CARE

COLLEGE OF ENGINEERING

(An Autonomous Institution)

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai
Accredited by NAAC with 'A' Grade
#27, Thayanur, Tiruchirappalli - 620009

Regulations 2024

Undergraduate Degree

B.E. / B. Tech./B.Des.

Full Time Programmes

Curriculum and Syllabus

CARE COLLEGE OF ENGINEERING:: TIRUCHIRAPPALLI 620 009
(AN AUTONOMOUS INSTITUTION)
REGULATION 2024
CURRICULUM AND SYLLABUS FOR FIRST YEAR
CHOICE BASED CREDIT SYSTEM

B.E. COMPUTER SCIENCE AND ENGINEERING

SEMESTER I

S. No	Course Code	Course Title	Category	Periods per week			No of Contact Periods	Credits
				L	T	P		
THEORY COURSES								
1	U24MA111	Matrices and Calculus	BSC	3	1	0	4	4
2	U24GE111	Problem solving using Python	ESC	3	0	0	3	3
3	U24HS111	Heritage of Tamils	HSMC	1	0	0	1	1
THEORY CUM PRACTICAL COURSES								
4	U24HS123	Communicative English for Engineers	HSMC	3	0	2	5	4
5	U24PH113	Engineering Physics	BSC	3	0	2	5	4
6	U24CY113	Engineering Chemistry	BSC	3	0	2	5	4
PRACTICAL COURSES								
7	U24GE122	Problem solving using Python Laboratory	ESC	0	0	4	4	2
			TOTAL	**16**	**1**	**10**	**27**	**22**

SEMESTER II

S. No	Course Code	Course Title	Category	Periods per week			No of Contact Periods	Credits
				L	T	P		
THEORY COURSES								
1	U24MA221	Discrete Mathematics	BSC	3	1	0	4	4
2	U24PH221	Physics for Information Science	BSC	3	0	0	3	3
3	U24CS211	C Programming	ESC	3	0	0	3	3
4	U24EC221	Digital Principles and Computer Organization	ESC	3	0	0	3	3
5	U24HS211	Tamils and Technology	HSMC	1	0	0	1	1
THEORY CUM PRACTICAL COURSES								
6	U24HS223	Technical English for Engineers	HSMC	2	0	2	4	3
PRACTICAL COURSES								
7	U24EE232	Engineering Practices for Circuit Branches	ESC	0	0	4	4	2
8	U24CS222	C Programming Laboratory	ESC	0	0	4	4	2
9	U24EM212	Professional Development	EEC	0	0	2	2	1
			TOTAL	**15**	**1**	**12**	**28**	**22**

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#27, Thayanur, Tiruchirappalli - 620009

Department of Computer Science and Engineering

Regulation 2024 Third Semester Curriculum

Sl. No	Course Code	Course Name	Category	No. of periods/week			Total Periods	Credits
				L	T	P		
1	U24MA321	Probability and Queueing Theory	BSC	3	1	0	4	4
2	U24CS311	Operating Systems	PCC	3	0	0	3	3
3	U24CS321	Data Structures	PCC	3	0	0	3	3
4	U24CS331	Object Oriented Programming using Java	PCC	3	0	0	3	3
5	U24CS341	Software Engineering	PCC	3	0	0	3	3
6	U24CS352	Data Structures Laboratory	PCC	0	0	4	4	2
7	U24CS362	Object Oriented Programming Laboratory	PCC	0	0	4	4	2
8	U24CS372	Operating Systems Laboratory	PCC	0	0	4	4	2
9	U24EM312	Design Thinking and Innovation	EEC	0	0	2	2	1
			Total	**15**	**2**	**14**	**31**	**23**

U24MA111	MATRICES AND CALCULUS	L	T	P	C
		3	1	0	4

Course Objectives:

- To develop the use of matrix algebra techniques those are needed to engineers for practical applications.
- To familiarize the students with differential calculus.
- To introduce the methods of solving linear and nonlinear ordinary differential equations.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.
- To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.

UNIT I MATRICES **9+3**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms – Applications: Stretching of an elastic membrane

UNIT II DIFFERENTIAL CALCULUS **9+3**

Functions of single variable – Limit of the function- Continuity and Differentiability - Mean value Theorems - Partial derivatives - Total derivative - Taylor series (in one and two variables) - Maxima and Minima (in one and two variables).

UNIT III ORDINARY DIFFERENTIAL EQUATION **9+3**

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients.

UNIT IV INTEGRAL CALCULUS **9+3**

Evaluation of definite and improper integrals - Change of order of integration - Double integrals in polar coordinates - Area enclosed by plane curves - Triple integrals.

UNIT V VECTOR CALCULUS **9+3**

Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

TOTAL: 60 PERIODS

Text Books

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 44th Edition, New Delhi, 2015.
2. Erwin Kreyszig. E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016

Reference Books

1. Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016
2. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
3. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.

Course Outcomes: At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge level**
CO1	Apply the matrix algebra methods for solving practical problems.	Applying
CO2	Apply differential calculus tools in solving various Engineering problems.	Applying
CO3	Apply various techniques in solving differential equations.	Applying
CO4	Apply double and triple integration techniques in solving areas and volumes.	Applying
CO5	Evaluate of line, surface and volume integrals using Gauss, Stokes and Green's Theorems.	Applying

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3						2	2		3		
CO2	3	3	3						2	2		3		
CO3	3	3	3						2	2		3		
CO4	3	3	3						2	2		3		
CO5	3	3	3						2	2		3		
Avg.	**3**	**3**	**3**						**2**	**2**		**3**		

U24GE111 PROBLEM SOLVING USING PYTHON

L	**T**	**P**	**C**
3	**0**	**0**	**3**

Course Objectives:

- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING 9

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode, debugging; values and types: int, float, Boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS, STRINGS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES 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; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT V FILES, MODULES, PACKAGES 9

Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file,

Voter's age validation, Marks range validation (0-100).

TOTAL: 45 PERIODS

Text Books

1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

Reference Books

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data'', Third Edition, MIT Press , 2021
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5. https://www.python.org/
6. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

Course Outcomes: At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge level**
CO1	Develop algorithmic solutions to simple computational problems.	Applying
CO2	Write simple python programs using the basic data types, expressions and Statements.	Applying
CO3	Write simple Python programs using conditionals and loops for solving problems and decompose a Python program into functions.	Applying
CO4	Represent compound data types using Python lists, tuples, dictionaries etc.	Applying
CO5	Read and write data from/to files in Python programs.	Applying

CO-PO/PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	2	1			2	3	3	2			
CO2	2	2	1	2	1			2	3	3	2			
CO3	2	2	1	2	1			2	3	3	2			
CO4	2	2	1	3	1			2	3	3	2			
CO5	2	2	1	3	1			2	3	3	2			
Avg.	**2**	**2**	**1**	**2**	**1**			**2**	**3**	**3**	**2**			

U24HS111 தமிழர் மரபு / HERITAGE OF TAMILS

L	**T**	**P**	**C**
1	**0**	**0**	**1**

Course Objectives:

- Recognize Tamil literature and its significance in Tamil culture.
- Introduce the Tamils' rich artistic and cultural legacy.
- Familiarize the different types of folk and martial arts that are unique to Tamil Nadu.
- Acquaint the concept of Thinai in Tamil literature and culture.
- Comprehend the significance of Tamil in developing Indian culture.

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, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV THINAI CONCEPT OF TAMILS 3

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

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

1. Social Life of Tamils (Dr.K.K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils - The Classical Period (Dr.S. Singaravelu) (Published by: International Institute of Tamil Studies.
3. Historical Heritage of the Tamils (Dr.S.V .Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M. Valarmathi) (Published by: International Institute of Tamil Studies).
5. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay) (Published by: The Author).
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
8. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book.

Course Outcomes: At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge level**
CO1	Describe the various types of Tamil Literature.	Understanding
CO2	Discuss about Tamil Arts and Sculpture.	Understanding
CO3	Explain the Tamil Folks and Martial Arts.	Understanding
CO4	Summarize the Thinai Concepts of Tamil.	Understanding
CO5	Review the contribution of Tamil Culture to Indian Culture and National Movements.	Understanding

CO-PO/PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2		2	2	3				
CO2						2		2	2	3				
CO3						2		2	2	3				
CO4						2		2	2	3				
CO5						2		2	2	3				
Avg.						**2**		**2**	**2**	**3**				

U24HS123	COMMUNICATIVE ENGLISH FOR ENGINEERS	L	T	P	C
		3	0	2	4

Course Objectives:

To improve the communicative competence of learners

- To learn to use basic grammatical structures in suitable contexts.
- To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text.
- To help learners use language effectively in both informal and professional contexts.
- To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.

UNIT I INTRODUCTION TO EFFECTIVE COMMUNICATION 1

What is effective communication? (Explain using activities) Why is communication critical for excellence during study, research and work? What are the seven C's of effective communication? What are key language skills? What is effective listening? What does it involve? What is effective speaking? What does it mean to be an excellent reader? What should you be able to do? What is effective writing? How does one develop language and communication skills? What does the course focus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance your English language and communication skills to get the best out of this course?

UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 8

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself. Grammar - Present Tense (simple and progressive); Question types: Wh / Yes or No / and Tags. Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

UNIT II NARRATION AND SUMMATION 9

Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs. Writing - Guided writing-- Paragraph writing; Short Report on an event (field trip etc.) Grammar –Past tense (simple); Subject-Verb Agreement; and Prepositions. Vocabulary - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.

UNIT III DESCRIPTION OF A PROCESS / PRODUCT 9

Reading – Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions; instructions; and Product /Process description. Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).

UNIT IV CLASSIFICATION AND RECOMMENDATIONS 9

Reading – Newspaper articles; Journal reports –and Non-Verbal Communication (tables, pie charts etc.). Writing – Note-making / Note-taking (*Study skills to be taught, not tested); Writing recommendations; Transferring information from non-verbal (chart, graph etc., to verbal mode) Grammar – Articles; Pronouns - Possessive & Relative pronouns. Vocabulary - Collocations; Fixed / Semi fixed expressions.

UNIT V EXPRESSION 9

Reading – Reading editorials; and Opinion Blogs; Writing – Essay Writing (Descriptive or narrative), Dialogue-writing. Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions – Content vs Function words.

TOTAL: 45 PERIODS

Sl. No.	Practical – List of experiments:
1	Listening comprehension
2	Telephone conversation & Introductions (listening & speaking)
3	Mock Interviews
4	Narrating personal experiences

5 Short Oral Presentations
6 Advertising a product
7 Situational conversation – 3 in a team
8 Creating educational videos
9 Group discussion
10 ICT based presentations

TOTAL: 30 PERIODS

Text Books

1. Communication Book, Portfolio Penguin, 2018. Authored by Mikael Krogerus, Roman Tschäppeler. ISBN-13 : 978-0241982280.
2. Communicative English for Engineers and Professionals, Pearson Education India, 2010. Authored by Bhatnagar Nitin, ISBN: 9788131732045, 8131732045
3. English for Science & Technology, Cambridge University Press, 2021. Authored by Dr.Veena Selvam, Dr.Sujatha Priyadarshini, Dr.Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

Reference Books

1. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2. English For Technical Communication (With CD) By AyshaViswamohan, McGraw Hill Education, ISBN: 0070264244, 2008.
3. How to win at Interviews & Group Discussions, Abhishek Publications, 2014. Authored by D.S. Cheema, ISBN: 9788182475175, 8182475171.

Course Outcomes: At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge level**
CO1	Explain different points of view during discussions.	Applying
CO2	Prepare for formal ICT based presentations and video creation.	Applying
CO3	Construct English sentences in both formal and informal contexts.	Applying
CO4	Interpret technical texts, audio materials and visual representation.	Understanding
CO5	Write letters, definitions, descriptions, narrations and essays on various topics.	Applying

CO-PO/PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								1	2	3		3		
CO2								1	2	3		3		
CO3								1	2	3		3		
CO4								1	2	3		3		
CO5								1	2	3		3		
Avg.								**1**	**2**	**3**		**3**		

U24PH113 **ENGINEERING PHYSICS** **L T P C**
3 0 2 4

Course Objectives:

- To make the students effectively to achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves, optics and its applications.
- To introduce the basics knowledge of lasers and fibre optics.
- Equipping the students to successfully understand the importance of quantum mechanics.
- To make the students understand the basics of crystal structure and its importance in studying materials properties.

UNIT I MECHANICS **9**

Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM

Rotation of rigid bodies: Rotational kinematics – Theorems of M .I –moment of inertia of continuous bodies – torque – rotational dynamics of rigid bodies — gyroscope - torsional pendulum – double pendulum

UNIT II ELECTROMAGNETIC WAVES AND OPTICS **9**

Maxwell's equations - wave equation; Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - Producing electromagnetic waves - Cell-phone reception.

Reflection and refraction of light waves - interference –Michelson interferometer –Theory of air wedge and experiment.

UNIT III LASERS AND FIBRE OPTICS **9**

Theory of laser - characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO2 laser, semiconductor laser –Basic applications of lasers in industry.

Fiber optics: Principle, Numerical aperture and acceptance angle –types of optical fibers (material, refractive index, mode)- fibre optic communication- losses associated with optical fibers- fibre optic sensors: pressure and displacement- medical endoscope.

UNIT IV QUANTUM MECHANICS **9**

Photons and light waves - Electrons and matter waves –Compton effect - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization – particle in a infinite potential well: 1D- particle in a infinite potential well:2D and 3D Boxes (Qualitative).

UNIT V CRYSTAL PHYSICS **9**

Crystal structures: Crystal structures: BCC, FCC and HCP – crystal imperfections- edge and screw dislocations – grain and twin boundaries - Burgers vector and elastic strain energy- Slip systems, plastic deformation of materials and Miller indices –distance between successive planes – crystalline and non-crystalline material.

TOTAL: 45 PERIODS

Sl. No.	Practical – List of experiments (Any Seven experiments)
1	Determination of rigidity modulus – Torsion pendulum
2	Determination of Young's modulus by non-uniform bending method
3	Determination of wavelength using Laser.
4	Determination of Numerical aperture and acceptance angle in an optical fiber.
5	Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6	Determination of thickness of a thin wire – Air wedge method
7	Determination of band gap of a semiconductor
8	Determination of Young's modulus by uniform bending method.
9	Compact disc- Determination of width of the groove using laser.
10	Simple harmonic oscillations of cantilever.
11	Spectrometer - Determination of wavelength of Mercury Spectrum using diffraction grating.
12	Michelson's interferometer -Determine the wave length of monochromatic light.
13	Melde's Experiment - Determine the Frequency of a tuning fork.

TOTAL: 30 PERIODS

Text Books

1. D. Kleppner and R. Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
2. E.M. Purcell and D.J. Morin, Electricity and Magnetism, Cambridge Univ. Press, 2013.
3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGraw- Hill (Indian Edition), 2017.

Reference Books

1. Gaur R K and Gupta S L, "Engineering Physics", Dhanpat Rai Publications, 2018.
2. Charles Kittel, "Introduction to Solid State Physics", Wiley India Pvt. Ltd, 7th ed., 2017.
3. D. K. Mynbaev and Lowell L. Scheiner, Fiber Optic Communication Technology, 2011,1st Edition, Pearson, USA.

Course Outcomes: At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge level**
CO1	Apply the principles of mechanics to solve problems.	Applying
CO2	Apply the knowledge of the Maxwell's equations for electromagnetic waves and optics.	Applying
CO3	Apply the knowledge on the concepts of laser and their applications in fiber optics.	Applying
CO4	Apply quantum mechanical principles towards the formation of energy bands.	Applying
CO5	Describe the basics of crystals, their structures and defects.	Understanding

CO-PO/PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2		2			1	2	2		3		
CO2	3	3	2		2			1	2	2		3		
CO3	3	3	2		2			1	2	2		3		
CO4	3	3	2		2			1	2	2		3		
CO5	3	3	2		2			1	2	2		3		
Avg.	**3**	**3**	**2**		**2**			**1**	**2**	**2**		**3**		

U24CY113 **ENGINEERING CHEMISTRY**

L	T	P	C
3	0	2	4

Course Objectives:

- To inculcate sound understanding of water quality parameters and water treatment techniques.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To introduce the basic concepts and applications of phase rule and composites.
- To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

UNIT I WATER AND ITS TREATMENT **9**

Water: Sources and impurities, Water quality parameters - color, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, fluoride and arsenic.

Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break-point chlorination). Desalination of brackish water-Reverse Osmosis.

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.

UNIT II NANOCHEMISTRY **9**

Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic);

Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. **Preparation of nanomaterials:** sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. **Applications of nanomaterials** in medicine, agriculture, energy, electronics and catalysis.

UNIT III PHASE RULE AND COMPOSITES **9**

Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process.

Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). **Nano**

Composites: Properties and applications of Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.

UNIT IV FUELS AND COMBUSTION **9**

Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, 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.

UNIT V ENERGY SOURCES AND STORAGE DEVICES **9**

Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of Silicon (si) Solar cell, Wind energy, Geo thermal energy.

Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion battery; Electric vehicles - working principles; Fuel cells: H_2-O_2 fuel cell, microbial fuel cell; Super capacitors: Storage principle, types and examples.

TOTAL: 45 PERIODS

Sl. No.	Practical – List of experiments
1	Determination of types and amount of alkalinity in a water sample. - Split the first experiment into two.
2	Determination of total, temporary & permanent hardness of water by EDTA method.
3	Determination of DO content of water sample by Winkler's method.
4	Determination of chloride content of water sample by Argentometric method.
5	Determination of strength of given hydrochloric acid using pH meter.
6.	Determination of strength of acids in a mixture of acids using conductivity meter.
7.	Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
8.	Conductometric titration of strong acid vs strong base.
9.	Estimation of iron content of the given solution using potentiometer.
10.	Estimation of sodium /potassium present in water using a flame photometer.

TOTAL: 30 PERIODS

Text Books:

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.

