil)*	ESC	3	0	0	3
7.	ME25C01	Engineering Graphics and Design *(Common to B.Tech. AI&DS, IT and B.E. CSE, CSE(CS), EEE,VLSI and Mech)*	ESC	2	0	2	3
8.	TA25C01	Heritage of Tamils / தமிழர் மரபு *(Commorto all B.E./B.TechProgrammes)*	HSMC	1	0	0	1
PRACTICAL COURSES							
9.	CS25C02	Programming in C Laboratory *(Common to B.Tech. AI&DS, IT and B.E. CSE, CSE(CS), ECE, EEE,VLSI and Civil)*	ESC	0	0	4	2
10.	PC25C01	Physics and Chemistry Laboratory *(Common to all B.E./B.Tech. Programmes)*	BSC	0	0	4	2
Total Credits							**24**

SEMESTER – II

Sl. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
THEORY							
1.	MA25C03	Probability and Statistics *(Common to B.Tech. AI&DS and B.E. CSE(CS))*	BSC	3	1	0	4
2.	PH25C02	Physics for Information Science *(Common to B.Tech. AI&DS, IT, B.E. CSE & CSE(CS))*	BSC	3	0	0	3
3.	EE25201	Digital Electronics and Measurements	ESC	3	1	0	4
4.	CS25C03	Python with Foundation of Data Science	PCC	3	0	0	3
5.	CH25C02	Environmental Science *(Common to all B.E./B.Tech. Programmes)*	BSC	2	0	0	2
6.	TA25C02	Tamils and Technology / தமிழரும் தொழில்நுட்பமும் *(Commorto all B.E./B.TechProgrammes)*	HSMC	1	0	0	1
THEORY WITH PRACTICAL COURSE							
7.	EN25C02	English Proficiency and Soft Skill *(Common to B.Tech. AI&DS, IT and B. E. CSE, CSE (CS), VLSI and Civil)*	HSMC	2	0	2	3
PRACTICAL COURSES							
8.	EE25205	Digital Electronics and Measurements Laboratory	ESC	0	0	4	2
9.	CS25C04	Python with Foundation of Data Science Laboratory	PCC	0	0	4	2
Total Credits							**24**

SEMESTER – III

Sl. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
THEORY							
1.	MA25C04	Discrete Mathematics *(Common to B.Tech. AI&DS, IT, B. E. CSE and CSE(CS)*	BSC	3	1	0	4
2.	AD25301	Operating System Principles	PCC	3	0	0	3
3.	AD25303	Data Structure Design	PCC	3	0	0	3
4.	AD25305	Principles of Artificial Intelligence	PCC	3	0	0	3
5.	AD25306	Software Engineering Principles and Design	PCC	3	1	0	4
THEORY WITH PRACTICAL COURSE							
6.	AD25307	Data Exploration and Analytics	PCC	2	0	2	3
PRACTICAL COURSES							
7.	AD25302	Operating System Principles Laboratory	PCC	0	0	3	1.5
8.	AD25304	Data Structure Design using Python Laboratory	PCC	0	0	3	1.5
Total Credits							23

SEMESTER – IV

Sl. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
THEORY							
1.	MA25401	Numerical Methods and Design of Experiments	BSC	3	1	0	4
2.	AD25401	Analysis of Algorithms	PCC	3	0	0	3
3.	AD25402	Database Design and Engineering	PCC	3	0	0	3
4.	AD25404	Computer Networking Principles	PCC	3	0	0	3
5.	AD25405	Principles of Machine Learning	PCC	3	0	0	3
THEORY WITH PRACTICAL COURSE							
6.	AD25407	Object Oriented Programming	PCC	2	0	2	3
PRACTICAL COURSES							
7.	AD25403	Database Design and Engineering Laboratory	PCC	0	0	3	1.5
8.	AD25406	Machine Learning Laboratory	PCC	0	0	3	1.5
9.	EN25C05	Communicative English – II *(Common to B.Tech. AI & DS, B.E. CSE(CS), Mech)*	HSMC	0	0	2	1
Total Credits							23

IP25C01	INDUCTION PROGRAMME *(Common to all B.E./B.Tech. Programmes)*	L	T	P	C
		0	0	0	0

This is a mandatory 2-week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

"Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfil his/her responsibility as an engineer, as a citizen and as a human being. Besides the above, several meta-skills and underlying values are needed."

"One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character."

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it every day for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real-life activities rather than lecturing.

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

(viii) Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering/Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity-based programme and **therefore there shall be no tests / assessments during this programme.**

REFERENCE:

- Guide to Induction program from AICTE

EN25C01	TECHNICAL ENGLISH *(Common to all B.E./B.Tech. Programmes)*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The course enables the students to:

- Recognize and Interpret listening cues for enhancing comprehending skills in spoken interactions
- Develop confidence in expressing ideas clearly in speaking situations.
- Understand and Apply vocabulary effectively while summarizing written content.
- Build the ability to plan and structure coherent written compositions
- Encourage articulation to support personal viewpoints in diverse formats.

UNIT I	INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION	9

Listening – Pronunciation, Stress, Syllable, Listening for general information and specific details **-** Listening and filling a form; **Speaking -** Self Introduction, asking for information to fill details in a form; **Reading -** Comprehension Passages - Skimming Scanning and intensive & extensive reading; **Writing -** Writing emails / letters (formal & informal - requisition, Complaint); **Grammar -** Parts of Speech (Nouns, Pronouns, Verbs, Adverbs, Adjectives, Prepositions, Conjunctions, Interjections), Kinds of Sentences; **Vocabulary -** Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

UNIT II	NARRATION AND SUMMATION	9

Listening - Listening short talks/ podcast/ stories / event narration, documentaries and say true or false **Speaking** - Narrating personal experiences/events, summarizing of documentaries/podcasts; **Reading** - Reading biographies, travelogues & technical blogs; **Writing** -- Paragraph writing, Short Report on an event (Industrial visits etc.); **Grammar** - Question types: Framing "WH" Questions & Yes or No Questions and Tenses; **Vocabulary** - Word forms (prefixes & suffixes), Antonyms, Phrasal verbs.

UNIT III	DESCRIPTION OF A PROCESS / PRODUCT	9

Listening - Listening to advertisements about products and process descriptions and summarize them: **Speaking** - Giving instruction to use the product; Presenting a product; **Reading** - Reading advertisements, gadget reviews; user manuals; **Writing** - Writing definitions; instructions; and Product /Process description; **Grammar** - Tenses, Subject - Verb Agreement; **Vocabulary** - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words)

UNIT IV	CLASSIFICATION AND RECOMMENDATIONS	9

Listening - Listening to TED Talks; differentiate instructions and recommendations; **Speaking** – Short Talk; Mini presentations and making recommendations; **Reading** - Newspaper articles - interviews, Non Verbal Communication (infographics, tables, pie charts etc) to understand and classify information **Writing** - Writing recommendations; Transferring information from non -verbal (chart, graph etc, to verbal mode) **Grammar** - Articles, Degrees of comparison; **Vocabulary** - Collocations; Fixed / Semi fixed expressions.

UNIT V	EXPRESSIONS	9

Listening - Listening to debates/ discussions; different viewpoints on an issue; and panel discussions; **Speaking** - Group discussions, Debates, and Expressing opinions through Simulations & Role-play; **Reading** - Reading editorials; and Opinion Blogs; **Writing** - Essay Writing (Descriptive or narrative); **Grammar** -Phrases & Clauses, Simple, Compound & Complex Sentences; **Vocabulary** - Connotations-Content vs. Function words.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Identify listening cues and respond appropriately in real-time communication.
CO2: Deliver spoken messages clearly and appropriately in varied contexts.
CO3: Use new vocabulary in context and summarize main ideas from texts.
CO4: Create and organize clear written composition
CO5: Express and justify opinions through oral written, and digital formats

TEXTBOOKS:

1. Shoba. K N.& Lourdes Joavani Rayen. “Communication Skills”, New Delhi, Cambridge University Press, 2021
2. Board of Editors, Fluency in English-A Course book for Undergraduate Engineers and Technologists. Orient Blackswan Pvt Ltd, Hyderabad: 2018
3. Jawahar, Jewelcy & Rathna.P. Communicative English Workbook. VRB Publishers Pvt Ltd. Chennai. 2018.

REFERENCES:

1. Department of English. Mindscapes English for Technologists and Engineers. Orient Black swan Ltd, Hyderabad: 2012
2. Verma, Shalini. Technical Communication for Engineers. Vikas Publishing House Pvt Ltd. New Delhi. 2015
3. Rizvi, Ashraf.M. Effective Technical Communication. MCGraw Hill Education Pvt Ltd. New Delhi. 2016.
4. Leech Geoffrey and Svartvik Jan. A Communicative Grammar of English. Third Edition, Routledge, New York. 2013

WEB SOURCES:

1. www.esl.org
2. elt.oup.com/learning resources
3. a4esl.org

CO-PO/PSO Mapping

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

MA25C01	LINEAR ALGEBRA AND CALCULUS *(Common to B.Tech. AI&DS & B.E.CSE (CS) Programmes)*	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

The main objectives of this course are:

- To establish the matrix concepts in engineering applications.
- To make use of the concepts of Differentiation and Integration in engineering problems.
- To evaluate basis and dimension of a Vector space.
- To represent linear transformations of a matrix.
- To compute an orthonormal basis of an inner product space for a given basis.

UNIT I	MATRICES	12

Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties of Eigenvalues and Eigenvectors – Cayley Hamilton theorem - Diagonalization of matrices by orthogonal transformation - Reduction of a quadratic form to canonical form by orthogonaltransformation – Nature of quadratic forms – Applications of matrices: Image Processing, Principal Component Analysis.

UNIT II	CALCULUS	12

Representation of functions – Limit of a function – Continuity – Derivatives – Implicit Differentiation – Logarithmic Differentiation – Maxima and Minima of functions of one variable.

Integration: Properties of Definite and Indefinite Integrals – Integration by parts – Trigonometric substitutions – Integration of rational functions by partial fraction.

UNIT III	VECTOR SPACES	12

Vector Space-Definition and Examples – Subspaces - Linearly Independence of Vectors- Basis and Dimension – Row Space and Column Space.

UNIT IV	LINEAR TRANSFORMATIONS	12

Linear Transformation: Definitions and Examples – Matrix Representation of a Linear Transformation - Range and Kernel of a linear mapping – Rank and Nullity.

UNIT V	INNER PRODUCT SPACES	12

Inner Product Spaces - Norms – Orthogonal Subspaces – Orthonormal Sets – Orthonormal Basis - Gram Schmidt Orhogonalisation Process.

TOTAL :60 PERIODS

COURSE OUTCOMES:

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

CO1: Apply the matrix algebra for Eigen value related application problems.

CO2: Apply differentiation and integration concepts in solving various Engineering problems.

CO3: Explain the fundamental concepts of Vector Spaces

CO4: Apply the Linear Transformation techniques in application problems.

CO5: Explain the basic concepts of Inner product Spaces, orthonormal set and orthonormal basis.

TEXT BOOKS:

1. Grewal.B.S. “Higher Engineering Mathematics”, 44th Edition, Khanna Publishers, New Delhi, 2018.
2. Bali N.P and Manish Goyal “A Text Book of Engineering Mathematics”, Eigth Edition Lakshmi Publications Pvt., Ltd., New Delhi, 2011
3. Stephen H. Friedberg, Arnold J, Insel and Lawrence E. Spence, "Linear Algebra ", 4th Edition, Pearson publications,India,2015.

REFERENCES:

1. James Stewart, "Calculus: Early Transcendentals", Eighth Edition, Cengage Learning, 8th edition New Delhi, 2015
2. Ramana. B.V., "Higher Engineering Mathematics", Sixth Edition, McGraw Hill Education Pvt. Ltd, New Delhi, 2010.
3. Jain. R.K. and Iyengar. S.R.K., “Advanced Engineering Mathematics”, Fifth Edition, Narosa Publications, New Delhi, 2016

CO-PO/PSO Mapping

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

PH25C01	ENGINEERING PHYSICS *(Common To I Year B.E./B.Tech. AI & DS, CSE, IT, CSE (CS), ECE, EEE, EE(VLSI) & CIVIL Engineering)*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To illustrate the effective understanding of mechanics.
- To gain knowledge on oscillations and thermal physics.
- To explain the working of laser and its applications.
- To outline the importance of quantum mechanics.
- To understand crystal structures and its applications.

UNIT-I	MECHANICS OF MATERIALS	9

Rigid body – Centre of mass: 1D & 3D – Elasticity –Hooke's law - Poisson's ratio - stress-strain diagram for ductile and brittle materials(basic) – Uses - Bending of beams – Cantilever - Simply supported beams - uniform and non-uniform bending - Young's modulus determination - I shaped girders.

UNIT-II	OSCILLATIONS AND THERMAL PHYSICS	9

Simple harmonic motion - Torsional pendulum –Introduction to Damped and Forced oscillations – Shock absorber – Resonance - Introduction to conduction, convection and radiation - Thermal expansion – Expansion joints – Bimetallic strip – Seebeck effect – thermocouple.

UNIT-III	LASERS	9

Laser – characteristics – spontaneous and stimulated emission - population – inversion - Metastable states - CO_2 laser, Semiconductor laser - Industrial and medical applications - Optical Fibers – Total internal reflection – Numerical aperture and acceptance angle – Fiber optic communication.

