MANAKULA VINAYAGAR INSTITUTE OF TECHNOLOGY
Approved by AICTE, New Delhi and Affiliated to Pondicherry University
Accredited by NBA & NAAC 'A' Grade
Kalitheerthalkuppam, Puducherry - 605107

Accredited by NBA NATIONAL BOARD OF ACCREDITATION

Accredited with Grade A NAAC

(An Autonomous Institution)

Curriculum & Syllabus

for

UG Degree Course

in

B.Tech

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

R 2025

2025-26

S.No.	Category	AICTE	PU R-2023	MIT Proposed AI&ML R-2025
1	Humanities and Social Sciences, including Management courses (HS)	16	13	11
2	Basic Science courses(BS)	23	24	20
3	Engineering Science courses including workshop, drawing, basics of Electronics / Electrical / Mechanical / Computer etc.(ES)	29	26	26
4	Professional core courses(PC)	59	68	69
5	Professional Elective courses relevant to chosen specialization/branch(PE)	12	12	12
6	Open Elective Courses – Electives from other technical and /or emerging subjects(OE)	09	09	9
7	Core Enrichment Courses (Project work, seminar and internship in industry or elsewhere) (CEC)	15	17	14
8	Employability Enhancement Courses (EEC)	-	-	-
9	Mandatory Courses(MCC) [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Knowledge Tradition]	non-credit	non-credit	non-credit
10	Certification Courses(CCC)	non-credit	non-credit	non-credit
Total		**163**	**169**	**161**

SUMMARY OF ALL COURSES

S.No	Course Category	I	II	III	IV	V	VI	VII	VIII	Total Credits
1	**HS**	2	3	-	3	3	-	-	-	**11**
2	**BS**	4	8	4	4	-	-	-	-	**20**
3	**ES**	13	10	3	-	-	-	-	-	**26**
4	**PC**	-	-	15	16	19	12	7	-	**69**
5	**PE**	-	-	-	-	-	6	3	3	**12**
6	**OE**	-	-	-	-	-		3	6	**9**
7	**CEC**	-	-	-	1	-	1	3	9	**14**
8	**EEC**	-	-	-	-	-	-	–	–	-
9	**MCC***	-	-	-	-	-	-	-	-	-
10	**CCC***	-	-	-	-	-	-	-	-	-
Total		**19**	**21**	**22**	**24**	**22**	19	**16**	**18**	**161**

SEMESTER I							
S.No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
THEORY							
1	25UMAT11	Matrices and Calculus	BS	3	1	0	4
2	25UECT12	Basic Electronics Engineering	ES	3	0	0	3
3	25UHST13	Universal Human Values II	HS	2	0	0	2
4	25UCST14	Computational Thinking for AIML	ES	3	0	0	3
INTEGRATION COURSE							
5	25UCSI15	Programming in C	ES	3	0	2	4
PRACTICAL							
6	25UECP16	Basic Electronics Engineering lab	ES	0	0	2	1
7	25UGEP17	Fabrication lab	ES	0	0	2	1
8	25UGEP18	Design Thinking &Idea Lab for AIML	ES	0	0	2	1
EMPLOYABILITYENHANCEMENTCOURSES							
9	25UPCE11	Career Development Skill	EEC	0	0	2	0
MANDATORYCOURSE							
10	25UMCC11	IKS – Concepts and applications in Engineering and Science	MCC	1	0	1	0
11	25UMCC12	Holistic Wellness	MCC	0	0	2	0
Total							**19**

SEMESTER II							
S.No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
THEORY							
1	25UMAT21	Differential Equations and Transforms	BS	3	1	0	4
2	25UCST22	Python Programming	ES	3	0	0	3
3	25UPHT23	Applied Physics for Computing Engineers	BS	3	0	0	3
INTEGRATION COURSE							
5	25UCSI24	Design System Design for AIML	ES	2	0	4	4
6	25UHSI26	Professional Communication for Engineers	HS	1	0	4	3
PRACTICAL							
7	25UPHP26	Applied Physics Lab	BS	0	0	2	1
8	25UCSP27	Python programming Lab	ES	0	0	2	2
9	25UGEP29	Engineering Graphics and Auto CAD	ES	0	0	2	1
EMPLOYABILITY ENHANCEMENT COURSES							
10	25UPCE21	Communication Skill	EEC	0	0	2	0
11	25UCCC21	Certification Course I	CCC	0	0	0	0
MANDATORYCOURSE							
12	25UMCC21	IKS in Humanities and Social Science	MCC	1	0	1	0
13	25UMCC22	Environmental Science &Sustainability	MCC	0	0	2	0
Total							**21**

SEMESTER III							
S.No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
THEORY							
1	25UMAT31	Fourier Series, Probability And Statistics	BS	3	1	0	4
2	25UAIT31	Data structures and Algorithms	PC	3	0	0	3
3	25UAIT32	Computer Architecture and Organization	ES	3	0	0	3
4	25UAIT33	Operating System	PC	3	0	0	3
5	25UAIT34	Data Visualization	PC	3	0	0	3
INTEGRATED COURSE							
6	25UAII31	Object Oriented Programming using JAVA	PC	2	0	4	4
PRACTICAL							
7	25UAIP31	Data structures and Algorithms Lab	PC	0	0	2	1
8	25UAIP32	Operating System Lab	PC	0	0	2	1
EMPLOYABILITY ENHANCEMENT COURSES							
9	25UPCE31	Personality Development Skills	EEC	0	0	2	0
10	25UCCCXX	Certification Courses-II	CCC	0	0	0	0
MANDATORY COURSES							
11	25UMCC31	Indian Constitution & Human Rights	MCC	2	0	0	0
Total							**22**

SEMESTER IV							
S.No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
THEORY							
1	25UMAT41	Discrete Mathematics	BS	3	1	0	4
2	25UAIT41	Computer Networks	PC	3	0	0	3
3	25UAIT42	Machine Learning	PC	3	0	0	3
4	25UAIT43	Artificial Intelligence	PC	3	0	0	3
5	25UHST41	Principles of Management	HS	3	0	0	3
INTEGRATED COURSE							
6	25UAII41	Database Management Systems	PC	2	0	4	4
PRACTICAL							
7	25UAIP41	Machine Learning Lab	PC	0	0	2	1
8	25UAIP42	Computer Networks Lab	PC	0	0	2	1
9	25UAIP43	Artificial Intelligence Lab	PC	0	0	2	1
CORE ENRICHMENT COURSES							
10	25UAIW41	Mini Project - I	CEC	0	0	2	1
EMPLOYABILITY ENHANCEMENT COURSES							
11	25UPCE41	Professionalism and Basic Aptitude	EEC	0	0	2	0
12	25UCCCXX	Certification Courses-III	CCC	0	0	0	0

MANDATORY COURSES							
13	25UMCC41	Entrepreneurial skills and Concepts	MCC	2	0	0	0
Total							**24**

SEMESTER I

25UMAT11	MATRICES AND CALCULUS	Category	L	T	P	Credit
		BS	3	1	0	4

Course Prerequisite

- Higher Secondary Level Mathematics

Course Objective

- To understand and gain the knowledge of matrix algebra, partial differentiation, double integration, triple integration and their application, curl, divergence. To familiar with vector differential operators, integral theorems (Green's, Stoke's, Gauss divergence).

Course Outcome

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

CO1	Find eigenvalues and eigenvectors, verify the Cayley-Hamilton theorem, and perform orthogonal diagonalization.	Apply (K3)
CO2	Compute partial derivatives, determine total derivatives, Jacobians, employ Taylor's series, and find extremes of functions of two variables.	Apply (K3)
CO3	Demonstrate proficiency in evaluating double integration and triple integration and using them to compute area and volume.	Apply (K3)
CO4	Compute gradients, divergence, curl, directional derivatives, and apply vector identities to solve vector field problems.	Apply (K3)
CO5	Apply Green's theorem, Stoke's theorem and Gauss divergence theorem.	Apply (K3)

SYLLABUS

UNIT I MATRICES (12)

Eigenvalues and Eigen vectors of a real matrix, Characteristic equation, Properties of Eigen values and Eigenvectors- Cayley-Hamilton Theorem, Diagonalization of matrices. Reduction of a quadratic form to canonical form by orthogonal transformation -Nature of quadratic forms.

UNIT II FUNCTIONS OF SEVERAL VARIABLES (12)

Partial derivatives-Total derivative- Differentiation of implicit functions, Change of variables-Jacobians and their properties-Taylor's series for functions of two variables- Maxima and minima, Lagrange's method of undetermined multipliers.

UNIT III INTEGRAL CALCULUS (12)

Multiple Integral – Change of order of integration (Cartesian form). Applications: Areas as a double integral (Cartesian form) – Volume as a triple integral (Cartesian form).

UNIT IV VECTOR DIFFERENTIATION (12)

Scalar and vector valued functions-gradient, tangent plane – directional derivative-divergence and curl- scalar and vector potentials. Statement of vector identities-simple problems.

UNIT V VECTOR INTEGRATION (12)

Line, surface and volume integrals- statements of Green's, Stoke's and Gauss Divergence theorems – verification and evaluation of vector integrals using them.

TOTAL PERIODS: 60

TEXT BOOKS

1.Veerarajan T., "Engineering Mathematics – I and II", Tata McGraw-Hill, New Delhi, 2014 and

2015.
2.Dr. M.K. Venkataraman, “Engineering Mathematics – Volume I and Volume II”, The National Publishing Company, Chennai 2008.

REFERENCE BOOKS

1. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Ramana B.V., “Higher Engineering Mathematics”, Tata McGraw-Hill, New Delhi, 2010.
3. Bali N.P and Manish Goyal., “A Text Book of Engineering Mathematics”, Laxmi Publications(P) Ltd, 2011.
4. Erwin Kreyszig, Advanced Engineering Mathematics (9th Edition), John Wiley & Sons, New Delhi, 2011.

Online Courses/NPTEL/SWAYAM:

https://nptel.ac.in/courses/111106100

https://nptel.ac.in/courses/111104125

https://nptel.ac.in/courses/111105121

https://nptel.ac.in/courses/111107112

CO-PO -PSO Mapping

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

Assessment Methodology	Assessment Tools	Marks
Test		25
Problem based Assignment	Moodle / Google form	5
Simulation/ Projectbased assignment	Demo and viva	5
Attendance		5
Total		**40**

25UECT12	BASIC ELECTRONICS ENGINEERING	Category	L	T	P	Credit
		ES	3	0	0	3

Course Prerequisite:

- Basic knowledge about electronic circuits

Course Objective

- To learn the fundamental skills in the construction of electronics circuit design and develop various electronic systems.

Course Outcome

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

CO1	Understand the semiconductor physics of the intrinsic, p, and n materials.	Understand
CO2	Understand the function and operation of diodes, transistors and amplifiers.	Understand
CO3	Analyze the performance of BJT & FETs and its uses in amplifiers and oscillators.	Analyze
CO4	Analyze and design operational amplifier circuits.	Analyze
CO5	Understand the architecture, functions & their applications of IC 741 OP-Amp.	Understand

SYLLABUS

UNIT I SEMI CONDUCTORS AND DIODES (9)

Conductors - Semiconductors - Intrinsic Semiconductors - Extrinsic Semiconductors. Diode Theory, Basic Ideas - ideal Diode - Forward and Reverse Bias - Diode Equation - Volt-Ampere Characteristic- Special diodes, symbol of zener diode - operation - V-I characteristics - symbol of photo diode - working principle - LED symbol and principle.

UNIT II RECTIFIERS (9)

Half-wave Rectifier - Full-wave and Bridge Rectifier - derivation of Ripple factor - efficiency of Half-wave -Full-wave and Bridge rectifiers, Merits and demerits of Half-wave - Full-wave and Bridge rectifiers - Comparisons of rectifiers.

UNIT III BIPOLAR JUNCTION &, FIELD-EFFECT TRANSISTORS(9)

Symbols of PNP and NPN transistors and their working principles -Transistor - Construction & working - Input and output characteristics of CB and CE configuration- Transistor as an Amplifier - Construction and working of JFET & MOSFET.

UNIT IV OSCILLATORS (9)

Principle of oscillation and Barkhausen criteria - LC oscillators: Hartley and Colpitts (operation and applications) - RC oscillators: Phase shift and Wien bridge (principle and working) - Crystal oscillator basics and applications-555 timer- Astable and Monostable Multivibrator

UNIT V OPERATIONAL AMPLIFIERS (9)

Characteristics of Op-Amps, Introduction to Op-amp - Op-amp Block Diagram - ideal and practical Op-Amps specifications - 741 Op-Amps & its features - Op-amp parameters &Measurement - Applications of Op-Amps: Inverting and Non-inverting amplifier - Integrator and differentiator - Comparators.

