CARE COLLEGE OF ENGINEERING

(An Autonomous Institution)

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai

No 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.TECH. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

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 Lab	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**

CARE COLLEGE OF ENGINEERING
(An Autonomous Institution)
Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai
Accredited by NAAC with 'A' Grade & NBA (CSE, ECE, MECH)
#27, Thayanur, Tiruchirappalli - 620009

Department of Artificial Intelligence and Data Science
Regulation 2024 Third Semester Curriculum

Sl. No	Course Code	Course Name	Category	No. of periods/week			Total Periods	Credits
				L	T	P		
1	U24MA341	Probability and Statistics	BSC	3	1	0	4	4
2	U24CS321	Data Structures	PCC	3	0	0	3	3
3	U24CS331	Object Oriented Programming using Java	PCC	3	0	0	3	3
4	U24AD311	Computer Networks	PCC	3	0	0	3	3
5	U24AD323	Data Exploration and Visualization	PCC	3	0	2	5	4
6	U24CS352	Data Structures Laboratory	PCC	0	0	4	4	2
7	U24CS362	Object Oriented Programming Laboratory	PCC	0	0	4	4	2
8	U24EM312	Design Thinking and Innovation	EEC	0	0	2	2	1
			Total	15	1	12	28	22

CARE COLLEGE OF ENGINEERING
(An Autonomous Institution)
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai
#27, Thayanur, Trichy 620 009

Department of Artificial Intelligence and Data Science

R2024 Fourth Semester Curriculum

S. No	Course Code	Course Title	Category	Periods per week			No of Contact Periods	Credits
				L	T	P		
1	U24MA411	Numerical Methods	BSC	3	1	0	4	4
2	U24AD411	Intelligent Systems	PCC	3	0	0	3	3
3	U24CS421	Database Management Systems	PCC	3	0	0	3	3
4	U24CS441	Design and Analysis of Algorithms	PCC	3	0	0	3	3
5	U24EM411	Aptitude and Reasoning – I	EEC	1	0	0	1	1
6	U24CS453	Web Technologies	PCC	1	0	4	5	3
7	U24AD422	Intelligent Systems Laboratory	PCC	0	0	4	4	2
8	U24CS462	Database Management Systems Laboratory	PCC	0	0	4	4	2
9	U24CS482	Design and Analysis of Algorithms Laboratory	PCC	0	0	4	4	2
10	U24EM422	Soft skills and Personality Development – I	EEC	0	0	2	2	1
			Total	**14**	**1**	**18**	**33**	**24**

CARE College of Engineering (Autonomous) Trichy-620 009

CARE COLLEGE OF ENGINEERING, TIRUCHIRAPPALLI 620 009
(AN AUTONOMOUS INSTITUTION)
DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
B.TECH. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
REGULATION 2024 CURRICULUM AND SYLLABUS
CHOICE BASED CREDIT SYSTEM (CBCS)
FIFTH SEMESTER

SL. NO	COURSE CODE	COURSE NAME	CATEGORY	PERIODS PER WEEK			TCP	C	CIA	ESE
				L	T	P				
THEORY COURSES										
1	U24AD511	Machine Learning	PCC	3	0	0	3	3	40	60
2	U24AD521	Data Science and Analytics	PCC	3	0	0	3	3	40	60
3	U24AD531	Cryptography and Cyber Security	PCC	3	0	0	3	3	40	60
4	U24CSFS02	UI and UX Design	PEC	1	0	4	5	3	50	50
5	U24EM511	Aptitude and Reasoning – II	EEC	2	0	0	2	2	100	-
6	U24MG511	Leadership and Team Management	EEC	2	0	0	2	2	40	60
THEORY CUM LABORATORY COURSES										
7	U24CS533	Embedded Systems and IoT System Design	PCC	1	0	4	5	3	50	50
PRACTICAL COURSES										
8	U24AD542	Machine Learning Laboratory	PCC	0	0	4	4	2	60	40
9	U24AD552	Data Science and Analytics Laboratory	PCC	0	0	4	4	2	60	40
10	U24EM522	Soft Skills and Personality Development – II	EEC	0	0	2	2	1	100	-
		Total		**15**	**0**	**18**	**33**	**24**		

ASSESSMENT SCHEME

Sl. No	Course Type	L	T	P	C	CIA Weightage (Theory)				CIA	ESE		CIA (W)	ESE (W)	Min. Marks to Pass for 100	
						T1	A1	T2	A2	Prac	Th	Prac			ESE	Total
1	U24AD511	3	0	0	3	60	40	60	40	-	100	-	40	60	45	50
2	U24AD521	3	0	0	3	60	40	60	40	-	100	-	40	60	45	50
3	U24AD531	3	0	0	3	60	40	60	40	-	100	-	40	60	45	50
4	U24CSFS02	1	0	4	3	-	-	60	40	100	-	100	50	50	45	50
5	U24EM511	2	0	0	2	-	-	-	-	-	-	-	100	-	-	50
6	U24MG511	2	0	0	2	60	40	60	40	-	100	-	40	60	45	50
7	U24CS533	1	0	4	3	-	-	60	40	100	-	100	50	50	45	50
8	U24AD542	0	0	4	2	-	-	-	-	100	-	100	60	40	45	50
9	U24AD552	0	0	4	2	-	-	-	-	100	-	100	60	40	45	50
10	U24EM522	0	0	2	1	-	-	-	-	-	-	-	100	-	-	50

(W) – Weightage

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	3	2	1	2	1			2	3	3	2			
CO2	3	2	1	2	1			2	3	3	2			
CO3	3	2	1	2	1			2	3	3	2			
CO4	3	2	1	3	1			2	3	3	2			
CO5	3	2	1	3	1			2	3	3	2			
Avg.	**3**	**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‘s 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		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**		

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 goldCoins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archaeological 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.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	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.	Practical – 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 Objectivess:

- 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

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	2	3	1	2	2	1	1		1	2	1	3		
CO2	1	2	1	2	2				1	1	1	2		
CO3	2	3	1	2	3				1	1	1	2		
CO4	2	1		1	1				2	1	1	2		
CO5	1	2	1	2	2	1	1		1	2	1	3		
Avg.	**1.6**	**2.2**	**10**	**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.Tech. Artificial Intelligence and Data Science
R2024 Third Semester Syllabus

		L	T	P	C
U24MA341	**PROBABILITY AND STATISTICS**	**3**	**1**	**0**	**4**

Course Objectives:

- To provide the required skills to apply statistical tools to engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To acquaint with knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which play a very important role in the fields of agriculture and statistical quality control

UNIT I PROBABILITY AND RANDOM VARIABLES 9+3

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 a random variable.

UNIT IITWO – DIMENSIONAL RANDOM VARIABLES 9+3

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

UNIT IIIESTIMATION THEORY 9+3

Unbiased estimators - Efficiency - Consistency - Sufficiency - Robustness - Method of moments - Method of maximum Likelihood - Interval estimation of Means - Differences between means, variations and ratio of two variances.

UNIT IV NON- PARAMETRIC TESTS 9+3

Introduction - The Sign test - The Signed - Rank test - Rank - sum tests - The U test - The H test - Tests based on Runs - Test of randomness - The Kolmogorov Tests.

UNIT V STATISTICAL QUALITY CONTROL 9+3

Control charts for measurements ($\overline{X}$ and R charts) – Control charts for attributes (c, p and np charts).Tolerance limits - Acceptance sampling.

TOTAL: 60 PERIODS

Text Books

1. Johnson. R.A., Miller. I.R and Freund. J.E, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2022.
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2019.
3. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5thEdition, 2016.
4. T.Veerarajan "Probability, Statistics and Random Process" 3rdEdition, Tata McGraw Hill Publishing Company limited, 2008.

Reference Books

1. Gupta. S.C. and Kapoor. V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3. Ross. S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 5th Edition, Elsevier, 2014.
4. Grewal. B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44thEdition, 2018.

Course Outcomes

CO	At the end of the course, the students will be able to	Knowledge level
CO1	Apply discrete and continuous distribution to solve the problems.	Applying
CO2	Calculate probabilities, marginal and conditional distributions of bivariate random variables.	Applying
CO3	Evaluate the properties of estimators.	Applying
CO4	Apply various method of non-parametric test to solve the problems.	Applying
CO5	Apply the concept of statistical quality control to identify the problems through data analysis.	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)

U24CS321 **DATA STRUCTURES** **(Common to B.E. Computer Science and Engineering)**

L	T	P	C
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 Graph - 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)

		L	T	P	C
U24CS331	**Object Oriented Programming using Java (Common to B.E. Computer Science and Engineering)**	**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)

U24AD311	Computer Networks	L	T	P	C
		3	0	0	3

Course Objective:

- To explain the protocol layering , Architecture of the Internet and Physical Layer.
- To learn the node-to -node data flow in Data link layer
- To examine network layer protocols and the functions of various routing protocols using a simulator tool.
- To familiarize the functions and protocols of the Transport layer.
- To learn the functions of Application layer and fundamentals in Network Security.

UNIT I INTRODUCTION 9

Data communication System-Network Types-Network Topologies- Protocol Layering-TCP/IP Protocol suite – OSI Reference Model- Interbet Architecture- Physical Layer: Data and Signals- Performance- wireless transmission, the public switched telephone networks, mobile telephone system.

UNIT II DATA LINK LAYER 8

Data Link Layer-Framing-Flow Control-Error Control-Data Link Layer Protocols: HDLC-PPP-Media Access Control,Ethernet Basics: CSMA/CD-Virtual LAN – Wireless LAN (802.11) Simulation of an error correction code using NS simulator.

UNIT III NETWORK LAYER 10

Internet protocol - IPV4 - IP Addressing -Forwarding of IP Packets -Subnetting - IPV6, Address Mapping- ARP, RARP, ICMP, DHCP. Routing and protocols: Unicast routing - Distance Vector Routing - RIP - Link State Routing – OSPF – Path-vector routing - BGP - Multicast Routing: DVMRP – PIM - Packet Capturing and its examination using WireShark, Simulation of routing algorithms using NS simulator.

UNIT IV TRANSPORT LAYER 9

Introduction-Transport Layer Protocols -Services - Port Numbers - User Datagram Protocol - Transmission Control Protocol – Quality of Service(QoS)-Congestion Control: Leaky Bucket and Token Bucket Algorithm- Congestion avoidance (DECbit, RED).

UNIT V APPLICATION LAYER AND NETWORK SECURITY 9

Introduction to sockets-Application Layer Protocols: DNS,EMAIL, FTP, HTTP Concepts of symmetric and asymmetric key cryptography. Sharing of symmetric keys - Diffie Hellman. Firewalls.