UNIT-IV	QUANTUM MECHANICS	9

Black body radiation (Qualitative) – Planck's hypothesis - Matter waves – de Broglie hypothesis - Electron microscope – Uncertainty Principle – The Schrodinger Wave equation (time-independent and time-dependent) – Physical significance of wave function - Degenerate energy states - Barrier penetration and quantum tunneling - Tunneling microscope.

UNIT-V	CRYSTAL PHYSICS	9

Crystal Bonding – Ionic – covalent – metallic and van der Wall's molecular bonding - Introduction to Crystal systems (unit cell, Bravais lattices, Miller indices) - Crystal structures - atomic packing density of BCC, FCC and HCP structures - crystal imperfections - point defects - edge and screw dislocations – grain boundaries. X-ray diffractometer.

TOTAL :45 PERIODS

COURSE OUTCOMES

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

CO1: Understand the basic properties of materials
CO2: Express the knowledge based on applications of oscillations and thermal Physics.
CO3: Know the basics of optics, lasers and its applications
CO4: Demonstrate the importance of quantum physics.
CO5: Apply the significance of crystal physics.

TEXTBOOKS:

1. Raymond A. Serway, John W. Jewett, Physics for Scientists and Engineers, Thomson Brooks/Cole, First Edition 2013.
2. D. Halliday, R. Resnick and J. Walker, Principles of Physics. John Wiley & Sons, 1 Tenth Edition, 2015.
3. N. Garcia, A. Damask and S. Schwarz, Physics for Computer Science Students, Springer- Verlag, First Edition, 2012.
4. Alan Giambattista, Betty McCarthy Richardson and Robert C. Richardson, College Physics, McGraw-Hill Higher Education, First Edition ,2012.

REFERENCES:

1. R. Wolfson, Essential University Physics. Volume 1 & 2. Pearson, First Edition, 2016.
2. D. Kleppner and R. Kolenkow. An Introduction to Mechanics, McGraw Hill Education, First Edition, 2017.
3. K. Thyagarajan and A. Ghatak. Lasers: Fundamentals and Applications. Springer, First Edition, 2012.

CO-PO/PSO Mapping

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

CH25C01	ENGINEERING CHEMISTRY *(Common to all B.E./B.Tech. Programmes)*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To inculcate the sound understanding of water quality parameters and water treatment techniques.
- To acquire basic principles and preparatory methods of nanomaterials.
- To describe the characteristics, applications of polymeric materials and composites.
- To illustrate the operating principles in electrochemistry and working processes and applications of storage devices.
- To use appropriate synthetic fuels and fuel additives for better combustion characteristics.

UNIT-I	WATER AND ITS TREATMENT	9

Water: Sources and impurities, **Water quality parameters:** Definition and significance of-colour, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, fluoride and arsenic. **Municipal water treatment:** primary treatment and disinfection (UV, Ozonation, break-point chlorination)**. Boiler troubles:** Scale and sludge, boiler corrosion, caustic embrittlement, priming & foaming. **Treatment of boiler feed water**: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning)
and external treatment – Ion exchange demineralization and zeolite process. **Desalination of brackish water**: Reverse Osmosis (RO) method.

UNIT-II	NANOCHEMISTRY	9

Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic). Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, and electrochemical deposition. Applications of nanomaterials. Sensors: Basic components, types and applications. Chemiresistive sensors - environmental monitoring – CO_2 sensor.

UNIT-III	POLYMERS AND COMPOSITES	9

Polymers: Classification, functionality of monomers, Types of polymerizations, free radical mechanism, degree of polymerization, weight and number average molecular weights (definition only). Engineering Plastics - Properties and types. Composites: Definition & need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and reinforcement (fiber, particulates, flakes and whiskers). Properties and applications: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites.

UNIT-IV	ELECTROCHEMICAL POWER SOURCES	9

Electrochemical cells – EMF, electrode potential, dependence of emf on electrolyte concentration – Nernst equation. Electrochemical series and its applications. Batteries: Types of batteries, primary battery - dry cell, secondary battery - lead acid battery, Zn-Carbon, and lithium-ion-battery; Fuel cells: H_2-O_2 fuel cell, Supercapacitors: Storage principle, types and examples. Electric vehicles - working principles

UNIT-V	FUELS AND COMBUSTION	9

Fuels: Introduction, classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, and manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), knocking - octane number, diesel oil - cetane number; Power alcohol and biodiesel. Combustion of fuels: Introduction, calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis - ORSAT Method. CO_2 emission and carbon foot print.

TOTAL :45 PERIODS

COURSE OUTCOMES

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

CO1: Infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.

CO2: Describe the basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.

CO 3: Apply the knowledge of polymers and composites for material selection requirements.

CO 4: Illustrate the basics of electrochemistry and apply them for suitable applications in energy sectors.

CO 5: Utilize different fuels and predict their performance and combustion characteristics.

TEXTBOOKS:

1. P. C. Jain and Monica Jain, “Engineering Chemistry”, 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018.
2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
3. S.S. Dara, “A text book of Engineering Chemistry”, 12th Edition, S. Chand Publishing, 2018.

REFERENCES:

1. B. S. Murty, P. Shankar, Baldev Raj, B.B. Rath and James Murday, “Text book of nanoscience and nanotechnology”, Universities Press-II M Series in Metallurgy and Materials Science, 2018.
2. O.G. Palanna, “Engineering Chemistry” 2nd Edition, McGraw Hill Education (India) Private Limited, 2017.
3. Friedrich Emich, “Engineering Chemistry”, Scientific International PVT, LTD, New Delhi, 2014.
4. Shikha Agarwal, “Engineering Chemistry-Fundamentals and Applications”, 2nd Edition, Cambridge University Press, Delhi, 2019
5. Gowarikar V. R., Viswanathan N.V. and Jayadev Sreedhar, “Polymer Science”, New Age International (P) Ltd., 2015.

CO-PO/PSO MAPPING

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

CS25C01	PROBLEM SOLVING USING C PROGRAMMING *(Common to B.Tech. AI&DS, IT and B.E. CSE, CSE(CS), ECE, EEE,VLSI and Civil)*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the constructs of C Programming.
- To apply conditional and looping constructs in C Programming to manage program execution flow.
- To develop applications that effectively use arrays and strings for data storage and manipulation
- To develop modular applications using functions and pointers.
- To design and implement applications using structures and unions for efficient handling of complex data types.

UNIT-I	INTRODUCTION	9

Evolution of Programming Languages - Programming Paradigms : Structured programming - Object Oriented programming - Functional programming -Algorithms - Pseudo code and Flowchart - Structure of C Program - Compilation Process -Preprocessor Directives - C Tokens.

UNIT-II	CONTROL FLOW STATEMENTS	9

Expressions –I/O Statements - Operators: Precedence and Associativity -Decision Making Statements: if -else if ladder, Nested if, Switch statements - Iterative Statements: For, While, Do while statements-Break, Continue Statements

UNIT-III	ARRAYS AND STRINGS	9

Arrays: Declaration, Initialization – One Dimensional Array – Multi Dimensional Arrays - String: String Operations - Sorting: Selection Sort - Searching: Linear and Binary Search.

UNIT-IV	FUNCTIONS AND POINTERS	9

Modular Programming: Function Prototype, Function Definition, Function Call, Built-in Functions: String Functions and Math Functions - User Defined Functions ─ Recursion - Pointers: Pointer Operators, Pointer Arithmetic, Arrays and Pointers, Array of Pointers - Parameter Passing: Pass by Value and Pass by Reference.

UNIT-V	STRUCTURES AND UNION	9

Structure: Defining and Processing a Structure - Nested Structures - Passing Structure to Functions - Array of Structure – Self referential Structure- Pointer to Structure - Union - Dynamic Memory Allocation - File Processing.

TOTAL :45 PERIODS

COURSE OUTCOMES

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

CO1: Demonstrate the constructs of C Programming
CO2: Build applications using Conditional and Looping constructs in C
CO3: Design applications using Arrays and Strings in C
CO4: Make use of Functions and Pointers and develop applications
CO5: Make use of Structure and Union to design applications

TEXTBOOKS:

1. ReemaThareja,“ Programming in C”,3rd edition, Oxford University Press,2023
2. Deitel.H.M, Deitel.P.J , "C: How to Program", Pearson, 9th Edition, New Delhi, 2022
3. PradipDey, ManasGhosh, "Programming in C", Oxford University, New Delhi, 2018

REFERENCES:

1. Gottfried B, "Programming with C", McGraw Hill, 4th Edition, Noida, 2018
2. Herbert Schildt, "C: The Complete Reference", McGraw Hill, 4th Edition, Noida, 2017
3. Kernighan, B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2015.

Suggested activities for assignment/Self Study

1. Design and develop flowchart for real time applications like ticket reservation system, Electricity Billing, Retail shop billing etc using online tools such as Smart draw, Luci, Canva etc.,
2. Programming/ Code Debugging using online programming platforms like Hackerrank, Leetcode, Code Chef

CO-PO/PSO Mapping:

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

ME25C01	ENGINEERING GRAPHICS AND DESIGN *(Common to B.Tech. AI&DS, IT and B.E. CSE, CSE(CS), EEE,VLSI and Mech)*	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- Apply fundamental concepts of engineering graphics and orthographic projections using basic 2D CAD software.
- Interpret and sketch the projection of simple solids and understand basic 3D CAD modeling techniques.
- Create sectional views and develop true shapes of solids through manual sketching and CAD tools.
- Apply isometric projection techniques and use basic AR/VR tools to visualize engineering objects.
- Sketch orthographic projections and understand the fundamentals of design for 3D printing and additive manufacturing.

UNIT-I	BASICS OF ENGINEERING GRAPHICS AND VISUALIZATION	9

Introduction to Engineering Graphics: Importance, applications, and tools. Use of Drafting Instruments: Lettering, dimensioning, line types, and scales. Orthographic Projections: Principles, projection of points, straight lines Introduction to CAD Software: Basics of 2D drawing and layout views. Demo on 2D CAD practice –Demo.Introduction to UX/UI in Engineering Design: Overview of the importance of user interface (UI) and user experience (UX) in engineering applications (e.g., dashboards, software interfaces) - Demo

UNIT-II	PROJECTION OF SOLIDS	9

Projection of Solids: Prisms, pyramids, cylinders, cones, with the axis inclined to principal planes. Basic CAD Modelling of Solids: Introduction to simple 3D modelling in CAD tools. Demo on 3D CAD practice – Demo.

UNIT-III	PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES	9

Sectioning of Solids: Sectional views of simple solids with cutting planes inclined to horizontal plane. True Shape of Sectional Views: Obtaining true shape and development of sections.

UNIT-IV	ISOMETRIC PROJECTIONS	9

Isometric Projection: Principles, isometric scale, and isometric views of simple solids like prisms, pyramids, cones and cylinders. Introduction to Visualization Tools: Use of simple AR/VR applications for viewing isometric and perspective projections. Demo on AR/VR – Demo.

UNIT-V	ORTHOGRAPHIC PROJECTIONS AND DESIGN APPLICATIONS	9

Freehand Sketching: Sketching orthographic views of simple isometric solids. Design for 3D Printing: Basics of modelling for additive manufacturing. Demo on 3D Printing – Demo.

TOTAL :45 PERIODS

COURSE OUTCOMES

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

CO1: Construct orthographic projections of points, lines, and simple objects using drafting tools and 2D CAD software.

CO2: Sketch projections of prisms, pyramids, cylinders, and cones and create basic 3D models using CAD software.

CO3: Generate sectional views and develop true shapes of simple solids using manual and CAD tools.

CO4: Create isometric projections and use AR/VR tools for enhanced spatial visualization of engineering objects.

CO5: Apply freehand sketching to produce orthographic projections and understand basic 3D printing design considerations.

TEXTBOOKS:

1. Natarajan K.V., “A text book of Engineering Graphics”, 31st Edition, Dhanalakshmi Publishers, Chennai, 2018.
2. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, 15th Edition, New Age International (P) Limited, 2018.
3. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, 53rd Edition, Charotar Publishing House, 2014.

REFERENCES:

1. S.S. Sashikiran., “The 7S Design Framework”, 1st Edition, Notion Press, 2024.
2. Rajiv Chopra, “Virtual and Augmented Reality” 1st Edition, Khanna Publishing House, 2021.
3. Sabrie Soloman, “3D Printing & Design”, 1st Edition, Khanna Publishing House, 2020.

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02
CO1	3	2	2	1	2	1	1	-	1	-	1	-	-
CO2	3	3	2	1	3	1	1	-	1	-	1	-	-
CO3	3	2	3	1	3	1	1	-	1	-	1	-	-
CO4	2	3	2	1	3	1	1	-	1	-	1	-	-
CO5	2	2	3	1	3	1	1	-	1	-	1	-	-

TA25C01	HERITAGE OF TAMILS (*Common to B.E. /B.Tech. Programmes)*	L	T	P	C
		1	0	0	1

UNIT I	LANGUAGE AND LITERATURE	3

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	3

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	3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambatt am, Valari, Tiger d ance - Sports and Games of Tamils.

UNIT IV	THINAI CONCEPT OF TAMILS	3

Flora and Faun a of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature- A ram Concept of Ta mils - Education and Literacy during Sangam Age - Ancient Cities and Ports of San gam Age - Export a nd Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V	CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE	3

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.