TOTAL PERIODS: 45

TEXTBOOKS:

1. Albert Malvino and David J Bates, "Electronic Principles", Tata McGraw–Hill, 9thEdition, 2021. (Unit 1 & 2)
2. Boyelstad, "Electronic Devices and Circuits Theory", Pearson Education, 11thEdition, 2013.(Unit 1, 2 & 3)
3. Morris Mano, "Digital design", PHI Learning, 4thEdition, 2016. (Unit 4)
4. Ramakanth A. Gayakwad, "Op-Amps and Linear Integrated Circuits", PHI, 4thEdition, 2015. (Unit 5)
5. D. Roy Chowdhury, "Linear Integrated Circuits", New Age International Pvt.Ltd., 5th Edition, 2018.(Unit 5)

REFERENCES:

1. Robert L.Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson/PHI, 10*th* Edition, 2010.
2. David A.Bell, "Electronic Devices and Circuits", Oxford, 5*th* Edition, 2009.
3. S.Salivahanan, Kumar, Vallavaraj, "Electronic Devices and Circuits", TATA McGraw Hill, 2*nd* Edition, 2003.
4. David A, "Operational Amplifiers & Linear ICs", Oxford Uni. Press, 3*rd* Edition, 2005. (Unit 5)

ONLINE / NPTEL Courses:

1. Introduction to Basic Electronics: https://archive.nptel.ac.in/courses/122/106/122106025/
2. Basic Electronics: https://archive.nptel.ac.in/courses/108/101/108101091/

CO-PO Mapping

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

Assessment Methodology	Assessment Tools	Marks
Test		25
Problem based Assignment	Moodle / Google form	5
Simulation (Python/Matlab/Scilab) Based Project assignment	Demo and viva	5
Attendance		5
Total		**40**

25UHST13	UNIVERSAL HUMAN VALUES II	Category	L	T	P	Credit
		HS	2	0	0	2

Course Objective:

• To highlight the plausible implications of such a holistic understanding in terms of ethical human conduct, trustful, mutually fulfilling human behaviour, and mutually enriching interaction with Nature.

Course Outcome

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

CO1	Understand holistic vision of life.	Understand
CO2	Enhance socially responsible behavior.	Understand
CO3	Understand the responsibility of environmental work.	Understand
CO4	Understand the Competence and Capabilities for Maintaining Health and Hygiene.	Understand
CO5	Appreciate the aspiration for excellence (merit) and gratitude for all.	Understand

Syllabus

UNIT I INTRODUCTION TO VALUE EDUCATION (9)

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity the Basic Human Aspirations, Happiness and Prosperity Current Scenario, Method to Fulfil the Basic Human Aspirations.

UNIT II HARMONY IN THE HUMAN BEING (9)

Understanding Human being as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.

UNIT III HARMONY IN THE FAMILY AND SOCIETY (9)

Harmony in the Family, the Basic Unit of Human Interaction, Trust, Foundational Value in Relationship, Respect, Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

UNIT IV HARMONY IN THE NATURE/EXISTENCE (9)

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence. Describing, Defining, Classifying, providingexamples or evidence, writing introduction and conclusion.

UNIT V IMPLICATIONS OF THE HOLISTIC UNDERSTANDING (9)

Natural Acceptance of Human Values, Definitive- ness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Hu- man Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models- Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.

TOTAL PERIODS: 45

TEXT BOOKS:

1. Premvir Kapoor, "Professional Ethics and Human Values", Khanna Book Publishing Company, New Delhi, 2022.
2. R RGaur,R Asthana, G P Bagaria, "The Textbook - A Foundation Course in Human Values and Professional Ethics", Excel Books, New Delhi, 2nd Revised Edition, 2019.
3. RR Gaur, R Asthana, G P Bagaria, "The Teacher's Manual- Teachers Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, 2019.

REFERENCES:

1. Annie Leonard, "The Story of Stuff", 2011.
2. A.N. Tripathi,"Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. Mohandas Karamchand Gandhi, "The Story of My Experiments with Truth", FP classic, 2009.
4. A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, "VanVidya: EkParichaya", 1999.

CO-PO Mapping

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

Assessment Methodology	Assessment Tools	Marks
Test		25
Case study analysis	Group discussion and report	5
Value-based project proposal	Presentation and peer evaluation	5
Attendance		5
Total		**40**

25UAIT14	COMPUTATIONAL THINKING FOR AIML	Category	L	T	P	Credit
		ES	3	0	0	3

Course Prerequisite

Higher Secondary Level Mathematics and General computer usage.

Course Objective

To develop computational thinking skills through understanding data, pattern recognition, algorithms, decomposition, abstraction, modeling, and complexity analysis in problem-solving and automation.

Course Outcomes

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

CO1	Understand the key concepts of computational aspects of algorithm.	Understand
CO2	Understand the fundamental concepts of data analytics, visualization techniques and logical thinking.	Remember
CO3	Apply decomposition and algorithmic thinking for everyday tasks using various problem solving techniques.	Apply
CO4	Apply the concepts of abstraction and modeling to represent system tasks.	Apply
CO5	Analyze the efficiency of sorting and search algorithms and debug program errors.	Analyze

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UNIT I INTRODUCTION TO COMPUTATIONAL THINKING (9)

Understanding the concepts: Decomposition, pattern recognition / data representation, generalization / abstraction and Algorithms. Complexity, Modeling, Automation, Analysis, visualization.

UNIT II UNDERSTANDING DATA AND PATTERN RECOGNITION (9)

Performing analytics on numeric data using any spreadsheet software and visualizing the data using charts, histograms, scatter plots, graphs, Logical thinking – reasoning, Pattern recognition in data, data sequences, puzzles, nonograms. Data Encryption – ciphering sentences and Compression

UNIT III DECOMPOSITION AND ALGORITHMIC THINKING (9)

Decomposition, Algorithmic thinking – creating oral algorithms for everyday tasks – visualizing algorithms through sequence of steps, pseudocode, flow charts, selection, iteration, functions and procedures

UNIT IV ABSTRACTION AND MODELING: (9)

Abstraction and Modeling, Automata and Finite State Machine, Object Description, Objects and Objects based modeling – Repair, Reuse, Recycle.

UNIT V ETHICAL AI AND APPLIED COMPUTATIONAL THINKING: (9)

Ethical dimensions in AI – fairness, bias, data privacy, accountability, and responsible development of intelligent systems. Application of computational thinking in real-world scenarios – identification of problems, decomposition, abstraction, and algorithmic design-Case study

TOTAL PERIODS: 45

TEXT BOOKS:

1. Karl Beecher, Computational Thinking – A Beginner's Guide to Problem–Solving and Programming, BCS Learning, 2017.
2. Venkatesh G, Madhavan Mukund, Computational Thinking, Notion Press, 1st Edition, 2021.
3. A.DavidD.Riley,KennyA.Hunt, Computational Thinking for the Modern Problem Solver, CRC Press, 2015

REFERENCE BOOKS

1. David Clark, Computational and Algorithmic Thinking Book 2, AMT Publishing, 2016.
2. Paul Curzon, "Computing Without Computers: A Gentle Introduction to Computer Programming, Data Structures, and Algorithms", 2014.
3. Wang Paul S, From computing to computational thinking, CRC Press, 2016.
4. Peter J. Denning, Matti Tedre, Computational Thinking, MIT Press, 2019.
5. Paolo Ferragina, Fabrizio Luccio, Computational Thinking_ First Algorithms, Then Code, Springer International Publishing, 2018.
6. Aman Yadav, Ulf Berthelsen, Computational Thinking in Education_ A Pedagogical Perspective, Routledge, 2021.
7. Zhiwei Xu, Jialin Zhang, Computational Thinking_ A Perspective on Computer Science, Springer, 2021.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	-	-	-	-	2	3
CO2	3	-	-	-	3	-	-	-	-	-	2
CO3	3	3	3	3	-	-	-	-	-	2	3
CO4	3	3	3	-	-	-	-	-	-	3	3
CO5	3	3	2	3	-	-	-	-	2	2	3

Assessment Methodology	Assessment Tools	Marks
Test		25
Problem based Assignment	Moodle/Google form	5
Project based	Demo and viva	5
Attendance		5
Total		**40**

25UCSI16	PROGRAMMING IN C	Category	L	T	P	Credit
		ES	3	0	2	4

Course Prerequisite

- Basic programming skills.

Course Objective

- To impart the knowledge of basic programming constructs of C language, arrays and strings, functions,structures, pointers and input/output file handling.

Course Outcomes:

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

CO1	Demonstrate knowledge on C Programming constructs and develop simple program in C using basic constructs.	Understand (K2)
CO2	Apply arrays and string operations to solve basic problems using C	Apply (K3)
CO3	Develop modular programs using functions, recursion, and pointers	Apply (K3)
CO4	Implement user-defined data types using structures, unions, and manage memory dynamically.	Apply (K3)
CO5	Implement file operations and manage memory dynamically using pointers and preprocessor directives.	Apply (K3)

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UNIT I INTRODUCTION TO PROGRAMMING PARADIGMS: (9)

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

UNIT II DECISION MAKING, ARRAYS AND STRINGS (9)

Introduction to Arrays: Declaration, Initialization – One dimensional array –Two dimensional arrays – String operations: length, compare, concatenate, copy – Selection sort, linear and binary search.

UNIT III FUNCTIONS AND POINTERS (9)

Modular programming – Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion, Binary Search using recursive functions – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Parameter passing: Pass by value, Pass by reference.

UNIT IV STRUCTURES AND UNION (9)

Structure – Nested structures – Pointer and Structures – Array of structures – Self-referential structures – typedef – Union – Storage classes and Visibility.

UNIT V FILE MANAGEMENT AND DYNAMIC MEMORY ALLOCATION:(9)

Files- Types of file processing, I/O Operations of File, Random access file, Command line arguments,Dynamic memory allocation – malloc, calloc, free, Preprocessor directive, Macro substitution, Compiler control directive.

TEXTBOOKS:

1. ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016.
2. E. Balagurusamy, "Programming in C" McGraw-Hill, 8th Edition, 2019.
3. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015.

REFERENCE BOOKS:

1. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", 8th edition, Pearson Education, 2018.
2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
3. Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", 2nd Edition, Oxford University Press, 2013.
4. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013

ONLINE/ NPTEL COURSES:

1. C for Everyone: Programming Fundamentals- https://www.coursera.org/learn/c-for-everyone
2. Art of C programming -https://onlinecourses.swayam2.ac.in/cec24_cs05/preview
3. Introduction to Programming in C.- https://onlinecourses.nptel.ac.in/noc22_cs40/preview

PRACTICE EXERCISES:

1. Study of Compilation and execution of simple C programs
2. Simple computational problems using arithmetic expressions (Arithmetic Operations, Area &circumference of a circle)
3. Problems involving if-then-else structures (ODD/EVEN numbers, Greatest Numbers)
4. Iterative problems e.g., sum of series (Factorial, Sum of Digits)
5. 1D and 2D, multi-dimensional arrays, traversal
6. Matrix problems, String operations (Addition, Subtraction, Multiplication, Palindrome StringOperations, String Handling Functions)
7. Simple functions (nCr Program, Swapping using call-by-reference)
8. Programming for solving Numerical methods problems (Palindrome Checking, Searching and Sorting Names)
9. Recursive functions (Factorial using Recursion)
10. Pointers: Pointers to functions, Arrays, Strings, Pointers to Pointers, Array of Pointers
11. Structures: Nested Structures, Pointers to Structures, Arrays of Structures and Unions.
12.Files: reading and writing, File pointers, file operations, random access, processor directives

CO-PO Mapping - PROGRAMMING IN C

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

Assessment Methodology	Assessment Tools	Marks
Theory Test		15
Coding assignments	Online submission	10
Mini project implementation	Code demo and documentation	10
Model Practical		10
Attendance		5
Total		**50**

25UECP16	BASIC ELECTRONICS ENGINEERING LAB	Category	L	T	P	Credit
		ES	0	0	2	1

Course Prerequisite:
Nil

Course Objective:

- To design and analyze electronic circuits such as diodes, rectifiers, Zener diode, BJT, FET. To verify the basic logic operations and simple arithmetic circuits using logic gates.

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

CO1	Understand the characteristics of basic electronic devices. Apply problem-solving skills, recognize and utilize the characteristics of diodes, rectifiers & transistors.	Apply
CO2	Interpret the Op-Amp-based inverting and non-inverting amplifier circuit.	Apply
CO3	Integrate diverse applications of Op-Amp in differentiator, integrator, adder & subtractor circuits.	Apply

LIST OF EXPERIMENTS

1. Measurement of different signal parameters using oscilloscope.
2. V-I characteristics of an ordinary p-n junction diode.
3. Full wave rectifier, with and without filter.
4. Half-wave rectifier and observe output waveform and measure ripple
5. Zener diode as a voltage regulator.
6. Input and output characteristics of BJT. (CE, CB)
7. Input and output characteristics of FET.
8. Op-Amp based inverting and non-inverting amplifier.
9. Op-Amp based differentiator and integrator.
10. Op-Amp based adder and subtractor.
11. 555 timer A stable and Monostable
12. RC phase shift oscillator

(Total Periods:45)

Assessment Methodology	**Assessment Tools**	**Marks**
Laboratory Conduction	Observation	10
Record work		10
Model exam		15
Viva		5
Virtual lab assignment	Review	5
Circuit Construction Task	demo	5
Attendance		10
Total		60

25UGEP17	FABRICATION LABORATORY	Category	L	T	P	Credit
		ES	0	0	2	1

Course Outcomes:

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

CO1	Assemble and disassemble various items/equipment.	Understand
CO2	Make simple parts using suitable welding processes.	Apply
CO3	Set up wiring of distribution boards, machines, etc.	Apply
CO4	Utilize the electronic components to fabricate simple equipment, aided with sensors and actuators.	Apply
CO5	Take advantage of modern manufacturing practices	Apply

LIST OF EXPERIMENTS

(A). Dis-assembly & Assembly Practices

i) Tools and its handling techniques.

ii) Dis-assembly and assembly of home appliances – Grinder Mixer Grinder, Ceiling Fan, Table Fan & Washing Machine.

iii. Dis-assembly and assembly of Air-Conditioners & Refrigerators.

iv. Dis-assembly and assembly of a Bicycle.