Reference Books:

1. Mary Francisca. L.J, Engineering Chemistry-I, 1, 2004.
2. O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.

Course Outcomes: At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge level**
CO1	Describe the water treatment processes and calculate the quality parameters of different types in Water Samples and Apply the appropriate method to find the PH, conductance and potential values of various solutions	Understanding
CO2	Apply the concepts of nano science in Engineering Applications.	Applying
CO3	Apply the knowledge of phase rule and composites for material selection requirements	Applying
CO4	Identify the types of fuels and calculate the calorific value, explosive range for engineering processes.	Understanding
CO5	Apply suitable energy resources for Engineering sectors.	Applying

CO-PO/PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3					1			1	2		2		
CO2	3					1			1	2		2		
CO3	3					1			1	2		2		
CO4	3					1			1	2		2		
CO5	3					1			1	2		2		
Avg.	**3**					**1**			**1**	**2**		**2**		

U24GE122 PROBLEM SOLVING USING PYTHON LABORATORY

L	T	P	C
0	0	4	2

Course Objectives:

- To learn about Variables, Operators available and how to write loops and decision statements in Python.
- To learn and Implement programs using non recursive and recursive functions.
- To Learn and execute a program using different Data Types - String, List, advance List, Dictionary, Tuple, Sets, Python Modules and packages.
- To learn how to read and write files in Python and also learn to use exception handling in Python applications for error handling.
- To build a mini project using fundamental programming constructs like variables, conditional logic, looping, and function and other required modules.

Sl. No.	Practical – List of experiments
1	Environment Setup and execute Basic Exercise to learn about Variables, Operators available in python.
2	Execute programs using Python Control Flow -Python Loops and Control Statements
3	Implement programs using String and array in python.
4	Write functions and pass arguments [Non-Recursive, Recursive] in Python
5	Execute program to learn different Data Types in python- String, List, advance List, Dictionary, Tuple, Sets
6	Learn and execute programs using Python Modules and packages.
7	Execute program using Python Directory and Files Management.
8	Implement program to learn about python exception handling
9	Mini project [Group project- demo and presentation]

TOTAL: 60 PERIODS

Text Books

1. Allen B. Downey, “Think Python: How to Think like a Computer Scientist”, 2nd Edition, O’Reilly Publishers, 2016.
2. Karl Beecher, “Computational Thinking: A Beginner's Guide to Problem Solving and Programming”, 1st Edition, BCS Learning & Development Limited, 2017.

Reference Books

1. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, “Computational Thinking: A Primer for Programmers and Data Scientists”, 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data, Third Edition, MIT Press, 2021
4. Eric Matthes, “Python Crash Course, A Hands - on Project Based Introduction to Programming”, 2nd Edition, No Starch Press, 2019.
5. https://www.python.org/
6. Martin C. Brown, “Python: The Complete Reference”, 4th Edition, Mc-Graw Hill, 2018.

Course Outcomes: At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge level**
CO1	Understand and make use of Variables, Operators available and how to write loops and decision statements in Python.	Applying
CO2	Execute programs to implement non recursive and recursive functions in python.	Applying
CO3	Write Python Programs using core data structures like array, string, Lists, Set, Dictionaries and use Tuples.	Applying
CO4	Use and carry out examples to handle File Systems and exception handling in Python.	Applying
CO5	Deconstruct exemplary applications in Python.	Analysing

CO-PO/PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	2	1			2	1	2	2		2	2
CO2	2	2	1	2	1			2	1	2	2		2	2
CO3	2	2	1	2	1			2	1	2	2		2	2
CO4	2	2	1	3	1			2	1	2	2		2	2
CO5	2	2	1	3	1	1	1	2	1	3	2	1	2	2
Avg.	**2**	**2**	**1**	**3**	**1**	**1**	**1**	**2**	**1**	**3**	**2**	**1**	**2**	**2**

U24MA221 **DISCRETE MATHEMATICS**

L	T	P	C
3	1	0	4

Course Objectives:

- To extend a student's logical and mathematical maturity and ability to deal with abstraction problems.
- To understand the basic concepts of combinatory.
- To introduce graph models and their basic concepts.
- To familiarize the applications of algebraic structures.
- To understand the concepts of sets, relation, function and Boolean algebra which are widely used in computer science and engineering.

UNIT I LOGIC **9+3**

Propositional logic – Propositional equivalences - Predicates and quantifiers – Rules of inference.

UNIT II COMBINATORICS **9+3**

Mathematical induction – The basics of counting – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle.

UNIT III SETS, RELATION, FUNCTION AND BOOLEAN ALGEBRA **9+3**

Basic concepts of Set theory - Laws of Set theory - Partition of set, Relations - Types of Relations: Equivalence relation, Partial ordering relation - Functions: Injective, Surjective, Bijective functions, Compositions of functions, Identity and Inverse functions. – Boolean algebra.

UNIT IV ALGEBRAIC STRUCTURES **9+3**

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Normal subgroup and cosets – Lagrange theorem.

UNIT V GRAPHS **9+3**

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – matching - coloring

TOTAL: 60 PERIODS

Text Books

1. Rosen. K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2017.
2. Tremblay. J.P. and Manohar. R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.

Reference Books

1. Grimaldi. R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 5th Edition, Pearson Education Asia, Delhi, 2013.
2. Koshy. T. "Discrete Mathematics with Applications", Elsevier Publications, 2006.

Course Outcomes: At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge level**
CO1	Apply truth tables to evaluate logical propositions.	Applying
CO2	Apply basic counting techniques to solve combinatorial problems.	Applying
CO3	Apply graph matching ideas in various matching related problems.	Applying
CO4	Apply the concepts and properties of algebraic structures to solve the problem.	Applying
CO5	Apply the concepts of set theory and Boolean algebra in computer science and engineering.	Applying

CO-PO/PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3						2	2		3		
CO2	3	3	3						2	2		3		
CO3	3	3	3						2	2		3		
CO4	3	3	3						2	2		3		
CO5	3	3	3						2	2		3		
Avg.	**3**	**3**	**3**						**2**	**2**		**3**		

U24PH221 PHYSICS FOR INFORMATION SCIENCE

L	**T**	**P**	**C**
3	**0**	**0**	**3**

Course Objectives:

- Ascertain about the concepts and properties of semiconductor materials.
- Describe about semiconductor devices and its applications.
- Understand basics of magnetic behaviour of materials and its applications.
- Apply optical properties of materials to the optoelectronics devices.
- Interpret the basics of quantum structures and their applications in Nano devices.

UNIT I SEMICONDUCTOR PHYSICS 9

Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors – Carrier concentration in P-type semiconductors – Variation of carrier concentration with temperature — Carrier transport in Semiconductor: drift and diffusion – Ohmic contacts – Schottky diode.

UNIT II SEMICONDUCTOR DEVICES 9

PN Junction diode and its characteristics – Zener diode and its characteristics – Transistors – FET – JFET – MOSFET – BJT – Basic logic gates (OR, NOT, AND, NAND, NOR) CNOT gate.

UNIT III MAGNETIC PROPERTIES OF MATERIALS 9

Magnetic dipole moment – atomic magnetic moments- magnetic permeability and susceptibility – Magnetic material classification: diamagnetism – paramagnetism – ferromagnetism – antiferromagnetism – ferrimagnetism – Domain Theory- M versus H behaviour – Hard and soft magnetic materials – examples

and uses–Magnetic principle in computer data storage – Magnetic hard disc (GMR sensor).

UNIT IV OPTICAL PROPERTIES OF MATERIALS 9

Classification of optical materials – carrier generation and recombination processes – photo current in a P-N diode – solar cell– LED – Organic LED – LCD – Laser diodes – Optical data storage techniques.

UNIT V NANOSTRUCTURES AND QUANTUM COMPUTING 9

Introduction – quantum confinement – quantum structures: quantum wells, wires and dots — band gap of nanomaterials. Quantum cellular automata – Quantum system for information processing – quantum states – classical bits – quantum bits or qubits – multiple qubits – advantage of quantum computing over classical computing.

TOTAL: 45 PERIODS

Text Books

1. Jasprit Singh, "Semiconductor Devices: Basic Principles", Wiley (Indian Edition), 2007.
2. S.O. Kasap, Principles of Electronic Materials and Devices, Mc-Graw Hill, 2018.
3. Parag K. Lala, Quantum Computing: A Beginner's Introduction, McGraw-Hill Education (Indian Edition), 2020.
4. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.

Reference Books

1. R. Murugasen, Modern Physics, S. Chand & Company, 2018.
2. R.F. Pierret. Semiconductor Device Fundamentals. Pearson (Indian Edition), 2006.
3. B. Rogers, J. Adams and S. Pennathur, Nanotechnology: Understanding Small Systems, CRC Press, 2014.
4. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson Education (Indian Edition) 2009.

Course Outcomes: At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge level**
CO1	Describe the basic knowledge of semiconductor physics and its applications.	Understanding
CO2	Describe the mechanism involved in construction and working of semiconductor diodes.	Understanding
CO3	Discuss the knowledge of Magnetic Properties of Materials.	Understanding
CO4	Illustrate the Optical properties of Materials.	Understanding
CO5	Describe the basics of Quantum Structures and Quantum Computing.	Understanding

CO-PO/PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1			2	2			1	1		2		
CO2	3	1			2	2			1	1		2		
CO3	3	1			2	2			1	1		2		
CO4	3	1			2	2			1	1		2		
CO5	3	1			2	2			1	1		2		
Avg.	**3**	**1**			**2**	**2**			**1**	**1**		**2**		

U24CS211 C PROGRAMMING

L	**T**	**P**	**C**
3	**0**	**0**	**3**

Course Objectives:

- To develop C Programs using basic programming constructs.
- To develop C programs using arrays and strings.
- To develop applications in C using functions, and pointers.
- To develop applications in C using structures.
- To do input/output and file handling in C.