TOTAL: 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழகவரலாறு – மகக்ளும்பண்பாடும் –கக.கக. பிள்ளள (வெளியீடு: தமிழ்நாடு பாடநூல் மறறும் கல்வியியல் பணிகள் கழகம்).
2. கணினிதத்மிழ் – முளனவர் இல. சுநத்ரம். (விகடன்பிரசுரம்).
3. கீழடி – ளவளகநதிகக்ளரயில்சங்ககாலநகரநாகரிகம் (வதால்லியல்துளறவவளியீடு)
4. பாருளந – ஆற்றங்களரநாகரிகம். (வதால்லியல் துளற வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - ‘Sangam City C ivilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

CS25C02	PROGRAMMING IN C LABORATORY *(Common to B.Tech. AI&DS, IT and B.E. CSE, CSE(CS), ECE, EEE,VLSI and Civil)*	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To describe the basics of algorithmic problem solving
- To develop programs in C using basic constructs.
- To develop programs in C using arrays and strings
- To develop applications in C using functions.
- To develop applications in C using Pointers, Structures, Union

LIST OF EXPERIMENTS **9**

Exercise 1: Basics of C programming

a. Identification and solving of simple real life or scientific or technical problems, and developing flow charts and Pseudo code for the same (Electricity Billing, Retail shop billing)
b. Write a program to print sample strings like “hello world”, “Welcome to C Programming” with different formats using escape sequences.
c. Write a Program to print different data types in ‘C’ and their ranges.
d. Write a Program to initialize, assignment & printing variables of different data types.

Exercise 2: Operators

a. Write a Program to demonstrate arithmetic, logical and relational operators.
b. Write a Program to demonstrate pre increment and post increment (++a, a++), pre decrement and post decrement (--a, a--)
c. Write a Program to read radius value from the keyboard and calculate the area of circle and print the result in both floating and exponential notation.
d. Write a Program to calculate simple interest.
e. Write a Program to convert temperature from Fahrenheit –Centigrade and vice-versa.

Exercise 3: Control Statements

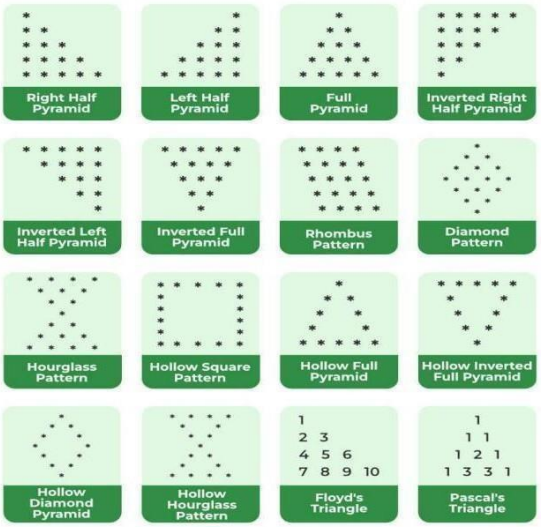
a. Write a Program to read marks of a student in six subjects and print whether pass or Fail. (using if-else).
b. Write a Program to calculate roots of quadratic equation.
c. Write a Program to calculate electricity bill. Read starting and ending meter reading. The charges are as follows.

Usage Slab(in Units)	Rate per unit(Rs)
Upto 400	4.80
401-500	6.45
500-600	8.55
601-800	9.65
800-1000	10.70
>1000	11.80

d. Write a Program to perform arithmetic operations using case control statement.
e. Write a Program to display names of days in a Week using case control statement.

Exercise 4: Looping operations

a. Write a program to calculate sum of individual digits of a given number.
b. Write a program to check whether given number is palindrome or not.
c. Write a program to print prime numbers in the given range.
d. Write a program to print the Fibonacci series for given ‘N’ value.
e. Write a program to print the following formats.



Exercise 5: 1-D and 2-D arrays

a. Write a program to store 10 elements in a 1-D array and print sum of the array, maximum and minimum element in an array.
b. Write a program to count no. of positive numbers, negative numbers and zeros in an array.
c. Write a program to count all subsets of given array with sum equal to given sum.
d. Write a program to search an element using linear search algorithm.
e. Write a program to sort the given elements using bubble sort algorithm.
f. Write a program to perform matrix addition, subtraction and multiplication.

Exercise 6: Strings

a. Write a program to perform various string manipulations using built-in functions.
b. Write a program to verify the given string is palindrome or not.
c. Write a program to Check if two strings are anagrams of each other.
d. Write a program to concatenate two strings using arrays.
e. Write a program to print the given strings in ascending order.

Exercise 7: Non recursive and recursive functions

a. Write an application to simulate basic calculator (+, -, *, /) using functions.
b. Write a program to find nth Fibonacci number using recursive and non-recursive number.
c. Write a program to find factorial of a number using recursive and non-recursive number.
d. Write a program to swap two numbers using Call by Value and Call by Reference.

Exercise 8: Pointers

a. Write a program to illustrate Pointers to array, strings, Pointers to Pointers, Array of Pointers
b. Write a program to sort an array using pointers.
c. Write a program to perform matrix multiplication using pointers.

Exercise 9: Structures and Union

a. Write a program to create structure for an account holder in a bank with following Fields: name, account number, address, balance and display the details of ‘n’ account holders.
b. Write a program to find total marks of individual student and average marks for ‘n’ students using structures.
c. Write a program to illustrate the functions of union.

Mini project

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Develop algorithmic solutions to simple computational Problems using flow chart and Pseudo code

CO2: Develop simple applications using basic C components.

CO3: Solve applications adopting array and string concepts in C.

CO4: Construct and implement applications in C using functions and pointers.

CO5: Make use of Structures and Union concepts to prepare applications in C.

CO-PO/PSO Mapping:

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

PC25C01	PHYSICS AND CHEMISTRY LABORATORY *(Common to all B.E. / B.Tech. programmes)*	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To explain the proper use of various kinds of laboratory equipment.
- To extend how data can be collected, presented and interpreted in a clear and concise manner.
- To infer problem solving skills and interpretation of experimental data.
- To summarize error in experimental measurements and techniques used to minimize such error.
- To translate the student as an active participant in each part of all lab exercises.

LIST OF EXPERIMENTS: PHYSICS LABORATORY **TOTAL: 30PERIODS**

1. Laser- Determination of the wavelength of the laser using grating. (Common to ALL)
2. Photoelectric effect – Determination of Planck's constant**.** (Common to ALL)
3. Hall effect – determination of Hall parameters. (Common to ALL)
4. 4 a) Optical fibre -Determination of Numerical aperture and acceptance angle.
   b) Compact disc- Determination of width of the groove using the laser. (Common to CSE, IT, AI&DS, CS(Cyber), ECE, EEE, EE(VLSI))
5. Spectrometer-Determination of the wavelength of light using grating. (Common to CSE,IT, AI&DS,CS(Cyber),ECE,EE(VLSI))
6. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects. (Common to CIVIL,EEE,MECH)
7. Determination of Young's modulus–cantilever method. (Common to CIVIL,MECH)

LIST OF EXPERIMENTS: CHEMISTRY LABORATORY (Any 7 experiments) **TOTAL: 30PERIODS**

1. Determination of chloride content of water sample by Argentometric method.
2. Determination of total hardness of water by EDTA method.
3. Determination of strength of acids in a mixture of acids using conductivity meter.
4. Conductometric titration of strong acid against strong base.
5. Determination of DO content of water sample by Winkler's method.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Estimation of iron content of the given solution using potentiometer.
8. Conductometric titration of barium chloride against sodium sulphate. (precipitation titration)
9. Preparation of nanoparticles (TiO_2/ZnO/CuO) by Sol-Gel method.
10. Determination of types and amount of alkalinity in water sample.

TOTAL: 60PERIODS

COURSE OUTCOMES:

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

CO1: Apply the knowledge, to gain hands-on experience with laboratory equipment.
CO2: Relate the graphical models to interpret the laboratory data.
CO3: Interpret quantitative reasoning and describing physical reality.
CO4: Apply the principle and process to access the scientific information.
CO5: Translate students to solve problems individually and collaboratively.

REFERENCES:

1. "Physics Laboratory Manual", Department of Physics, Velammal College of Engineering & Technology, Madurai (2021)
2. P. Mani, "Physics Laboratory", Dhanam Publications, Third Edition 2021.
3. J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, "Vogel's Textbook of Quantitative Chemical Analysis" 2009.

*****Each class is divided into two batches (30 students / batch) and each batch will perform their experiments alternatively per week in physics and chemistry laboratories.

CO-PO/PSO Mapping

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

VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
SEMESTER -II

MA25C03	PROBABILITY AND STATISTICS *(Common to B.Tech. AI&DS,IT, B.E. CSE & CSE(CS))*	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- To develop the concepts of probability and distributions.
- To Compute different measures of central tendency, dispersion and to interpret the data
- To explain the knowledge of testing of hypothesis for small and large samples.
- To describe the concepts of non-parametric tests which involved in statistics.
- To make use of the notion of control and measurement charts in statistics and its techniques in engineering and management problems.

UNIT I	PROBABILITY	12

Axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Uniform, Exponential and Normal distributions .

UNIT II	STATISTICS	12

Measures of central tendency - Arithmetic mean - Geometric mean - Harmonic mean - Median - Mode - Measures of dispersion - Range - Standard deviation - Coefficient of variation - Correlation - Coefficient of correlation - Lines of regression.

UNIT III	TESTING OF HYPOTHESIS	12

Large sample test based on Normal distribution for single mean and difference of means – Tests based on t, X^2 and F distributions for testing means and variances — Contingency table (Test for Independency) — Goodness of fit.

UNIT IV	NON- PARAMETRIC TESTS	12

Introduction - The Sign test - The Signed - Rank test - Rank - sum tests - The U test - The H test – The Kolmogorov Tests .

UNIT V	STATISTICAL QUALITY CONTROL	12

Control charts for measurements (π and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits

TOTAL :60 PERIODS

COURSE OUTCOMES

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

CO1: Apply the fundamental knowledge of the concepts of probability and have knowledge standard distributions which can describe real life phenomenon.

CO2: Investigate the various measures of central tendency and measures of dispersion.

CO3: Explain the test of hypothesis for small and large samples by using various test like t-test, F-test, Z- test and X^2 test.

CO4: Apply the non-parametric tests of signed test, Rank test, U test and H test in the field of statistical quality control.

CO5: Use the notion of control and measurement charts in statistics and its techniques used in Engineering problems.

TEXTBOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 4th Edition, 2018.
2. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012.
3. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata Mc Graw Hill, 4th Edition, 2007.

REFERENCES:

1. Gupta. S.C. and Kapoor. V. K., “Fundamentals of Mathematical Statistics”, Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
2. T. Veerarajan, Probability, Statistics and Random Processes, Tata Mc Graw Hill, 3rd Edition, 2008.
3. Devore. J.L., "Probability and Statistics for Engineering and the Sciences”, Cengage Learning,New Delhi, 8th Edition, 2014.

CO-PO/PSO Mapping

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

PH25C02	PHYSICS FOR INFORMATION SCIENCE *(Common to B.Tech. AI&DS, IT, B.E. CSE & CSE(CS))*	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To infer the importance of studying electrical properties of materials.
- To extend the students knowledge in semiconductor physics and display devices.
- To illustrate knowledge of magnetic and optical data storage techniques.
- To summarize the different properties of sensors and applications.
- To translate an idea of quantum confinement and quantum computing.

UNIT I	ELECTRON THEORY OF MATERIALS	9

Classical and quantum free electron theory of metals – merits and demerits - Fermi-Dirac statistics– density of states - band theory of solids (qualitative) - Intrinsic semiconductors: energy band – diagram - direct and indirect band gap semiconductors - carrier concentrations and conductivity - extrinsic semiconductors: n, p-type doping.

UNIT II	SEMICONDUCTORS AND DISPLAY DEVICES	9

Semiconductors: Hall Effect - Schottky junction - Ohmic contacts – Schottky diode - optical absorption and solar cell – LED construction and working (White LED's – organic LEDs) – Laser diode - LCD construction and working.

UNIT III	MAGNETIC AND OPTICAL DATA STORAGE TECHNIQUES	9

Introduction – Ferromagnetic materials – Ferrites - Soft and Hard magnetic materials – GMR sensors - magnetic disk memories – Principle of magnetic recording – Materials for magnetic data storage - Optical data storage capacity of CD – advantages of CD – DVD – Blu-ray DVD - holographic storage.

UNIT IV	SENSORS	9

Introduction – piezoelectric pressure sensor - capacitance pressure sensor - Capacitor plate sensor- piezoelectric devices for motion sensing - Hall effect based speed sensor – photodiodes –phototransistors - photovoltaic devices - Pyroelectric detector - semiconductor based IR sensors.

UNIT V	QUANTUM COMPUTING	9

Introduction - quantum states – classical bits – quantum bits or qubits – multiple qubits - quantum gates - CNOT gate - Quantum cellular automation – Advantages of quantum computing over classical computing – Silicon based Quantum Computer.