Total Periods:45

Text Books

1 Behrouz A. Forouzan, Data Communications and Networking with TCP/IP Protocol Suite, Sixth Edition TMH, 2022.
2 AS Tanenbaum, DJ Wetherall, Computer Networks, 5th Ed., Prentice-Hall, 2010

Reference Books

1 JF Kurose, KW Ross, Computer Networking: A Top-Down Approach, 5th Ed., Addison-Wesley, 2009.
2 Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.
3 W Stallings, Cryptography and Network Security, Principles and Practice, 5th Ed., Prentice-Hall, 2010

4 Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill, 2012.
5 Teerawat Issariyakul and Ekram Hossain, Introduction to Network Simulator NS2, Springer Publisher, 2009

Course Outcomes

CO	At the end of the course, the students will be able to	Knowledge Level
CO1	Explain the basic layers functionalities and working of Physical Layer	Applying
CO2	Illustrate the basics of data flow in data link layer	Applying
CO3	Illustrate the network layer protocolsa and evaluate different routing algorithms using NS simulator.	Analyzing
CO4	Determine various Transport Layer protocols & parameters for congestion control using different algorithms.	Applying
CO5	Illustrate the basics of data flow in data link layer	Applying

CO-PO & PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	3	-	-	3	3	-	3	3	2
CO2	3	3	-	-	2	-	-	3	3	-	3	2	2
CO3	2	2	-	-	2	-	-	3	3	-	3	2	2
CO4	2	3	-	-	2	-	-	3	3	-	3	2	3
CO5	3	2	-	-	2	-	-	3	3	-	3	3	2
AVG	2 .6	2 .4	-	-	2 .2	-	-	3	3	-	3	2 .4	2 .2

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

U24AD323 DATA EXPLORATION AND VISUALIZATION

L	T	P	C
3	0	2	4

Course Objective:

1. To outline an overview of exploratory data analysis.
2. To implement data visualization using Matplotlib.
3. To perform univariate data exploration and analysis.
4. To apply bivariate data exploration and analysis.
5. To use Data exploration and visualization techniques for multivariate and time series data.

UNIT I EXPLORATORY DATA ANALYSIS 9

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques - Grouping Datasets - data aggregation – Pivot tables and cross-tabulations.

UNIT II VISUALIZING USING MATPLOTLIB 9

Importing Matplotlib – Simple line plots – Simple scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

UNIT III UNIVARIATE ANALYSIS 9

Introduction to Single variable: Distributions and Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality - Smoothing Time Series.

UNIT IV BIVARIATE ANALYSIS 9

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

UNIT V MULTIVARIATE AND TIME SERIES ANALYSIS 9

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

Total Periods: 45

Laboratory Exercises

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

Total Periods: 30

Text Books

1. Suresh Kumar Mukhiya, Usman Ahmed, “Hands-On Exploratory Data Analysis with Python”, Packt Publishing, 2020.
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", Oreilly, 1st Edition, 2016.
3. Catherine Marsh, Jane Elliott, “Exploring Data: An Introduction to Data Analysis for Social Scientists”, Wiley Publications, 2nd Edition, 2008.

Reference Books

1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
2. Claus O. Wilke, “Fundamentals of Data Visualization”, O’reilly Publications, 2019.

3. Matthew O. Ward, Georges Grinstein, Daniel Keim, “Interactive Data Visualization: Foundations, Techniques, and Applications”, 2nd Edition, CRC Press, 2015.

Course Outcomes

CO	At the end of the course, the students will be able to	Knowledge Level
CO1	Understand the fundamentals of exploratory data analysis.	Understanding
CO2	Implement the data visualization using Matplotlib.	Applying
CO3	Perform univariate data exploration and analysis.	Applying
CO4	Apply bivariate data exploration and analysis.	Applying
CO5	Apply Data exploration and visualization techniques for multivariate and time series data.	Applying

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2				2	2		2	2	2
CO2	3	2	2	3				2	2		2	2	2
CO3	3	2	2	2	2			2	2		2	2	2
CO4	3	2	2	3				2	2		2	2	2
CO5	3	2	2	2	2			2	2		2	2	2
Avg.	**3**	**2**	**2**	**2.5**	**2**			**2**	**2**		**2**	**2**	**2**

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

U24CS352 DATA STRUCTURES LABORATORY (Common to B.E. Computer Science and Engineering)

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)

		L	T	P	C
U24CS362	**Object Oriented Programming Laboratory (Common to B.E. Computer Science and Engineering)**	**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)

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)

B.Tech: Artificial Intelligence and Data Science

R2024 Fourth Semester Syllabus

U24MA411	NUMERICAL METHODS	L	T	P	C
		3	1	0	4

Course Objectives:

- To introduce the basic concepts of solving algebraic and transcendental equations.
- To understand techniques of interpolation and polynomial fitting.
- To understand methods too numerical differentiation and integration.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.
- To understand the knowledge of various techniques and methods of solving various types of partial differential equations.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3

Solution of algebraic and transcendental equations – Fixed Point iteration – Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigen values of a matrix by Power method.

UNIT II INTERPOLATION AND APPROXIMATION 9+3

Lagrange's interpolation – Interpolation with unequal intervals: Newton's divided difference interpolation – Interpolation with equal intervals: Newton's forward and backward difference formulae - Cubic Splines.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9+3

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

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9+3

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

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9+3

Finite difference methods for solving second order two - point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

TOTAL: 60 PERIODS

Text Books

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Burden, R.L and Faires, J.D, "Numerical Analysis", 9thEdition, Cengage Learning, 2016.
3. Steven C Chapra and Raymond P Canale, "Numerical Methods for Engineers", Tata McGraw Hill, New Delhi, 2021.
4. Richard L. B and Douglas J. F, "Numerical Analysis", Thomas Learning, New York, 2017.

Reference Books

1	Sastry. S.S, "Introductory Methods of Numerical Analysis", PHI Learning Pvt. Ltd, 5thEdition, 2015.
2	Gerald. C.F. and Wheatley.P.O., "Applied Numerical Analysis", Pearson Education, Asia, 7thEdition, New Delhi, 2006.
3.	Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd, 3rdEdition, New Delhi, 2007.
4	Veerarajan T, Ramachandran R, "Numerical Methods with Programs in C", Tata McGraw Hill, 2ndEdition, New Delhi, 2008.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Determine the numerical solution of algebraic, transcendental and system of linear equations.	Applying
CO2	Apply appropriate numerical methods to solve the interpolation with equal and unequal intervals.	Applying
CO3	Apply the numerical techniques of differentiation and integration for engineering problems.	Applying
CO4	Determine the solution of ordinary differential equation of first order by Euler, Taylor and Runge-Kutta methods.	Applying
CO5	Determine the Solution of partial and ordinary differential equations with initial and boundary conditions by using certain techniques with	Applying

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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**			

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

U24AD411	INTELLIGENT SYSTEMS	L	T	P	C
		3	0	0	3

Course Objective:

- Explain the architecture and behavior of intelligent agents and describe uninformed search strategies for solving problems.
- Describe heuristic and local search techniques used in solving optimization problems.
- Explain the application of game search and constraint satisfaction in solving strategic and combinatorial problems.
- Illustrate the use of propositional and first-order logic in representing knowledge and inference.
- Explain the concepts of Bayesian inference and their use in AI systems.

UNIT I- INTELLIGENT AGENTS 9

Introduction to AI– Agents and Environments– Concept of Rationality–Nature of Environments– Structure of Agents. Problem Solving Agents– Search Algorithms– Uninformed Search Strategies.

UNIT II-PROBLEM SOLVING 9

Heuristic Search Strategies – Heuristic Functions. Local Search and Optimization Problems– Local Search in Continuous Space– Search with Non-Deterministic Actions– Search in Partially Observable Environments– Online Search Agents and Unknown Environments

UNIT III-LOGICAL REASONING 9

Logic- Propositional Logic - Propositional Theorem Proving – Propositional model checking - First Order Logic-Syntax and Semantics – Inference in First order logic– Forward Chaining – Backward Chaining– Resolution.

UNIT IV-GAME PLAYING AND CSP 9

Game Theory – Optimal Decisions in Games – Alpha –Beta Search – Monte –Carlo Tree Search – Stochastic Games – Partially Observable Games. Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search for CSP – Structure Of CSP.

UNIT V-PROBABILISTIC REASONING AND APPLICATION 9

Acting Under Uncertainty– Bayesian Inference - Navie Bayes Models– Probabilistic Reasoning– Semantics of Bayesian Networks– Exact Inference in BN – Approximate Inference in BN. Application – Natural Language Processing - Large Language Models - Fuzzy Logic

Total Periods: 45

Text Books

1	S. Russel and P. Norvig, "Artificial Intelligence–A Modern Approach", Fourth Edition, Pearson Education, 2023.

Reference Books

1	David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence: a logical approach", Oxford University Press, New Delhi 2006.
2	G.Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", Sixth Edition, Pearson Education, New Delhi Reprint 2021.
3.	J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers, New Delhi Reprint 2023.

Online References

1. http://nptel.ac.in
2. www.ics.uci.edu/~smyth/courses/cs271/topic0_introduction.ppt
3. www.cs.utexas.edu/users/ear/nsc110/.../DSMirrorsArtificialIntelligence.ppt
4. www.pafkiet.edu.pk/coe/Artificial_Intelligence.ppt
5. www.cs.berkeley.edu/~russell/slides/

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Apply intelligent agent architecture and uninformed search strategies to solve defined problems.	Applying
CO2	Apply heuristic and local search methods to solve optimization problems.	Applying
CO3	Apply game search and constraint satisfaction techniques to solve decision-making problems.	Applying
CO4	Apply propositional and first-order logic to perform reasoning using inference techniques.	Applying
CO5	Apply probabilistic reasoning methods such as Bayesian inference in AI systems.	Applying

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	3	3	2			2	3	3	2		
CO2	2	2	2	2	2			2	2	3	2		
CO3	2	2	2	2	2			2	2	2	3		
CO4	2	2	2	2	2			2	2	2	2		
CO5	3	2	2	2	2			3	2	2	2		
Avg.	**2.4**	**2**	**2.2**	**2.2**	**2**			**2.2**	**2.2**	**2.4**	**2.2**		

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

U24CS421	DATABASE MANAGEMENT SYSTEMS (Common to B. Tech AI&DS)	L	T	P	C
		3	0	0	3

Course Objective:

- To introduce the fundamental concepts of database systems and help students model real-world data and relationships using Entity-Relationship (ER) diagrams.
- To develop the ability to formulate and solve data retrieval and manipulation problems using relational algebra and SQL, including complex query operations.
- To provide a strong foundation in database design by applying normalization techniques to eliminate data redundancy and update anomalies in relational databases.
- To explain the concepts of transaction management and concurrency control**,** enabling students to handle concurrent transactions and implement recovery mechanisms in database applications.
- To expose students to advanced database technologies**,** including distributed databases, NoSQL systems, and database security mechanisms, for building scalable and secure applications.