(B). Welding Practices

i. Welding Procedure, Selection & Safety Measures.

ii. Power source of Arc Welding – Gas Metal Arc Welding & Gas Tungsten Arc Welding processes.

iii. Hands-on session of preparing base material & Joint groove for welding.

iv. Hands-on session of MAW, GMAW, GTAW, on Carbon Steel & Stainless Stell plates/pipes, for fabrication of a simple part.

(C)Electrical Wiring Practices

i. Electrical Installation tools, equipment & safety measures.

ii.Hands-on session of basic electrical connections for Fuses, Miniature Circuit Breakers and Distribution Box,

iii.Hands-on session of electrical connections for Lighting, Fans, Calling Bells.

iv. Hands-on session of electrical connections for Motors & Uninterruptible Power Supply.

(D)Electronics Components / Equipment Practices

i. Electronic components, equipment & safety measures.

ii. Dis-assembly and assembly of Computers.

iii. Hands-on session of Soldering Practices in a Printed Circuit Breaker.

iv. Hands-on session of Bridge Rectifier, Op-Amp and Transimpedance amplifier.

v. Hands-on session of integration of sensors and actuators with a Microcontroller.

vi. Demonstration of Programmable Logic Control Circuit.

(E). Contemporary Systems

i. Demonstration of Solid Modelling of components.

ii. Demonstration of Assembly Modelling of components.

iii.Fabrication of simple components/parts using 3D Printers.

iv. Demonstration of cutting of wood/metal in different complex shapes using Laser Cutting Machine.

CO PO Mapping - FABRICATION LAB													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
1	3	3	3	2	3	2	-	1	1	-	3	1	2
2	3	3	3	2	3	2	-	1	1	-	3	1	2
3	3	3	3	2	3	2	-	1	1	-	3	1	2
4	3	3	3	2	3	2	-	2	1	-	3	1	2
5	3	3	3	2	3	2	-	3	1	3	3	1	2

Assessment Methodology	**Assessment Tools**	**Marks**
Laboratory Conduction	Observation	10
Record work		10
Model exam		15
Viva		5
PCB design and fabrication	Working prototype demo	5
3D Model contest	Review	5
Attendance		10
Total		60

25UAIP18	DESIGN THINKING AND IDEA LAB FOR AIML	Category	L	T	P	Credit
		ES	0	0	2	1

Course Prerequisite

- Basic Knowledge of Science and interest in creative problem solving

Course Objective

- To introduce students to the principles, methodologies, and frameworks of design thinking for solving real-world problems.To cultivate user-centric, empathetic, and creative thinking through experiential learning and hands-on activities.

Course Outcome

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

CO1	Understand the fundamentals of design thinking, including its origin, process models, and tools.	Understand
CO2	Apply empathy tools and defining methods to understand user needs and formulate clear problem statements in design thinking.	Apply
CO3	Generate creative and innovative ideas using ideation techniques such as brainstorming, mind mapping, and lateral thinking.	Apply
CO4	Apply prototyping techniques to translate ideas into tangible models through iterative development of low-fidelity prototypes.	Apply
CO5	Interpret feedback from prototype testing and iteratively improve the design to better align with user needs.	Analyze

Syllabus

UNIT I FUNDAMENTALS OF DESIGN THINKING

Design Thinking Process: Types of the thinking process, Common methods to change the human thinking process, Design thinking: Definition, Origin of design thinking, Importance of design thinking, Design vs Design thinking, Problem solving, the need of design thinking; An approach to design thinking**,** Design thinking Process model, Design thinking tools.

Case Studies: General, Engineering and Service applications

Activities: Identify Opportunity and Scope of the Project. Explore the possibilities and prepare a design brief

UNIT II: EMPATHIZE AND DEFINE

Design thinking phases, how to empathize, Role of empathy in design thinking, the purpose of empathy maps, Things to be done prior to empathy mapping, Activities during and after the session, Understanding empathy tools: Customer Journey Map, Personas.

Define- Methods of Define Phase: Storytelling, Critical items diagrams, Define success

Activities: Apply the methods of empathizing and Define Phases Finalize the problem statement

UNIT I IDEATION

Challenges in idea generation, Visualize, Empathize, and Ideate method, Importance of visualizing and empathizing before ideating, Applying the method**,** Create Thinking**,** Generating Design Ideas**,** Lateral Thinking**,** Analogies**,** Brainstorming**,** Mind mapping**,**

National Group Technique**,** Synectic's**,** Development of work**,** Analytical Thinking**,** Group Activities. Ideation Tools: How Might We? (HMW), Storyboard, Brainstorming. What is design innovation? A mindset for innovation**,** and asking "What if?" asking "What wows?" and "What works?"

Activities- Apply the methods of Ideate Phase: Generate Lots of Ideas

UNIT I V PROTOTYPING

What is a prototype? - Prototyping as a mindset, prototype examples, prototyping for products; Why we prototype? Fidelity for prototypes, Process of prototyping- Minimum Viable prototype.

Activities: Apply the Methods of the Prototype Phase: Create prototypes for selected ideas

UNIT V TING PROTOTYPES FOR AI

Prototyping for AI digital products: Design simple chatbot UI screens, Preparation; Prototyping for chatbot UI screens; Testing Prototypes with Users: Share the interactive prototype (chat UI) with a few users and ask feedback; Create a Pitch-Plan for scaling up-Road map for Implementation, Integrate chatbot into website or social media platforms, Fine-tuning and Submission of the project report

Activities: Collect feedback; iterate and improve ideas

Present your solution using the Digital Poster presentation.

TEXTBOOKS:

1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins Publishers Ltd.
2. IdrisMootee, Design Thinking for Strategic Innovation,2013, John Wiley & Sons Inc

REFERENCE BOOKS

1. Peter G. Rowe, Design Thinking: Understanding How Designers Think and Work, MIT Press, 1991.
2. Don Norman, The Design of Everyday Things, Basic Books, 2013.
3. Tom Kelley and David Kelley, Creative Confidence: Unleashing the Creative Potential Within Us All, Crown Business, 2013.
4. Todd Zaki Warfel, Prototyping: A Practitioner's Guide, Rosenfeld Media, 2009.
5. Clive L. Dym, Patrick Little, Elizabeth J. Orwin, Engineering Design: A Project-Based Introduction, Wiley, 2011.
6. Karl T. Ulrich and Steven D. Eppinger, Product Design and Development, McGraw-Hill Education, 2015.
7. Charles Platt, Make: Electronics: Learning Through Discovery, Maker Media, 2011.

CO-PO Mapping

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

Assessment Methodology	**Assessment Tools**	**Marks**
Laboratory Conduction	Observation	10
Record work		10
RPA and BOT Building		20
Virtual lab assignment	Review	10
Attendance		10
Total		**60**

25UPCE11	CAREER DEVELOPMENT SKILLS	Category	L	T	P	Credit
		EEC	0	0	2	0

Prerequisite: Basic communication skills and foundational knowledge of workplace behaviour.

Course Objective

To empower students with the skills for self-discovery, goal achievement, effective time management, and personal effectiveness, alongside foundational knowledge in career planning, emotional intelligence, higher education, competitive exams, and entrepreneurship

Course Outcome

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

CO1	Help students assess themselves, explore career options, and set actionable goals through structured planning.
CO2	Develop motivation, enhance personality effectiveness, and instill discipline for personal and professional growth.
CO3	Build awareness and practice of grooming, hygiene, positive attitudes, manners, and professional behavior.
CO4	Strengthen self-awareness, time and stress management, and emotional intelligence for balanced personal development.
CO5	Introduce students to higher education paths, competitive exams, and the fundamentals of entrepreneurship and business planning

SYLLABUS

UNIT 1 **6 Hrs**

Career Planning: Introduction to Career Planning - Self-Assessment for Career Planning - Exploring Career Options- Developing a Career Plan;

Goal Settings: Understanding Goal Setting - Setting Effective Goals - Action Plan Development - Practical Exercises

UNIT 2 **6 Hrs**

Motivation – I: Definition and Importance of Motivation - Types of Motivation - Theories of Motivation - Factors Affecting Motivation

Personality Effectiveness: Components of Personality Effectiveness - Communication Skills - /Interpersonal Skills - Practical Exercises

Building Personality and Discipline: Introduction to Personality Development - Building Positive Habits - Discipline and Self-Control - Practical Application

UNIT 3 **6 Hrs**

Grooming, hygiene and Cleanliness: Personal Hygiene Practices - Body Grooming Techniques - Environmental Cleanliness - Mental and Social Impact of Grooming and Hygiene.

Attitudes, Manners and Behaviour: Understanding Attitudes - Developing Positive Attitudes - Manners and Etiquette - Procedures and Protocols

UNIT 4 **6 Hrs**

Self- Awareness & Self Confidence: Introduction to Self-Awareness- Understanding Strengths and Weaknesses- Building Self-Confidence- Practical Application

Time Management:Introduction to Time Management - Planning and Prioritizing Tasks- Overcoming Procrastination- Practical Time Management

Stress Management: Understanding Stress- Stress Management Techniques-Coping Strategies- Practical Application

Emotional Intelligence:Introduction to Emotional Intelligence- Managing Emotions- Social Awareness and Relationship Management-Practical Exercises

UNIT 5 **6 Hrs**

Introduction to Higher Education, Competitive exams:Overview of Higher Education- Competitive Exams Overview - Exam Preparation Techniques

Introduction to Entrepreneurship: Understanding Entrepreneurship- Developing a Business Idea - Business Planning.

Text Book

1. Soft skills for Managers by Dr. T. KALYANA CHAKRAVATHI
   Personal Development and Soft Skills by BARUN K MITRA, Oxford Higher Education

Reference Book

1. The Emotionally Intelligent Workplace by DANIEL GOLEMAN.
2. Communication skills and soft skills an integrated approach by E. SURESH KUMAR, P. SREEHARI, J SAVITHRI.
3. Top Talking in English (international communication skills) by CHARLES T. RAJENDRA Soft skills by RAJ LAKSHMI SURYAVANSHI, Gurucool Publishing

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	2	2	2	2
CO2	-	-	-	-	2	-	-	2	-	-	2
CO3	-	-	-	-	-	-	2	2	-	-	2
CO4	-	-	-	-	-	-	-	2	2	-	2
CO5	-	-	-	-	-	2	2	-	-	-	2

25UMCC11	IKS – CONCEPTS AND APPLICATIONS IN ENGINEERING AND SCIENCE	Category	L	T	P	Credit
		MCC	0	0	2	0

Course Prerequisite

- Basic understanding of science and engineering fundamentals

Course Objective

- Familiarize students with traditional Indian knowledge systems and their scientific
- foundations
- Explore the integration of ancient wisdom with modern engineering practices
- Understand sustainable technologies and innovations rooted in Indian traditions
- Develop appreciation for indigenous knowledge in solving contemporary challenges
- Foster research mindset towards validating and modernizing traditional practices

Course Outcome

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

CO1	Understand the historical development and scientific basis of Indian Knowledge Systems	Understand
CO2	Analyze traditional Indian practices in mathematics, astronomy, metallurgy, andmedicine	Analyze
CO3	Apply IKS principles to contemporary engineering and scientific problems	Apply
CO4	Evaluate the sustainability aspects of traditional Indian technologies	Evaluate
CO5	Create innovative solutions by integrating traditional knowledge with modernscience	Create

Syllabus

UNIT I INTRODUCTION TO INDIAN KNOWLEDGE SYSTEMS

Historical overview of Indian Knowledge Systems - Scientific methodology in ancient India - Major texts and scholars: Vedas, Upanishads, Charaka Samhita, Sushruta Samhita - Transmission and preservation of knowledge - Contemporary relevance and global recognition.

UNIT II: MATHEMATICS AND ASTRONOMY IN ANCIENT INDIA

Indian contributions to mathematics: Zero, decimal system, trigonometry - Aryabhata, Brahmagupta, Bhaskara's contributions - Astronomical observations and calendar systems - Navigation techniques and geographical knowledge - Applications in modern engineering calculations.

UNIT III: METALLURGY, MATERIALS, AND ARCHITECTURE

Ancient Indian metallurgy: Iron pillar of Delhi, Wootz steel - Traditional building materials and techniques -Architectural marvels: Structural engineering principles - Water harvesting and management systems - Sustainable construction practices.

UNIT IV: RENEWABLE ENERGY AND CLIMATE CHANGE

Ayurveda: Principles and scientific validation - Traditional agricultural practices and crop management – Biodiversity conservation methods - Food preservation techniques - Biotechnology applications in traditional practices.

UNIT V: INTEGRATION WITH MODERN SCIENCE AND TECHNOLOGY

Validating traditional knowledge through modern scientific methods - Case studies of successful IKS-modern science integration - Intellectual property and traditional knowledge protection - Research opportunities and career prospects - Future directions and challenges

TEXTBOOKS:

1. Subhash Kak, “The Nature of Physical Reality”, Mount Meru Publishing, 2016
2. B.V. Subbarayappa, “Indian Astronomy: A Source Book”, Nehru Centre, 2008
3. Kapila Vatsyayan, “Traditional Indian Art and Culture”, Cambridge University Press, 2015

REFERENCE BOOKS & WEB RESOURCES

1. P.P. Divakaran, “The Mathematics of India: Concepts, Methods, Connections”,Springer, 2018
2. S.N. Sen, “Ancient Indian History and Civilization”, New Age International, 2010
3. National Mission for Manuscripts - www.namami.gov.in
4. Digital Library of Traditional Ecological Knowledge - www.frlht.org
5. CSIR Traditional Knowledge Digital Library - www.tkdl.res.in

CO PO Mapping

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

25UMCC13	HOLISTIC WELLNESS	Category	L	T	P	Credit
		MCC	0	0	2	0

Course Prerequisite

- Nil

Course Objective

- Foundational concepts of holistic wellness, emphasizing the integration of physical, mental, emotional, and Internal well-being, create a balanced lifestyle that promotes overall health and happiness through practical activities.
- Explore advanced techniques in mental, emotional, and spiritual well-being, with an emphasis on creating sustainable wellness habits.