TOTAL :45 PERIODS

COURSE OUTCOMES

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

CO1: Demonstrate the classical and quantum electron theories, and semiconductors.
CO2: Infer knowledge on the basics of semiconductor physics and its applications in various devices.
CO3: Summarize magnetic properties of materials and their applications in data storage.
CO4: Extend the functioning of sensors.
CO5: Translate the basics of quantum structures towards quantum computing.

TEXTBOOKS:

1. Jasprit Singh, "Semiconductor Devices Basic Principles", First Edition (Indian Edition), Wiley, 2007.
2. S.O. Kasap,"Principles of Electronic Materials and Devices", Fourth Edition (Indian Edition), McGraw-Hill Education, 2020.
3. Ian R Sinclair, Sensors and Transducersǁ, Third Edition, Newnes publishers, 2011.
4. Parag K. Lala, "Quantum Computing: A Beginner's Introduction", First Edition (Indian Edition) McGraw-Hill Education, 2020.

1. Charles Kittel, "Introduction to Solid State Physics", First Edition (Indian Edition) Wiley, 2019.
2. Y.B.Band and Y.Avishai, "Quantum Mechanics with Applications to Nanotechnology and Information Science", First Edition, Academic Press, 2013.
3. V.V.Mitin, V.A. Kochelap and M.A.Stroscio, "Introduction to Nanoelectronics", First Edition, Cambridge

University.Press, 2008.
4. G.W. Hanson, “Fundamentals of Nanoelectronics”, First Edition (Indian Edition), Pearson Education 2009.
5. B.Rogers, J.Adams and S.Pennathur, “Nanotechnology: Understanding Small Systems”, First Edition, CRC Press, 2014.
6. Krzysztof Iniewski, Smart sensors for industrial applications, CRC Press Taylor and Francis, First Edition, 2019.

CO-PO/PSO Mapping

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

EE25201	DIGITAL ELECTRONICS AND MEASUREMENTS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- To build various number systems and digital logical families.
- To solve combinational circuits and reduction techniques.
- To model synchronous sequential circuits using flip flops
- To develop asynchronous sequential circuits using flip flops and PLD's.
- To summarize various measurements techniques using Bridges.

UNIT I	NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES	12

Review of number systems, binary codes, error detection and correction codes (Parity and Hamming code) — Digital Logic Families -comparison of RTL, DTL, TTL, ECL and MOS families -operation, characteristics of digital logic family.

UNIT II	COMBINATIONAL CIRCUITS	12

Combinational logic — representation of logic functions-SOP and POS forms, K-map representations - Minimization using K maps — simplification and implementation of combinational logic — multiplexers and de multiplexers — code converters, adders, subtractors, Encoders and Decoders.

UNIT III	SYNCHRONOUS SEQUENTIAL CIRCUITS	12

Sequential logic- SR, JK, D and T flip flops - level triggering and edge triggering - counters - asynchronous and synchronous type - Modulo counters - Shift registers - design of synchronous sequential circuits – Moore and Melay models - Counters, state diagram - state reduction - state assignment.

UNIT IV	ASYNCHRONOUS SEQUENTIAL CIRCUITS	12

Asynchronous sequential logic circuits - Transition Stability, flow Stability-race conditions, hazards & errors in digital circuits - Analysis of asynchronous sequential logic circuits - Introduction to Programmable Logic Devices: PLA, PAL, PROM, FPGA

UNIT V	COMPARATIVE METHODS OF MEASUREMENTS	12

D.C potentiometers, D.C (Wheat stone, Kelvin and Kelvin Double bridge) & A.C bridges (Maxwell, Anderson and Schering bridges), transformer ratio bridges, self-balancing bridges. Interference & screening — Multiple earth and earth loops — Electrostatic and electromagnetic Interference — Grounding techniques.

TOTAL :60 PERIODS

COURSE OUTCOMES

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

CO1: Apply Number Systems and different Digital Logic Families.
CO2: Construct combinational logic circuits and various reduction techniques.
CO3: Make use of flip-flops to design synchronous sequential circuit.
CO4: Model asynchronous sequential circuits and types of PLD's.
CO5: Explain the operation of various measurement techniques.

TEXTBOOKS:

1. S. Salivhanan, S. Arivazhagan, "Digital Circuits and Design", 5th Edition, Oxford University Press, 2018.
2. A.K.Shawney, "A Course in Electrical and Electronic Measurements and Instrumentation", 4th Edition, Visionias, 2022.

REFERENCES:

1. Leach, Malvino, Saha, "Digital Principles and Applications", 8th Edition, McGraw Hill, 2014.
2. M. Morris Mano, Michael D. Ciletti, "Digital Design - With an Introduction to the Verilog HDL, VHDL, and System Verilog", 6th Edition, McGraw Hill,2018.
3. Ronald J. Tocci , "Digital Systems", 10th Edition, Pearson education, 2009.
4. Thomas L. Floyd, "Digital Fundamentals", 11th Edition, Pearson Education, 2017.
5. S Salivahanan, R Rengaraj, G R Venkatakrishnan, "Measurements and Instrumentation", 1st Edition, McGraw Hill, 2018.

CO-PO/PSO Mapping

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

CS25C03	PYTHON WITH FOUNDATION OF DATA SCIENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To utilize Python for effective problem-solving.
- To make use of Python data structures for representing complex datasets.
- To learn the foundational principles of Data Science with Python.
- To develop Python programs for data analysis using Python libraries.
- To understand probability distributions and make statistical inferences.

UNIT-I	INTRODUCTION TO PYTHON PROGRAMMING	9

Python interpreter and interactive mode- Variables and Data Types- Operators-Control Structures - functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays.

UNIT-II	COLLECTIONS AND FILE HANDLING	9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Files: reading and writing files and exceptions Handling.

UNIT-III	OVERVIEW OF DATA SCIENCE	9

Introduction: Need for data science – Benefits and uses – Facets of data, Data science process: Retrieving data – Cleansing, integrating, and transforming data – Data analysis – Build the models –Presenting findings and building applications.

UNIT-IV	DATA PREPROCESSING	9

Data manipulation: Reading and selection – Filtering missing data – Sorting – Grouping – Ranking and Plotting- Fundamental Python Libraries for Data Science- Data Manipulation with Pandas-Sample programs to pre-process and visualize data.

UNIT-V	DESCRIPTIVE STATISTICS &STATISTICAL INFERENCE	9

Data Preparation – Exploratory Data Analysis: Data summarization – Data distribution –Estimation: Mean-Variance – Sampling – Covariance – Correlation. Frequentist Approach – Measuring the Variability in Estimates: Point estimates – Confidence intervals; Hypothesis Testing.

TOTAL :45 PERIODS

COURSE OUTCOMES

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

CO1: Utilize strings, functions and control statements to solve real-world problems.
CO2: Build programs by utilizing Python data structures.
CO3: Illustrate the importance of data science and its processes.
CO4: Develop Python programs to conduct data analysis.
CO5: Make use of descriptive and statistical techniques to interpret and analyze data.

TEXTBOOKS:

1. Vijay Kumar Sharma, Vimal Kumar, Swati Sharma, Shashwat Pathak, “Python Programming – A Practical Approach”, CRC Press, First Edition, 2022.
2. Davy Cielen, Arno D B Meysman, Mohamed Ali, “Introducing Data Science – Big data, Machine Learning, and more using Python tools”, Manning Publications Co, 2016.
3. Laura Igual, Santi Segua, “Introduction to Data Science – A Python Approach to Concepts, Techniques and Applications”, Springer Nature, 2017.

REFERENCES:

1. Urban, Michael.Murach, Joel. “Murach's Python Programming”, United States: Mike Murach & Associates, Incorporated, Second Edition, 2021.
2. Jake VanderPlas, “Python Data Science Handbook: Essential Tools for Working with Data”, O’Reilly Media, 2016.

CO-PO/PSO Mapping

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

CH25C02	ENVIRONMENTAL SCIENCE *(Common to all B.E / B.Tech. Programmes)*	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

- To acquire the basic understanding of the structure and function of an ecosystem and biodiversity
- To understand the environmental impacts of natural resources.
- To recognize causes, effects and control measures of different types of pollution.
- To comprehend the importance of disaster management, environmental ethics and values.
- To assess the environmental impact and effects on ecosystem functions

UNIT-I	ENVIRONMENT, ECOSYSTEM AND BIODIVERSITY	6

Definition, scope and importance of environment – need for public awareness - ecosystem- general structure and function of an ecosystem- ecological succession-biodiversity-types-values of biodiversity-endangered and endemic species-red data book- hot spots of biodiversity-criteria- hot spots in India-threats to biodiversity(man-animal conflicts, habitat loss, poaching) - case studies - conservation of biodiversity- in-situ and ex-situ conservation – case studies for conservation of biodiversity in Mudumalai.

UNIT-II	NATURAL RESOURCES AND ITS ENVIRONMENTAL IMPACTS	6

Natural resources-forest resource-ecological functions – causes, effects and control measures of deforestation-water resource-sources-conflict over water-dams benefits and problems-food resource-overgrazing- impacts of over grazing- impacts of modern agriculture-Energy Resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternative energy sources, - wind mills and solar panels- case studies.

UNIT-III	ENVIRONMENTAL POLLUTION AND CONTROL	6

Air pollution-causes, effects and control methods - water pollution- causes, effects-waste water treatment-soil pollution-causes, effects-solid waste management - causes, effects and management - E- waste: composition and generation of E-waste pollutants, hazardous properties, Effects of pollutant on human health and environment, domestic E- waste disposal, Basic principles of E waste management, Component of E-waste management. Pollution control acts - air, water- wildlife - E- waste management rules - case studies - role of an individual in control of pollution.

UNIT-IV	DISASTER MANAGEMENT AND ENVIRONMENTAL ETHICS	6

Disaster management-causes, effects and management of- flood, landslide, earthquake and tsunami-case studies- environmental ethics - value education-traditional value systems in India-water conservation-rain water harvesting-watershed management.

UNIT-V	SUSTAINABLE MANAGEMENT AND PRACTICES	6

Social issues - climate change - causes, effects and control measures - global warming - causes, effects and control measures - Acid rain - causes, effects and control measures - ozone layer depletion - causes, effects and control measures - nuclear accident and holocausts — Sustainability - concept, needs and challenges - economic, social and aspects of sustainability - from unsustainability to sustainability - EIA - Sustainable development – goals, target - green buildings - ISO 14000 series.

TOTAL :30 PERIODS

COURSE OUTCOMES

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

CO1: Elucidate the concept, structure and function of an ecosystem and biodiversity.
CO2: Demonstrate the environmental impressions of natural resources.
CO3: Illustrate the appropriate management approach for pollution control.
CO4: Practice the proper way of managing disaster with environmental ethics.
CO5: Assess the impact of the environment on humans, and consider its roles and worth.

TEXTBOOKS:

1. Kaushik, and C. P. Kaushik. “Environmental Science and Engineering”, 6th Edition, New Age International, 2018.
2. S. K. Garg and K. Garg, Ecological and Environmental studies, Khanna Publishers, 2015.
3. Wright and Nebel, Environmental science towards a sustainable future, 12th Editon, Prentice Hall of India Ltd, 2015.

REFERENCES:

1. Erach Bharucha, “Text book of Environmental studies for Undergraduate courses”, 3rd Edition, UGC, 2021.
2. P. Ravi, and Agrahari, Environmental ecology, Biodiversity, climatic change & Disaster management, 1st Edition, McGraw Hill, 2020
3. Benney Joseph, “Environmental Science and Engineering”, 1st Edition, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2017.

CO-PO/PSO Mapping

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

TA25C02	TAMIL AND TECHNOLOGY *(Common to all B.E./B.Tech. Programmes)*	L	T	P	C
		1	0	0	1

UNIT I	**WEAVING AND CERAMIC TECHNOLOGY**	**3**

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffition Potteries.

UNIT II	**DESIGN AND CONSTRUCTION TECHNOLOGY**	**3**

Designing and Structural construction House & Designs in household materials during Sangam AgeBuilding 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 Peri od - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III	**MANUFACTURING TECHNOLOGY**	**3**

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 beats - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT IV	**AGRICULTURE AND IRRIGATION TECHNOLOGY**	**3**

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

UNIT V	**SCIENTIFIC TAMIL & TAMIL COMPUTING**	**3**

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.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழகவரலாறு – மகக்ளும்பண்பாடும் –கக.கக. பிள்ளள (வவளியீடு:
2. தமிழ்நாடுபாடநூல்மறறும்கல்வியியல்பணிகள்கழகம்).
3. கணினிதத்மிழ் – முளனவர்இல. சுநத்ரம். (விகடன்பிரசுரம்).
4. கீழடி–ளவளகநதிகக்ளரயில்சங்ககாலநகரநாகரிகம் (வதால்லியல்துளறவவளியீடு)
5. வபாருளந – ஆற்றங்களரநாகரிகம். (வதால்லியல்துளறவவளியீடு)
6. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
7. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
8. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
9. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
10. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
11. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
12. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
13. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference

EN25C02	ENGLISH PROFICIENCY AND SOFT SKILL (TwP) *(Common to B.Tech. AI&DS, IT and B. E. CSE, CSE(CS), VLSI and Civil)*	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

The course enables the students to:

- Strengthen LSRW (Listening, Speaking, Reading, Writing) competencies in English.
- Demonstrate effective communication skills in meeting academic requirements.
- Integrate and interpret graphical data in logical writing using verbal reasoning.
- Produce formal writings for effective internal and external communication.
- Present and adapt concepts according to the target audience, fostering essential soft skills.