UNIT – I INTRODUCTION TO DATABASE SYSTEMS 9

Introduction to Databases– File System Vs Database System – Data Models – Schemas and Instances – DBMS Architecture – Centralized – Client Server – Database Applications–Entity-Relationship Model – Entity-Relationship Diagrams - Enhanced-ER Model

UNIT-II - RELATIONAL DATABASES 9

Relational Model – Constraints – Keys – Dependencies – Relational Algebra – Unary, Binary, Set and Extended Relational Algebra operations – SQL– Data Definition – Data Manipulation and Retrieval Queries – Nested Queries – Joins – Views– Cursors – Procedures – Functions – Triggers – Embedded and Dynamic SQL

Unit III - Database Design 9

Dependencies and Normal forms, - functional dependencies, 1NF, 2NF, 3NF and BCNF, 4NF, and 5NF, Domain Key Normal Form, Query processing and Query optimization

Unit – IV – Transactions 9

Transaction Concepts – ACID Properties – Schedules – Serializability – Transaction support in SQL – Need for Concurrency – Concurrency control –Two Phase Locking- Timestamp – Multiversion – Validation and Snapshot isolation– Multiple Granularity locking – Deadlock Handling – Recovery Concepts – Recovery based on deferred and immediate update – Shadow paging – ARIES Algorithm

Unit V – Advanced Database concepts 9

Distributed Databases-Architecture-Transaction Processing- XML Database - NOSQL Databases: Introduction – CAP Theorem – Document Based systems – Key value Stores – Column Based Systems – Graph Databases- Database Security: Security issues – Access control based on privileges – Role Based access control – SQL Injection

Total Periods: 45

Text Books

1	Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", 7th Edition, Tata McGraw Hill, 2019
2	Ramez Elmasri and Navathe, "Fundamentals of Database Systems", 7th Ed., Pearson, 2021

Reference Books

1	C. J. Date, A. Kannan and S. Swamynathan, "An Introduction to Database Systems", 8th ed, Pearson Education, 2006
2	Andreas Meier, Michael Kaufmann, "SQL & NoSQL Databases: Models, Languages, Consistency Options and Architectures for Big Data Management", 1st Edition 2019.

Online References

1. https://nptel.ac.in/courses/106105175
2. https://onlinecourses.nptel.ac.in/noc25_cs40/
3. https://www.scaler.com/topics/course/dbms/

Course Outcomes

CO	At the end of the course, the students will be able to	Knowledge Level
CO1	Apply data and relationship among data of a real time application using ER model	Applying
CO2	Formulate solutions to a broad range of query problems using relational algebra/ SQL	Applying
CO3	Apply normalization theory to normalize the relations in RDBMS to avoid redundancy and anomalies	Applying
CO4	Explain the impact and consequences of concurrent transactions, deadlock and their recovery in a realistic database application.	Understanding
CO5	Describe advanced database concepts including distributed databases, NoSQL models, and database security techniques to design and manage scalable, secure data systems.	Understanding

CO-PO/PSO Mapping

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

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

U24CS441	DESIGN AND ANALYSIS OF ALGORITHM (Common to B. Tech AI&DS)	L	T	P	C
		3	0	0	3

Course Objective:

- Understand the fundamental concepts of algorithms and their efficiency analysis.
- Apply various algorithm design techniques across different paradigms.
- Develop skills to analyze and optimize algorithm performance in diverse scenarios.
- Evaluate the theoretical limitations of algorithmic approaches and computational power.
- Apply appropriate strategies for solving complex and hard computational problems.

Unit I-INTRODUCTION 9

Notion of an Algorithm–Fundamentals of Algorithmic Problem Solving–Important Problem Types–Fundamentals of the Analysis of Algorithm Efficiency–Analysis Framework-Asymptotic Notations and their properties – Empirical analysis - Mathematical analysis of Recursive and Non-recursive algorithms - Visualization

Unit-II-BRUTE FORCE AND DIVIDE-AND-CONQUER 9

Brute Force – String Matching-Exhaustive Search-Traveling Salesman- Problem-Knapsack Problem-Assignment problem. Divide and Conquer Methodology– Multiplication of Large Integers and Strassen's Matrix Multiplication– Closest-Pair and Convex-Hull Problems. Decrease and Conquer- Topological Sorting – Transform and Conquer: Presorting – Heaps and Heap Sort.

Unit-III-DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE 9

Dynamic programming –Principle of optimality-Coin changing problem– Warshall's and Floyd's algorithms –Optimal Binary Search Trees – Multistage graph - Knapsack Problem and Memory functions. Greedy Technique – Dijkstra's algorithm - Huffman Trees and codes – 0/1 Knapsack problem.

Unit-IV-ITERATIVE IMPROVEMENT 9

The Simplex Method-The Maximum-Flow Problem–Maximum Matching in Bipartite Graphs - The Stable marriage Problem

Unit-V-BACKTRACKING AND BRANCH AND BOUND 9

Lower – Bound Arguments - P, NP, NP-Complete and NP Hard Problems. Backtracking– N-Queen problem—Hamiltonian Circuit Problem - Subset Sum Problem. Branch and Bound –LIFO Search and FIFO search – Assignment Problem- Knapsack Problem–Traveling Salesman Problem.

Total Periods: 45

Text Books

1	Anany Levitin, ''Introduction to the Design and Analysis of Algorithms ", 3rd Edition, Pearson Education

Reference Books

1	Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Computer Algorithms / C++ ", Second Edition , Universities Press, 2019
2	Thomas H Cormen, Charles ELeiserson, Ronald L Rivest , Clifford Stein, "Introduction to Algorithms", 4th Edition, PHI Learning Private Limited, 2022.
3	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2013.
4	S. Sridhar, "Design and Analysis of Algorithms", Oxford University Press, Second Edition, 2023.

Online References:

- https://nptel.ac.in/courses/106/101/106101060/
- https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms-spring-2015/
- https://www.classcentral.com/course/swayam-design-and-analysis-of-algorithms-3984
- https://www.coursera.org/learn/analysis-of-algorithms

Course Outcomes

CO	At the end of the course, the students will be able to	Knowledge level
CO1	Apply mathematical techniques to analyze the efficiency of recursive and non-recursive algorithms.	Applying
CO2	Solve algorithmic problems using brute force, divide – and – conquer strategies.	Applying
CO3	Implement and apply dynamic programming and greedy techniques to develop efficient solutions.	Applying
CO4	Employ iterative improvement methods to address optimization problems.	Applying
CO5	Apply backtracking and branch-and-bound techniques to solve problems with computational limitations.	Applying

CO-PO/PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	3	2			2	2		3	3	3
CO2	3	3	3	2	2			2	2		3	3	3
CO3	3	3	3	2	2			2	2		3	3	3
CO4	3	3	3	2	2			2	2		3	3	3
CO5	3	3	3	2	2			2	2		3	3	3
Avg.	3	3	2.8	2.2	2			2	2		3	3	3

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

U24EM411	APTITUDE AND REASONING – I	L	T	P	C
		1	0	0	1

Course Objective:

- Enhance analytical and logical reasoning skills to solve problems efficiently.
- Strengthen understanding of basic arithmetic, algebra, geometry, and data interpretation.
- Train students to approach problems systematically and apply suitable techniques.
- Foster quick thinking and reduce error rates through practice and time-bound exercises.

Syllabus

Topic titles	No of periods
Quantitative aptitude • Numbers: Number series, arithmetic progression, geometric progression • HCF and LCM: Highest common factor – split method, division method, Least Common Multiples – prime factor method, division method. • Simplification – BODMAS rule • Average and Percentage • Simple and Compound Interest • Profit, loss and discounts • Ratio and proportion: Ratio – compound ratio, inverse ratio. Proportion – direct proportion, inverse proportion • Mixture and alligation: Mixture, alligation, mean concentration • Problems based on ages • Partnerships: Simple partnership, compound partnership	20
Reasoning: • Number series and letter series • Odd one out • Coding and decoding • Missing characters/numbers and analogies • Blood relations problems • Direction sense tests • Sequencing and ranking test	10

References

1	R.V. Praveen, "Quantitative Aptitude and Reasoning", 3rd Edition , Eastern Economy Edition, PHI Learning, New Delhi, 2016
2	Dr. R.S. Aggarwal, " Quantitative Aptitude", S Chand Publishing, New Delhi 2017
3	Dr. R.S. Aggarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning", S Chand Publishing, New Delhi 2017
4	https://www.indiabix.com/
5	https://www.geeksforgeeks.org/
6	https://faceprep.in/
7	https://prepinsta.com/
8	https://www.javatpoint.com/

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Solve quantitative aptitude problems involving arithmetic, algebra, percentages, ratios, etc., using logical approaches.	Applying
CO2	Analyze problems and apply reasoning strategies such as deduction, inference, and pattern recognition.	Analysing
CO3	Solve problems in simple and compound interest, profit, loss and discount	Applying
CO4	Solve problems based on ages and partnership	Applying
CO5	Demonstrate improved performance in time-bound aptitude tests through consistent practice.	Applying

CO-PO/PSO Mapping

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

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

U24CS453	WEB TECHNOLOGIES (Common to B. Tech AI&DS)	L	T	P	C
		1	0	4	3

Course Objective:

- Develop structured web pages using HTML5 and CSS 3 by incorporating control elements
- Understand and apply modern client-side technologies
- Develop basic server-side web applications that integrate front-end forms with back-end processing
- Develop PHP applications that interact with XML in web systems
- Develop web application using frameworks and tool

Unit I-WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0

Web Essentials: Clients, Servers and Communication – The Internet – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Drag and Drop – Audio – Video controls - CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations.

Unit II-CLIENT SIDE PROGRAMMING

Java Script: An introduction to JavaScript–JavaScript DOM Model-Exception Handling-Validation-Built-in-objects-Event Handling- DHTML with JavaScript, JQuery introduction-JSON introduction.

Unit III-SERVER SIDE PROGRAMMING

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies and End points concepts - DATABASE CONNECTIVITY: JDBC.

Unit IV-PHP and XML

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions-Form Validation. XML: Basic XML- Document Type Definition- XML Schema, XML Parsers and Validation, XSL.