UNIT I BASICS OF C PROGRAMMING **9**

Introduction to programming paradigms - Structure of C program - C programming: Data Types –Storage classes - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions - Input/Output statements, Assignment statements – Decision making statements - Switch statement - Looping statements – Pre-processor directives – Compilation process.

UNIT II ARRAYS AND STRINGS **9**

Introduction to Arrays: Declaration, Initialization – One dimensional array – Example Program**:** Computing Mean, Median and Mode - Two dimensional arrays – Example Program: Matrix Operations (Addition, Scaling, Determinant and Transpose) - String operations: length, compare, concatenate, copy – Selection sort, linear and binary search.

UNIT III FUNCTIONS AND POINTERS **9**

Introduction to functions: Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion – Example Program: Computation of Sine series, Scientific calculator using built-in functions, Binary Search using recursive functions – Pointers –Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Example Program: Sorting of names – Parameter passing: Pass by value, Pass by reference – Example Program: Swapping of two numbers and changing the value of a variable using pass by reference.

UNIT IV STRUCTURES **9**

Structure - Nested structures – Pointer and Structures – Array of structures – Example Program using structures and pointers – Self-referential structures – Dynamic memory allocation - Singly linked list – typedef.

UNIT V FILE PROCESSING **9**

Files – Types of file processing: Sequential access, Random access – Sequential access file - Example Program: Finding average of numbers stored in sequential access file - Random access file - Example Program: Transaction processing using random access files – Command line arguments.

TOTAL: 45 PERIODS

Text Books

1. Reema Thareja, “Programming in C”, Oxford University Press, Second Edition, 2021.
2. Kernighan, B.W and Ritchie, D.M, “The C Programming language”, Second Edition, Pearson Education, 2022.

Reference Books

1. Paul Deitel and Harvey Deitel, “C How to Program”, Seventh edition, Pearson Publication.
2. Juneja, B. L and Anita Seth, “Programming in C”, CENGAGE Learning India Pvt. Ltd., 2011.

Course Outcomes: At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge level**
CO1	Develop simple applications in C using basic constructs	Applying
CO2	Design and implement applications using arrays and strings	Applying
CO3	Develop and implement applications in C using functions and pointers.	Applying
CO4	Develop applications in C using structures.	Applying
CO5	Design applications using sequential and random access file processing.	Applying

CO-PO/PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	2	2	1	1		2	2	1	3		
CO2	3	2	1	2	2				2	2	1	2		
CO3	3	3	1	2	3				2	2	1	2		
CO4	3	1		1	1				2	2	1	2		
CO5	3	2	1	2	2	1	1		2	2	1	3		
Avg.	**3**	**2.2**	**1**	**1.8**	**2**	**1**	**1**		**2**	**2**	**1.00**	**2.40**		

U24EC221 DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION

L	T	P	C
3	0	0	3

Course Objectives:

- To analyze and design combinational circuits.
- To analyze and design sequential circuits
- To understand the basic structure and operation of a digital computer.
- To study the design of data path unit, control unit for processor and to familiarize with the hazards.
- To understand the concept of various memories and I/O interfacing.

UNIT I COMBINATIONAL LOGIC **9**

Combinational Circuits – Karnaugh Map - Analysis and Design Procedures – Binary Adder – Subtractor – Decimal Adder - Magnitude Comparator – Decoder – Encoder – Multiplexers - Demultiplexers.

UNIT II SYNCHRONOUS SEQUENTIAL LOGIC **9**

Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, circuit implementation - Registers – Counters.

UNIT III COMPUTER FUNDAMENTALS **9**

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High Level Language.

UNIT IV PROCESSOR **9**

Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control – Pipelining – Data Hazard – Control Hazards.

UNIT V MEMORY AND I/O **9**

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA

TOTAL: 45 PERIODS

Text Books

1. M. Morris Mano, Michael D. Ciletti, “Digital Design : With an Introduction to the Verilog HDL, VHDL, and System Verilog”, Sixth Edition, Pearson Education, 2018.
2. David A. Patterson, John L. Hennessy, “Computer Organization and Design, The Hardware / Software Interface”, Sixth Edition, Morgan Kaufmann/Elsevier, 2020.

Reference Books

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, “Computer Organization and Embedded Systems”, Sixth Edition, Tata McGraw-Hill, 2012.

2. William Stallings, “Computer Organization and Architecture – Designing for Performance”, Tenth Edition, Pearson Education, 2016.
3. M. Morris Mano, “Digital Logic and Computer Design”, Pearson Education, 2016.

Course Outcomes: At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge level**
CO1	Design various combinational digital circuits using logic gates.	Applying
CO2	Design sequential circuits and analyze the design procedures.	Applying
CO3	Explain the fundamentals of computer systems and analyze the execution of an instruction.	Analyzing
CO4	Analyze different types of control design and identify hazards.	Analyzing
CO5	Describe the characteristics of various memory systems and I/O communication.	Understanding

CO-PO/PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	1	1	1	1	2	3	2	3
CO2	3	3	3	3	2	1	1	1	1	1	2	3	1	2
CO3	3	3	3	3	2	2	1	1	1	1	2	3	2	3
CO4	3	3	3	3	1	1	1	1	1	1	1	2	1	3
CO5	3	3	3	3	1	2	1	1	1	1	1	2	1	2
Avg.	**3**	**3**	**3**	**3**	**1.8**	**1.6**	**1**	**1**	**1**	**1**	**1.6**	**2.6**	**1.4**	**2.6**

U24HS211 **தமிழரும் தொழில்நுட்பமும் / TAMILS AND TECHNOLOGY**

L	**T**	**P**	**C**
1	**0**	**0**	**1**

Course Objectives:

- To facilitate the student to understand weaving and technology of sangam age.
- To create an awareness on structural design of Tamils during sangam age.
- To help students to distinguish between all the levels of manufacturing technology in ancient period.
- To understand the ancient knowledge of agriculture and irrigation technology.
- To enable the students to understand the digitalization of Tamil Language.

UNIT I WEAVING AND CERAMIC TECHNOLOGY **3**

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

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY **3**

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

UNIT III MANUFACTURING TECHNOLOGY **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 Books

1. Social Life of Tamils (Dr. K.K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies.
3. Historical Heritage of the Tamils (Dr.S.V. Subatamanian, Dr. K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies).
5. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.P illay) (Published by: The Author).
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
8. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book.

Course Outcomes: At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge level**
CO1	Review the Weaving and Ceramic Technology during Tamil Sangam Age.	Understanding
CO2	Describe the Construction Technology and various Architecture during Tamil Sangam Age.	Understanding
CO3	Discuss the Manufacturing Technology with Archaeological Evidences.	Understanding
CO4	Explain the Agriculture and Irrigation Technology during Tamil Sangam Age.	Understanding
CO5	Describe Tamil Software and Digitalization Tamil Literatures.	Understanding

CO-PO/PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			2			2		2	1	3				
CO2			2			2		2	1	3				
CO3			2			2		2	1	3				
CO4			2			2		2	1	3				
CO5			2			2		2	1	3				
Avg.			**2**			**2**		**2**	**1**	**3**				

U24HS223 **TECHNICAL ENGLISH FOR ENGINEERS**

L	**T**	**P**	**C**
2	**0**	**2**	**3**

Course Objectives:

- To engage learners in meaningful language activities to improve their LSRW skills.
- To enhance learners' awareness of general rules of writing for specific audiences.
- To help learners understand the purpose, audience, contexts of different types of writing.
- To develop analytical thinking skills for problem solving in communicative contexts.
- To demonstrate an understanding of job applications and interviews for internship and placements.

UNIT I MAKING COMPARISONS **6**

Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases.

UNIT II EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING 6

Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints. Grammar - Active Passive Voice transformations, Infinitive and Gerunds.

UNIT III PROBLEM SOLVING 6

Reading - Case Studies, excerpts from literary texts, news reports etc. Writing – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay. Grammar – Error correction; If conditional sentences.

UNIT IV REPORTING OF EVENTS AND RESEARCH 6

Reading –Newspaper articles; Writing – Proposal writing - Picture description - Accident Report, Survey Report. Grammar – Reported Speech, Modals Vocabulary – Conjunctions- use of prepositions.

UNIT V THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY 6

Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar – Numerical adjectives, Relative Clauses.

TOTAL: 30 PERIODS

Sl. No.	List of experiments
1	Role Play Exercises Based on Workplace Contexts
2	Understanding lexical items via movie clippings – Individual task
3	Discussing news stories
4	Dialogues (with cue cards)-Understanding common technology terms
5	Pronunciation, Intonation, Stress and Rhythm (Level 1)
6	Pronunciation, Intonation, Stress and Rhythm (Level 2)
7	Public Speech: Talking about self in a Professional Setting, Introduction of Speakers, Vote of thanks - 3 in a team
8	Writing a short article (Can be compiled as a magazine)
9	Verbal ability exercises for competitive examinations
10	Visume

TOTAL: 30 PERIODS

Text Books

1. English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University.
2. English for Science & Technology Cambridge University Press 2021 Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.
3. Better English Pronunciation, (2005), J.D. O'Connor, Second Edition, ISBN-13:978-0521682589.