Course Outcome

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

CO1	Understand the basic principles of holistic wellness. Apply strategies for maintaining physical health, including nutrition and exercise	Understand
CO2	Practice mindfulness techniques to enhance mental and emotional well-being.	Analyze
CO3	Develop a personal wellness plan incorporating various aspects of holistic health.	Apply
CO4	Apply advanced techniques in mindfulness, meditation, and stress management.	Evaluate
CO5	develop resilience and adaptability in maintaining wellness. Refine and sustain a personalized holistic wellness plan.	Create

Syllabus

UNIT I INTRODUCTION TO HOLISTIC AND PHYSICAL WELLNESS

Overview of holistic wellness: physical, mental, emotional, and internal health- The importance of balance in overall well-being. Importance of physical activity and exercise- Understanding nutrition and its role in health- Sleep hygiene and its impact on well-being.

Hands-on activity: Self-assessment of current wellness status.Designing a personalized fitness and nutrition plan.

UNIT II: MENTAL AND EMOTIONAL WELLNESS:

Stress management techniques- The role of Yoga, mindfulness and meditation in mental health- Emotional intelligence and its impact on relationships.

Hands-on activity: Practicing Yoga, mindfulness and emotional regulation exercises.

UNIT III: INTEGRATING WELLNESS PRACTICES:

Combining physical, mental, emotional, and Internal wellness practices into daily life - Developing a balanced wellness plan.

Hands-on activity: Creating a comprehensive personal wellness plan.

UNIT IV: EMOTIONAL RESILIENCEAND ADVANCED MINDFULNESS

Deepening mindfulness practices for enhanced mental clarity- Exploring different forms of meditation (e.g., guided, transcendental, movement-based). Building emotional resilience through positive psychology practices- Cognitive-behavioural strategies for managing stress and anxiety.

Hands-on activity: Developing and practicing a resilience toolkit. Daily meditation practice and journaling reflections.

UNIT V: INTERNAL GROWTH AND SUSTAINING WELLNESS PRACTICES:

Exploring the deeper aspects of internal wellness and self-actualization- Reflective practices for discovering life purpose and meaning. Strategies for maintaining wellness habits over the long term- Adapting wellness plans to life changes and challenges-

Hands-on activity: Revising and finalizing a long-term personal wellness plan. Creating a vision board or personal mission statement.

TEXTBOOKS:

1. Jayanna, Krishnamurthy., Science & Practice of Integrative Health & Wellbeing Lifestyle., White Falcon Publishing (2020).
2. Rosenberg, Marshall Bertram., Nonviolent Communication: A Language of Life., Puddle Dancer Press, Encinitas, CA (2015).
3. Patel, Kamlesh. Heartfulness Way: Heart-Based Meditations for Spiritual Transformation, Kamlesh Patel, 2018.

REFERENCE BOOKS

1. B.K.S Iyengar., Yoga: The Path to Holistic Health., Dorling Kindersley Limited, City of Publication (2001)
2.Goleman Daniel., Emotional Intelligence., Bloomsbury India, India, (2021).
3.James Allen., As a Man Thinketh., Maple Press, Noida, (2010)
4.Swami Budhanandha., Will power and its development., Advaita Ashrama Mayavati, Pithoragarh, Himalayas from its Publication Department, Calcutta. (2001)
5.KalderdonAdizesIchak., What Matters in Life: Lessons I Learned from Opening My Heart
., WS Press, Newtown, PA (2023)
6. Jayanna, Krishnamurthy., Science & Practice of Integrative Health & Wellbeing Lifestyle., White Falcon Publishing (2020).
7. Lipton, Bruce., The Biology of Belief 10th Anniversary Edition: Unleashing the Power of Consciousness, Matter & Miracles, Hay House, Carlsbad (2015).

WEB RESOURCES

1. Learning Suryanamskar
2. Yoga for well-being
3. Nutritional Educational contents
4. Introduction to Psychology
5. Guided Meditation
6. Simplified physical exercises instructions
7. Simplified Physical Exercises
8. Life skills and value education
9. James Allen Library

CO PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	2	-	2	-	-	-
CO2	-	-	-	-	-	2	-	-	-	-	-
CO3	-	-	-	-	-	2	-	-	-	-	3
CO4	-	-	-	-	-	2	-	-	-	-	3
CO5	-	-	-	-	-	2	-	-	-	-	3

SEMESTER II

25UMAT21	DIFFERENTIAL EQUATIONS & TRANSFORMS	Category	L	T	P	Credit
		BS	3	1	0	4

Course Prerequisite-

- Engineering Mathematics-I

Course Objective

- To introduce mathematical tools to solve first order differentiation equations.
- To gain knowledge of problem-solving techniques of PDE.
- To understand concept of the Laplace transform.
- To inculcate the computation knowledge in Laplace transforms.
- To acquaint with Fourier Transform techniques used in a wide variety of situations involving functions that are not necessarily periodic.

Course Outcome

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

CO1	Solve higher order differential equations	Apply
CO2	Formulate and solve various types of partial differential equations	Apply
CO3	Apply Laplace transforms and initial and final value theorems to solve engineering problems involving step, impulse and periodic functions.	Apply
CO4	Apply Laplace transforms to solve ordinary differential equations with constant coefficients and simultaneous ordinary differential equations	Apply
CO5	Apply Fourier transform techniques, including Fourier integral theorem, properties of Fourier transforms, convolution, and Parseval's identity	Apply

SYLLABUS

UNIT I ORDINARY DIFFERENTIAL EQUATIONS (12)

Differential Equations (Higher order): Linear differential equations of higher order – with constant coefficients, the operator D, Euler 's linear equation of higher order with variable coefficients - simultaneous linear differential equations, solution by variation of parameters method.

UNIT II PARTIAL DIFFERENTIAL EQUATIONS (12)

Formation of partial differential equations- Solutions of standard types of first order partial differential equations- Lagrange's linear equation- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT III LAPLACE TRANSFORM (12)

Existence conditions-Transforms of elementary functions- Properties, Transform of unit step function and unit impulse function -Transforms of derivatives and integrals- Transforms of Periodic Functions- Initial and final value theorems.

UNIT IV INVERSE LAPLACE TRANSFORM (12)

Inverse Laplace Transforms – Properties, Convolution theorem, Application - Solution of ordinary differential equations with constant coefficients -Solution of simultaneous ordinary differential equations.

UNIT V FOURIER TRANSFORM (12)

Fourier Integral theorem (statement only), Fourier transform and its inverse – Properties, Fourier sine and cosine transform - Properties, Convolution and Parseval's identity.

TOTAL PERIODS:60

TEXTBOOKS:

1. Veerarajan T., "Engineering Mathematics – I and II",Tata McGraw-Hill, New Delhi, 2014 and 2015.
2. Dr. M.K. Venkataraman, "Engineering Mathematics – Volume I and Volume II", The National Publishing Company, Chennai 2008.

REFERENCE BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2015.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2010.
3. Bali N.P and Manish Goyal., "A Text Book of Engineering Mathematics", Laxmi Publications(P) Ltd, 2011.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 9th Edition, 2011.

ONLINE COURSES/NPTEL/SWAYAM:

1. https://nptel.ac.in/courses/111106139
2. https://nptel.ac.in/courses/111101153
3. https://nptel.ac.in/courses/111107119

CO-PO Mapping

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

Assessment Methodology	Assessment Tools	Marks
Test		25
Mathematical modeling assignment	Analytical solution presentation	5
Transform applications project	Demo and viva	5
Attendance		5
Total		**40**

25UAIT22	PYTHON PROGRAMMING	Category	L	T	P	Credit
		ES	3	0	0	3

Course Prerequisite:

- Programming in C

Course Objective:

- To impart the knowledge of Python basic structure, components, object storage, exception handling, and graphics toolkit using Tinker.

Course Outcome

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

CO1	Understand Python's basic syntax, data types, and control statements, and apply built-in functions for manipulating numbers and text.	Understand
CO2	Analyze and use Python operators, collections, and file handling concepts, and evaluate type conversions and assignments for effective programming.	Analyze
CO3	**Understand** object-oriented concepts, **develop** functions, classes, and modules, and **analyze** inheritance and advanced function calling techniques.	Apply
CO4	**Understand** exception handling mechanisms, **develop** robust file I/O operations, and **analyze** methods to control file paths and errors.	Apply
CO5	**Understand** GUI programming fundamentals, **develop** interactive applications using Tkinter and Turtle graphics, and **analyze** the use of widgets and dialog boxes.	Apply

SYLLABUS

UNIT I INTRODUCTION(9)

History of python - Features of Python - Basic syntax: Indentations, comments - Statement and expressions - Python Identifiers and keywords – variables - Datatypes: int, complex, float, Boolean, string - String slicing - String built in function - Operator basics.

UNIT II CONTROL STATEMENT (9)

Control statements: if - if-else - if-elif-else – while – for – break – continue - pass. List – tuple - set and dictionary - Type conversion: Implicit and explicit(Type casting)

UNIT III FUNCTIONS AND PACKAGES (9)

Functions in python - parameters and arguments - return type - Global and local scope - Lambda functions - Built in functions - recursive function. Modules - Importing Modules - Packages and Interface - creating a module

UNIT IV OOPS AND EXCEPTION HANDLING (9)

Class and object: creating class, creating class methods, Inheritance, Abstraction and Excapsulation, Method overloading, Exceptional handling, Built-in exceptions.

UNIT V FILES AND GUI PROGRAMMING (9)

Files, File operations, reading a file content, writing a file, modifying files pos, controlling file I/O, Manipulating file paths. GUI Programming toolkits – Introduction to Tkinter – Creating GUI widgets – Resizing – Configuring widget options – Creating Layouts – Radio buttons – Check boxes – Dialog boxes – Drawing using Turtle

TOTAL PERIODS: 45

TEXTBOOKS:

1. Martin C. Brown, "The Complete Reference - Python", Tata McGraw Hill Indian Edition, 2010. (UNIT 1-4)
2. Alan D. Moore Python GUI programming with Tkinter: Design and build functional and user-friendly GUI applications,2021. (Unit-5)

REFERENCES

1. Wesley J Chun, -Core Python Applications Programming, Prentice Hall, 2012.
2. Eric Matthes, "A Hands-On, Project-Based Introduction to Programming", 2nd Edition,2019.

ONLINE/ NPTEL COURSES:

1. Programming, Data Structures and Algorithms using Python https://nptel.ac.in/courses/106106145
2. The Joy of Computing using Python- https://nptel.ac.in/courses/106106182
3. Python for Data Science- https://nptel.ac.in/courses/106106212

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

Assessment Methodology	Assessment Tools	Marks
Test		25
Coding assignments	Online submission	5
Mini project implementation	Code demo and documentation	5
Attendance		5
Total		**40**

25UPHT23	APPLIED PHYSICS FOR COMPUTING ENGINEERS	Category	L	T	P	Credit
		BS	3	0	0	3

Course Prerequisite

- **Solid-state physics basics, Atomic models and bonding,**Semiconductor theory.

Course Objective:

- To make the students understand the importance in studying electrical properties of materials, semiconductor physics, wave function in quantum mechanics and its practical application in technologies. To inculcate an idea of the significance of nanostructures, quantum confinement, ensuing nano device applications and quantum computing.

Course Outcome

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

CO1	**Relate** how electrons work inside solid materials and why different materials have different electrical properties - from metals that conduct well to insulators that don't conduct at all, with semiconductors falling in between	Understand K2
CO2	**Understand** how pure and doped semiconductors work, including their energy structures, carrier behavior, and how electrons and holes move through them under electric fields and concentration gradients.	Understand K2
CO3	**Understand** and explain the properties of matter waves andparticle in a one-dimensional infinite potential well **,**quantization of energy levels.	Understand K2
CO4	**Understand the** basic mechanisms of light absorption, emission, and scatteringin various materials **.**Explore the function of photo detectors**,** and their application in light sensing technologies**.**	Understand K2
CO5	**Understand** classical bits and quantum bits (qubits)**,** and understand theirrepresentation using quantum states**.** Apply basic quantum logic gates**, such** as theCNOT gate**,** and explore multi-qubit operations**.**	Understand K2

SYLLABUS

UNIT IELECTRICAL PROPERTIES OF MATERIALS (9)

Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Wiedemann-Franz law – Success and failures - electrons in metals – Particle in a three dimensional box – degenerate states – Fermi- Dirac statistics – Density of energy states – Electron in periodic potential: Bloch theorem – metals and insulators - Energy bands in solids– tight binding approximation - Electron effective mass – concept of hole.

UNIT II SEMICONDUCTOR PHYSICS (9)

Intrinsic Semiconductors – Energy band diagram – direct and indirect semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in Ntype& P-type semiconductors – Carrier transport: Velocity-electric field relations – drift and diffusion transport - Einstein's relation – Hall effect and devices – Zener and avalanche breakdown in p-n junctions - Ohmic contacts – tunnel diode - Schottky diode – MOS capacitor - power transistor.