Unit V-INTRODUCTION TO ANGULAR and WEB APPLICATIONS FRAMEWORKS

Introduction to AngularJS, MVC Architecture, Understanding ng attributes, Expressions and data binding, Conditional Directives, Style Directives, Forms, Services; Web Applications Frameworks and Tools – Firebase- Docker- Node JS- React- Django, UI & UX.

Total :15 Periods

Practical – List of experiments	
1	Design an interactive web page for a travel agency using HTML image maps. Embed a world map image and define hot spots on specific countries. When each hot spot is clicked, display related information such as tourist attractions or travel packages for that country.
2	Design a personal web page to showcase profile, hobbies, and contact information. To demonstrate your understanding of web design principles, create the web page using inline, internal, and external CSS styles. Ensure that each type of CSS is clearly applied and visually reflected in different sections of the page.

3	Design an online registration form for a student portal. The form should validate user inputs such as name, email, password, and mobile number on the client side using DHTML (JavaScript + HTML + CSS). Create a dynamic web page that displays real-time validation feedback without reloading the page.
4	You have joined as a trainee web administrator at a software company. Your first task is to set up an Apache Tomcat web server on a Windows/Linux system to deploy Java-based web applications. Document the complete installation steps, configuration process, and how to verify the server is running successfully.
5	Develop a college portal using Java Servlets. i) Create a web application where users can submit data through an HTML form, and the data should be processed using a Servlet. ii) implement session tracking to maintain user information (like username or login status) across multiple pages.
6	Design and implement a three-tier web application using Java, JSP, and a MySQL database to conduct an online examination. The application should include features for student login, question retrieval, answer submission, and result generation.
7	Develop a dynamic website using PHP for a small business. The site should handle form submissions, perform server-side validation, and interact with a MySQL database to store user data. Create and test PHP programs that demonstrate these features effectively.
8	Design a data exchange format for a college admission system. Use XML to store student data, define the structure using XML Schema (XSD), and format the output using XSLT. Demonstrate how XML and XSLT can be used to separate data from presentation and ensure validation through schema.
	Total : 60 **Total: 15 +60 =75**

Text Books

1. Internet and World Wide Web: How to Program by Paul Deitel, Harvey Deitel, and Abbey Deitel 5th Edition, Pearson , 2021
2. Angular 6 for Enterprise-Ready Web Applications, Doguhan Uluca, 1st edition, Packt Publishing.
3. Uttam K.Roy, "Web Technologies", Oxford University Press, 2011.
4. Learning Angular – 3rd Edition by Aristeidis Bampakos & Pablo Deeleman , 2020

Reference Books

1. Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, Wiley Publications, 2017
2. Stephen Wynkoop and John Burke "Running a Perfect Website", QUE, 2nd Edition,1999
3. Gopalan N.P. and Akilandeswari J., "Web Technology", Prentice Hall of India, 2011.
4. Angular: Up and Running: Learning Angular, Step by Step, Shyam Seshadri, 1st edition, O'Reilly

Web Resources :

1. https://developer.mozilla.org/en-US/
5. https://www.freecodecamp.org/

Course Outcomes: At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Construct a basic website using HTML and Cascading Style Sheets	Applying
CO2	Construct a dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.	Applying
CO3	Develop server side programs using Servlets and JSP	Applying
CO4	Construct simple web pages in PHP and to represent data in XML format.	Applying
CO5	Develop interactive web applications	Applying

CO PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	3	3	3	3	3	2	3	3	3	3	3
CO2	3	2	2	3	2	3	3	2	3	2	3	3	3
CO3	3	3	3	3	3	2	3	2	2	3	3	2	3
CO4	3	3	3	3	2	2	2	2	3	3	3	2	3
CO5	3	2	3	3	2	2	2	2	2	3	3	3	3
Ave	**3**	**2.4**	**2.8**	**3**	**2.4**	**2.4**	**2.6**	**2**	**2.6**	**2.8**	**3**	**2.6**	**3**

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

U24AD422	INTELLIGENT SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

Course Objective:

- To apply basic search algorithms such as those used in solving classical AI problems like the 8-puzzle**,** 8-queens, and crypt arithmetic**.**
- To implement informed search algorithms like **A*** and memory-bounded A* for solving path finding and optimization problems**.**
- To apply game-playing algorithms and CSP techniques using Minimax**,** alpha-beta pruning**,** backtracking**,** and constraint propagation for strategic and combinatorial problems**.**
- To implement reasoning techniques in propositional and first-order logic**,** including model checking**,** forward and backward chaining**,** and **r**esolution**.**
- To construct and use probabilistic models, including Naive Bayes and Bayesian Networks**,** for inference in uncertain environments.

S. No.	List of experiments
1	Implement and analyze basic search strategies (Breadth-First Search, Depth-First Search, Backtracking, etc.) to solve classical AI problems such as 8-Puzzle, 8-Queens, and Crypt Arithmetic.
2	Implement and analyze A* and Memory Bounded A* (such as Simplified Memory Bounded A* – SMA*) algorithms for solving heuristic search problems.
3	Implement and analyze propositional logic model checking algorithms to verify whether a given propositional formula is satisfied in all possible models (truth assignments).
4	Implement forward chaining inference for first-order logic (FOL) and automatically derive conclusions from a given knowledge base of facts and rules.
5	Implement backward chaining inference for first-order logic (FOL) to determine if a goal can be derived from a given knowledge base of facts and rules.
6	Implement resolution-based reasoning in first-order logic (FOL) to check the satisfiability of knowledge base and derive conclusions automatically.
7	Implement Minimax algorithm for game playing(Alpha-Beta pruning)
8	Implement and analyze the solution of real-world problems such as map coloring, Sudoku, or 8-Queens using the Constraint Satisfaction Problem (CSP) framework.
9	Implement a Naive Bayes probabilistic model for classification and apply it to real-world datasets to predict outcomes based on prior probabilities and likelihoods.
10	Implement a Bayesian Network for a real-world scenario and perform probabilistic inference to compute the likelihood of events given evidence.

Course Outcomes:

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

CO	Course Outcome Statement	Knowledge Level
CO1	Apply uninformed search algorithms to solve classical AI problems such as the 8-puzzle, 8-queens, and crypt arithmetic.	Applying
CO2	Implement informed search strategies such as A* and memory-bounded A* to solve path finding and optimization problems.	Apply
CO3	Apply game search algorithms and constraint satisfaction techniques to solve strategic decision-making and combinatorial problems.	Apply
CO4	Apply propositional and first-order logic to implement reasoning methods such as model checking, forward chaining, backward chaining, and resolution.	Apply
CO5	Implement probabilistic reasoning techniques using Naive Bayes models and Bayesian Networks for exact and approximate inference in uncertain environments.	Apply

CO – PO MAPPING

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

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

U24CS462	DATABASE MANAGEMENT SYSTEMS LABORATORY (Common to B. Tech AI&DS)	L	T	P	C
		0	0	4	2

Course Objective:

- To enable students to understand and use SQL commands for data definition, manipulation, and control to manage database tables effectively.
- To train students in writing SQL queries, including simple, nested, and join queries with aggregate functions, for efficient data retrieval and report generation.
- To introduce techniques for optimizing and simplifying database access**, including** the creation and use of Views, Indexes, and Synonyms for real-time applications and reporting.
- To expose students to advanced SQL features**,** such as stored procedures, functions, triggers, and exception handling, and demonstrate how to integrate them within applications.
- To provide practical knowledge in developing GUI-based database applications**,** enabling real-time interaction with backend databases.

List of experiments

1. Create a database to manage student admissions. Design SQL tables using Data Definition Language (DDL) commands with appropriate integrity constraints like PRIMARY KEY, FOREIGN KEY, NOT NULL, and UNIQUE. Ensure data consistency and relational integrity among Student, Department, and Course tables.
2. Write DML queries to perform data manipulation by inserting new student details, update their phone number, address based on student request, and delete records of students those who have graduated.
3. Demonstrate the use of DCL (GRANT, REVOKE) and TCL (COMMIT, ROLLBACK, SAVEPOINT) to manage permissions and control transactions effectively in the students' management system.
4. Write SQL queries to retrieve required information using simple queries, nested queries, subqueries, and different types of joins for the student management reports. Demonstrate how each query type helps in fetching meaningful data for academic analysis and reporting.
5. Write SQL queries using aggregation operators (like SUM, AVG, MAX, MIN, COUNT) to summarize students' marks and use GROUP BY to group results by department or subject, and apply ORDER BY to display the results in a meaningful order. Generate reports such as average marks per department, highest marks in each subject, and total number of students per batch.
6. A college database manages student records, admission numbers, and frequently accessed data from multiple tables. To improve performance and simplify access, create indexes for tables, implement Views for reporting, and Synonyms to simplify object names. Demonstrate the creation and usage of Views, indexes, and Synonyms in this scenario with appropriate SQL queries.
7. Write simple PL/SQL programs to automate repetitive database operations like inserting records, validating student marks, and calculating totals using conditional and loop constructs. Create and test PL/SQL blocks using variables, IF conditions, and loops to perform basic database tasks.

8. Create stored procedures to calculate total and average marks and a function to determine the result status (Pass/Fail) for students' academic assessment system. Demonstrate the use of both procedures and functions with sample data.
9. Create SQL triggers for the automatic update of student's arrear count status based on end semester results.
10. Implement exception handling to ensure that the test marks should be between 0 and 100 else catch and handle these errors gracefully without crashing.
11. Create an XML-based database to store student details such as name, roll number, department, and email. Design the XML file and validate it using an appropriate XML Schema Definition (XSD) to ensure data integrity. Ensure the XML follows the correct structure and all fields meet the defined constraints.
12. Develop a student record system for a training institute. The system must store data such as student name, course, contact info, and enrollment status using a NoSQL database like MongoDB. Design and create a simple NoSQL database with appropriate collections and insert sample documents to represent at least 5 students.
13. Develop a simple GUI based database application and incorporate all the above-mentioned features
    a. Inventory management system
    b. Library Management system
    c. Ticket reservation system
    d. Food ordering system
    e. Examination registration system

Course Outcomes:

CO	Course Outcome Statement	Knowledge Level
CO1	Apply SQL data definition, manipulation, and control commands to create, manage, and maintain relational database tables	Applying
CO2	Perform efficient data retrieval operations using Views, simple, nested, and join queries, along with aggregate functions to generate meaningful reports.	Applying
CO3	Optimize and simplify database access in real-time applications by creating and using Views, Indexes, and Synonyms for better performance and easier reporting.	Applying
CO4	Develop and use advanced SQL features, such as stored procedures, functions, triggers, and exception handling, and integrate them within database applications.	Applying
CO5	Design and develop GUI-based applications that interact with relational databases for real-time data operations and user interface integration.	Applying

CO – PO MAPPING

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

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

U24CS482	DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY (Common to B.Tech. AI & DS)	L	T	P	C
		0	0	4	2

Course Objective:

- Apply algorithmic techniques to solve computational problems using recursion and non-recursive methods.
- Apply divide-and-conquer, decrease-and-conquer, and transform-and-conquer strategies to develop efficient solutions for standard algorithmic problems.
- Apply dynamic programming and greedy techniques to design solutions for optimization problems.
- Apply iterative improvement methods such as the Simplex Method to model and solve real-world optimization scenarios.
- Apply backtracking and branch-and-bound techniques to solve combinatorial and computationally hard problems.