UNIT-I	INTRODUCTION TO COMMUNICATION PROFICIENCY	6

Listening: Listening to native speaker's Telephone Conversations; **Speaking:** Sharing Childhood Experiences, dialogues (Informal & Formal), Talking about Favorite Personalities; **Reading:** Technical texts from - Newspapers /websites, Job Advertisements - Telephone Phrases; **Writing:** Statements, Issue based writing essay, Graphs, Checklist; **Grammar:** Error Spotting; **Vocabulary:** Misspelt Words; **Soft Skills:** Leadership Skills

UNIT-II	TECHNICAL TALKS AND TEAM DYNAMICS	6

Listening: Listening to Technical Talks, Scientific Lectures and Short Conversations; **Speaking:** Career choice, Describing recent innovations in Technology; **Reading:** Speed-reading - Identifying the various transitions in a text - Paragraphing; **Writing:** Precise writing - Letter of Enquiry, Quotation, Order, Claim Letters- Response to complaints; **Grammar:** Numerical Adjectives, Active & Passive Voice, Use of Impersonal Passive form; **Vocabulary:** Jumbled sentences. **Soft Skills:** Teamwork

UNIT-III	CAREER INSIGHTS AND DECISION MAKING	6

Listening: Job Interviews, Interview Skills, FAQs - Sports Commentaries/Animated stories/Anecdotes / Event narration; **Speaking:** Interviewing Celebrities and Entrepreneurs; **Reading:** Short stories - Critical reading; **Writing:** Cover Letter & Resume, Project Proposal writing using AI tools **Grammar:** Embedded sentences; **Vocabulary:** Foreign words used in English (from other languages); **Soft Skills:** Decision Making.

UNIT-IV	PROFESSIONAL WRITING AND ANALYTICAL SKILLS	6

Listening: TED Talks; **Speaking:** Presentation Skills; **Reading:** Developing analytical skills - Company profiles; **Writing:** Writing Statement of Purpose (SOP)-Emails, Memos, Notices and Circulars, Internship Application Letters; **Grammar:** Punctuation, If Conditionals; **Vocabulary:** Verbal reasoning; **Soft Skills:** Time Management

UNIT-V	ART OF REPORTING AND PANEL DISCUSSIONS	6

Listening: Model debate and reviewing the performance of each participant - Panel discussion; **Speaking:** Group communication- Discussing social issues, current affairs and debate; **Reading:** Fitting sentences in a paragraph - Cause and Effect Essays, Technical papers and case studies; **Writing:** Accident Report and Feasibility Report, Minutes of the Meeting; **Grammar:** Cause and Effect expressions , Reported speech; **Vocabulary:** Verbal Analogies; **Soft Skills:** Conflict Resolution

PRACTICAL COURSE

PRACTICAL SYLLABUS	INTRA PERSONAL, INTERPERSONAL, ORGANIZATIONAL AND MASS COMMUNICATION	15

Listening: Listening to TED Talks and Practice Exercises - Making a Critical Appreciation of Video Content - Answering Cloze Test Based on Listening.

Speaking: Self-Introduction-Introducing Resource Persons and Chief Guests - Developing Stories Using Picture Prompts - Language Etiquette in Different Situations - Expressing Agreement and Conflict Management and Seeking Information - Expressing Feelings - Affection, Anger, Regret etc. - Team Reviewing and Appraisal on any Social Event, Short Talk on Technical Topics.

Reading: Making Inference in Reading - Reading Longer Texts with Time Frame - Reading and Interpreting Data using different types of Texts, Magazines and Internet Materials - Editing/Proof reading - Reading Research Papers.

Writing: Abstract Writing - Mind Mapping and Brainstorming on any Social Event/Issue - Creating a Product Review Blog, Making PowerPoint Presentations (MS Power point & Google Slides) and Creating PPT using AI tools.

TOTAL :45 PERIODS

COURSE OUTCOMES

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

CO1: Demonstrate improved LSRW competencies in English.
CO2: Exhibit enhanced academic communication skills.
CO3: Integrate graphical data into logical writing.
CO4: Compose formal documents for communication.
CO5: Adapt and present concepts to diverse audiences with the usage of soft skills.

TEXTBOOKS:

1. Gangalakshmi, C, Rathika, B, Saranraj, L. Professional English for Engineers. New Delhi: Cengage, 2022.
2. Shoba K. N. and Lourdes Joavani Rayen, “Communicative English”, Cambridge University Press, Cambridge, 2021.
3. Raymond Murphy, “Intermediate English Grammar”, Cambridge University Press, New Delhi, 2020.

REFERENCES:

1. Raman, Meenakshi and Sangeetha Sharma. Communication Skills. New Delhi: OUP, 2018.
2. Jawahar, Jewelcy & Rathna.P. Communicative English Workbook. VRB Publishers Pvt Ltd. Chennai. 2018.
3. R. C. Sharma Krishna Mohan - Business Correspondence and Report Writing a Practical Approach to Technical Communication - McGraw Hill India (2017).

Teaching Resources and Websites:

1. Open Online Repositories from Oxford/ Cambridge/ British Council/ Voice of America
2. https://www.youtube.com/@TEDx
3. https://youtu.be/dzR4E49zNLI?si=0RL4C_vV1i1Kz2iR
4. AI tools : www.magicschool.ai, www.typeset.io, www.gamma.app, www.veed.io

CO-PO/PSO Mapping

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

EE25205	DIGITAL ELECTRONICS AND MEASUREMENTS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To apply the basics of digital electronics, Boolean algebra, and
- To develop and test Combinational logic circuits.
- To model and test Sequential logic circuits using dedicated IC's.
- To experiment with calibration of Instruments.
- To identify the uses of sensors for measurement of temperature.

LIST OF EXPERIMENTS

1. Verification of the truth tables of Logic gates.
2. Design and verification of the truth tables of Half and Full adder circuits.
3. Design and verification of the truth tables of Half and Full subtractor circuits.
4. Verification of the truth table of the Multiplexer 74150 and De-Multiplexer 74154.
5. Verify the truth table of a J-K flip-flop (7476) &D flip-flop (7474).
6. Operate the counters 7490, 7493.
7. Design of 4-bit shift register.
8. Calibration of PMMC Ammeter & PMMC Voltmeter.
9. Use Light Dependent Resistor (LDR) and control an LED that should switch-on/off
10. depending on the light.
11. Calibration of Temperature sensor.

TOTAL :60PERIODS

COURSE OUTCOMES:

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

CO1: Construct truth tables of logic gates.

CO2: Make use of the truth tables of different Combinational circuits.

CO3: Model different sequential circuits like Registers and Counters using flip-flops.

CO4: Solve the errors present in measuring instruments and calibrate them.

CO5: Plan the calibration of temperature measurement using Sensors.

CO-PO-PSO Mapping

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

CS25C04	PYTHON WITH FOUNDATION OF DATA SCIENCE LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To understand basic Python concepts, including variables, data types, operators, control structures, functions, and strings.
- To learn data structures like lists, tuples, and dictionaries, and file-handling techniques.
- To introduce the data science process, including retrieval, cleaning, analysis, and modeling.
- To develop skills in data manipulation and preprocessing with pandas.
- To gain foundational knowledge in descriptive statistics and statistical inference.

LIST OF EXPERIMENTS

1. Practice using the Python interpreter and interactive mode. Explore variable assignments, basic data types, and type conversions. Use operators to perform simple arithmetic and logical operations.
2. Create conditional statements and loops to work with control structures. Define functions to modularize code and explore string manipulations, slicing, and formatting.
3. Store and organize data using lists, tuples, and dictionaries. Practice adding, updating, and retrieving elements and comparing mutable and immutable data structures.
4. Practice reading from and writing to files. Use exception handling for common file errors, and learn about data handling techniques when working with external files.
5. Practice basic data exploration techniques to identify data types, check for missing values, and understand data distributions.
6. Use simple data cleansing and transformation techniques, such as handling missing data, and practice integrating data from multiple sources. Conclude by creating a summarized report of the cleaned data.
7. Use `pandas` to manipulate datasets by performing filtering, grouping, and sorting operations. Practice handling missing data and ranking data based on specific attributes.
8. Plot data for better visualization and insight. Use `matplotlib` for creating bar charts, histograms, and scatter plots, and explore fundamental data science libraries in Python.
9. Calculate descriptive statistics on a dataset, including measures of central tendency and variability. Use these statistics to interpret data distributions.
10. Perform statistical inference by creating confidence intervals, performing hypothesis testing, and interpreting p-values and statistical significance.
11. Team Based Mini Project – Data Analysis and Visualization for a real world problem.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Develop skills in basic Python syntax, variables, and control structures to create simple programs.

CO2: Make use of collections and handle text and CSV files for data input and output.

CO3: Demonstrate the steps in the data science process and apply basic data preparation techniques.

CO4: Develop data manipulation abilities, including filtering, sorting, and grouping data.

CO5: Apply statistical methods to analyze data distributions and test hypotheses.

REFERENCES:

1. Vijay Kumar Sharma, Vimal Kumar, Swati Sharma, Shashwat Pathak, “Python Programming – A Practical Approach”, CRC Press, First Edition, 2022.
2. Davy Cielen, Arno D B Meysman, Mohamed Ali, “Introducing Data Science – Big data, Machine Learning, and more using Python tools”, Manning Publications Co, 2016.
3. Laura Igual, Santi Segua, “Introduction to Data Science – A Python Approach to Concepts, Techniques and Applications”, Springer Nature, 2017.

CO-PO Mapping

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

VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
SEMESTER-III

MA25C04	DISCRETE MATHEMATICS *(Common to B.Tech. AI&DS, IT, B.E. CSE & CSE (CS))*	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

The main objectives of this course are:

- To extend student's logical ability to deal with abstraction.
- To familiarize students with advanced counting techniques.
- To enhance the fundamental concepts and terminology of graph theory.
- To familiarize the applications of algebraic structures.
- To explain the fundamental concepts and significance of Lattices and Boolean algebra.

UNIT-I	LOGIC AND PROOFS	12

Propositional logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.

UNIT-II	COMBINATORICS	12

Mathematical induction – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications.

UNIT-III	GRAPHS	12

Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

UNIT-IV	GROUP THEORY	12

Groups – Permutation Group - Dihedral group - Cyclic Group - Subgroups –Group Homomorphism –Cosets – Normal subgroup - Quotient group - Lagrange's theorem.

UNIT-V	LATTICES AND BOOLEAN ALGEBRA	12

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Some special lattices: Bounded, Modular, Distributive, complemented.

TOTAL :60 PERIODS

COURSE OUTCOMES:

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

CO1: Translate statements between natural language and formal logical expressions, including propositional and predicate logic.
CO2: Explain the basic concepts of Combinatorics.
CO3: Make use of the concept of graph theory in computer science and engineering.
CO4: Disseminate the concepts of group theory in computer applications.
CO5: Illustrate Lattice structures using Hasse diagrams and interpret their theoretic properties

TEXTBOOKS:

1. Veerarajan T. "Discrete Mathematics with Graph Theory and Combinatorics",8th reprint Tata McGraw Hill Publication Ltd., New Delhi, 2017.
2. Tremblay J.P. & Manohar.R,"Discrete Mathematics Structures with Application to Computer Science", 1st Edition 30th reprint, Tata McGraw Hill Publication Ltd., New Delhi, 2011

REFERENCES:

1. Grimaldi.R.P. "Discrete and Combinatorial Mathematics: An applied Introduction", 5th Edition, Pearson Education Asia, Delhi, 2019.
2. Rosen, K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub.Co. Ltd., New Delhi, 2017
3. Bernard Kolman, Robert C Busby, Sharon Cutler Ross, "Discrete Mathematical Structures", 3rd Edition, Prentice Hall, New Delhi, 2017.

CO-PO/PSO MAPPING:

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

AD25301	OPERATING SYSTEM PRINCIPLES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the basics and functions of operating systems.
- To analyze Scheduling algorithms and process synchronization.
- To analyze various memory management schemes.
- To be familiar with I/O management and File systems.
- To be familiar with the basics of virtual machines and Mobile OS like iOS and Android.

UNIT-I	INTRODUCTION	9

Computer System - Elements and organization; Operating System Overview - Objectives and Functions - Evolution of Operating System; Operating System Structures – Operating System Services - User Operating System Interface - System Calls – System Programs - Design and Implementation - Structuring methods

UNIT-II	PROCESS MANAGEMENT	9

Basic process concepts – CPU Scheduling – Scheduling algorithms – Threads - Multithread Models – Threading issues; Process Synchronization - The critical-section problem - Synchronization hardware – Semaphores– Classic problems of synchronization – Monitors – Deadlocks Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT-III	MEMORY MANAGEMENT	9

Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table - Segmentation; Virtual Memory - Demand Paging – Copy on Write – Page Replacement – Allocation of frames -Thrashing.

UNIT-IV	I/O SYSTEMS	9

File concept – Access methods – Directory structure – File-system mounting – Protection – Directory implementation – Allocation methods – Free-space management – Disk scheduling – Disk management – Swap-space management – Protection.

UNIT-V	VIRTUAL MACHINES AND MOBILE OS	9

Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Mobile OS - iOS and Android.