UNIT III QUANTUM PHYSICS (9)

De Broglie hypothesis of matter waves; properties of matter wave; Wave function; Physical interpretation of wave function; Heisenberg uncertainty principle; non existence of electron in nucleus; Schrodinger ‘s time dependent wave equation; time independent wave equation; Particle trapped in one dimensional infinite potential well, – tunneling (qualitative) - scanning tunneling microscope, Quantum Computing.

UNIT IV OPTICAL PROPERTIES OF MATERIALS (9)

Classification of optical materials – carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and Semiconductors (concepts only) - photo current in a P- N diode – solar cell –photo detectors - LED – Organic LED – Laser diodes – excitons - quantum confined Stark effect – quantum dot laser.

UNIT V NANODEVICES AND QUANTUM COMPUTING (9)

Introduction - quantum confinement– quantum structures:quantum wells, wires and dots — band gap of nanomaterials. Tunneling – Single electron phenomena: Coulomb blockade-resonant-tunneling diode – single electron transistor – quantum cellular automata - Quantum system for information processing - quantum states – classical bits – quantum bits or qubits – CNOT gate -multiple qubits – Bloch sphere –quantum gates – advantage of quantum computing over classical computing

TOTAL PERIODS: 45

TEXTBOOKS

1. Umesh K Mishra & Jasprit Singh, “Semiconductor Device Physics and Design”, Springer, 2008.
2. Wahab, M.A. “Solid State Physics: Structure and Properties of Materials”. Narosa Publishing House, 2009.
3. Kasap, S.O. “Principles of Electronic Materials and Devices”, McGraw-Hill Education, 2007
4. Bhattacharya, D.K. & Poonam, T. ―Engineering Physics‖. Oxford University Press, 2015.
5. Jasprit Singh, ―Semiconductor Devices: Basic Principles, Wiley 2012.
6. Garcia, N. & Damask, A. ―Physics for Computer Science Students‖. Springer-Verlag, 2012

REFERENCES

1. Charles Kittel, Introduction to Solid State Physics, WileyIndiaEdition,2019.
2. Y.B.Band and Y. Avishai, Quantum Mechanics with Applications to Nanotechnology and Information Science, Academic Press, 2013.
3. V.V. Mitin, V.A.Kochelap and M.A.Stroscio ,Introduction to Nanoelectronics, Cambridge Univ. Press, 2008.
4. G.W.Hanson, Fundamentals of Nano electronics, Pearson Education (Indian Edition) 2009

CO-PO Mapping											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	3	-	-	2	-	-	-	-	2
CO2	3	3	3	-	-	2	-	-	-	-	2
CO3	3	3	3	-	-	2	-	-	-	-	2
CO4	3	3	3	-	-	2	-	-	-	-	2
CO5	3	3	3	-	-	2	-	-	-	-	2

Assessment Methodology	**Assessment Tools**	**Marks**
Test		25
MCQ unit wise 10 questions	Moodle / Google form	5
Virtual lab based assignment	Demo and viva	5
Attendance		5
Total		**40**

25UAII24	DIGITAL SYSTEM DESIGN FOR AIML	Category	L	T	P	Credit
		ES	3	0	2	4

Course Prerequisite

- Basic Programming Knowledge

Course Objective

- To design combinational logic circuits and Sequential logic circuits, including multiplexers, decoders, encoders, adders, subtractors, flip-flops and Latches. To learn the basics of IoT devices and types of boards.

Course Outcome

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

CO1	Understand the application of number representation and basic codes.	Understand
CO2	Understand Boolean algebra and its foundational theorems and use of the Karnaugh map simplification.	Understand
CO3	Design and analyse Combinational Logic Design and Programmable Logic Devices.	Analyse
CO4	Design and construct Combinational Logic circuits and Synchronous Sequential Circuits.	Analyse
CO5	Design and implement combinational logic circuits using PROM, PLA, and PAL	Apply

SYLLABUS

UNIT-I BASIC CONCEPTS (9)

Number System: Binary Number Representations – Signed Numbers and Complements, Unsigned, Fixed Point, and Floating-Point numbers. Addition and subtraction with 1‘s and 2‘s complements. Codes for detecting and correcting errors: Even and Odd parity codes

UNIT-II BOOLEAN ALGEBRA (9)

Boolean Algebra: Basic theorems- Postulates- Duality – Boolean Function- Canonical form- Standard form. Simplification of Boolean Function: Karnaugh Map Method. Basic Theorems - Simplification of K-map functions.

UNIT – III COMBINATIONAL LOGIC DESIGN (9)

Combinational Logic Design: Half adder - Full adder– Parallel Adder- Carry Look Ahead Adder – BCD Adder – Magnitude Comparator – Encoders and Decoders – Multiplexers – Code converters – Parity generator, Parity checker.

UNIT – IV SEQUENTIAL CIRCUITS (9)

Sequential Circuits: General model of sequential circuits –latches – Master-slave Configuration- Flip-Flops - Concept of State – State diagram – State Table. Design of Synchronous counters- Asynchronous counters- Shift Register- PN Sequence generator.

UNIT – VPROGRAMMABLE LOGIC DEVICES (9)

Programmable Logic Devices: PROM – EPROM – EEPROM- Programmable Logic Array (PLA) – Programmable Array Logic (PAL) -Realization of combinational circuits using PROM, PLA, and PAL.

TOTAL PERIODS: 45

TEXTBOOK(S)

1. M. Morris Mano and Michael D. Ciletti, Digital Design: With an Introduction to the Verilog HDL and System Verilog, 2018, 6th Edition, Pearson Pvt. Ltd.

REFERENCE BOOKS

1. Ming-Bo Lin, Digital Systems Design and Practice: Using Verilog HDL and FPGAs, 2015, 2nd Edition, Create Space Independent Publishing Platform.
2. Samir Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis, 2009, 2nd edition, Prentice Hall of India Pvt. Ltd.
3. Stephen Brown and Zvonko Vranesic, Fundamentals of Digital Logic with Verilog Design, 2013, 3rd Edition, McGraw-Hill Higher Education.

ONLINE/ NPTEL COURSES:

1. Digital Circuits: https://onlinecourses.nptel.ac.in/noc23 ee115
2. Digital Circuits Design: https://onlinecourses.nptel.ac.in/noc22 ee110
3. Microelectronics: Devices to Circuits: https://nptel.ac.in/courses/108107142

Mapping with Program Outcomes											
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
1	3	3	2	-	-	-	-	-	-	-	2
2	3	3	3	2	-	-	-	-	-	-	2
3	3	3	3	2	2	-	-	-	-	-	2
4	3	3	3	2	2	-	-	-	-	-	2
5	3	2	3	-	2	-	-	-	-	-	2

LIST OF EXPERIMENTS

1. Study Of Logic Gates
2. A) Design and Implementation of Adder
   B) Design And Implementation of Subtractor
3. Design And Implementation of Binary to Gray Code and Gray to Binary.
4. Design And Implementation Of 4-Bit Binary Adder/ Subtractor and BCD Adder Using IC7483
4. Design And Implementation 4-Bit Magnitude Comparator Using Logic Gates.
5. Design And Implementation of 4:1 Multiplexer Using Logic Gates.
6. Design And Implementation of Priority Encoder.
7. Study Of Flip-Flops Using Gates

8 Design and Implementation of Ring Counter and Johnson Counter Using a Shift Register IC.

9. Design And Implementation 3-Bit Binary Up/Down Counter Using ICs.
10. Simulation Of Combinational Circuits Using LTspice Tools.
11. Design And Implementation Of 4-Bit Adder-Subtractor and BCD Adder Using IC7483

Assessment Methodology	**Assessment Tools**	**Marks**
Theory Test		15
Logic design project	Hardware implementation	10
Digital system simulation (TINKERCAD)	Demo and viva	10
Model Practical		10
Attendance		5
Total		**50**

25UHSI25	PROFESSIONAL COMMUNICATION FOR ENGINEERS	Category	L	T	P	Credit
		HS	1	0	4	3

Course Prerequisite:

- Basics of English Language

Course Objective:

- To improve the communicative competence of learners
- To learn to use basic grammatic 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 professional contexts
- To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals

Course Outcome

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

CO1	Use appropriate words in a professional context.	Understand
CO2	Gain understanding of basic grammatic structures and use them in right context.	Understand
CO3	Speak fluently and accurately in formal and informal communicative contexts	Understand
CO4	Write definitions, descriptions, narrations and essays on various topics	Understand
CO5	Express their opinions effectively in both oral and written medium of communication	Analyze

SYLLABUS

UNIT I INTRODUCTION TO COMMUNICATION (9)

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?

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).

LAB ACTIVITY: Extempore (Oral), Conversation on asking directions, Listening – Telephone conversation; Speaking Self-introduction; Telephone conversation – Video conferencing etiquette.

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.

LAB ACTIVITY: Listening – Travel podcast; Speaking – Narrating and sharing personal experiences through a podcast, Autobiography of a famous Personality

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).

LAB ACTIVITY: Listening – Railway / Airport Announcements, Travel Vlogs; Speaking – Describing a place or picture description

UNIT-IV VISUALIZATION AND CLASSIFICATION (9)

Listening – TED talks Speaking – Interviewing a celebrity/Famous Personality Reading – Company profiles, Business Letters Vocabulary– Discourse Markers, Linking words and Phrases Collocation. Grammar – Pronouns, Conjunction, Preposition Writing – Interpretation of Charts and Graphs

LAB ACTIVITY: Picture Description, about purchasing a product, Summarizing a TED talk, Role play, Narrating an unforgettable event

UNIT V EXPRESSION COMMUNICATION (9)

Listening – Watching Movies / Listening to Dialogues and Conversations Speaking – Role play, Panel Discussion, Debate Reading – Blogs, Novels, Short Stories Vocabulary – Phrasal Verbs Grammar– Simple/Compound/Complex Sentences, Error Spotting, Punctuation. Writing – Descriptive Essay, Dialogue Writing

LAB ACTIVITY: Listening /Reading Comprehension, Developing a story using given Vocabulary, Mini Presentation on General topic (ICT tools), Group Discussion

TOTAL PERIODS: 45

TEXTBOOKS

Technical Communication: Principles and Practice Meenakshi Raman & Sangeeta Sharma Oxford University Press 3rd Edition (or latest)

Communication Skills Sanjay Kumar & Pushp Lata, Oxford University Press, 2nd Edition (2015)

Effective Technical Communication*:* M. Ashraf Rizvi, McGraw-Hill Education, 2nd Edition (2017)

1.A Course Book on Technical English By Lakshmi Narayanan, Scitech Publications (India) Pvt. Ltd.(English For Technical Communication (With CD) By Aysha Viswamohan, McGraw-Hill Education, ISBN : 0070264244.)

2. Effective Communication Skill, Kulbhusan Kumar, R S Salaria, Khanna Publishing House.

3. Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi, 2003.

Mapping with Programme Outcomes											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	1	-	-	2	-	-	-	-	3	2
CO2	1	2	-	-	2	-	-	2	-	3	2
CO3	1	2	-	-	-	-	-	1	-	3	2
CO4	1	3	-	-	3	-	1	2	-	3	2
CO5	1	2	-	-	2	-	1	3	-	3	2

Assessment Methodology	**Assessment Tools**	**Marks**
Test		15
Listening and reading Comprehension	Online tool	5
Speaking assessment (Oral)	review	10
Online assessment test	Online tool	10
Content creation Competition	Peer review	5
Attendance		5
Total		**50**

25UPHP27	APPLIED PHYSICS LAB	Category	L	T	P	Credit
		BS	0	0	2	1

Course Prerequisite:

- Basic Programming Knowledge

Course Objective:

- To improve the knowledge about the theory learned in the class. To improve ability to analyze experimental result and write laboratory report.

Course Outcome

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

CO1	Perform the experiments based on laser and fiber optics and its characteristics.	Analyse
CO2	Perform the experiments using a spectrometer.	Analyse
CO3	Perform experiments on semiconductor devices and analyze their characteristics.	Analyse

LIST OF EXPERIMENTS

1. Determination of angle of divergence of a laser beam using laser.
2. Determination of particle size of lycopodium powder using semiconductor laser.
3. Determination of wavelength of laser light using semiconductor laser diffraction.
4. Determination of numerical aperture and acceptance angle in an optical fiber.
5. Determination of Dispersive power of a prism using Spectrometer.
6. Determination of wavelength of mercury spectrum – spectrometer grating .
7. Determination of band gap of a semiconductor.
8. Determination of solar cell characteristics**.**

Assessment Methodology	Assessment Tools	Marks
Laboratory Conduction	Observation	10
Record work		10
Model exam		15
Viva		5
Virtual lab assignment	Review	5
STEM based model creation	Presentation	5
Attendance		10
Total		**60**

25UAIP27	PYTHON PROGRAMMING LAB	Category	L	T	P	Credit
		BS	0	0	4	2

Course Prerequisite:

- Programming Knowledge in C

Course Objective:

- To improve the programming knowledge in Python and its various components.