Reference Books

1. Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
3. A Modern Approach to Verbal & Non-Verbal Reasoning - Includes Latest Questions and their Solutions, Revised Edition, R.S. Aggarwal, January 2018.

Course Outcomes: At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge level**
CO1	Articulate English with proper pronunciation, intonation, stress and rhythm.	Applying
CO2	Develop verbal ability skills for attending competitive examinations.	Applying
CO3	Employ speaking and writing skills in professional contexts.	Applying
CO4	Write effective resumes in the context of job search.	Applying
CO5	Interpret the denotative and connotative meanings of technical texts.	Understanding

CO-PO/PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								1	2	3		3		
CO2								1	2	3		3		
CO3								1	2	3		3		
CO4								1	2	3		3		
CO5								1	2	3		3		
Avg.								**1**	**2**	**3**		**3**		

U24CE232 ENGINEERING PRACTICES FOR CIRCUIT BRANCHES

L	T	P	C
0	0	4	2

Course Objectives:

- To gain practical experience in characterizing electronic devices
- To solder and test simple electronic circuits on PCB
- To verify KVL and KCL using series and parallel circuits
- To perform various electrical joints in common household electrical wire work.
- To measure of electrical quantities in different electrical circuits

ELECTRONIC ENGINEERING PRACTICES

1. Study of Electronic Components and Equipment
2. Resistor Value using Colour coding
3. Generation of AC signal using Function Generator and Measurement of its parameter using CRO / DSO
4. Study of logic gates - AND, OR, NOT, NOR, NAND and XOR
5. Soldering simple electronic circuits and checking continuity.
6. Verification of KVL and KCL using series and parallel circuits
7. Controlling smart devices using Mobile phone
8. Study of troubleshooting steps in Mobile Repairing

ELECTRICAL ENGINEERING PRACTICES

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power and power factor in RLC circuit.
5. Measurement of energy using a single-phase energy meter.
6. Measurement of resistance to earth of electrical equipment.

Course Outcome Statement		
CO	**At the end of the course, the students will be able to**	**Knowledge Level**
CO1	Analyze the characteristics of basic electronic devices	Applying
CO2	Perform simple electronic circuits on PCB	Applying
CO3	Solve KVL and KCL using series and parallel circuits	Applying
CO4	Perform various electrical joints in common household electrical wire work.	Applying
CO5	Calculate electrical quantities in different electrical circuits	Applying

CO-PO/PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3						2	3	2		2		
CO2	3	2	2					2	3	2		2		
CO3	3	3	3					2	3	2				
CO4	3	2				2		2	3	2		3		
CO5	3	2	2			2		2	3	2		3		
Avg.	**3**	**2.4**	**2.3**			**2**		**2**	**3**	**2**		**2.5**		

U24CS222 **C PROGRAMMING LABORATORY**

L	T	P	C
0	0	4	2

Course Objectives:

- To develop programs in C using basic constructs.
- To develop applications in C using strings.
- To develop applications in C using pointers, functions.
- To develop applications in C using structures.
- To develop applications in C using file processing.

S. No	List of Experiments
1	Programs using, I/O statements and expressions.
2	Programs using decision-making constructs.
3	Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.
4	Check whether a given number is Armstrong number or not?
5	Given a set of numbers like <10, 36, 54, 89, 12, 27>, find sum of weights based on the following conditions. • 5 if it is a perfect cube. • 4 if it is a multiple of 4 and divisible by 6. • 3 if it is a prime number. Sort the numbers based on the weight in the increasing order as shown below <10, its weight>, <36, its weight> <89, its weight>
6	Populate an array with height of persons and find how many persons are above the average height.
7	Populate a two dimensional array with height and weight of persons and compute the Body Mass Index of the individuals.
8	From a given paragraph perform the following using built-in functions: a. Find the total number of words. b. Capitalize the first word of each sentence. c. Replace a given word with another word.
9	Solve towers of Hanoi using recursion.
10	Sort the list of numbers using pass by reference.
11	Generate salary slip of employees using structures and pointers.
12	Compute internal marks of students for five different subjects using structures and functions.
13	Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.
14	Count the number of account holders whose balance is less than the minimum balance using sequential access file.
15	Create a “Railway reservation system” with the following modules: Booking, Availability checking, Cancellation and Prepare chart

S. No	List of Experiments

Course Outcome Statement		
CO	At the end of the course, the students will be able to	**Knowledge Level**
CO1	Develop C programs for simple applications	Applying
CO2	Develop C programs for constructs, arrays and strings.	Applying
CO3	Develop C programs involving functions and recursion	Applying
CO4	Develop C programs involving pointers, and structures.	Applying
CO5	Design applications using sequential and random-access file processing.	Applying

CO-PO/PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	2	2	1	1		1	2	1	3		
CO2	3	2	1	2	2				1	1	1	2		
CO3	3	3	1	2	3				1	1	1	2		
CO4	3	1		1	1				2	1	1	2		
CO5	3	2	1	2	2	1	1		1	2	1	3		
Avg.	**3**	**2.2**	**1**	**1.8**	**2**	**1**	**1**		**1.2**	**1.4**	**1**	**2.4**		

U24EM212 **PROFESSIONAL DEVELOPMENT**

L	T	P	C
0	0	2	1

Course Objectives:

- To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.
- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations

Sl. No	List of exercises
1	**MS WORD: (10 Periods)** Create and format a document Working with tables Working with Bullets and Lists Working with styles, shapes, smart art, charts Inserting objects, charts and importing objects from other office tools Creating and Using document templates Inserting equations, symbols and special characters Working with Table of contents and References, citations Insert and review comments Create bookmarks, hyperlinks, endnotes footnote Viewing document in different modes Working with document protection and security Inspect document for accessibility
2	**MS EXCEL: 10 Periods** Create worksheets, insert and format data Work with different types of data: text, currency, date, numeric etc. Split, validate, consolidate, Convert data Sort and filter data Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,)

	Work with Lookup and reference formulae Create and Work with different types of charts Use pivot tables to summarize and analyse data Perform data analysis using own formulae and functions Combine data from multiple worksheets using own formulae and built-in functions to generate results Export data and sheets to other file formats Working with macros Protecting data and Securing the workbook
3	**MS POWERPOINT: 10 Periods** Select slide templates, layout and themes Formatting slide content and using bullets and numbering Insert and format images, smart art, tables, charts Using Slide master, notes and handout master Working with animation and transitions Organize and Group slides Import or create and use media objects: audio, video, animation Perform slideshow recording and Record narration and create presentable videos
	Total: 30 Hours

Course Outcomes: At the end of the course, the students will be able		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Create quality documents, by structuring and organizing content for their day to day technical and academic requirements using MS Word	Applying
CO2	Perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding using MS Excel	Applying
CO3	Create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects using MS Power Point	Applying
CO4	Prepare an effective report using MS word and MS Excell on any subject content	Applying
CO5	Present the report using MS Power Point	Applying

CO-PO/PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1									2	2		2		
CO2									2	2		2		
CO3									2	2		2		
CO4									2	2		2		
CO5									2	2		2		
Avg.									**2**	**2**		**2**		

B.E. Computer Science and Engineering
R2024 Third Semester Syllabus

U24MA321 PROBABILITY AND QUEUEING THEORY

L	T	P	C
3	1	0	4

Course Objectives:

- To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions with applications to engineering which can describe the real-life phenomenon.
- To understand the concept of queueing models and their applications in engineering.
- To understand the significance of advanced queueing models.
- To provide the required mathematical support for real life problems and develop probabilistic models which can be used in several areas of science and engineering.

UNIT I PROBABILITY AND RANDOM VARIABLES 9+3

Probability – Axioms of probability – Conditional probability – Baye‘s theorem – Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions-Functions of Random variable.

UNIT II TWO – DIMENSIONAL RANDOM VARIABLES 9+3

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables.

UNIT III RANDOM PROCESSES 9+3

Classification – **Stationary process: SSS process and WSS process**– Markov process – Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations – Limiting distributions.

UNIT IV QUEUEING MODELS 9+3

Markovian queues – Birth and Death processes –Kendal's Notation -– Little’s formula-Single and multiple server queueing models (M/M/1):(Infinite /FIFO),(M/M/s):(Infinite /FIFO),(M/M/1):(k /FIFO),(M/M/s):(k /FIFO)

UNIT V ADVANCED QUEUEING MODELS 9+3

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

TOTAL: 60 PERIODS

Text Books

1. Gross, D., Shortle, J.F, Thompson, J.M and Harris. C.M., “Fundamentals of Queueing Theory", Wiley Student 4th Edition, 2014.
2. Ibe, O.C., “Fundamentals of Applied Probability and Random Processes", Elsevier, 2nd Edition, 2014.
3. M.B.K .Moorthy, K. Subramania, A. Santha, "Probability and Queueing Theory", Scitech Publications,2015.
4. T. Veerarajan, "Probability, Statistics and Random Process",3rd edition, Tata McGraw Hill Publishing Company limited, 2008.