TOTAL :45 PERIODS

COURSE OUTCOMES:

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

CO1: Express the basic concepts of operating systems and its functions.

CO2: Implement the CPU Scheduling algorithms and deadlock, prevention, detection and also avoidance algorithms.

CO3: Demonstrate various memory management schemes and paging technique.

CO4: Elaborate the functionality of file system, I/O system and compare Disk scheduling like SSTF, SCAN, LOOK.

CO5: Examine the difference between iOS and Android Operating Systems.

TEXTBOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”ǁ, 10th Edition, John Wiley and Sons Inc., 2018. .

REFERENCES:

1. Andrew S.Tanenbaum,"Modern Operating Systems”, Second Edition, Addison Wesley,2001.
2. D M Dhamdhere, "Operating Systems: A Concept-based Approach”, Second Edition, Tata McGraw-Hill Education,2007.
3. Charles Crowley, "Operating Systems: A Design-Oriented Approach”, Tata McGraw Hill Educationǁ,1996.

CO-PO/PSO MAPPING:

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

AD25303	DATA STRUCTURE DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provide the foundation of data structures and use classes, objects, methods, inheritance in Python.
- To store and manipulate data using lists, dictionaries and impart knowledge on searching and sorting techniques.
- To learn about the Arrays and Linked list data structures in Python.
- To implement Stack and Queues in Python.
- To Perform Search operation in Graphs and Trees.

UNIT-I	OOPS CONCEPTS	9

Class, object, constructors, types of variables, types of methods. Inheritance: single, multiple, multi-level, hierarchical, hybrid, Polymorphism: with functions and objects, with class methods, with inheritance, Abstraction: abstract classes.

UNIT II	DATA STRUCTURES	9

Definition, Linear Data Structures, Non-Linear Data Structures, Python Specific Data Structures: List, Tuples, Set, Dictionaries, Comprehensions and its Types, Strings, slicing, Searching -Linear Search and Binary Search, Sorting - Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort.

UNIT-III	ARRAYS&LINKED LIST	9

Arrays - Overview, Types of Arrays, Operations on Arrays, Arrays vs List. Linked Lists – Implementation of Singly Linked Lists, Doubly Linked Lists, and Circular Linked Lists.

UNIT-IV	STACK & QUEUES	9

Stacks - Overview of Stack, Implementation of Stack (List & Linked list), Applications of Stack
Queues: Overview of Queue, Implementation of Queue (List & Linked list), Applications of Queues, Priority Queues.

UNIT-V	GRAPHS & TREES	9

Graphs -Introduction, Directed vs Undirected Graphs, Weighted vs Unweighted Graphs, Representations, Breadth First Search, Depth First Search. Trees - Overview of Trees, Tree Terminology, Binary Trees, Tree Traversals, Binary Search Trees, AVL Trees.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Interpret the concepts of Object Oriented Programming in python.
CO2: Identify and apply the most suitable data structure for a given real world problem.
CO3: Identify the operations of Arrays and linked lists.
CO4: Apply various data structures like stacks and queues to solve problems.
CO5: Summarize the concepts of graphs and trees including traversal techniques like DFS and BFS

TEXTBOOKS:

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Data Structures & Algorithms in Python, Wiley, 2021.

REFERENCES:

1. Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7, 2nd Edition by Dr. Basant Agarwal, Benjamin Baka.
2. Data Structures and Algorithms with Python by Kent D. Lee and Steve Hubbard.
3. Problem Solving with Algorithms and Data Structures Using Python by Bradley N Miller and David L. Ranum.
4. Core Python Programming -Second Edition,R. Nageswara Rao, Dreamtech Press

CO-PO/PSO MAPPING:

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

AD25305	PRINCIPLES OF ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To establish theoretical knowledge and understanding in the field of Artificial Intelligence and identify its possible applications of Intelligent Systems.
- To plan and formulate a non-trivial problem as a state space and apply intelligent search algorithms to identify optimal solutions.
- To develop and design methods to make decisions in complex uncertain environments.
- To make use of knowledge representation systems for real-world problems.
- To understand machine learning algorithms for solving real-world problems.

UNIT-I	INTRODUCTION TO AI AND INTELLIGENT SYSTEMS	9

Definition, Scope, and History of AI-Turing Test and its Implications, Intelligent Agents and their Classifications, Structure of Intelligent Agents, Applications of Intelligent Systems.

UNIT-II	PROBLEM SOLVING	9

Problem Representation and State-Space Search - Uninformed Search Algorithms- BFS, DFS, UCS, Informed Search Algorithms - A* Algorithm and Heuristics.

UNIT-III	SEARCH IN COMPLEX ENVIRONMENTS	9

Adversarial Search - Games, Optimal Decisions in Games, The Minimax Algorithm, Alpha-BetaPruning, and Constraint Satisfaction Problems (CSP), Backtracking Search for CSPs.

UNIT-IV	KNOWLEDGE REPRESENTATION AND REASONING	9

Propositional and Predicate Logic, Resolution and Inference Rules, Semantic Networks and Frames, Ontologies and Knowledge Graphs.

UNIT-V	MACHINE LEARNING	9

Introduction to Machine Learning and its Types, Supervised Learning - Regression, Classification, Unsupervised Learning - Clustering, Dimensionality Reduction.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Build artificial intelligence techniques to solve real-world problems.
CO2: Make use of search algorithms to solve problems in a state-space.
CO3: Select adversarial search techniques to make optimal decisions in games.
CO4: Construct knowledge representation in propositional and predicate logic.
CO5: Choose machine learning techniques to classify data and cluster data.

TEXTBOOKS:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, 4th Edition, Pearson Education, 2021.
2. Ethem Alpaydin, “Introduction to Machine Learning”, 4thEdition, MIT Press, 2020.
3. Saikat Dull, S. Chandramouli, Das, “Machine Learning”,1st Edition, Pearson,2018.

REFERENCES:

1. Deepak Khemani, “Artificial Intelligence”, 2ndEdition, TataMcGrawHillEducation,2013.
2. Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”,1stEdition, McGrawHill,2008.
3. PatrickH.Winston,"ArtificialIntelligence",3rdEdition, PearsonEducation,2006.

CO-PO/PSO MAPPING:

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

AD25306	SOFTWARE ENGINEERING PRINCIPLES AND DESIGN	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- To learn the concepts of software process.
- To gain knowledge about analysis and design.
- To acquire knowledge on developing UML diagrams.
- To know about software testing and project execution.
- To learn about agile development methodology.

UNIT-I	SOFTWARE PROCESS AND DEVELOPMENT	12

Software engineering concepts – Development activities – Software lifecycle models –Classical waterfall – Iterative waterfall – Prototyping – Evolutionary –Spiral – Win Win Spiral model – Prototyping model – Increment model – RAD model – Specialized process models – The rational unified process

UNIT-II	SOFTWARE REQUIREMENTS ANALYSIS, DESIGN CONCEPTS AND PRINCIPLES	12

Software Requirement Analysis & Design - Functional and non-functional – Software requirement document – Requirement engineering process – Feasibility studies – Functional and behavioral models - Structured analysis and data dictionary–Design process and concepts–Design heuristic – Architectural design – Mapping data flow into a software architecture –Data design – User interface design – Real time software design.

UNIT-III	OBJECT ORIENTED ANALYSIS AND DESIGN	12

Introduction to OOAD with OO Basics — Unified Process - UML Diagrams – Static, Dynamic & Implementation Diagrams.

UNIT-IV	SOFTWARE TESTING & PROJECT MANAGEMENT	12

Taxonomy of software testing – Types of S/W testing – Black box testing – White box testing – Regression testing – Unit testing – Integration testing – Validation testing – System testing – Software cost estimation – Function point models – COCOMO Model – Delphi method –Project planning – Project scheduling – Risk management – Software configuration management.

UNIT-V	AGILE SOFTWARE DEVELOPMENT AND SCRUM FRAMEWORK	12

Fundamentals of Agile Process Methods – Values – Principles – stakeholders – Challenges – Agile Manifesto and Principles - Agile project management – Design and development practices in Agile projects - User Stories – Agile Testing – Scrum Framework - Scrum Practices – Applying Scrum – Need of scrum – working of scrum – Advanced Scrum Applications – Scrum and the Organization – scrum values – Scrum case study – Tools for Agile project management.

TOTAL :60 PERIODS

COURSE OUTCOMES:

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

CO1: Apply software engineering principles for software development of a project or product.

CO2: Use software requirement specification to construct software requirement document and design software according to the specification.

CO3: Construct UML diagrams to design project deliverables.

CO4: Apply different testing strategies to write test cases and to manage the software.

CO5: Organize Agile Scrum and develop user stories for software projects.

TEXTBOOKS:

1. Roger S. Pressman, “Software Engineering: A practitioner’s Approach”, McGraw-Hill International Edition, Seventh Edition, 2014.
2. Craig Larman, “Applying UML and Patterns: An Introduction to Object Oriented Analysis and Design and Iterative Development”, Third Edition, Pearson Education, 2005.
3. Robert C. Martin, “Agile Software Development, Principles, Patterns and Practices”, Pearson Education Limited, First Edition, 2013

REFERENCES:

1. Martin Fowler, —UML Distilled: A Brief Guide to the Standard Object Modeling Languagell, Third edition, Addison Wesley, 2003.
2. Ian Sommerville, “Software engineering”, Pearson Education Limited, Ninth Edition, 2012
3. James F.Peters and Witold Pedrycz, “Software Engineering, An Engineering Approach”, Wiley-India, Third Edition, 2007

CO-PO/PSO MAPPING:

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

AD25307	DATA EXPLORATION AND ANALYTICS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the overview of exploratory data analysis.
- To analyze data using data visualization.
- To perform univariate data exploration and analysis
- To apply bivariate data exploration and analysis.
- To use Data exploration and visualization techniques for multivariate and time series data.

UNIT-I	EXPLORATORY DATA ANALYSIS	6

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques- Case study - attack for tampering with recommender systems.

UNIT-II	EDA USING PYTHON	6

Data Manipulation using Pandas – Pandas Objects – Data Indexing and Selection – Operating on Data – Handling Missing Data – Hierarchical Indexing – Combining datasets – Concat, Append, Merge and Join – Aggregation and grouping – Pivot Tables – Vectorized String Operations

UNIT-III	UNIVARIATE ANALYSIS	6

Introduction to Single variable: Distribution Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality.

UNIT-IV	BIVARIATE ANALYSIS	6

Relationships between Two Variables - Percentage Tables - Analysing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines.

UNIT-V	MULTIVARIATE AND TIME SERIES ANALYSIS	6

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time based indexing – Visualizing – Grouping -Resampling.

TOTAL:30 PERIODS

PRACTICAL EXERCISES

1. Install the data Analysis and Visualization tool: R/ Python /Tableau Public/ Power BI.
2. Perform exploratory data analysis (EDA) with datasets like email data set. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get different insights from the data.
3. Working with Numpy arrays, Pandas data frames , Basic plots using Matplotlib.
4. Explore various variable and row filters in R for cleaning data. Apply various plot features in R on sample data sets and visualize.
5. Perform Time Series Analysis and apply the various visualization techniques.
6. Perform Data Analysis and representation on a Map using various Map data sets with Mouse Rollover effect, user interaction, etc..
7. Build cartographic visualization for multiple datasets involving various countries of the world; states and districts in India etc.
8. Perform EDA on Wine Quality Data Set.
9. Use a case study on a data set and apply the various EDA and visualization techniques and present an analysis report.

PRACTICAL:30 PERIODS

TOTAL:60 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Summarize the fundamentals of exploratory data analysis
CO2: Implement the data visualization using Matplotlib.
CO3: Perform univariate data exploration and analysis for a sample dataset.
CO4: Apply bivariate data exploration and analysis for a sample dataset.
CO5: Evaluate data exploration and visualization techniques for multivariate and time series data**.**

TEXT BOOKS:

1. Suresh Kumar Mukhiya, Usman Ahmed, ―Hands-On Exploratory Data Analysis with Python‖, Packt Publishing, 2020. (Unit 1)
2. Robert S. Witte and John S. Witte, ―Statistics‖, Eleventh Edition, Wiley Publications, 2017 (Unit 2)
3. Catherine Marsh, Jane Elliott, ―Exploring Data: An Introduction to Data Analysis for Social Scientists‖, Wiley Publications, 2nd Edition, 2008. (Unit 3,4,5)

REFERENCES:

1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", First Edition, O Reilly, 2017. (Unit 2)
3. Matthew O. Ward, Georges Grinstein, Daniel Keim, ―Interactive DatVisualization: Foundations, Techniques, and Applications, 2nd Edition, CRC press, 2015.
4. Claus O. Wilke, “Fundamentals of Data Visualization”, O’reilly publications, 2019.

CO-PO/PSO MAPPING:

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

AD25302	OPERATING SYSTEM PRINCIPLES LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the basics of UNIX commands and shell programming.
- To implement CPU Scheduling algorithm and Deadlock Avoidance, Detection Algorithms.
- To implement Page Replacement Algorithms
- To implement various memory allocation methods and Threading.
- To be familiar with File Organization and File Allocation Strategies

LIST OF EXPERIMENTS

1. Installation of Linux Operating System
2. Illustrate UNIX commands and simulate the commands like cp, ls, grep using Shell.
3. Write C programs to implement the various CPU Scheduling Algorithms
4. Illustrate the inter process communication strategy
5. Implement mutual exclusion by Semaphore
6. Write C programs to avoid Deadlock using Banker's Algorithm
7. Write a C program to Implement Deadlock Detection Algorithm
8. Write C program to implement Threading and Synchronization Applications.
9. Implement the paging Technique using C program
10. Implement various page replacement algorithms
11. Implement memory allocation methods for fixed partition.
12. Implement File Organization and File Allocation strategies.