EXPERIMENTS

1. Identify and solve simple real-life/scientific/technical problems. (Electricity Billing, Retail shop billing, Sin series, etc).
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists and tuples.
5. Implementing real-time/technical applications using Sets and dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets &Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of a shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8 Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
9. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age, validity, student mark range validation)
10. Create a Python module with basic math functions and import it into another program.
11. Exploring Pygame tool. Developing a game activity using Pygame, like bouncing ball, car race, etc.
12. Create a simple Tkinter window with title and size.
13. Create a GUI with Label, Button, Entry box, and display the entered text on button click.
14. Design a GUI form with radio buttons and checkboxes and print selected options.
15. Use message box to show an alert or confirmation dialog.
16. Write a program to draw a square, circle, and triangle using Turtle.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	3	2	2	1	-	-	-	-	-	-	3
CO 2	3	2	2	1	-	-	-	-	-	-	3
CO 3	3	2	2	1	-	-	-	-	-	-	3
CO 4	3	2	2	1	-	-	-	-	-	-	3
CO 5	3	3	3	2	-	-	-	-	-	3	3

Assessment Methodology	Assessment Tools	Marks
Laboratory Conduction	Observation	10
Record work		10
Model exam		15
Viva		5
Mini Project	demo	10
Attendance		10
Total		**60**

25UGEP29	ENGINEERING GRAPHICS AND AUTO CAD LAB	Category	L	T	P	Credit
		ES	0	0	2	1

Course Prerequisite:

- Basic knowledge of geometry and fundamentals of computer operation.

Course Objective:

- To provides hands-on training in engineering drawing techniques and the use of AutoCAD software. The objective is to equip students with the skills to produce accurate 2D and 3D technical drawings, interpret engineering details, and apply CAD tools for design documentation.

Course Outcome

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

CO1	Use drawing instruments and follow BIS standards in manual drawings.	Understand
CO2	Develop orthographic and isometric projections manually	Analyze
CO3	Create and modify 2D drawings using AutoCAD	Apply
CO4	Generate sectional and dimensioned views in AutoCAD.	Evaluate
CO5	Apply CAD tools to visualize and plot engineering components.	Apply

Syllabus

UNIT-I

Introduction to Standards for Engineering Drawing practice, Lettering, Line work and Dimensioning. Conic sections, Involutes, Spirals, Helix. Projection of Points, Lines and planes

UNIT-II

Projection of Solids and Sections of solids

UNIT-III

Development of surfaces

UNIT-IV

Isometric projections and Conversion of pictorial to Orthographic views

UNIT-V

Computer Aided Drafting: Introduction to Computer Graphics and Drafting, AutoCAD,2-D diagrams of simple geometries using Auto- CAD script.

Text Books:

1. K.R.Gopalakrishna and Sudhir Gopalakrishna, Engineering Graphics,Inzinc Publishers, 2007.

REFERENCES

1. N.D.Bhatt, Engineering Drawing,49th edition,Chorotar Publishing House,2006.
2. K.Venugopal, Engineering DrawingandGraphics+AutoCAD,4th edition,NewAgeInternational Publication Ltd.,2004.
3. DavidIcook and Robert NMc Dougal, Engineering Graphics and Design with computer applications, Holt – Sounders Int. Edn.1985.
4. James D Bethuneandet.al., Modern Drafting,PrenticeHallInt.,1989.

CO PO Mapping											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	-	-	-		-	-	-	-	-	-
CO2	3	-	-	-		-	-	-	-	-	-
CO3	-	-	3	-	3	-	-	-	-	-	-
CO4	-	-	2	-	2	-	-	-	-	-	-
CO5	-	-		-	2	-	-	-	-	-	-

Assessment Methodology	**Assessment Tools**	**Marks**
Laboratory Conduction	Observation	10
Record work		10
Model exam		15
Viva		5
Virtual lab assignment	Review	5
Circuit Construction Task	demo	5
Attendance		10
Total		**60**

25UPCE21	COMMUNICATION SKILLS	Category	L	T	P	Credit
		EEC	0	0	2	0

Prerequisite: Carrier Development Skills

Preamble/ Course Objective: Ability to plan and manage their career paths effectively. It focuses on developing self-assessment, goal setting, and decision-making skills. Students will learn to research career options and align them with personal strengths and values.

Course Outcome

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

CO1	Develop sustained motivation and enhance interpersonal skills for effective communication and teamwork.
CO2	Build active listening and conversation skills essential for collaborative and respectful team interactions
CO3	Strengthen reading comprehension and writing clarity through critical analysis and audience-focused expression.
CO4	Improve public speaking and presentation skills while fostering self-assessment through SWOT analysis.
CO5	Promote team collaboration and communication through practical activities like debates and group problem-solving

Syllabus

UNIT 1: **10 Hrs**

Motivation –II: Intrinsic vs. Extrinsic Motivation- Goal Setting and Achievement - Building and Sustaining Motivation **Interpersonal skills:** Effective Communication - Active Listening - Conflict Resolution - Teamwork and Collaboration

UNIT 2: **10Hrs**

Listening Skills: Roles and Responsibilities in a Team - Building Trust and Respect Among Team Members – Effective Team Communication

Conversation skills: Starting and Maintaining a Conversation - Non-Verbal Communication Cues- Active Listening and Responding.

UNIT 3: **10 Hrs**

Reading Skills: Skimming and Scanning Techniques – Critical reading and Interpretation

Writing Skills:Grammar and Syntax - Clarity and Conciseness- Audience Awareness

UNIT 4: **10 Hrs**

Presentation Speaking Skills: Speech Structure and Organization – Verbal Delivery Techniques**Public speaking skills**: Confidence and overcoming Anxiety –Effective message Delivery

SWOT Analysis: Identifying Internal Factors – Analyzing External Factors

UNIT 5: **8 Hrs**

Team Building: Roles and Responsibilities in a team – Communication and Trust – Conflict resolution and Problem Solving

Active Sessions: Debate – Picture Connector

Text Books:

1. Soft skills for Managers by Dr. T. KALYANA CHAKRAVATHI
2. Personal Development and Soft Skills by BARUN K MITRA, Oxford Higher Education

Reference Books:

1. The Emotionally Intelligent Workplace by DANIEL GOLEMAN.
2. Communication skills and soft skills an integrated approach by E. SURESH KUMAR, P. SREEHARI, J SAVITHRI.
3. Top Talking in English (international communication skills) by CHARLES T. RAJENDRA
4. Soft skills by RAJ LAKSHMI SURYAVANSHI, Gurucool Publishing

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1:								2	2	2	2
CO2:									3	3	
CO3:										3	
CO4:								2		2	2
CO5:									3	3	

25UMCC21	IKS IN HUMANITIES AND SOCIAL SCIENCE	Category	L	T	P	Credit
		MCC	1	0	1	0

Course Prerequisite:

- Basic understanding of Indian history and culture

Course Objective:

- This course explores Indian Knowledge Systems in the context of humanities and social sciences, providing students with a deeper understanding of India's intellectual heritage.

Course Outcomes:

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

CO1	Understand the philosophical foundations and methodologies of Indian knowledge systems in the humanities.	Understand
CO2	Analyze Indian contributions to literature, arts, social organization, and governance systems	Analyze
CO3	Apply principles from Indian philosophical traditions to contemporary social and ethical issues	Apply
CO4	Evaluate the relevance and adaptability of traditional knowledge in modern social contexts	Evaluate
CO5	Create connections between ancient wisdom and contemporary challenges in society	Create

Syllabus

UNIT I: Philosophical Foundations of Indian Knowledge Systems (6 Hours) - Darshanas (Schools of Philosophy): Samkhya, Yoga, Nyaya, Vaisheshika, Mimamsa, Vedanta - Epistemology in Indian philosophy: Pramanas (means of knowledge) - Ethics and moral philosophy in Indian traditions - Concept of Dharma, Artha, Kama, and Moksha - Comparative study with Western philosophical traditions

UNIT II: Indian Literary and Artistic Traditions (6 Hours) - Sanskrit literature: Vedas, Upanishads, Puranas, Epics (Ramayana, Mahabharata) - Classical poetry and drama: Kalidasa, Bhartrhari, Bhasa - Regional literature and folk traditions - Indian classical music and dance: Theoretical foundations - Visual arts: Sculpture, painting, and architectural styles - Aesthetics in Indian tradition: Rasa theory and Alamkara shastra

UNIT III: Social Organization and Governance (6 Hours) - Ancient Indian social structure and organization - Varna and Ashrama systems: Historical context and evolution - Village self-governance: Panchayati Raj origins - Arthashastra: Principles of statecraft and administration - Justice system: Dharmashastra and Rajadharma - Economic systems: Trade, agriculture, and crafts

UNIT IV: Educational Systems and Knowledge Transmission (6 Hours) - Gurukula system: Teacher-student relationship - Ancient universities: Nalanda, Takshashila, Vikramshila - Oral tradition and preservation of knowledge - Women's education in ancient India - Integration of spiritual and material learning - Comparison with modern educational approach

UNIT V: Contemporary Relevance and Applications (6 Hours) - Indian knowledge systems in modern governance - Traditional conflict resolution mechanisms - Environmental consciousness in Indian traditions - Community-based development models - Gender studies: Women in Indian philosophical traditions - Relevance of Indian ethics in corporate governance - Cultural preservation and modernization challenges

LEARNING ACTIVITIES

Research Projects: 1. **Philosophical Analysis Project** - Study of a specific philosophical school - Comparison with contemporary thought - Presentation of findings

2. **Literary Heritage Study**
   - Analysis of classical texts
   - Cultural significance evaluation
   - Creative interpretation through modern media
3. **Social Systems Research**
   - Historical analysis of governance models
   - Contemporary applications study
   - Policy recommendation development
4. **Case Study Analysis**
   - Traditional knowledge applications
   - Success stories and challenges
   - Future implementation strategies

TEXTBOOKS

1. S. Radhakrishnan, "Indian Philosophy", Oxford University Press, 2008
2. A.L. Basham, "The Wonder That Was India", Rupa Publications, 2017
3. Kapila Vatsyayan, "Traditional Indian Art and Culture", Cambridge University Press, 2015

REFERENCE BOOKS

1. Heinrich Zimmer, "Philosophies of India", Princeton University Press, 1989
2. Romila Thapar, "Early India: From the Origins to AD 1300", Penguin Books, 2015
3. K.M. Munshi, "The History and Culture of the Indian People", Bharatiya Vidya Bhavan
4. Digital Library of India: https://www.dli.gov.in
5. Sahapedia - Encyclopedia of Indian Culture: https://www.sahapedia.org
6. Indian Council of Historical Research: https://ichr.ac.in
7. Archaeological Survey of India: https://asi.nic.in

Mapping with Programme Outcomes

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

25UMCC22	ENVIRONMENTAL SCIENCE AND SUSTAINABILITY	Category	L	T	P	Credit
		MCC	0	0	2	0

Course Prerequisite:

- Basic knowledge of chemistry, biology, and physics.

Course Objective:

- Understand fundamental concepts of environmental science and ecology
- Analyze environmental problems and their engineering solutions
- Develop awareness about sustainable development and green technologies
- Explore renewable energy systems and waste management strategies
- Foster environmental consciousness and responsible engineering practices

Course Outcome

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

CO1	Understand fundamental principles of environmental science and ecosystem dynamics	Understand
CO2	Analyze various types of pollution and their impact on human health and the environment	Analyze
CO3	Apply principles of sustainable development in engineering design and decision-making	Apply
CO4	Evaluate renewable energy technologies and waste management systems	Evaluate
CO5	Design environmentally sustainable solutions for engineering problems	Apply

SYLLABUS

UNIT IINTRODUCTION TO ENVIRONMENTAL SCIENCE AND ECOLOG (6)

Definition, scope and importance of environmental science - Structure and function of ecosystems - Biogeochemical cycles: Carbon, nitrogen, phosphorus, sulfur cycles - Biodiversity and its conservation - Environmental impact assessment principles.

UNIT IIENVIRONMENTAL POLLUTION AND CONTROL (6)

Air pollution: Sources, effects, and control measures - Water pollution: Industrial and domestic sources, treatment methods - Soil pollution: Causes, effects, and remediation techniques - Noise pollution: Sources, effects, and control - Solid waste management: 3R principles, waste-to-energy.