S. No.	List of Experiments
1	Develop a Python program that implements both recursive and non-recursive versions of factorial and Fibonacci algorithms. Compare their execution times and demonstrate how computational growth progresses from O(log n) to O(n!), helping analysts understand algorithmic efficiency and scalability in real-world data processing.
2	Create a Python program that multiplies two matrices using Strassen's Algorithm (Divide and Conquer method). Compare its execution time with the standard matrix multiplication approach to determine which is more efficient for large image or data matrix
3	Write a Python program that accepts a Directed Acyclic Graph (DAG) representing task dependencies and produces a topological ordering of tasks using the DFS algorithm. Demonstrate how this approach ensures proper task scheduling without violating dependencies.
4	Develop a Python program that sorts a list of integers (e.g., product prices or student marks) using Heap Sort (Transform and Conquer method). Allow the user to visualize the heap construction process and the sorted output, illustrating how sorting algorithms enhance search efficiency in real-world applications.
5	Develop a Python program using Dynamic Programming to solve the following optimization problems: (i) Coin Change Problem – Compute the minimum number of coins required to make a given amount (e.g., optimizing ATM withdrawal denominations). (ii) Floyd's Algorithm – Find shortest paths between all pairs of cities in a transportation network. (iii) Knapsack Problem – Maximize total profit/value of selected items under a given budget or weight constraint (e.g., investment portfolio optimization).
6	Develop a Python program using the Greedy Technique to solve the following problems: (i) Dijkstra's Algorithm – Determine the shortest route from a source city to all other cities in a transportation or logistics network. (ii) Huffman Coding – Implement data compression for transmitting large files efficiently, displaying the generated Huffman Tree and encoded values. The program should allow the user to input data and visualize the results.

7	Develop a Python program using the Simplex Method to solve a real-world production optimization problem. For example, a factory producing two types of products wants to maximize profit while considering constraints on labor hours and raw materials. The program should allow the user to input the objective function and constraints, and display step-by-step tableau iterations leading to the optimal production plan.
8	Develop a Python program using the Backtracking technique to solve the following problems that simulate real-world game and puzzle logic generation: (i) N-Queen Problem – Display all possible safe arrangements of N queens on an N×N chessboard, ensuring that no two queens attack each other. (This mimics the decision-making process in chess AI for positioning pieces safely.) (ii) Subset Sum Problem – Display all subsets of a given set that sum up to a target value. (This is useful for designing puzzle games or scenarios involving optimal subset selection, such as matching resources or scores.) The program should allow user input for each problem and display all valid configurations clearly.
9	Develop a Python program using Branch and Bound to solve the following problems: (i) Assignment Problem – Assign workers to tasks so that the total cost is minimized (applicable in workforce scheduling). (ii) Traveling Salesman Problem (TSP) – Determine the optimal route for a delivery truck visiting multiple cities exactly once with minimum total distance. The program should take user input for costs or distances and clearly display the optimal path and total cost.

Course Outcomes

CO	Course Outcome Statement	Knowledge Level
CO1	Develop Python programs implementing recursive and non-recursive algorithms and compare their efficiency in terms of execution time and space usage**.**	Applying
CO2	Apply brute-force, divide-and-conquer, decrease-and-conquer, and transform-and-conquer techniques to solve standard algorithmic problems.	Applying
CO3	Apply dynamic programming and greedy techniques to solve optimization problems efficiently.	Applying
CO4	Apply iterative improvement methods to develop solutions for real-world optimization scenarios.	Applying
CO5	Implement backtracking and branch-and-bound to handle problems with computational limitations or intractability.	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	2	3	2	3		
CO2	3	3	3	3	2	2	2	2	3	2	3		
CO3	3	3	3	3	2	2	2	2	3	2	3		
CO4	3	3	3	3	2	3	2	2	3	2	3		
CO5	3	3	3	3	2	3	2	2	3	2	3		

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

U24EM422	SOFT SKILLS AND PERSONALITY DEVELOPMENT – I	L	T	P	C
		0	0	2	1

Course Objective:

- To understand and interpret human perception and behavior, enhancing interpersonal awareness.
- To enhance self-management, including habit formation, stress regulation, and personal productivity
- Develop conflict-resolution skills, aiming for win-win outcomes through structured strategies.
- Strengthen communication abilities—active listening, telephone etiquette, and overcoming listening barriers.

List of Exercises

Sl. No.	List of Exercises
1	Introduction: A New Approach to Learning, Planning and Goal-Setting
2	Human Perceptions: Understanding People
3	Aiming for Excellence: Developing Potential and Self-Actualisation
4	Self-Management Skills- Time management & Self-motivation
5	Self-Management Skills- Stress management & Adaptability
6	Conflict Resolution Skills
7	Using The Zeigarnik Effect for Productivity and Personal Growth, Forming Habits of Success
8	Communication: Significance of Listening, Active Listening, Barriers to Active Listening
9	Telephone Communication: Basic Telephone Skills, Advanced Telephone Skills , Essential Telephone Skills
10	Profile Building
	Total Periods: 30

Text Books

1	Dorch, Patricia. What Are Soft Skills? New York: Execu Dress Publisher, 2013.
2	Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. Washington, DC: Pfeiffer & Company, 2013.

Reference Books

1	Klaus, Peggy, Jane Rohman & Molly Hamaker. The Hard Truth about Soft Skills. London: HarperCollins E-books, 2007.
2	Petes S. J., Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw-Hill Education, 2011.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Develop an actionable growth plan aligning self-development with objectives.	Applying
CO2	Analyze the habit loop; design personal interventions to break bad habits.	Analysing
CO3	Analyze examples of interpersonal conflict, propose dual solutions using conflict-model frameworks.	Analysing
CO4	Apply stress-management strategies: reframing, planning, relaxation exercises.	Applying
CO5	Apply techniques to rectify the barriers in active listening	Applying

CO-PO/PSO Mapping

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

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

SYLLABUS SEMESTER V

U24AD511	MACHINE LEARNING	L	T	P	C
		3	0	0	3

Course Objective:

- Understand the fundamental concepts, types, and modelling approaches of Machine Learning.
- Analyze and apply classification techniques such as Decision Trees, Support Vector Machines, and regularization methods.
- Explore and implement ensemble methods, clustering algorithms, and dimensionality reduction techniques.
- Examine and apply probabilistic learning models including Bayesian methods, graphical models, and Markov processes.
- Design and develop machine learning models using Artificial Neural Networks and Reinforcement Learning techniques.

Detailed Syllabus

UNIT I MACHINE LEARNING BASICS	**9**
Introduction to Machine Learning (ML) - Essential concepts of ML – Types of Machine learning methods – Early trends in Machine learning – Data understanding, representation and visualization – Hypothesis - Modelling in Machine learning - Classification: Probability theory and – Generative vs. discriminative training – Self-supervised Learning and Transfer learning.	
UNIT II CLASSIFICATION TECHNIQUES	**9**
Regularization techniques - Decision Tree based Learning algorithms – Induction algorithms – Regression trees - Instance based Learning - Support Vector Machines: Hard and soft margin – Functional and Geometric margin - Maximum margin linear separators – Kernels for learning non-linear functions.	
UNIT III ENSEMBLE, CLUSTERING AND DIMENSIONALITY REDUCTION	**9**
Ensemble Learning: Using committees of multiple hypotheses. Bagging - Random Forest - Adaptive Boosting, Stacking and DECORATE - Active learning with ensembles – Clustering – K-means Clustering– Hierarchical Clustering - Expectation Maximization algorithm – Gaussian Mixture Model – Dimensionality Reduction – Principal Component Analysis (PCA) – Linear Discriminant Analysis (LDA) - Latent Variable Models (LVM) – Latent Dirichlet Allocation – Independent Component Analysis (ICA)	
UNIT IV PROBABILISTIC LEARNING MODEL	**9**
Bayesian Learning - Naive Bayes Algorithm - Introduction to Graphs – Bayesian Belief Networks - Inference in Graphical Models - Markov Chain – Markov Model - Hidden Markov Models – Inference – Learning - Generalization – Undirected Graphical Models	
UNIT V ANN & REINFORCEMENT LEARNING	**9**
Artificial Neural Networks – Structure and Activation functions – Perceptron – Multi Layer Perceptron - Back Propagation – Gradient descent training - Radial Basis function Neural Network-Overview of Reinforcement Learning - Components of Reinforcement Learning - Markov decision process - Model Based Learning - Model Free Learning - Q Learning.	
	Total Periods: 45

Learning Resources

1	Ameet V Joshi, “Machine Learning and Artificial Intelligence”, Springer Publications, 2023.
2	Sridhar S. and Vijayalakshmi M., “Machine Learning”, Oxford University Press, 2022.
3	Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer Publications, 2016.
4	John D. Kelleher, Brain Mac Namee, Aoife D’ Arcy, “Fundamentals of Machine learning for Predictive Data Analytics, Algorithms, Worked Examples and case studies”, MIT press, 2015
5	Tom Mitchell, “Machine Learning”, McGraw-Hill, 1997
6	Stuart Jonathan Russell, Peter Norvig, John Canny, Artificial Intelligence: A Modern Approach, Prentice Hall, 2020
7	Machine Learning Dummies, John Paul Muller, Luca Massaron, Wiley Publications, 2021
8	Jerome Friedman, Robert Tibshirani, Trevor Hastie, “The Elements of Statistical Learning”, Springer, 2017.