TOTAL :45PERIODS

COURSE OUTCOMES:

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

CO1: Apply UNIX Commands and use C program for cp, ls and grep.

CO2: Apply various CPU Scheduling Algorithms like FCFS, SJF, RR, Priority and handle deadlock.

CO3: Examine page replacement algorithm for FIFO, LFU, LRU and calculate the page hit and page fault.

CO4: Implement various memory management techniques for a fixed partition

CO5: Implement various File Organization and File Allocation techniques like Sequential, Linked, Indexed.

CO-PO/PSO MAPPING:

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

AD25304	DATA STRUCTURE DESIGN USING PYTHON LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

- To demonstrate the OOPS concept in python.
- To Implement various Searching and Sorting Techniques.
- To Create different linear data structures like linked lists, stacks, and queues.
- To Create non-linear data structures like trees and graphs.
- To define various Trees and Graph structures in python.

LIST OF EXPERIMENTS

1. Write a program to implement Inheritance.
2. Write a program for Linear Search and Binary search.
3. Write a program to implement Bubble Sort and Selection Sort.
4. Write a program to implement Merge sort and Quick sort
5. Write a program to implement Stacks and Queues
6. Write a program to implement Singly Linked List
7. Write a program to implement Doubly Linked list
8. Write a program to implement Circular Linked list
9. Write a program to implement Binary Search Tree
10. Write a program to implement BFS & DFS
11. Write a program to implement Binary Tree traversal.
12. Write a program to implement a Graph Data Structure using Adjacency List and Matrix in Python

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Demonstrate the OOPS concepts.
CO2: Interpret the data structure concepts.
CO3: Implement Array and Linked list operations
CO4: Make use of Stack and Queue in real world applications
CO5: Interpret the application of Trees and Graphs.

CO-PO/PSO MAPPING:

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

VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
SEMESTER-IV

MA25401	NUMERICAL METHODS AND DESIGN OF EXPERIMENTS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- To outline the basic concepts for solving algebraic and transcendental equations.
- To explore the fundamental concepts and principles of interpolation and approximation.
- To explain the various numerical techniques of differentiation and integration for solving engineering Problems.
- To describe the various techniques and methods of solving ordinary differential equations.
- To apply Statistical methods for comparing treatment and analysing variance in designed experiments.

UNIT-I	SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS	12

Solution of algebraic and transcendental equations — Fixed point iteration method — Newton Raphson method — Solution of linear system of equations — Gauss elimination method — Pivoting — Gauss Jordan method — Iterative methods of Gauss Jacobi and Gauss Seidel — Eigenvalues of a matrix by Power method.

UNIT-II	INTERPOLATION AND APPROXIMATION	12

Interpolation with unequal intervals — Lagranges interpolation — Newton's divided difference interpolation —Difference operators and relations — Interpolation with equal intervals — Newton's forward and backward difference formulae.

UNIT-III	NUMERICAL DIFFERENTIATION AND INTEGRATION	12

Approximation of derivatives using interpolation polynomials — Numerical integration using Trapezoidal, Simpson's 1/3 rule— Two point and three point Gaussian quadrature formulae — Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT-IV	INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS	12

Single step methods — Taylor's series method — Euler's method — Modified Euler's method — Fourth order Runge — Kutta method for solving first order equations — Multi step methods — Milne's and Adams — Bash forth predictor corrector methods for solving first order equations.

UNIT-V	DESIGN OF EXPERIMENTS	12

One way and two way classifications – Completely randomized design – Randomized block design – Latin square design.

TOTAL :60 PERIODS

COURSE OUTCOMES:

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

CO1: Apply the basic concepts and techniques of solving algebraic and transcendental equations.
CO2: Compute the numerical techniques of interpolation and error approximations in various intervals.
CO3: Use suitable numerical techniques to evaluate the approximation of derivatives and integrals.
CO4: Solve the ordinary differential equations with initial conditions by using suitable techniques.
CO5: Examine the given data with the concepts of design of experiment.

TEXTBOOKS:

1. Veerarajan.T and Ramachandran T, "Numerical Methods with Programming in C" , 2nd Tata McGraw Hill Publication Ltd, 2007.
2. **Kreyszig, E.,** "Advanced Engineering Mathematics", 11th Edition, Wiley, New Delhi, 2023.

REFERENCES:

1. Chen, T., An Introduction to Numerical Methods and Analysis, 3rd Edition, Springer, 2023.
2. Sastry, S.S., *Introductory Methods of Numerical Analysis*, 5th Edition, PHI Learning, New Delhi, 2021.
3. Ross, S.M., *Introduction to Probability and Statistics for Engineers and Scientists*, 6th Edition, Academic Press, 2021.

CO-PO/PSO MAPPING:

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

AD25401	ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To apply the algorithm analysis techniques on searching and sorting algorithms
- To critically analyse the different graph representations with algorithms like Bellman-Ford, Dijkstra's and Floyd –Warshall algorithm
- To implement algorithms using divide-and-conquer methodology
- To solve programming problems using state space tree
- To know the concepts behind NP Completeness, Approximation algorithms and randomized algorithms

UNIT-I	INTRODUCTION	9

Algorithm analysis: Time and space complexity - Asymptotic Notations and its properties Best case, Worst case and average case analysis – Recurrence relation: substitution method - Lower bounds –searching: linear search, binary search and Interpolation Search, Pattern search: The naïve string matching algorithm - Rabin-Karp algorithm - Knuth-Morris-Pratt algorithm. Sorting: Insertion sort –heap sort .

UNIT-II	GRAPH ALGORITHMS	9

Graph algorithms: Representations of graphs - Graph traversal: DFS – BFS - applications - Connectivity, strong connectivity, bi-connectivity - Minimum spanning tree: Kruskal's and Prim's algorithm- Shortest path: Bellman-Ford algorithm - Dijkstra's algorithm - Floyd-Warshall algorithm Network flow: Flow networks - Ford-Fulkerson method – Matching: Maximum bipartite matching.

UNIT-III	ALGORITHM DESIGN TECHNIQUES	9

Divide and Conquer methodology: Finding maximum and minimum - Merge sort - Quick sort Dynamic programming: Elements of dynamic programming — Matrix-chain multiplication - Multi stage graph — Optimal Binary Search Trees. Greedy Technique: Elements of the greedy strategy - Activity-selection problem –- Optimal Merge pattern — Huffman Trees.

UNIT-IV	STATE SPACE SEARCH ALGORITHMS	9

Backtracking: n-Queens problem - Hamiltonian Circuit Problem - Subset Sum Problem – Graph colouring problem Branch and Bound: Solving 15-Puzzle problem - Assignment problem – Knapsack Problem - Travelling Salesman Problem.

UNIT-V	NP-COMPLETE AND APPROXIMATION ALGORITHM	9

Tractable and intractable problems: Polynomial time algorithms – Venn diagram representation – NP algorithms - NP-hardness and NP-completeness – Bin Packing problem - Problem reduction: TSP – 3CNF problem. Approximation Algorithms: TSP - Randomized Algorithms: concept and application - primality testing - randomized quick sort - Finding kth smallest number.

TOTAL :45 PERIODS

COURSE OUTCOMES:

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

CO1: Analyze the efficiency of algorithms using various frameworks like substitution method and sorting method

CO2: Apply graph algorithms to solve problems and analyze their efficiency using Bellman-Ford, Dijkstra's and Floyd –Warshall algorithm.

CO3: Recognize the algorithm design techniques like divide and conquer, dynamic programming and greedy techniques to solve problems

CO4: Use the state space tree method for solving 15-Puzzle, Knapsack and travelling salesman problems.

CO5: Slove problems using approximation algorithms and randomized algorithms.

TEXTBOOKS:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 2nd Edition, Pearson Education, 2015.

REFERENCES:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, Prentice Hall of India, 2009.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Reprint

Edition, Pearson Education, 2006 .
3. S. Sridhar, “Design and Analysis of Algorithms”, Oxford university press, 2014.

CO-PO/PSO MAPPING:

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

AD25402	DATABASE DESIGN AND ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To design database using ER model and SQL.
- To apply functional dependencies and normalization concept in real time problems.
- To acquire knowledge on transactions, file organization and query processing.
- To understand basic data engineering concepts.
- To analyze the principle of data architecture and storage.

UNIT-I	INTRODUCTION AND DATABASE DESIGN	9

Database System – Purpose – Views of Data – System Structure - Models – Relational Model – ER Model - SQL Fundamentals & Features.

UNIT-II	NORMALIZATION	9

Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms – Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies & Fourth Normal Form – Join Dependencies & Fifth Normal Form.

UNIT-III	TRANSACTION AND IMPLEMENTATION TECHNIQUES	9

Transaction – ACID properties – Schedules – Serializability – Concurrency Control – Locking Protocol – Two Phase Locking – Deadlock - RAID – File Organization - Indexing and Hashing - Query Processing.

UNIT-IV	FUNDAMENTALS OF DATA ENGINEERING	9

Fundamentals Data Engineering, Data Engineering Lifecycle, Data Engineering vs. Data Science, Data Engineering Skills and Activities, Business and Technical Responsibilities.

UNIT-V	DATA ARCHITECTURE AND STORAGE	9

Principles of Data Architecture, Types of Data Architecture -Data Warehouse, Data Lake, Cloud vs. On-Premises Storage, Data Storage Systems, Distributed Storage, Object Storage, Data Platforms and Data Catalogs.

TOTAL :45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify entities, attributes and their relationship, prepare ER model and use basics of SQL to write query.

CO2: Use functional dependencies, normal forms to design and normalize a database.

CO3: Summarize interleaved operations of transaction, file organization strategies, parsing and execution of SQL Statements.

CO4: Understand and summarize basics of data engineering concepts.

CO5: Analyze the principles governing Data Architecture and Storage in different applications.

TEXTBOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Seventh Edition, Tata McGraw Hill, 2021.
2. Joe Reis, Matt Housley, “Fundamentals of Data Engineering”, 1st Edition, O’Reilly Media, 2022.

REFERENCES:

1. Paul Crickard, “Data Engineering with Python”, First Edition, Packet, 2020.
2. Brian Shive, “Data Engineering”, First Edition, Kindle Edition, 2013.
3. Hamid Mahmood Qureshi, Hammad Sharif, “Snowflake Cookbook: Techniques for building modern cloud data warehousing solutions”, 1st Edition, Kindle Edition, 2021.
4. Andreas Kretz, “The Data Engineering Cookbook”, The Data Engineering Academy, 2019.

CO-PO/PSO MAPPING:

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

AD25404	COMPUTER NETWORKING PRINCIPLES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basic fundamental concepts, functionalities of physical layer
- To understand the functionalities of data link layer.
- To learn the concepts in transport layer and application layer.
- To learn the fundamentals of cryptography.
- To understand the application layer security standards and real time security practices.

UNIT-I	NETWORKING PRINCIPLES AND PHYSICAL LAYER	9

History of Computer Networking and Internet – Protocols – Network Edge – Network Core – Layered Architecture – OSI Model – Internet Architecture (TCP/IP model) – Networking Devices: Hubs – Bridges – Switches – Routers – Gateways – Performance Metrics- Physical layer –Topology – Transmission media – Switched Communications Networks – Circuit Switching – Packet Switching – Comparison of Circuit Switching and Packet Switching.

UNIT-II	DATA LINK LAYER	9

Data Link Layer – Framing – Flow control – Error Detection and Correction – Media Access Control – Ethernet Basics – CSMA/CD – Virtual LAN – Wireless LAN (802.11).

UNIT-III	NETWORK LAYER	9

Introduction to Network Layer – Switching concepts – Internet Protocol (IP) – IPv4 Addressing – Subnetting – Classless Inter Domain Routing (CIDR) – Variable Length Subnet Mask (VLSM) – DHCP – ARP – Network Address Translation (NAT) – ICMP – IPv6 Addressing – SDN – Routing Principles – Distance Vector Routing – Link State Routing – RIP – OSPF – BGP – Introduction to Quality of Service (QoS)

UNIT-IV	TRANSPORT LAYER AND COMMUNICATION TECHNIQUES	9

Transport-Layer Services – Multiplexing and Demultiplexing – Connectionless Transport : UDP – Reliable Data Transfer – Connection-Oriented Transport: TCP – Flow Control – Retransmission Strategies – Principles of Congestion Control – TCP Congestion Control - cellular Internet access – 3G, 4G, 5G

UNIT-V	APPLICATION LAYER AND NETWORK SECURITY PRACTICES	9

Application Layer protocols – HTTP – FTP – SMTP – DNS - Network Security – Principles of Cryptography – Message Integrity and Digital Signatures – End-Point Authentication - Electronic Mail Security: Pretty Good Privacy - Firewalls and Intrusion Detection Systems - Cloud Security and IoT security.

TOTAL :45 PERIODS

COURSE OUTCOMES:

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

CO1: Outline the features of networks and organize the physical layer performance based on metrics, topology and transmission media.