UNIT IIISUSTAINABLE DEVELOPMENT AND GREEN TECHNOLOGIES (6)

Concept of sustainable development and SDGs - Life cycle assessment (LCA) principles - Green building concepts and LEED certification - Cleaner production and industrial ecology - Environmental management systems (ISO 14001)

UNIT IV RENEWABLE ENERGY AND CLIMATE CHANGE (6)

Solar energy systems: Photovoltaic and thermal applications - Wind energy: Technology and site assessment - Hydroelectric and geothermal energy systems - Climate change: Causes, effects, and mitigation strategies - Carbon footprint and carbon trading mechanisms

UNIT V ENVIRONMENTAL REGULATIONS AND CASE STUDIES (6)

Environmental laws and regulations in India - Environmental clearance procedures - Corporate environmental responsibility - Case studies of environmental disasters and lessons learned - Future trends in environmental technology

TOTAL PERIODS: 30

TEXT BOOKS

1. G. Tyler Miller Jr., "Environmental Science: Working with the Earth", Cengage Learning, 2019
2. C. Anil Kumar, "Environmental Science and Engineering", PHI Learning, 2018
3. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, 2017

REFERENCE BOOK & WEB RESOURCES

1. Richard T. Wright, "Environmental Science: Toward a Sustainable Future", Pearson, 2017
2. Daniel B. Botkin, "Environmental Science: Earth as a Living Planet", Wiley, 2018
3. Central Pollution Control Board - www.cpcb.nic.in
4. Ministry of Environment and Forests - www.moef.gov.in
5. UN Environment Programme - www.unep.org
6. NPTEL Environmental Science Courses - nptel.ac.in

Mapping with Programme Outcomes

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

SEMESTER III

SEMESTER III							
S.No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
THEORY							
1	25UMAT31	Fourier Series, Probability And Statistics	BS	3	1	0	4
2	25UAIT31	Data structures and Algorithms	PC	3	0	0	3
3	25UAIT32	Computer Architecture and Organization	ES	3	0	0	3
4	25UAIT33	Operating System	PC	3	0	0	3
5	25UAIT34	Data Visualization	PC	3	0	0	3
INTEGRATED COURSE							
6	25UAII31	Object Oriented Programming using Java	PC	2	0	4	4
PRACTICAL							
7	25UAIP31	Data structures and Algorithms Lab	PC	0	0	2	1
8	25UAIP32	Operating System Lab	PC	0	0	2	1
EMPLOYABILITY ENHANCEMENT COURSES							
9	25UPCE31	Personality Development Skills	EEC	0	0	2	0
10	25UCCCXX	Certification Courses-II	CCC	0	0	0	0
MANDATORY COURSES							
11	25UMCC31	Indian Constitution & Human Rights	MCC	2	0	0	0
Total							**22**

FOURIER SERIES, PROBABILITY AND STATISTICS			
(Common to CSE, ICB, AIML & RA)			
Course Code:	25UMAT31	**Course Type:**	Theory
Teaching Periods / Week (L:T:P):	3:1:0	**Credits:**	4
Total Teaching Periods:	60	**CAM+ ESE Mark:**	40+60=100
Teaching Department:	MATHS		

Course Objectives:

To impart knowledge on Fourier series using change of intervals

Unit 1	**FOURIER SERIES**	**Periods:12**

Dirichlet 's conditions – General Fourier series - Expansion of periodic function into Fourier series – Fourier series for odd and even functions – Half-range Fourier cosine and sine series – Change of interval – Related problems.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT
	RBT Level: Apply

Unit 2	**PARSEVAL'S THEOREM & HARMONIC ANALYSIS**	**Periods:12**

Root Mean Square Value – Parseval 's theorem on Fourier Coefficients. Complex form of Fourier series – Harmonic Analysis.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT
	RBT Level: Apply

Unit 3	**DISCRETE RANDOM VARIABLES**	**Periods:12**

Random Variables and their event spaces – The probability mass function – Distribution functions – Binomial – Geometric – Negative Binomial and Poisson (Excluding Derivation of Mean, variance and MGF)

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT
	RBT Level: Apply

Unit 4	**CONTINUOUS RANDOM VARIABLES**	**Periods:12**

Probability density function – Exponential distribution – Gamma – Uniform – Gaussian distributions (Excluding Derivation of Mean, variance and MGF).

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Problem Solving
	RBT Level: Apply

Unit 5	**STATISTICS**	**Periods:12**

Measures of central tendency – Arithmetic Mean, Median, Mode and Standard deviation – Correlation – Rank correlation and regression.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Problem Solving
	RBT Level: Apply
Total	**Periods: 60**

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study, Students' performance in continuous Assessment / Student Presentations, Model Exam.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Compute a periodic function into series form.

CO2: Solve engineering problems on Fourier series expansion of complex functions, Harmonic analysis and Parseval's theorem.

CO3: Apply the concept of probability in random variables.

CO4: Solve the problem using continuous random variables.

CO5: Understand the basic concepts of Statistics.

Text Books:

1. M.K. Venkataraman, "Engineering Mathematics, The National Publishing Company, Madras, 2016.
2. Balaji, "Engineering Mathematics II and Transforms and Partial Differential Equations", Balaji publishers, 18th Edition, 2018.
3. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Co. New Delhi, 2019.
4. B.S. Grewal, "Higher Engineering Mathematics", Khanna publishers - Paperback – 3rd Edition - 2017.
5. T. Veerarajan, "Probability, Statistics and Random Processes", Tata McGraw-Hill Education, 2008.
6. Dr. A. Singaravelu, "Probability and Statistics", Meenakshi Agency, Paperback – 1, 2019.

References:

1. N.P. Bali and Dr. Manish Goyal, "Engineering Mathematics", Lakshmi Publications Pvt. Ltd. New Delhi, 9th Edition, 2015.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 10th Edition 2019.
3. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill, New Delhi 2018.
4. Ravish R. Singh, Mukul Bhatt "Engineering Mathematics", McGraw-Hill, 1stEdition, 2017.

5. William Mendenhall, Robert J. Beaver, Barbara M. Beaver: "Introduction to Probability & Statistics", Cengage Learning; 15th Edition 2019.
6. Richard. A. Johnson, Irwin Miller and John E. Freund," Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2018.

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/111105121/
2. https://nptel.ac.in/courses/111105035/
3. http:// www.stat110.net
4. http://www.nptel.ac.in/courses/111105035 (R.V)
5. http:// www.probabilitycourse.com.

CO-PO& PSO Mapping

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

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

DATA STRUCTURES AND ALGORITHMS			
Course Code:	25UAIT31	**Course Type:**	Theory
Teaching Periods / Week (L:T:P):	3:0:0	**Credits:**	3
Total Teaching Periods:	45	**CAM+ ESE Mark:**	40+60=100
Teaching Department:	AI&ML		

Course Objectives:

To impart comprehensive knowledge of fundamental data structures and algorithmic design techniques, enabling learners to analyze, implement, and apply efficient solutions to computational problems.

Unit 1	**BASIC TERMINOLOGIES OF DATA STRUCTURES**	**Periods:9**

Introduction: Data structures- Definition, Types. Algorithm: Definitions and notations- asymptotic notations, Properties. Analyzing algorithms: Space and Time Complexity-Array and its operations. Searching: Linear search- Binary Search- Fibonacci search. Sorting Algorithms: Selection Sort- Bubble Sort-Insertion sort- Heap sort. Hashing -Hash function and Hash table -Collision resolution Techniques.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT
	RBT Level: Apply

Unit 2	**STACK, QUEUE AND LINKED LISTS**	**Periods:9**

Stacks: Definition - Operations - Applications of Stack. Queues: Definition-Operations - Priority queues - De-queues - Applications of queue. Linked List: Singly Linked List- Doubly Linked List - Circular Linked List - Linked stacks - Linked queues - Applications of Linked List.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT
	RBT Level: Analyze

Unit 3	**TREE AND GRAPH**	**Periods:9**

Tree: Terminology - Representation - Operations -Traversals-Applications - Binary tree- Binary search tree - AVL tree- B Trees. Graph: Terminology- Representation- Traversals -Applications -single source shortest path algorithm -Topological sort.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT
	RBT Level: Analyze

Unit 4	**DIVIDE & CONQUER AND GREEDY METHOD**	**Periods:9**

D&C method: Recursion- analyzing recursive algorithms-maximum and minimum - merge sort - quick sort. Greedy Method: subset paradigm - ordering paradigm - knapsack problem - minimum spanning tree algorithms - optimal storage on tapes.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT

	RBT Level: Analyze	
Unit 5	**DYNAMIC PROGRAMMING AND BACKTRACKING**	**Periods:9**
Dynamic Programming: General method - multi-stage graphs - 0/1 Knapsack -Traveling salesman problem. Backtracking: The general method - 8-queens problem - sum of subsets - Hamiltonian cycle.		
Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Problem Solving	
	RBT Level: Analyze	
Total		**Periods: 45**

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study Students' performance in continuous Assessment / Student Presentations, Model Exam

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Explain the fundamental concepts of data structures, algorithm analysis, searching, sorting, and hashing techniques.

CO2: Design and implement linear data structures such as stacks, queues, and linked lists for solving computational problems.

CO3: Apply tree and graph data structures along with their traversal and optimization algorithms to model and solve real-world problems.

CO4: Analyze and implement Divide and Conquer and Greedy strategies for efficient algorithm design.

CO5: Analyze and apply Dynamic Programming and Backtracking techniques to solve optimization and combinatorial problems.

Textbooks:

1. Ellis Horowitz, Sartaj Sahni," Fundamentals of Data Structures", Illustrated Edition, Computer Science Press, 2018.
2. Thomas H. Coreman, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", PHI, Third Edition, 2010.
3. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, "Data Structures and Algorithms", 4th Edition, 2009.
4. Michael T. Goodrich and Robert, Tamassia, Wiley "Data Structures and Algorithms in Python", by, 1st Edition.

References:

1. D. Samanta, "Classic Data Structures", Prentice-Hall of India, Second Edition, 2012.
2. John Canning, Alan Broder, Robert Lafore, "Data Structures & Algorithms in Python", Addison-Wesley Professional,1st Edition, 2022

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/106106145 Introduction to Data Structures and Algorithms
2. https://nptel.ac.in/courses/106106182 Programming, Data Structures and Algorithms Using Python
3. https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_cs81

CO-PO & PSO Mapping

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

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

COMPUTER ARCHITECTURE AND ORGANIZATION			
Course Code:	25UAIT32	**Course Type:**	Theory
Teaching Periods / Week (L:T:P):	3:0:0	**Credits:**	3
Total Teaching Periods:	45	**CAM+ ESE Mark:**	40+60=100
Teaching Department:	AI&ML		

Course Objectives:

To learn the basic components of computer, instruction set architecture, memory hierarchy, Input Output Operations, basic processing concept and Pipelining.

Unit 1	**BASIC STRUCTURE OF COMPUTER & ISA**	**Periods:9**

Computer Types - Functional Units –Basic operational Concepts – Memory Location and Addresses-Instruction and Instruction sequencing-Addressing Modes-IA32 Registers –IA32 Addressing –IA 32 instructions-Program flow control –Logic and shift rotate operations-I/O Operations-Subroutines-Other Instruction.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 2	**INPUT OUTPUT ORGANIZATION**	**Periods:9**

Accessing I/O Devices-Interrupts-Hardware-Enabling and Disabling Interrupts-Handling Multiple Devices-Exceptions-Direct Memory Access-Buses-Synchronous Bus –Asynchronous Bus-Interface Circuits-Standard I/O interfaces.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 3	**MEMORY SYSTEM**	**Periods:9**

Basic Concepts – RAM memory-Internal organization of Memory Chip-Static Memory – Dynamic Memory-Read Only Memory –Memory Hierarchy-Cache memory-Mapping Functions-Replacement Algorithms-Performance Considerations-Virtual Memory-Secondary Storage.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 4	**BASIC PROCESSING UNIT**	**Periods:9**

Fundamental Concepts-Execution of Complete Instruction-Multiple Bus Organization-Hardwired Control-Micro programmed control-Microinstructions-Micro program sequencing-wide branch addressing.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 5	**PIPELINING**	**Periods:9**

Basic Concepts – Data Hazard-operand forwarding-Handling Data Hazards in Software – Instruction Hazard-Unconditional Branches- Branch Prediction-Influence on Instruction Set- Datapath and

Control Considerations – Superscalar Operations.		
Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz	
	RBT Level: Apply	
Total		**Periods: 45**

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study, Students' performance in continuous Assessment / Student Presentations, Model Exam.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Infer the functional units of computer and basic operations, studying about IA 32 Registers and Addressing modes, Shift/Rotate Instructions.

CO2: Discuss about the Accessing of I/O Devices, Interrupt working principles, Use of Interrupts in Operating Systems, Pentium Interrupt Structure, Direct Memory Access, Busses, Standard I/O Interfaces.

CO3: Discuss the Basic Concepts of memory system, Semiconductor RAM Memories, Read-Only Memories, Memory Hierarchy, Cache Memories, Performance Considerations, Virtual memory, Secondary Storage.

CO4: Infer Some Fundamental Concepts of processing unit ,Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control and Micro programmed Micro programme Control

CO5: Interpreting the Pipelining Concepts, Data Hazards, Instruction Hazards, Influence On Instructions Sets, Data path and Control Considerations, Superscalar Operations, Performance Considerations

Textbooks:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization ", Fifth Edition, Tata McGraw-Hill, 2011

References:

1. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 2016.
2. William Stallings, "Computer Organization and Architecture – Designing for Performance" Tenth Edition, Pearson Education, 2016.
3. David A.Patterson and John L.Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Elsevier,5th Edition, 2014.

Web links and Video Lectures (e-Resources):

1. Introduction to Computer Systems and its submodules: https://nptel.ac.in/courses/106103068
2. Computer Organization and Architecture: https://nptel.ac.in/courses/106106166
3. Computer Organization and Architecture A Pedagogical Aspect: https://nptel.ac.in/courses/106103180

CO-PO& PSO Mapping													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2	1	1	-	-	-	-	-	-	-	1	1
CO2	3	2	1	1	-	-	-	-	-	-	-	1	1
CO3	3	2	1	1	-	-	-	-	-	-	-	1	1
CO4	3	3	1	1	-	-	-	-	-	-	-	1	1
CO5	3	3	1	1	-	-	-	-	-	-	-	1	1
AVG	3	2.4	1	1	-	-	-	-	-	-	-	1	1
1 – Low, 2 – Medium, 3 – High, '-' – No correlation													

OPERATING SYSTEMS			
(Common to AIML,CSE & IT)			
Course Code:	25UAIT33	**Course Type:**	Theory
Teaching Periods / Week (L:T:P):	3:0:0	**Credits:**	3
Total Teaching Periods:	45	**CAM+ ESE Mark:**	40+60=100
Teaching Department:	AI&ML		

Course Objectives:

To have an overview of different types of operating systems and Operating system Services with case study of the Linux System, Windows and Android.