Reference Books

1. Taha, H.A., "Operations Research", 11th Edition, Pearson India Education Services, Delhi, 2023.
2. Trivedi, K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2nd Edition, John Wiley and Sons, 2016.
3. Scott L. Miller, Donald. G. Childers, "Probability and Random Process”, An imprint of Elsevier,2011.
4. J. Medhi, Stochastic Models in Queueing Theory, 2nd Edition, Academic Press, 2003 (Elsevier India Edition, 2006).

Course Outcomes

CO	At the end of the course, the students will be able to	Knowledge level
CO1	Apply a fundamental knowledge of the Probability Concepts.	Applying
CO2	Apply the concepts based on two Dimensional Random variables.	Applying
CO3	Apply random Process technique to find simple solutions to the Mathematical Problems.	Applying
CO4	Apply the concepts and acquire skills in queuing Models.	Applying
CO5	Apply real Life Time phenomenon which evolve with respect to time in a probabilistic manner.	Applying

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3					2	2		3
CO2	3	3	3					2	2		3
CO3	3	3	3					2	2		3
CO4	3	3	3					2	2		3
CO5	3	3	3					2	2		3
Avg.	**3**	**3**	**3**					**2**	**2**		**3**

CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CS311	Operating Systems	L	T	P	C
		3	0	0	3

Course Objective:

1. To understand the fundamental principles and functions of operating systems.
2. To explore process management for efficient computing.
3. To analyze advanced memory management and its role in performance optimization.
4. To understand storage management, file systems and their implementation.
5. To gain insights into virtualization, and mobile operating systems.

Unit I : INTRODUCTION AND PROCESS 8

Operating Systems Overview and Evolution - Objectives and Functions - Structures – Operating Systems Services - User Operating System Interface - System Calls – System Services - Design and Implementation - Process Concept - Process Scheduling - Operations on Processes - Inter- process Communication.

Unit II PROCESS MANAGEMENT 10

Threads - Multithread Models – Threading Issues; CPU Scheduling - Scheduling algorithms - Process Synchronization - The Critical-Section problem – Peterson's Solution – Mutex Locks – Semaphores – Monitors – Liveness – Classical problems of synchronization; Deadlock - Methods, prevention, avoidance, detection, Recovery.

Unit III MEMORY MANAGEMENT 10

Contiguous Memory Allocation – Paging - Structure of the Page Table – Swapping; Segmentation, Segmentation with paging; Virtual Memory - Demand Paging – Copy on Write - Page Replacement - Allocation of Frames.

Unit IV STORAGE MANAGEMENT 10

Disk Scheduling, - Disk Management – RAID Structure; I/O Systems – I/O Hardware - Kernel I/O subsystem; File-System Interface - File concept - Access methods - Directory Structure - Directory Organization and Protection; File System Implementation - File System Structure - Directory implementation - Allocation Methods - Free Space Management - Recovery.

Unit V VIRTUAL MACHINES AND MOBILE OS 7

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 Periods: 45

TEXT BOOKS

1 Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2018.
2 William Stallings, "Operating Systems: Internals and Design Principles", 9 th Edition, Prentice Hall, 2019.
3 Andrew S. Tanenbaum, Herbert Bos, "Modern Operating Systems", Pearson, 5th Edition, 2022.

REFERENCE BOOKS

1 Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau, "Operating Systems: Three Easy Pieces", 2020.
2 Daniel Bovet and Marco Cesati, "Understanding the Linux Kernel", 3rd Edition, O'Reilly Media, 2020.

3 Richard Blum and Christine Bresnahan, "Linux Command Line and Shell Scripting Bible", 4th Edition, Wiley, 2021.

ONLINE REFERENCES

1. https://archive.nptel.ac.in/Courses/106/105/106105214/
2. https://onlinecourses.nptel.ac.in/noc21_cs72
3. https://onlinecourses.nptel.ac.in/noc21_cs88

Course Outcomes

CO	At the end of the course, the students will be able to	Knowledge Level
CO1	Describe the basic components of operating system.	Understanding
CO2	Apply scheduling and synchronization algorithms to manage processes efficiently.	Applying
CO3	Analyze different memory management techniques and their impact on system performance.	Analyzing
CO4	Apply the file system and I/O management techniques to optimize storage	Applying
CO5	Compare the features and architectures of virtualization and mobile operating systems.	Understanding

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	3				2	2	2	3	3	3
CO2	3	3	3	3				2	2	2	3	3	3
CO3	3	3	2	3				2	2	2	3	3	3
CO4	3	3	3	3				2	2	2	3	3	3
CO5	3	2	2	3				2	2	2	3	3	3
Avg.	3	2.6	2.4	3				2	2	2	3	3	3

CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CS321 **DATA STRUCTURES** **L T P C**

(Common to B.Tech. AI&DS) **3 0 0 3**

Course Objective:

1. To insights the concepts of ADTs.
2. To learn linear data structures–list, stack and queue.
3. To apply sorting, searching and hashing algorithms.
4. To apply tree data structures.
5. To apply Graph structures.

Unit I LISTS **9**

Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation – Singly linked lists–Circularly linked lists – Doubly-linked lists – Applications of lists – Polynomial ADT – Radix Sort – Multilists.

Unit II STACK AND QUEUE 9

Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions - Infix to Postfix conversion–Function Calls– Queue ADT–Operations–Circular Queue–DeQueue – Applications of Queues.

Unit III SEARCHING, SORTING AND HASHING TECHNIQUES 9

Searching – Linear Search – Binary Search. Sorting – Merge Sort – Quick Sort - Insertion sort – Bubble sort – Selection sort – Shell sort — Hashing –Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

Unit IV TREE 9

Tree ADT – Tree Traversals-Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees – B-Tree – B+Tree – Priority Queue (Heaps) – Binary Heap

Unit V GRAPH 9

Graph Definition – Representation of Graphs – Types of Graphs - Breadth- first traversal – Depth-first traversal — Bi-connectivity – Euler circuits – Topological Sort –Dijkstra's algorithm – Minimum Spanning Tree –Prim's algorithm –Kruskal's algorithm

Total Periods: 45

TEXT BOOKS

1 Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, Data Structures & Algorithms in Python", John Wiley & Sons Inc., 2021.

2 Lee, Kent D., Hubbard, Steve, "Data Structures and Algorithms with Python" Springer Edition 2015.

REFERENCE BOOKS

1 Thomas H. Cormen, Charles E Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms" Fourth Edition, PHI, 2022

2 Kruse, "Data Structures and Program Design", Pearson Education, 2006

ONLINE REFERENCES

1. https://nptel.ac.in/courses/106/102/106102064/

2. https://nptel.ac.in/courses/106/106/106106133/

Course Outcomes

CO	At the end of the course, the students will be able to	Knowledge Level
CO1	Apply linked list including singly, double and circular list for solving Problems	Applying
CO2	Apply linear data structure including stack, queue and dequeue to solve a given problem	Applying
CO3	Analyze the various searching and sorting algorithms.	Applying
CO4	Apply appropriate algorithms for tree applications	Applying
CO5	Apply appropriate algorithms for graph applications	Applying

CO-PO/PSO Mapping

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

CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CS331	Object Oriented Programming using Java (Common to B.Tech. AI&DS)	L	T	P	C
		3	0	0	3

Course Objective:

- To understand Object Oriented Programming concepts and basics of Java programming language.
- To learn the principles of packages, inheritance and interfaces
- To apply a java application with threads and an exception handling mechanism
- To apply generic classes and use I/O streams and string classes
- To design and build Graphical User Interface Application using JAVAFX

Unit I INTRODUCTION TO OOP AND JAVA 9

Overview of OOP-Features of Object Oriented Programming –Java Buzzwords – Overview of Java– Data Types, Variables and Arrays –Operators – Control Statements – Programming Structures in Java -Defining classes in Java – Constructors-Methods -Access specifiers - Static members- Java Doc comments.

Unit II INHERITANCE , PACKAGES AND INTERFACES 9

Overloading Methods –Objects as Parameters- Returning Objects-Static, Nested and Inner Classes. Inheritance: Basics– Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance. Packages and Interfaces: Packages –Packages and Member Access –Importing Packages – Interfaces.

Unit III EXCEPTION HANDLING AND MULTITHREADING 9

Exception Handling basics – Try and Catch - Multiple catch – Nested try Statements – Java's Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model–Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication-Suspending –Resuming, and Stopping Threads –Multithreading.

Unit IV I/O, GENERICS, STRING HANDLING 9

I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.

Unit V JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS 9

JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, Toggle Button – Radio Buttons – ListView – ComboBox – ChoiceBox – Text Controls – ScrollPane. Layouts – FlowPane – HBox and VBox – Border Pane – StackPane – GridPane.Menu-Menu bars-MenuItem.

Total Periods: 45

TEXT BOOKS

1 Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, New Delhi, 2021.