CO2: Make use of data link layer features to calculate error codes and apply protocols for the given network.

CO3: Construct a network based on IP addressing and find shortest path among nodes using routing algorithm.

CO4: Use the features of transport layer and Compare congestion effects in a network.

CO5: Summarize application layer protocols and apply security practices for real time applications.

TEXTBOOKS:

1. Behrouz A. Foruzan, “Data communication and Networking”, Tata McGraw-Hill, Fifth Edition, 2013
2. Cryptography and Network Security: Principles and Practice, 6th Edition, William Stallings, 2014, Pearson, ISBN 13:9780133354690.

REFERENCES:

1. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Morgan Kauffmann Publishers Inc., Third Edition, 2011
2. Computer Networks -- Andrew S Tanenbaum, 4th Edition, Pearson Education, 2018.
3. William Stallings, “Data and Computer Communication”, Pearson Education, Sixth Edition, 2000.
4. Network Security: Private Communications in a Public World, M. Speciner, R. Perlman, C. Kaufman, Prentice Hall, 2002.

CO-PO/PSO MAPPING:

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

AD25405	PRINCIPLES OF MACHINE LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the concepts of machine learning
- To explore the different supervised learning techniques
- To learn different aspects of unsupervised learning algorithm
- To learn the role of probabilistic methods for machine learning
- To understand the basic concepts of neural networks and deep learning .

UNIT-I	INTRODUCTION TO MACHINE LEARNING	9

Introduction to Machine Learning (ML), Essential Concepts of ML, Types of Learning, Machine Learning Methods based on Time, Dimensionality, Linearity and Non Linearity, Early Trends in Machine Learning, Data Understanding Representation and Visualization.

UNIT-II	SUPERVISED LEARNING ALGORITHMS	9

Linear, Non-Linear, Multi-Class and Multi-Label Classification, Support Vector Machine, Decision Trees: ID3, Classification and Regression Trees (CART), Regression: Linear Regression, Multiple Linear Regression, Logistic Regression.

UNIT-III	UNSUPERVISED LEARNING	9

Clustering, Nearest Neighbor Models, K-Means, Hierarchical Clustering, KD Trees. Dimensionality Reduction, Linear Discriminant Analysis, Principal Component Analysis, Factor Analysis, Independent Component Analysis.

UNIT-IV	LEARNING METHODS	9

Introduction, Naïve Bayes Algorithm, Maximum Likelihood, Maximum Apriori, Bayesian Belief Networks, Probabilistic Modelling of Problems, Inference in Bayesian Belief Networks, Probability Density Estimation, Sequence Models, Markov Models, Hidden Markov Models.

UNIT-V	NEURAL NETWORKS AND DEEP LEARNING	9

Neural Networks, Biological Motivation, Perceptron, Multi-Layer Perceptron, Feed Forward Network, Back Propagation, Activation and Loss Functions, Limitations of Machine Learning, Deep Learning, Convolution Neural Networks, Recurrent Neural Networks, Use Cases.

TOTAL :45 PERIODS

COURSE OUTCOMES

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

CO1: Explain the basic concepts of machine learning.
CO2: Design supervised learning models.
CO3: Construct unsupervised learning algorithms.
CO4: Implement Probabilistic Modelling for an application and analyze the results.
CO5: Determine the functions of neural network and deep learning.

TEXTBOOKS:

1. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Fourth Edition, 2020.
2. Tom Mitchell, “Machine Learning”, McGraw Hill, 3rd Edition, 2017
3. Stephen Marsland, “Machine Learning: An Algorithmic Perspective, “Second Edition”, CRC Press, 2014.

REFERENCES:

1. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, “Foundations of Machine Learning”, Second Edition, MIT Press, 2018.
2. Jason Bell, —Machine learning – Hands on for Developers and Technical Professionals‖, First Edition, Wiley, 2014.
3. Peter Flach, —Machine Learning: The Art and Science of Algorithms that Make Sense of Data‖, First Edition, Cambridge University Pres.

CO-PO/PSO MAPPING:

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

AD25407	OBJECT ORIENTED PROGRAMMING (TwP)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To gain foundational knowledge in C++ programming.
- To provide comprehensive understanding of object-oriented principles.
- To gain advanced knowledge of the concepts such as inheritance and polymorphism in C++.
- To learn fundamental characteristics of Java.
- To know the principles of packages, inheritance, and interfaces

UNIT-I	OBJECT ORIENTED PROGRAMMING FUNDAMENTALS	6

C++ Programming features - Data Abstraction - Encapsulation - class - object - constructors - static members – constant members – member functions – pointers – references - Role of this pointer Storage classes – function as arguments.

UNIT-II	INHERITANCE AND POLYMORPHISM	6

String Handling – Copy Constructor - Polymorphism – compile time and run time polymorphisms – function overloading – operators overloading – dynamic memory allocation - Nested classes - Inheritance – virtual functions.

UNIT-III	EXCEPTION HANDLING	6

Abstract class – Exception handling - Standard libraries - Generic Programming - templates – class template - function template – STL – containers – iterators – function adaptors – allocators - Parameterizing the class.

UNIT-IV	INTRODUCTION TO JAVA FUNDAMENTALS	6

Defining classes in Java – constructors, methods-access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays, Packages - Javadoc comments,Introduction to Functional Programming Concepts – Lamda Expressions – Functional Interfaces – Streams API.

UNIT-V	INHERITANCE AND INTERFACES	6

Super classes- sub classes –Protected members – constructors in sub classes - The Object class – abstract classes and methods - final methods and classes. Defining an interface, implementing interface, differences between classes and interfaces and extending interfaces - Object cloning - inner classes, Array Lists – Strings.

30 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

I. Do the following exercises for any one project given in the list of sample projects.

1. Implement a C++ program to create a class called “simple class”. Create a constructor and destructor for this class called simple class.
2. Implement a C++ program for a Copy Constructor. Create a Person class with a name and an age and create a copy constructor to create a new object with the same name and age as the source object.
3. Implement a C++ program for Overloading Functions with different number of parameters for addition in a calculator.
4. Implement a C++ program that demonstrates polymorphism using a basic example of shapes.
5. Develop a java application with an Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of

BP as PF, 0.1% of BP for staff club funds. Generate pay slips for the employees with their gross and net salary.

6. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea( ) that prints the area of the given shape.
7. Solve the above problem using an interface.
8. Implement exception handling and creation of user defined exceptions.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Implement object-oriented features including classes, objects, pointers and encapsulation.
CO2: Implement string handling, polymorphism and inheritance using C ++
CO3: Implement exception handling and generic programming with templates using C ++
CO4: Develop Java programs using OOP principles
CO5: Develop Java programs with the concept of inheritance and interfaces.

TEXTBOOKS:

1. Herbert Schildt, “C++: The Complete Reference”, 5th Edition, Tata Mc-Graw Hill Publishers, 2014.
2. Herbert Schildt, “Java: The Complete Reference”, 12th Edition, McGraw Hill Education, New Delhi, 2021.

REFERENCES:

1. Ira Pohl, “Object Oriented Programming using C++”, 2nd Edition, Pearson Education, Reprint, 2004.
2. Paul Deitel Harvey Deitel, Java, How to Program, Prentice Hall; 9th edition, 2018

CO-PO/PSO MAPPING:

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

AD25403	DATABASE DESIGN AND ENGINEERING LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

The main objectives of this course are:

- To gain knowledge on basic commands of database.
- To execute constraints, views, sequence and synonyms.
- To understand execution of nested queries, procedures and functions.
- To be familiar with front end tool and database connectivity.
- To create simple datasets and implement visualization.

LIST OF EXPERIMENTS

1. Database Development Life cycle:
    - Problem definition and Requirement analysis
    - Scope and Constraints
2. Implement the database using SQL Data Definition with Constraints.
3. Query the database using SQL Manipulation and Control Statements.
4. Implementation Views, Sequences and Synonyms.
5. Query the database using Set Operators, Nested Queries and Join Queries.
6. Querying/Managing the database using SQL Programming
   - Stored Procedures/Functions
   - Constraints and security using Triggers
7. Database Design using ER Modeling, Normalization and Implementation for any application.
8. Database Connectivity with Front End Tools.
9. Case Study using Real Time Application – Collection of data – Create Dataset for the Application.
10. Create data visualization for any real time application.

Hardware: Standalone Desktops
Software: Oracle, NetBeans, VisualStudio, any open source tool for visualization

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Use DDL, DML & DCL commands to experiment the creation of database.
CO2: Create an application to execute Views, Sequence and Synonyms.
CO3: Test a database application using nested queries and join queries.
CO4: Construct simple codes to execute functions and procedures.
CO5: Design an application using ER diagram, normalization and create simple dataset.

CO-PO/PSO MAPPING:

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

AD25406	MACHINE LEARNING LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

- The main objectives of this course are:
- To Understand the fundamental concepts of Machine Learning and its significance
- To build supervised learning models.
- To construct unsupervised learning models.
- To Introduce and implement the Naïve Bayes algorithm for probabilistic classification.
- To identify the working principles of neural network including the back propagation algorithm

LIST OF EXPERIMENTS

LIST OF EXPERIMENTS

1. Implement loading and exploring a machine learning dataset
2. Demonstrate various data pre-processing techniques for a given dataset.
3. Implement a Support Vector Machine (SVM) model.
4. Develop Logistic Regression Model for a given dataset
5. Develop Decision Tree Classification model for a given dataset and use it to classify a new sample
6. Implement Naïve Bayes Classification in Python.
7. Implement Random Forest ensemble method on a given dataset.
8. Implement a Principal Component Analysis (PCA) algorithm.
9. Implement a K-Nearest Neighbors (KNN) classifier.
10. Build Artificial Neural Network model with back propagation for the given dataset

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify and apply the appropriate machine learning algorithm for a given problem.

CO2: Evaluate the Supervised learning models preprocessed through various feature engineering algorithms.

CO3: Implement and apply dimensionality reduction techniques such as principal component analysis.

CO4: Apply the Naive Bayes algorithm to obtain maximum likelihood, and maximum a posteriori estimation.

CO5: Understand the basic concepts of neural network model and design the same

CO-PO/PSO MAPPING:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	K3	K4	K5	K5	K6	K3	K2	K3	K3	K2	K3	K3	K3	K4
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	2
CO2	3	3	2	2	2	-	-	-	-	-	-	-	3	3
CO3	3	2	2	2	1	-	-	-	-	-	-	-	3	2
CO4	3	3	3	3	2	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	2	-	-	-	-	-	-	-	3	3

EN25C05	COMMUNICATIVE ENGLISH – II *(Common to B.Tech. AI & DS, B.E. CSE(CS), Mech)*	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

The course enables the students:

- To describe the skills involved in critical reading and purposeful writing.
- To identify the abilities essential for success in engineering coursework and related contexts.
- To outline the key features of effective technical writing.
- To discuss the processes involved in logical inquiry and objective evaluation.
- To summarize the impacts of research topics and present project plans effectively in written form.

UNIT-I	TECHNIQUES IN PARAGRAPH CONSTRUCTION AND COMPREHENSION	6

Reading - Strategies for effective reading – usage of glossaries and footnotes to enhance reading skills, Comprehension reading, understanding different types of content. **Writing**-Planning a synopsis- synopsis preparation -paragraph writing format. Exercise –Writing a descriptive paragraph.

UNIT-II	ADVANCED WRITING SKILLS - ORGANIZING	6

Reading-Reading for details-using graphic organizers. **Writing** - exercises to state reasons and examples to support ideas in writing- exercises to clearly state opinion or ideas. Writing a paragraph with reasons and examples -writing an opinion paragraph.

UNIT-III	CORE COMPONENTS OF EXTENDED TEXTS	6

Reading- Understanding pronoun references and the use of connectors to establish coherence within passages - speed reading techniques - The 4-3-2-1 Drilling technique. **Writing-** Hints developing, Idea mapping and prompt expansion. Elements of a good essay-Types of essays- descriptive/ narrative, issue-based, argumentative and analytical essays.

UNIT-IV	ADVANCED WRITING IN PERSONAL AND TECHNICAL CONTEXTS	6

Writing- Cohesion of ideas, organization of ideas, Email writing, Business letters, Memo writing- editing and proofreading. Writing a resume with a job application. Response writing- Peer review and feedback.

UNIT-V	LANGUAGE FOR A PROFESSIONAL SETTING	6

Reading- Critical reading and thinking- reading and comprehending texts of different domains. **Writing**-statement of purpose- letter of recommendation- drafting meeting agendas and minutes.

TOTAL :30 PERIODS

COURSE OUTCOMES

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

CO1: Describe the main ideas in complex texts accurately.

CO2: Demonstrate the principles of effective technical writing.

CO3: Discuss the basic concepts involved in critical thinking.

CO4: Outline the features of effective communication.

CO5: Summarize the steps to improve project and proposal writing skills.

TEXTBOOKS:

1. Debra Daise, CharlNorloff, and Paul Carne Reading and Writing (Level 4) Oxford University Press: Oxford, 2011

REFERENCES:

1. U.S. Ramasamy. English Essentials - I. VRB Publishers, New Delhi, 2025.
2. E. Suresh Kumar and et al. Enriching Speaking and Writing Skills. Second Edition. Orient Black swan: Hyderabad, 2012

CO-PO/PSO MAPPING:

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