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Describe and differentiate the fundamental concepts, types, and basic models of Machine Learning.	Understand
CO2	Apply and evaluate classification techniques such as Decision Trees, Support Vector Machines, and regularization methods to solve real-world problems.	Apply
CO3	Implement ensemble methods, clustering algorithms, and dimensionality reduction techniques for improved model performance.	Apply
CO4	Analyze and construct probabilistic models using Bayesian methods, graphical models, and Markov processes for inference and prediction.	Analyze
CO5	Develop intelligent systems using Artificial Neural Networks and Reinforcement Learning techniques.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	2	1	-	-	2	2	-	2	2	1
CO2	3	3	2	2	2	-	-	2	2	-	2	2	2
CO3	3	3	3	2	3	-	-	2	2	-	2	3	2
CO4	3	3	2	2	2	-	-	2	2	-	2	2	2
CO5	3	3	3	2	3	-	-	2	2	-	2	3	3
Avg.	3	2.8	2.2	2	2.2	-	-	2	2	-	2	2.4	2

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

U24AD521	DATA SCIENCE AND ANALYTICS	L	T	P	C
		3	0	0	3

Course Objective:

- Understand and apply data collection, pre-processing, and data cleaning techniques in data science.
- Analyze and summarize data using descriptive statistics and visualization methods.
- Apply machine learning techniques for regression and classification tasks.
- Evaluate models using appropriate data handling strategies and performance metrics.
- Analyze and interpret data analytics methods such as feature selection, error measurement, and predictive modelling.

Detailed Syllabus

UNIT I INTRODUCTION TO DATA SCIENCE	**9**
Introduction to Data Science - Overview of Data - Sources of Data - Types of Data - data distribution –Data Collection methods-User studies in Lab and Field-Web Scrapping-Categories of Data Cleaning -Tools for Data Science.	
UNIT II DESCRIPTIVE DATA ANALYSIS	**9**
Dataset Construction - Sampling of data - Stem and Leaf Plots - Frequency table - Time Series data - Central Tendency Measures of the location of data - Dispersion measures - Correlation analysis – basics of Principal Component analysis (PCA) - Independent component analysis – Hypothesis testing – Statistical Tests.	
UNIT III PREDICTIVE MODELLING: REGRESSION AND CLASSIFICATION	**9**
Overview of Machine learning concepts – Rules for data splitting - Model construction using regression and Classification models - Linear regression and multiple regression models - KNN classification models –Comparison Models- Regression line – least squares regression line – standard error of estimate – interpretation of r2 – multiple regression equations – regression toward the mean.	
UNIT IV DATA HANDLING AND MODEL EVALUATION	**9**
Data aggregation – Data Transformation: merging datasets, reshaping data – Data enrichment: missing values ,Normalization-Model Evaluation - Cross-validation techniques - Accuracy metrics – Model Performance Analysis: Contingency table, ROC curve, Precision-recall curves	
UNIT V DATA ANALYTICS	**9**
Introduction- Information-based learning- Handling alternative feature selection - Impurity metrics - Continuous descriptive features and targets- Similarity-based learning- Feature space- Predicting continuous targets-Error based learning- Measuring Error.	
Total Periods :45	

Learning Resources

1	Davy Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.
2	Grus, Joel, “Data science from scratch: first principles with python”, O'Reilly Media, 2nd Edition, 2019.
3	Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016.
4	Peter Bruce, Andrew Bruce, Peter Gedeck,” Practical Statistics for Data Scientists”, O′Reilly; 2nd edition, 2020.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Apply data collection, inspection, and pre-processing techniques for data cleaning.	Apply
CO2	Analyze and summarize datasets using descriptive statistical methods.	Analyze
CO3	Apply regression and classification models to solve real-world data science problems using programming tools.	Apply
CO4	Evaluate model performance using data handling strategies and validation techniques.	Evaluate
CO5	Analyze and interpret data analytics methods to improve model accuracy and insights.	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	2	2	-	-	2	2	-	2	2	1
CO2	3	3	2	2	2	-	-	2	2	-	2	2	2
CO3	3	3	3	2	3	-	-	2	2	-	2	3	3
CO4	3	3	2	2	3	-	-	2	2	-	2	2	2
CO5	3	3	2	2	2	-	-	2	2	-	2	3	2
Avg.	3	2.8	2	2	2.4	-	-	2	2	-	2	2.4	2

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

U24AD531	CRYPTOGRAPHY AND CYBER SECURITY	L	T	P	C
		3	0	0	3

Course Objective:

- Understand and analyze fundamental concepts of computer security, security models, and cryptographic systems.
- Apply mathematical foundations and symmetric key cryptographic techniques for secure communication.
- Analyze and implement asymmetric cryptographic algorithms and key exchange mechanisms.
- Evaluate authentication, integrity, and digital signature schemes used in secure systems.
- Understand and assess cyber threats, cybercrimes, and security mechanisms in modern computing environments.

Detailed Syllabus

UNIT I INTRODUCTION TO SECURITY **9**

Computer Security Concepts – The OSI Security Architecture – Security Attacks – Security Services and Mechanisms – A Model for Network Security – Classical encryption techniques: Substitution techniques, Transposition techniques, Steganography – Foundations of modern cryptography: Perfect security – Information Theory – Product Cryptosystem – Cryptanalysis.

UNIT II SYMMETRIC CIPHERS **9**

Number theory – Algebraic Structures – Modular Arithmetic - Euclid‘s algorithm – Congruence and matrices – Group, Rings, Fields, Finite Fields SYMMETRIC KEY CIPHERS: SDES – Block Ciphers – DES, Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Pseudorandom Number Generators – RC4 – Key distribution.

UNIT III ASYMMETRIC CRYPTOGRAPHY **9**

Mathematics of Asymmetric Key Cryptography: Primes – Primality Testing – Factorization – Euler’s totient function, Fermat’s and Euler’s Theorem – Chinese Remainder Theorem – Exponentiation and logarithm ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange -– Elliptic curve arithmetic – Elliptic curve cryptography.

UNIT IV INTEGRITY AND AUTHENTICATION ALGORITHMS **9**

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function: HMAC, CMAC – SHA – Digital signature and authentication protocols – DSS – Schnorr Digital Signature Scheme – ElGamal cryptosystem – Entity Authentication: Biometrics, Passwords, Challenge Response protocols – Authentication applications – Kerberos MUTUAL TRUST: Key management and distribution – Symmetric key distribution using symmetric and asymmetric encryption – Distribution of public keys – X.509 Certificates.

UNIT V CYBER CRIMES AND CYBER SECURITY **9**

Cyber Crime and Information Security – classifications of Cyber Crimes – Tools and Methods – Password Cracking, Keyloggers, Spywares, SQL Injection – Network Access Control – Cloud Security – Web Security – Wireless Security.

Total Periods: 45

Learning Resources

1	William Stallings, "Cryptography and Network Security - Principles and Practice", Seventh Edition, Pearson Education, 2017.
2	Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber crimes, Computer Forensics and Legal Perspectives”, First Edition, Wiley India, 2011.
3	Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata Mc Graw Hill, 2015
4	Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition, Prentice Hall, New Delhi, 2015.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Describe and differentiate security concepts, types of attacks, and fundamental cryptographic principles.	Understand
CO2	Apply symmetric key cryptographic techniques and mathematical foundations for secure communication.	Apply
CO3	Implement asymmetric cryptographic algorithms and key exchange mechanisms.	Apply
CO4	Evaluate authentication, integrity, and digital signature schemes for secure systems.	Evaluate
CO5	Analyze cyber threats and apply appropriate cybersecurity measures to mitigate risks.	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	2	1			2	2		2	2	1
CO2	3	3	2	2	2			2	2		2	2	2
CO3	3	3	3	2	2			2	2		2	3	2
CO4	3	3	2	2	2			2	2		2	2	2
CO5	3	3	2	2	3			2	2		2	3	3
Avg.	3	2.8	2	2	2			2	2		2	2.4	2

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

U24CSFS02	UI AND UX DESIGN	L	T	P	C
		1	0	4	3

Course Objective:

- To provide a sound understanding of UI & UX principles.
- To understand the design field and the role of UX in product development.
- To learn various research methods and ideation techniques used in UI/UX design.
- To explore the tools used in UI & UX development.
- To apply wireframes, prototypes, and user-centered design concepts.

Detailed Syllabus

UNIT I FOUNDATIONS OF DESIGN Introduction – UI vs UX – Stages of Design Thinking – Divergent & Convergent Thinking – Brainstorming – Game-storming – Observational Empathy.
UNIT II FOUNDATIONS OF UI DESIGN FOUNDATIONS OF DESIGN Visual & UI Principles – UI Elements & Patterns – Interaction Behaviours – Branding – Style Guides – Visual Consistency & Hierarchy.
UNIT III FOUNDATIONS OF UX DESIGN Introduction to User Experience – Importance of UX – Understanding UX – Introduction about UX Research Methods – UX Design Activities – Defining Product Goals – UX Workflow – Design Ideation & Prototyping – Task Flows – Card Sorting – Storyboards – UX Deliverables.
UNIT IV WIREFRAMING, PROTOTYPING & TESTING Low/Mid/High Fidelity Wireframes – Mockups – Efficient Designing – Interactive Prototypes – Usability Testing – UX Metrics – Synthesizing Test Findings – Prototype Iteration.
UNIT V RESEARCH, IDEATION & INFORMATION ARCHITECTURE Problem Identification – Research Methods – Persona Creation – Scenario Building – Flow Diagrams – Task Flow Mapping – Information Architecture – User Needs & Requirements.
Total Periods: 15

List of Experiments

Sl. No.	List of Experiments
1	Design a responsive website for a College Event Management System. Mini Project Idea: Students should design layouts for: • Desktop view • Tablet view • Mobile view
2	Create interaction patterns for a Food Delivery App. Design interactions such as: • Add to cart button animation • Swipe to delete item • Loading indicators • Checkout confirmation popup
3	Design a Library Management System Interface. Create a UI Style Guide including: • Typography

	• Button styles • Color palette • Icons • Layout grids
4	Build a Mobile App Prototype for Bus Ticket Booking. Design screens for: • Login • Search buses • Seat selection • Payment • Ticket confirmation
5	Design a Smart Study Planner App for Students. Follow the design thinking steps: • Empathize • Define • Ideate • Prototype • Test
6	Improve the College Website Navigation System.
7	Create ideas for a Campus Navigation App. Use brainstorming methods such as: • Mind mapping • Crazy 8 technique • Affinity diagrams
8	Design a UI pattern library for an E-commerce Website. Include: • Mood board • Color palette • Typography • Buttons • Form elements • Cards and navigation components
9	Solve a sample application problem through UX workflow.- Design an Assignment Reminder Application. • UX Workflow: • Problem definition • User research • Ideation • Wireframes • Prototype
10	Conduct end-to-end UX research (user research → persona → scenarios → mapping).-Develop a College Bus Tracking Application.
11	Sketch wireframes and build a prototype.- Design a Simple Online Grocery Shopping App. • Create wireframes for: • Home page • Product listing • Product details • Cart • Checkout

12	Conduct usability testing and refine prototype.- Test the Online Grocery Shopping App Prototype. Ask 5 users to perform tasks: • Search product • Add item to cart • Complete checkout • Collect feedback • Improve design
	Total Periods: 60
	Total: 15+60 = 75 Periods