2 Herbert Schildt, "Introducing JavaFX 8 Programming", 1st Edition, McGraw Hill Education, New Delhi, 2021.

REFERENCE BOOKS

1 Cay S. Horstmann, "Core Java Fundamentals", Volume 1, 11th Edition, Prentice Hall, 2018.

2 K. Arnold and J. Gosling, "The JAVA programming language", Third edition, Pearson Education, 2000.

ONLINE REFERENCES

1. https://nptel.ac.in/courses/106/105/106105191/
2. https://onlinecourses.nptel.ac.in/noc21_cs56/preview
3. https://www.hackerrank.com/domains/java
4. https://www.codechef.com/wiki/java

Course Outcome

CO	At the end of the course, the students will be able to	Knowledge Level
CO1	Apply the basic concepts of OOP.	Applying
CO2	Apply the principles of packages, inheritance and interfaces	Applying
CO3	Apply the exception handling mechanisms and multithreaded model to solve real world problems	Applying
CO4	Develop Java applications with I/O packages, string classes, Collections and generics concepts	Applying
CO5	Implement the concepts of event handling and JavaFX components and controls for developing GUI based applications	Applying

CO-PO/PSO Mapping

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

CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CS341	Software Engineering	L	T	P	C
		3	0	0	3

Course Objective:

- To understand the software life cycle models.
- To understand the importance of the software development process.
- To understand the significance of UML models.
- To apply designing and testing principles in software development process.
- To develop correct and robust software products

Unit I INTRODUCTION 9

Introduction to Software Engineering – Software Process – Perspective Process Model – Specialized Process Model – Specialized Process Model – Unified Process Model – Agile process – Extreme programming- XP Process.

Unit II REQUIREMENTS ANALYSIS AND MODELLING 9

Requirements Engineering – Functional and Non-Functional Requirements – Eliciting Requirements – Developing Use case – Requirement Model - Negotiation Requirements – Validation Requirements – Requirement Analysis – Modelling: Domain Analysis and Modelling – Scenario Based Modelling – UML Model – Data Modelling – Class Based Modelling.

Unit III SOFTWARE DESIGN 9

Design process – Design Concepts-Design Model– Architectural Design – Architectural styles, Architectural Design, Architectural Mapping using Data Flow– User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

Unit IV SOFTWARE TESTING STRATEGIES 9

Introduction to Software Testing – Software Testing Life Cycle (STLC) – Strategic Approach to Software Testing – Strategic Issues – Test Strategies for Conventional Software – Unit Testing – Integration Testing – System Testing – The Art of Debugging – Conventional Applications: Basis Path Testing – Control Structure Testing – Black Box Testing – White Box Testing – Model Based Testing – Testing Object Oriented Applications- CASE TOOLS.

Unit V SOFTWARE PROJECT MANAGEMENT 9

Software Project Management: Estimation – LOC, FP Based Estimation, Six sigma and CMM levels, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection – Risk Management-Risk Identification-RMMM Plan-CASE TOOLS

Total Periods: 45

TEXT BOOKS

1 R.S. Pressman, “Software Engineering – A Practitioner’s Approach”, Nineth Edition, McGraw Hill, International Edition, 2024.

2 Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals of Software Engineering, 2nd edition, PHI Learning Pvt. Ltd., 2010.

REFERENCE BOOKS

1 Bernd Bruegge and Allen H. Dutoit, “Object-Oriented Software Engineering: Using UML, Patterns and Java”, Third Edition, Pearson Education, 2009.

2 Craig Larman, Applying UML and Patterns, 3rd ed, Pearson Education, 2005.

ONLINE REFERENCES

1. https://nptel.ac.in/courses/106/105/106105182/

2. https://www.udemy.com/topic/software-testing/

Course Outcomes

CO	At the end of the course, the students will be able to	Knowledge Level
CO1	Compare various Software Development Lifecycle Models	Analyzing
CO2	Develop the UML model for software projects.	Applying
CO3	Develop suitable models for designing application software.	Applying
CO4	Apply software testing procedures in software development process.	Applying
CO5	Construct the software project management and software maintenance practices.	Applying

CO-PO/PSO Mapping

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

CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CS352	DATA STRUCTURES LABORATORY (Common to B.Tech. AI&DS)	L	T	P	C
		0	0	4	2

Course Objective:

- To demonstrate array implementation of linear data structure algorithms.
- To implement the applications using Stack.
- To implement the applications using Linked list
- To implement Binary search tree and AVL tree algorithms.
- To implement the Heap algorithm.
- To implement Dijkstra's algorithm.
- To implement Prim's algorithm
- To implement Sorting, Searching and Hashing algorithms

Sl. No	List of experiments
1	Design and develop a Python-based application that implements Stack, Queue, and Circular Queue using arrays. Apply these data structures to solve practical problems such as browser history navigation (Stack), customer service ticketing system (Queue), and a circular buffer for real-time data streaming (Circular Queue).

2 Design and develop an application that utilizes a linked list to manage dynamic data efficiently. Apply it to real-world scenarios such as contact management in a phonebook, playlist management in a music player.

3 Design and develop an application that implements Stack and Queue Abstract Data Types (ADTs) to solve practical problems such as expression evaluation (infix to postfix conversion).

4 Design and develop an application that demonstrates the real-world use of List, Stack, and Queue ADTs. Implement scenarios such as task management using a Queue, expression evaluation using a Stack, and dynamic data storage using a List in a contact management system or social media feed.

5 Design and develop an application that implements Binary Search Trees (BST) to efficiently manage and retrieve data. Apply BST to solve real-world problems such as contact management in a phonebook, auto-suggestion in search engines.

6 Develop an application that implements AVL Trees to maintain balanced and efficient data retrieval. Apply AVL Trees to real-world scenarios such as optimizing database indexing, managing dynamic leaderboards in gaming applications, or implementing auto-balancing dictionaries for fast search operations.

7 Implement heaps using priority queues, applying them to problems like task scheduling and resource allocation.

8 Develop an application that implements Dijkstra's Algorithm to find the shortest path in a network. Apply this algorithm to real-world scenarios such as GPS-based navigation systems, network routing optimization, or emergency response route planning.

9 Develop an application that implements Prim's Algorithm to find the Minimum Spanning Tree (MST) of a network. Apply this algorithm to solve real-world problems such as optimizing road networks, minimizing wiring costs in circuit design, or designing efficient communication networks.

10 Develop an application that implements Linear Search and Binary Search to efficiently retrieve data from a dataset. Apply these searching techniques to real-world scenarios such as product search in an e-commerce platform, student record retrieval in a database, or keyword search in a text document.

11 Develop an application that implements Insertion Sort and Selection Sort to efficiently organize and manage data. Apply these sorting techniques to real-world scenarios such as ranking student grades, arranging customer transaction records, or sorting a list of product prices in an e-commerce platform.

12 Develop an application that implements Merge Sort to efficiently sort large datasets. Apply Merge Sort in real-world scenarios such as sorting customer transaction records in an e-commerce platform, organizing log files in a server, or optimizing search results in a database system.

13 Develop an application that implements Open Addressing techniques, including Linear Probing and Quadratic Probing, for efficient hash table management. Apply these techniques to solve real-world problems such as fast data retrieval in database indexing, caching mechanisms in web browsers, or duplicate detection in large datasets.

Total Periods: 60

Course Outcomes:

CO	At the end of the course, the students will be able to	Knowledge Level
CO1	Apply Linear data structure -Linked lists.	Applying
CO2	Apply Stacks and Queue for real time applications.	Applying
CO3	Apply Binary Search tree and AVL tree operations.	Applying
CO4	Develop applications using graph algorithms.	Applying
CO5	Analyze the various searching and sorting algorithms.	Analysing

CO-PO/PSO Mapping

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

CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CS362	**Object Oriented Programming Laboratory (Common to B.Tech. AI&DS)**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

Course Objective:

- To build real-world applications using java.
- To understand and apply the concepts of classes, packages, interfaces, inheritance, Exception handling and file processing.
- To develop applications using multithreading
- To Build applications using generic programming
- To Develop the java application using JavaFX controls and events programming

Sl No	List of Experiments
1	Develop a Java application that allows users to search and sort data efficiently. Implement sequential search and binary search to find specific records (e.g., student details, product inventory). Integrate selection sort and insertion sort to organize datasets, such as sorting customer orders by date or arranging exam scores in ascending orr.
2	Develop a Java application that implements Stack and Queue data structures using classes and objects. Apply these structures to real-world scenarios such as managing browser history (Stack) and handling customer requests in a service center (Queue).
3	Develop a Java application that demonstrates multilevel inheritance by simulating a real-world scenario, such as a company's employee management system. Implement a class hierarchy where a base class Person is extended by Employee, which is further extended by specialized roles like Manager or Developer. Include methods to display employee details and calculate salaries based on roles.
4	Create an abstract class Shape with two integer attributes and an abstract method print Area(). Implement three subclasses: Rectangle, Triangle, and Circle, each overriding print Area() to calculate and display their respective areas.

5 Develop a Java application that demonstrates the use of the extends keyword with interfaces. Implement a real-world scenario such as a payment system where multiple payment methods (Credit Card, PayPal, UPI) extend a common payment interface to ensure seamless transactions.

6 Develop a Java application that demonstrates exception handling by creating user-defined exceptions. Apply this in a real-world scenario, such as validating user input in a banking system, handling insufficient balance exceptions in an ATM simulation, or managing invalid login attempts in an authentication system.

7 Develop a Java-based multi-threaded application to simulate the Producer-Consumer problem using Threads. Implement synchronization techniques to ensure proper coordination between producers and consumers, such as managing a shared buffer for real-world applications like job scheduling in an operating system or message queues in a communication system.

8 Develop a Java application that performs essential file operations such as creating, reading, writing, and deleting files. Implement real-world use cases like logging system activities, managing user data, or handling configuration files for an application.

9 Develop a Java application that performs essential file operations such as creating, reading, writing, and deleting files. Implement real-world use cases like logging system activities, managing user data, or handling configuration files for an application.

10 Develop a JavaFX-based desktop application that utilizes various controls, layouts, and menus to create an interactive user interface. Implement features such as a to-do list manager, a student record system, or a simple inventory management system, ensuring a user-friendly experience with responsive design.

11 Write a java program that connects to a database using JDBC
Develop a Java-based application that connects to a database using JDBC. Implement functionality to insert user data, such as a registration form for a library management system, employee records for an HR system, or product details for an inventory management system
Develop a Java-based application that connects to a database using JDBC. Implement functionality to manage and delete records, such as removing outdated user information from a customer database or deleting inactive product listings from an inventory system.

Total Periods: 60

Course Outcomes

CO	At the end of the course, the students will be able to	Knowledge Level
CO1	Apply java programs using object-oriented programming concepts	Applying
CO2	Apply object-oriented concepts such as package, exceptions for simple applications.	Applying
CO3	Apply multithreading concept for simple java program.	Applying
CO4	Develop Simple application using generic classes.	Applying
CO5	Create GUIs and event driven programming applications for real world problems.	Applying

CO-PO/PSO Mapping

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

CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CS372	Operating Systems Laboratory	L	T	P	C
		0	0	4	2

Course Objective:

- To understand and practice basic UNIX commands and shell programming.
- To implement and analyze CPU scheduling algorithms.
- To simulate memory management techniques.
- To develop programs for file organization and allocation strategies.
- To install, configure, and manage operating systems using virtualization.

Sl No	List of Experiments
1.	Install a Windows operating system on a new computer, ensuring proper partitioning, driver installation, and system configuration
2.	Illustrate basic UNIX commands to manage files, handle processes, and navigate directories effectively. Provide real-world scenarios where these commands are useful.
3.	You are working as a system administrator, and your organization requires frequent backups of important files. Write a shell script that automates the process of copying specific files from one directory to another at regular intervals. Additionally, modify the script to perform simple arithmetic operations, such as calculating the total size of the copied files. Test and demonstrate your script with sample files.
4.	Develop a program that creates a child process using the fork() system call. The parent process should wait for the child process to complete before exiting. Display the Process ID (PID) of both parent and child processes using getpid(). Additionally, implement proper resource management by closing any unnecessary file descriptors using the close() system call.
5.	Design and implement a scheduling that allows users to input process details (arrival time, burst time, priority, etc.) and visualize the execution of different CPU scheduling algorithms (FCFS, SJF, Round Robin, and Priority Scheduling). Analyze the turnaround time and waiting time for each algorithm and compare their efficiency
6.	A company wants to develop a multi-process application where one process generates real-time sensor data, and another process analyzes it. Implement a solution using inter-process communication (IPC) with pipes or shared memory to enable seamless data transfer between these processes. Demonstrate how the sender and receiver processes interact and ensure efficient data handling.
7.	Develop a multi-threaded program where multiple processes attempt to write to a shared resource (e.g., a log file or a critical section of memory). Use semaphores to ensure mutual exclusion, preventing race conditions and ensuring only one process accesses the resource at a time. Test the implementation with multiple concurrent processes and analyze its effectiveness.

8. A bank manages loan requests from multiple customers. To prevent resource deadlock, the bank follows a safe resource allocation strategy. Develop a program that takes customer loan requests, checks for safe resource allocation using the Banker's Algorithm, and determines whether the request should be granted or denied. Test your program with different scenarios to validate its effectiveness in avoiding deadlocks.

9. A multi-user banking system processes multiple transactions simultaneously. To prevent deadlocks, the system needs an efficient resource allocation strategy. Develop a simulation where multiple processes request resources dynamically. Implement a deadlock prevention technique such as resource ordering, preemption, or circular wait avoidance. Demonstrate how your algorithm ensures that deadlocks do not occur while maintaining system efficiency.
10. A university's computer lab is experiencing memory fragmentation issues due to inefficient memory allocation. As a system developer, design and implement a paging technique that efficiently manages memory allocation and translation between logical and physical addresses. Your solution should include a page table for address mapping and handle page faults effectively. Simulate a scenario where multiple processes request memory, and demonstrate how paging resolves fragmentation issues.

11. Design and implement a memory management system that simulates dynamic memory allocation using First Fit, Best Fit, and Worst Fit strategies. Given a set of memory block sizes and incoming process sizes, develop a program that efficiently allocates memory and evaluates the performance of each strategy in terms of fragmentation and allocation success rate.

12. Design and develop a memory management system that simulates page replacement in an operating system. Implement FIFO, LRU, and Optimal page replacement algorithms to manage page faults efficiently. Compare the performance of these algorithms by running different reference string inputs and analyze which algorithm minimizes page faults the most in various scenarios.
13. A company maintains employee records in a file system. Each employee's details (ID, Name, Department, and Salary) need to be stored efficiently. Implement a program that organizes these records using Sequential, Indexed, and Linked file organization methods. Compare their efficiency in terms of search time and storage utilization.

14. Design and develop a program that simulates file storage in an operating system by implementing Sequential, Indexed, and Linked file allocation strategies. Given a set of files with varying sizes, your program should allocate disk blocks efficiently, handle file access requests, and display the allocation structure for each method.
15. Design and develop a disk scheduling application that allows users to input a sequence of disk requests and visualize the execution of FCFS, SSTF, and LOOK scheduling algorithms. Compare their performance based on seek time and total head movement.
16. Install a Linux guest operating system using VMware or VirtualBox.

Total Periods: 60

Course Outcomes

CO	At the end of the course, the students will be able to	Knowledge Level
CO1	Apply the basic UNIX commands and shell scripting for process and file management.	Applying
CO2	Analyze the various CPU scheduling algorithms.	Analyzing
CO3	Compare memory allocation and page replacement techniques.	Analyzing
CO4	Apply file organization and allocation strategies for storage systems.	Applying
CO5	Apply the disk scheduling algorithms for optimal performance.	Applying

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2
CO1	3	2			3	2	3	3	3	2	2	3	3
CO2	3	3	2	2	3	2	3	3	3	2	2	3	3
CO3	3	3	2	3	3	2	3	3	3	2	2	3	3
CO4	3	2	3	2	3	2	3	3	3	2	2	3	3
CO5	3	3	2	2	3	2	3	3	3	2	2	3	3
Avg.	3	2.6	2.25	2.25	3	2	3	3	3	2	2	3	3

CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24EM312	DESIGN THINKING AND INNOVATION (Common to B.E. Civil, CSE and Mechanical and B./Tech. AIDS in Third Semester and B.E. ECE in Fifth Semester)	L	T	P	C
		0	0	2	1

Course Objective:

- Empathizing with users to uncover their real problems and desires.
- Promoting out-of-the-box thinking to develop unique and effective solutions.
- Using prototyping, testing, and refining ideas to ensure the best outcome.
- Testing assumptions early to prevent costly mistakes and enhance decision-making.
- Creating innovative products, services, or processes that improve market competitiveness.

Sl No	List of Exercises	No of periods
1	Design Thinking – models – Why design thinking? Case Studies. Innovation – 7Cs of Innovation. Identify a case study.	4
2	Empathize – tools - customer Journey map – case studies – Empathize the identified case study	4
3	Analyze – tools, multi-whys, case study, conflict of interest. Analyze the identified case study	4
4	Ideate and solve – brainstorming – TRIZ method, trial and error method – Solve the identified case study	4
5	Prototype/process and test – tools and methods – create a prototype for the identified case study	4
6	Iterate to improve the prototype/process – revisit the methods to improve the prototype.	8
7	Submit the report and final prototype/process of the case study.	2
	Total Periods	**30**

Text Books

1 Pavan Soni, Design your thinking, Penguin Random House India Pvt, Ltd., India, 2022
2 Don Norman, The Desing of everyday things, Basic Books, New York, 2013

Reference Books

1 B.K. Chakravarthy, Janaki Krishnamoorthi, Innovation by Design Lessons from Post Box Design & Development, Springer, New Delhi 2013

2 Balaramadurai, Karmic Design Thinking, 2020

3 Design by Innovation NPTEL Course B.K. Chakravarthy IIT Bombay https:/ /npt el.ac.in/ courses/107 101086

4 Design Thinking and Innovation NPTEL Cours Ravi Poovaiah, IIT Bombay https:/ /onlinecourses.swa yam2.ac.in/ aic23_g e17/preview

5 Design Thinking A Premier NPTEL Course, Prof. Ashwin Mahalingam, Prof. Bala Ramadurai, IIT Madras https:/ /onlinecourses.npt el.a c.in/ noc22 _mg32/ preview

Course Outcomes

CO	At the end of the course, the students will be able to	Knowledge Level
CO1	Apply the tools to empathize the identified case study	Applying
CO2	Analyze the data and information to conceptualize the solution for the case study	Analyzing
CO3	Ideate and solve the case study using appropriate tools	Applying
CO4	Create a prototype/process of the case study	Creating
CO5	Iterate to improvise the prototype/process of the case study	Analyzing

CO-PO/PSO Mapping

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

CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)