Learning Resources

1	Joel Marsh, “UX for Beginners”, O’Reilly, 2022.
2	Jon Yablonski, “Laws of UX: Using Psychology to Design Better Products & Services”, O’Reilly, 2021.
3	Jennifer Tidwell, Charles Brewer, A. Valencia, Designing Interfaces, 3rd Edition, 2020.
4	Steve Krug, Don’t Make Me Think, 2022.
5	https://www.interaction-design.org/
6	https://www.smashingmagazine.com/articles

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Apply UI/UX fundamentals and design principles.	Apply
CO2	Analyze UI/UX design of any product/application.	Analyze
CO3	Apply UX skills in product development.	Apply
CO4	Analyze sketching and prototyping principles to evaluate and improve user interface design solutions.	Analyze
CO5	Apply wireframes and working prototypes concepts	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	3	2	3	2	2	2	-	2	3	2	3
CO2	2	2	3	2	3	2	2	2	3	2	3	2	3
CO3	2	2	3	2	3	2	2	2	3	2	3	2	3
CO4	2	2	3	2	3	2	2	2	-	2	3	2	3
CO5	2	2	3	2	3	2	2	2	3	2	3	2	3
Avg	2	1.8	3	2	3	2	2	2	3	3	3	2	3

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

U24EM511	APTITUDE AND RESONING – II	L	T	P	C
		2	0	0	2

Course Objective:

- Enhance analytical and logical reasoning skills to solve problems efficiently.
- Strengthen understanding of basic arithmetic, algebra, geometry, and data interpretation.
- Train students to approach problems systematically and apply suitable techniques.
- Foster quick thinking and reduce error rates through practice and time-bound exercises**.**
- Understand data interpretation using bar chart, pie chart and table chart

Detailed Syllabus

Topic titles	No of periods
Quantitative aptitude • Time and work • Pipes and Cistern • Chain Rule and wages • Time speed and distance • Train problems • Boats and streams • Races and games • Permutations and Combinations • Probability • Heights and distance • Logarithms • Surds and indices • Mensuration – 2D, 3D • Date interpretation – pie chart, bar chart, table chart. Data sufficiency in logical reasoning	20
Reasoning: • Symbols and notations • Mathematical operators and Venn diagrams • Puzzles • Cubes and Dice • Clocks and Calendars • Critical Reasoning • Non-verbal reasoning • Verbal Ability	10
	Total Periods: 30

Learning Resources

1	R.V. Praveen, “Quantitative Aptitude and Reasoning”, 3rd Edition, Eastern Economy Edition, PHI Learning, New Delhi, 2016
2	Dr. R.S. Aggarwal, “Quantitative Aptitude”, S Chand Publishing, New Delhi 2017
3	Dr. R.S. Aggarwal, “A Modern Approach to Verbal & Non-Verbal Reasoning”, S Chand Publishing, New Delhi 2017
4	https://www.indiabix.com/
5	https://www.geeksforgeeks.org/
6	https://faceprep.in/
7	https://prepinsta.com/
8	https://www.javatpoint.com/

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Solve quantitative aptitude problems involving time & work, chain rule and wages etc., using logical approaches.	Apply
CO2	Analyze problems and apply reasoning strategies such as deduction, inference, and pattern recognition.	Analyse
CO3	Solve problems on data interpretation, including bar charts, pie charts, tables, and graphs.	Apply
CO4	Solve problems in probability, height and distance and logarithms logically	Apply
CO5	Demonstrate improved performance in time-bound aptitude tests through consistent practice.	Apply

Course Articulation Matrix

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

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

U24MG511	LEADERSHIP AND TEAM MANAGEMENT	L	T	P	C
		2	0	0	2

Course Objective:

- To introduce students to fundamental leadership theories, models, and frameworks for understanding leadership effectiveness.
- To develop the ability to analyze leadership styles, personality traits, emotional intelligence, and ethical values in organizational contexts.
- To enhance students' competence in evaluating leadership behaviour, decision-making, and crisis management in diverse environments.
- To equip students with skills to lead groups and teams through effective communication, delegation, conflict management, and motivation.
- To enable students to design and apply strategies for developing high-performance, multicultural, and virtual teams using contemporary leadership practices.

Detailed Syllabus

UNIT I INTRODUCTION TO LEADERSHIP & TEAM MANAGEMENT	**6**
Leadership Myths; Interactional Framework for analyzing leadership; Leadership Development: The First 90 Days as a Leader; Leader Development- The Action-Observation-Reflection Model. LMX Theory and Normative Decision Model; Situational Leadership Model; Contingency Model and Path Goal Theory.	
UNIT II LEADERSHIP TYPES AND ATTRIBUTES	**6**
Emotional Approach Charismatic and Transformational Leadership; Leadership for Tomorrow, Leadership Attributes; Personality Traits and Leadership; Personality Types and Leadership; Intelligence and Leadership; Emotional Intelligence and Leadership. Power and Leadership; The art of influence in leadership; Leadership and "Doing the Right Things; Character-Based Approach to Leadership; Role of Ethics and Values in Organisational Leadership	
UNIT III LEADERSHIP BEHAVIOUR	**6**
Leadership Behaviour, Assessing Leadership Behaviour: Multi-rater feedback instruments, The Dark Side of Leadership -Destructive Leadership, Managerial Incompetence and Derailment, Negotiation and Leadership, Leadership in Crisis Situation, The Situation and The Environment, Culture and Leadership, Global Leadership, Motivation and Leadership	
UNIT IV INTRODUCTION TO GROUPS AND TEAMS	**6**
Characteristics of Leaders, Followers and Situation, Group Dynamics, Team Formation, Delegation and Empowerment, Leading Teams: Enhancing Teamwork Within a Group, The Leader's Role in Team-Based Organizations, Leader Actions That Foster Team Effectiveness, Offsite Training and Team Development, Understanding Team Processes and Team Coaching, Team Decision Making and Conflict Management, Virtual Teams	
UNIT V MANAGING MULTICULTURAL TEAMS	**6**
Building Great Teams, Experiential Learning, Action Learning, Developmental Planning: Gaps Analysis, Coaching and Mentoring, Women in Leadership Roles, Building Effective Relationship with Subordinates and Peers, Fostering Followers Satisfaction, The Art of Communication, Setting Goals and Providing Constructive Feedback, Enhancing Creativity Problem Solving Skill, Building High-Performance Teams: The Rocket Model, Building Credibility and Trust, Skills for Developing others.	
	Total Periods:30

Learning Resources

1	Peter G. Northouse, “Leadership: Theory and Practice”, 8th Edition, Sage Publications, 2019.
2	Stephen P. Robbins and Timothy A. Judge, “Organizational Behavior”, 18th Edition, Pearson Education, 2019.
3	Robert N. Lussier and Christopher F. Achua, “Leadership: Theory, Application, and Skill Development”, 6th Edition, Cengage Learning, 2016.
4	Jon R. Katzenbach and Douglas K. Smith, “The Wisdom of Teams”, Harvard Business School Press, 2005.
5	Daniel Goleman, “Emotional Intelligence”, Bantam Books, 2006.
6	Leadership and Team Effectiveness, Dr. Santosh Rangnekar, IIT Roorkee (NPTEL Course) https://onlinecourses.nptel.ac.in/noc22_mg39/preview

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain and compare major leadership theories, models, and frameworks.	Understand
CO2	Describe leadership styles, attributes, personality, and emotional intelligence in organizational situations.	Understand
CO3	Discuss leadership behaviour, ethics, power, and decision-making in complex and crisis situations.	Understand
CO4	Illustrate leadership principles to manage groups, teams, conflicts, and motivation effectively.	Understand
CO5	Explain leadership development and team-building strategies for high-performance, multicultural, and virtual teams.	Understand

Course Articulation Matrix

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

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

U24CS533	EMBEDDED SYSTEMS AND IOT SYSTEM DESIGN	L	T	P	C
		1	0	4	3

Course Objective:

- To understand the architecture and operation of 8-bit microcontrollers for embedded applications.
- To develop programs using Embedded C for real-time operations and multitasking.
- To evaluate the operation and interfacing of various sensors used in IoT environments.
- To analyze and implement sensor integration using Arduino and Raspberry Pi with appropriate communication protocols.
- To analyze real-time IoT case studies and assess the potential of IoT solutions in various application domains

Detailed Syllabus

UNIT I 8-BIT EMBEDDED PROCESSOR 8-Bit Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling.
UNIT II EMBEDDED C PROGRAMMING Memory and I/O Devices Interfacing – Programming Embedded Systems in C – Need for RTOS – Multiple Tasks and Processes – Context Switching – Priority-Based Scheduling Policies
UNIT III SENSORS Introduction and need for sensors in IoT - Classification of sensors – active and passive - Analog and digital sensors – working principles - Ultrasonic sensor: operation and interfacing - Temperature and humidity sensor: operation and interfacing.
UNIT IV SENSOR INTEGRATION AND CLOUD PLATFORM Sensor data acquisition using Arduino & Raspberry Pi - Data communication protocols – MQTT & HTTP - IoT cloud platforms Overview: ThingSpeak, Blynk, AWS IoT - Uploading sensor data to cloud - Real-time monitoring and data visualization.
UNIT V CASE STUDIES Smart home automation using IoT - Smart city applications and traffic monitoring - IoT-based environmental monitoring system - Smart agriculture and irrigation system - Industrial IoT applications - Future trends and challenges in IoT.
Total Periods: 15

List of Experiments

Sl. No.	List of Experiments
1	Write 8051 Assembly Language experiments using simulator.
2	Test data transfer between registers and memory.
3	Perform ALU operations.
4	Write Basic and arithmetic Programs Using Embedded C.
5	Introduction to Arduino platform and programming
6	Explore different communication methods with IoT devices(Zigbee,GSM,Bluetooth)

7	Introduction to Raspberry PI platform and python programming
8	Interfacing sensors with Raspberry PI
9	Communicate between Arduino and Raspberry PI using any wireless medium
10	Setup a cloud platform to log the data
11	Log Data using Raspberry PI and upload to the cloud platform Design an IOT based system
12	Mini Projects: Design an IOT based system. • Smart Home Automation using IoT • IoT-based Smart Agriculture System • IoT-based Environmental Monitoring System • IoT-based Smart Parking System • IoT-based Industrial Application System • IoT-based EV Charging & Fleet Monitoring System
	Total Periods: 60
	Total: 15+60 = 75 Periods

Learning Resources

1	Peter Waher, “Mastering the Internet of Things: Design and Deploy Solutions Using IoT Platforms”,Packt Publishing,2nd Edition, 2023
2	David Hanes et al., “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, First Edition 2022.
3	“Introduction to Internet of Things”, Prof.SudipMisra,IIT Kharagpur, NPTEL. https://nptel.ac.in/courses/106105166
4	“Components and Applications of Internet of Things”, Prof. Sanjoy Kumar Parida,IIT Patna-, Swayam. https://onlinecourses.swayam2.ac.in/arp19_ap52/preview

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course outcome Statement**	**Knowledge Level**
CO1	Describe the architecture, instruction set, and programming of 8-bit embedded processors.	Analyze
CO2	Develop embedded C programs for interfacing peripherals and managing multiple tasks using RTOS concepts.	Apply
CO3	Integrate multiple sensors with Arduino and Raspberry Pi using appropriate communication protocols to create functional IoT prototypes.	Evaluate
CO4	Develop cloud-enabled IoT systems for real-time data monitoring and visualization.	Create
CO5	Design IoT-based solutions for domains such as smart homes, agriculture, industries, and environment monitoring.	Create

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	3			2	3	3		2	3	3
CO2	3	3	3	3		3	2	3	3	3	2	3	3
CO3	3	3	3	3		3	2	3	3	3	2	3	3
CO4	3	3	3	3	3	3	2	3	3	3	2	3	3
CO5	3	3	3	3	3	3	2	3	3	3	2	3	3
Avg.	3.0	3.0	3.0	3.0	3.0	3.0	2.0	3.0	3.0	3.0	2.0	3.0	3.0

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

U24AD542	MACHINE LEARNING LABORATORY	L	T	P	C
		0	0	4	2

Course Objective:

- Apply data pre-processing and visualization techniques to prepare datasets for analysis.
- Develop machine learning models for classification, regression, and clustering tasks.
- Employ ensemble techniques and methods to improve model performance and avoid overfitting.
- Design and implement Artificial Neural Networks for solving machine learning problems.
- Apply machine learning algorithms to solve practical problems in real-world scenarios.

List of Experiments

Sl. No.	List of Experiments
1	Explore datasets like Iris or MNIST to understand data patterns, distributions, and detect missing values, using plots like histograms, scatter plots, and pair plots to visualize key characteristics.
2	Implement the ID3 decision tree algorithm to classify data based on features, such as predicting student performance or species type, and visualize the decision tree to interpret predictions.
3	Apply techniques like train-test split, cross-validation, and regularization to handle overfitting and ensure the model generalizes well for real-world predictions.
4	Use Support Vector Machines (SVM) to classify complex datasets, such as distinguishing spam emails from non-spam, creating robust decision boundaries.
5	Apply ensemble methods like Bagging, Boosting, and DECORATE to improve accuracy and reduce variance in predictions, useful in real-world problems such as crop disease or customer behavior prediction.
6	Implement k-Nearest Neighbour (KNN) to classify or recommend items based on similarity to existing data points, ideal for recommendation systems or pattern recognition tasks.
7	Use k-Means clustering to group similar data points, for example segmenting customers by purchasing patterns, supporting real-time decision-making in marketing and analytics.
8	Apply Naive Bayes to classify text or categorical data efficiently, such as labeling reviews as positive or negative, which is simple yet effective for sentiment analysis and spam detection.
9	Use linear regression to predict continuous outcomes like sales, temperature, or stock prices from input features, useful for forecasting and trend analysis.
10	Train an Artificial Neural Network (ANN) with backpropagation to recognize patterns such as handwritten digits or classification tasks, optimizing network weights for accuracy.
11	Build a facial recognition system using ANN to detect and recognize faces in images or video streams, applicable in attendance systems or security applications.
12	Apply Random Forest to analyze social media posts or reviews, classify sentiment as positive, negative, or neutral, and generate insights for marketing and customer feedback.
	Total Periods: 60

Learning Resources

1	Ameet V Joshi, “Machine Learning and Artificial Intelligence”, Springer Publications, 2020.
2	Sridhar S. and Vijayalakshmi M., “Machine Learning”, Oxford University Press, 2021.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Apply techniques to analyze datasets, identify patterns, distributions, and missing values using visualization tools.	Apply
CO2	Develop and implement machine learning models for classification, regression, and prediction tasks.	Apply
CO3	Employ ensemble methods and overfitting prevention techniques to improve model accuracy and generalization.	Apply
CO4	Implement Artificial Neural Networks for pattern recognition, facial recognition, and related applications.	Apply
CO5	Apply machine learning algorithms to solve real-world problems such as fraud detection and sentiment analysis.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	2	2	2	2	2	2	2	3	2
CO2	3	2	3	2	2	2	2	2	2	2	2	3	2
CO3	2	2	2	2	2	2	2	2	2	2	2	2	2
CO4	3	2	3	2	2	2	2	2	2	2	2	3	2
CO5	3	3	3	2	2	2	2	2	2	2	2	3	3
Avg.	2.8	2.2	2.6	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.8	2.2

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

U24AD552	DATA SCIENCE AND ANALYTICS LABORATORY	L	T	P	C
		0	0	4	2

Course Objective:

- Apply the pre-processing techniques to prepare data for analysis.
- Apply the Exploratory data analysis to the datasets.
- Analyze the data using multiple regression techniques.
- Apply the data normalization and evaluate the model performance.
- Apply the feature selection techniques and implement the data analysis using similarity-bas learning method.

List of Experiments

Sl No	List of Experiments
1	Explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages.
2	A business analyst is preparing a comprehensive sales performance report for her organization. The required data comes from multiple sources: a. monthly sales logs stored as text files, b. detailed customer records stored in Excel sheets c. real-time market data available on the web. Read the data from text files, Excel and the web.
3	Exploring various commands for doing descriptive analytics on the Iris data set.
4	Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following: a. Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis. b. Bivariate analysis: Linear and logistic regression modeling c. Multiple Regression analysis d. Also compare the results of the above analysis for the two data sets.
5	Apply and explore various plotting functions on UCI data sets. a. Normal curves b. Density and contour plots c. Correlation and scatter plots d. Histograms e. Three-dimensional plotting
6	Apply the data aggregation operations such as grouping and summarizing values in the dataset.
7	A healthcare analytics company is developing a predictive model to identify patients at high risk of developing a chronic disease. The dataset collected from multiple hospitals contains several numerical and categorical features, but some entries are missing due to incomplete patient records. To Handle missing values, apply data normalization, and perform appropriate data transformation techniques.
8	Apply cross-validation to evaluate the performance of a predictive model, and use accuracy metrics such as ROC curves and precision-recall curves to assess the model's effectiveness.
9	Analyze the classifier performance using the precision –recall curves.

10	Analyze the different data normalization techniques for the data enrichment.
11	A real-estate company wants to predict house prices using a dataset containing both continuous and categorical features. Apply feature selection techniques to identify the most relevant predictors for the continuous target.
12	Implement a similarity-based learning method and evaluate the model's performance by measuring errors to refine the model's accuracy.
13	Calculate Gini Impurity and Entropy using a Decision Tree Classifier
	Total Periods: 60

Learning Resources

1	Davy Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.
2	Grus, Joel, “Data science from scratch: first principles with python”, O'Reilly Media, 2019.
3	Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016.
4	Peter Bruce, Andrew Bruce, Peter Gedeck,” Practical Statistics for Data Scientists”, O′Reilly; 2nd edition, 2020.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Apply the pre-processing techniques for the data analysis.	Apply
CO2	Apply the Regression and correlation of the variables of the data.	Apply
CO3	Analyze and interpret univariate and bivariate data using appropriate visualization techniques to identify patterns, relationships, and trends.	Analyze
CO4	Apply the aggregation, normalization of the data and evaluate the model performance.	Apply
CO5	Apply the feature selection techniques and the learning methods for data analysis by identifying key features and accurately predicting or grouping data points.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	3	2	3	2	2	2	2	1		3	2
CO2	2	3	3	3	3	2	2	2	2	1		3	2
CO3	2	3	3	3	3	2	2	2	2	2		3	3
CO4	3	3	3	3	3	2	2	2	2	1	1	3	3
CO5	3	3	3	3	3	2	2	2	3	2	1	3	3
Avg.	2.4	2.8	3	2.8	3	2	2	2	2.2	1.4	1	3	2.6

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

U24EM522	SOFT SKILLS AND PERSONALITY DEVELOPMENT – II	L	T	P	C
		0	0	2	1

Course Objective:

- To improve written communication etiquette, covering email principles, netiquette, and proper messaging practices.
- To communicate effectively with clarity, active listening, and overcoming sender–receiver barriers.
- To develop non-verbal awareness, interpreting body language and cues, especially in high-stakes contexts (interviews, presentations).
- To enhance public speaking and presentation skills using visuals, confidence building, and anxiety management.
- To cultivate integrity-driven human relations, emphasizing listening, trust, and ethical communication

List of Exercises

Sl. No.	List of Exercises
1	Technology and Communication: Technological Personality, Mobile Personality?
2	Communication Skills: Effective Communication
3	Barriers to Communication: Arising out of Sender/Receiver's Personality, Interpersonal Transactions, Miscommunication
4	Nonverbal Communication: Introduction And Importance, Issues and Types, Basics and Universals
5	Body Language: For Interviews, For Group Discussions
6	Presentation Skills: Overcoming Fear, Becoming A Professional, The Role of Body Language
7	Presentation Skills: Using Visuals
8	Reading Skills: Effective Reading
9	Human Relations: Developing Trust and Integrity
10	Visume
	Total Periods: 30

Learning Resources

1	Dorch, Patricia. What Are Soft Skills? New York: Execu Dress Publisher, 2013.
2	Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. Washington, DC: Pfeiffer & Company, 2013.
3	Klaus, Peggy, Jane Rohman & Molly Hamaker. The Hard Truth about Soft Skills. London: HarperCollins E-books, 2007.
4	Petes S. J., Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw-Hill Education, 2011.

5	Enhancing Soft Skills and Personality, Dr. T. Ravichandran, IIT Kanpur NPTEL Course: https://onlinecourses.nptel.ac.in/noc26_hs47/preview
6	Developing Soft Skills and Personality, Dr. T. Ravichandran, IIT Kanpur NPTEL Course: https://nptel.ac.in/courses/109104107

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Write effective emails using email principles and etiquette	Apply
CO2	Design visuals using principles of clarity, readability, and relevance (graphs, slides, props).	Apply
CO3	Apply the communication model to real-world situations, accounting for tone, style, barriers	Apply
CO4	Compare self-assessed nonverbal behaviours to standardized benchmarks.	Understand
CO5	Apply confident body language techniques in interviews and group discussion simulations.	Apply

Course Articulation Matrix

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

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