Unit 1	**INTRODUCTION TO OPERATING SYTSEMS**	**Periods:9**

Computer-System Organization - OS Structures- Operating-System Operations, Operating System Services, System Calls, System Programs – Processes- Concept, Scheduling, Operations on Processes, Inter-process Communication. Threads- Overview, Multithreading, Threading issues - CPU Scheduling – Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling, Real-Time Scheduling.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 2	**PROCESS MANAGEMENT**	**Periods:9**

The Critical- Section Problem, Synchronization Hardware, Semaphores, Classic problems of Synchronization, Monitors. Deadlock- Characterization, Methods for handling Deadlocks, Deadlock Prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlocks.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 3	**MEMORY MANAGEMENT**	**Periods:9**

Swapping, Contiguous Memory allocation, Paging, Segmentation, Structure of the Page table, Virtual Memory, Demand Paging, Page Replacement, Allocation of frames, Thrashing.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 4	**FILE SYSTEM INTERFACE**	**Periods:9**

File Concept, Access Methods, Directory and Disk Structure, File System Mounting, File Sharing, Protection. File System Implementation – Directory Implementation, Allocation Methods, Free-space Management. Kernel I/O Subsystems - Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 5	THE LINUX SYSTEM	Periods:9
Design Principles, Kernel Modules, Security - Windows - Design Principles, System Components, Networking - Mobile OS- Android - Design Goals, Android Architecture, Android Applications.		
Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz	
	RBT Level: Apply	
Total		**Periods: 45**

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study, Students' performance in continuous Assessment / Student Presentations, Model Exam.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Gain the knowledge of different types of operating systems, processes, threads and CPU scheduling concepts.

CO2: Realize the need for Process Synchronization and the various constructs for Process Synchronization.

CO3: Gain knowledge about file systems, directory management and mass storage systems.

CO4: Solve the problem using continuous random variables

CO5: Be familiar with the basics of OS like Linux and Windows and Android OS.

Textbooks:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2018.
2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022.

References:

1. Harvey M. Deitel, Paul J. Deitel, and David R. Choffnes, "Operating Systems", Prentice Hall, Third edition,2003.
2. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.
3. Gary J. Nutt, "Operating Systems: A Modern Perspective", Addison-Wesley, Second edition, 2001.

Web links and Video Lectures (e-Resources):

1. https://web.cs.wpi.edu/~cs3013/c07/
2. http://codex.cs.yale.edu/avi/os-book/OS8/os8c/slide-dir/
3. http://www.cse.iitd.ac.in/~sbansal/os/
4. https://archive.nptel.ac.in/courses/106/105/106105214/

CO-PO& PSO MAPPING													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO 2**
CO1	2	-	1	-	1	-	-	-	-	-	-	-	2
CO2	2	2	1	1	-	-	-	-	-	-	-	-	2
CO3	2	2	1	1	-	-	-	-	-	-	-	-	2
CO4	2	3	1	1	-	-	-	-	-	-	-	-	2
CO5	2	3	1	1	2	-	-	-	-	-	-	-	2
AVG	2	2	1	0.8	0.6	-	-	-	-	-	-	-	2
1 – Low, 2 – Medium, 3 – High, '-' – No correlation													

DATA VISUALIZATION			
Course Code:	25UAIT34	**Course Type:**	Theory
Teaching Periods / Week (L:T:P):	3:0:0	**Credits:**	3
Total Teaching Periods:	45	**CAM+ ESE Mark:**	40+60=100
Teaching Department:	AI&ML		

Course Objectives:

To impart knowledge on the basic concepts of Data visualization technique and preparing and Pre-processing data.

Unit1	**DATA VISUALIZATION**	**Periods: 9**

History of Visualization – Need for Visualization - Interactive Visualization – Web Specific Components – Common Types of Data Visualization – Data Visualization and Info graphics – Dashboards.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit2	**DATA ABSTRACTION**	**Periods: 9**

Data Set types – Attribute Types – Semantics. Task Abstraction: Actions – Targets. Charts – Data Preprocessing - Choosing the optimal charts– Making charts effective – Context in Visualization - Analyzing Visual Patterns – Beautiful vs Useful Design - Cognitive Load Theory - Responsive Design principles.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit3	**INTRODUCTION TO DATA VISUALIZATION TOOLS**	**Periods: 9**

Benefits of Data Visualization Tools - Data Visualization Tools - Google Data Studio - Qlikview - Tableau - Power BI - Features of Data Visualization Tool - Salient features of tools - Data Access from Data Sources - Data Transformation - Extraction, Transformation and Load (ETL) - Messy data - Data formats and schemas - Data blending or fusion - Methods for data cleansing - Data profiling - Open source data-cleansing tools.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit4	**DATA VISUALIZATION AND TABLEAU**	**Periods: 9**

Introduction to Tableau - Tableau Products Suite - Tableau File Types - Connecting to Data Sources: Working on Excel Data – Connecting to a Text Data Source - Handling R Data - Connecting to MS Access Database - Creating Basic Charts and Graphs: Creating a Pie Chart - Creating a Bar Chart - Creating a Line Graph - Discovering Scatter Plot.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz	
	RBT Level: Apply	
Unit5	**DATA VISUALIZATION AND QLIK**	**Periods: 9**
Performance and Tuning and Scalability - Qlik View Data Modeling - Best Practices for Loading - Advanced Expressions - Advanced Scripting - Styling up - Building Dashboards - Security - Data Visualization Strategy - Sales Perspective - Financial Perspective - Marketing Perspective.		
Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz	
	RBT Level: Apply	
Total		**Periods : 45**

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study / Students' performance in continuous Assessment / Student Presentations, Model Exam

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: To understand the Objectives of Data Visualization.

CO2: To understand professional data visualization techniques.

CO3: To understand data analysis and visualizations.

CO4: To learn the dataset with elements of a webpage, and modify the elements based on the data.

CO5: To build interactive Dashboards and Visualizations.

Textbooks:

1. Shai Vaingast, "Beginning Python Visualization - Crafting Visual Transformation Scripts", Apress, 2nd Edition, 2014.
2. Matthew O.Ward, "Interactive Data Visualization: Foundations, Techniques, and Applications", AK Peters / CRC Press.
3. Seema Acharya, "Data Visualization with Tableau", Packt Publishing, 2018.

References:

1. Andrew Rininsland and Swizec Teller, "D3.js 4.x Data Visualization", 3rd Edition, Kindle, 2017.
2. Wes Mc Kinney, "Python for Data Analysis", O'Reilly Media,2012.

Web links and Video Lectures (e-Resources):

1. https://archive.nptel.ac.in/courses/106/106/106106212/

CO-PO& PSO MAPPING													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO 2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2
CO2	3	-	-	1	-	-	-	-	-	-	-	-	2
CO3	3	-	-	-	1	-	-	-	-	-	-	-	2
CO4	3	2	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	3	3	2	-	-	-	-	-	-	-	2
AVG	3	0.8	0.6	0.8	0.6	-	-	-	-	-	-	-	2
1 – Low, 2 – Medium, 3 – High, '-' – No correlation													

OBJECT ORIENTED PROGRAMMING USING JAVA			
Course Code:	25UAII31	**Course Type:**	Integrated Course
Teaching Periods / Week (L:T:P):	2:0:4	**Credits:**	4
Total Teaching Periods:	60	**CAM+ ESE Mark:**	50+50=100
Teaching Department:	AI&ML		

Course Objectives:

To introduce learners to the foundational principles of Java programming and guides them through structured problem-solving using classes, objects, and reusable code.

Unit 1	**INTRODUCTION TO OOP AND JAVA**	**Periods: 12**

Overview of OOP – Object oriented programming paradigms – 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

Practical:

1. Program to implement constructors and destructors with array of objects.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 2	**INHERITANCE, PACKAGES AND INTERFACES**	**Periods: 12**

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- Design Pattern, Creational. Structural, Behavioral.

Practical:

1. Program to demonstrate function overloading.
2. Program to implement different types of inheritances like multiple, Multilevel and hybrid.
3. I/O Program to demonstrate the use of abstract classes.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 3	**EXCEPTION HANDLING AND MULTITHREADING**	**Periods: 12**

Exception Handling basics – Multiple catch Clauses – 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. Wrappers – Auto boxing

Practical:

1. Program to demonstrate I/O streams and functions.
2. Program to perform all possible type conversions.
3. Program to demonstrate exception handling technique.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 4	**I/O, GENERICS, STRING HANDLING**	**Periods: 12**

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.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 5	**JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS**	**Periods: 12**

JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, Toggle Button – Radio Buttons – List View – Combo Box – Choice Box – Text Controls – Scroll Pane. Layouts – Flow Pane – HBox and VBox – Border Pane – Stack Pane – Grid Pane. Menus – Basics – Menu – Menu bars – Menu Item.

Practical:

1. Program to implement networking concepts.
2. Program to design and implement JDBC.
3. Program to design an event handling event for simulating a simple calculator.
4. Build GUI based application development using JavaFX.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Total	**Periods: 60**

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study, Students' performance in continuous Assessment / Student Presentations, Model Exam.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Understand the principles of Object-Oriented Programming (OOP) and its implementation using Java, including classes, methods, and access specifiers.

CO2: Apply concepts of inheritance, polymorphism, and abstraction in developing Java programs.

CO3: Analyze error-handling mechanisms using exception handling and implement multithreading for concurrent programming.

CO4: Develop generic programs and handle strings effectively using Java's built-in libraries.

CO5: Design graphical user interfaces (GUIs) and event-driven applications using JavaFX controls, layouts, and menus.

Textbooks:

1. Herbert Schildt, "Java: The Complete Reference", McGraw Hill Education, 11th Edition, 2019.
2. Herbert Schildt, "Introducing JavaFX 8 Programming", McGraw Hill Education,1st Edition, 2015.

References:

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

Web links and Video Lectures (e-Resources):

1. Object Oriented System Development using UML: https://nptel.ac.in/courses/106105224
2. Java: https://nptel.ac.in/courses/106105225

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	1	2	3
CO2	3	2	1	1	-	-	-	-	-	-	2	2	3
CO3	3	3	2	2	2	-	-	-	-	-	2	3	3
CO4	2	1	1	3	3	-	-	-	-	-	3	3	2
CO5	2	2	1	3	3	-	-	-	-	-	3	3	2
AVG	2.6	2	1.0	1.8	1.6	-	-	-	-	-	2.2	2.6	2.6

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

DATA STRUCTURES AND ALGORITHMS LAB			
Course Code:	25UAIP31	**Course Type:**	Practical
Teaching Periods/Week(L:T:P):	0:0:2	**Credits:**	1
Total Teaching Periods:	45	**CAM+ESE Mark:**	60+40=100
Teaching Department:	AI&ML		

Course Objectives:

To enable students write programs using various data structures, analyze and understand the benefits of choosing the right data structure.

Practical Exercises: **Periods : 45**

LIST OF EXPERIMENTS

1. Searching Algorithms (With the Number of Key Comparisons) - Sequential, Binary and Fibonacci Search Algorithms on an Ordered List
2. Sorting Algorithms: Insertion Sort, Selection Sort, Bubble Sort, Quick Sort, Heap Sort and Merge Sort.
3. Implementation of Stack and Its Operations.
4. Application of Stack for Converting an Arithmetic Expression into Postfix Form and Evaluation of Postfix Expression.
5. Implementation of Queue, Circular Queue, Priority Queue, Dequeue and Their Operations.
6. Implementation of Singly Linked List, Doubly Linked List, Circular Linked List.
7. Implementation of Binary Tree and Binary Traversal Techniques.
8. Implementation of Graph Traversal Techniques.
9. Implement Dijkstra's Algorithm to Obtain the Shortest Paths.
10. Implementation of Hash Tables and its Operations.

Software Required:

1. Python

References:

1. D. Samanta, "Classic Data Structures", Prentice-Hall of India, Second Edition, 2012.
2. John Canning, Alan Broder, Robert Lafore, "Data Structures & Algorithms in Python", Addison-Wesley Professional,1st Edition, 2022.

Course Outcomes:

CO1: Discuss the Algorithmic Notation with the programming principles for creating the programs for analysis and sorting techniques**.**

CO2: Interpret the operations and applications of linear data structures Stack, queue with applications dynamic Storage management.

CO3: Apply the Concepts of Linked List and its types in real world scenario

CO4: Apply the tree concepts binary tree and its terminologies with the representation and traversal applications in search tree, AVL tree and B Trees.

CO5: Discuss the concepts of sets, tables and graphs

CO–PO & PSO Mapping

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

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

OPERATING SYSTEMS LAB			
Course Code:	25UAIP32	**Course Type:**	Practical
Teaching Periods/Week(L:T:P):	0:0:2	**Credits:**	1
Total Teaching Periods:	45	**CAM+ESE Mark:**	60+40=100
Teaching Department:	AI&ML		

Course Objectives:

The program execution and requirements processes, threads, memory management, files and to impart Hands-on practical experience in different OS concepts.

Practical Exercises: **Periods:45**

LIST OF EXPERIMENTS (All experiments to be worked in LINUX environment)

1. Installation of windows operating system
2. Install any guest operating system like Linux using VMware.
3. Illustrate

a. UNIX commands

b. Shell Programming using System Calls:fork(), exit(), getpid(), wait(), close(), open(), read() ,write(), grep().

4. Write C programs to implement the various CPU Scheduling Algorithms
5. Implement mutual exclusion by Semaphore
6. Write C programs to avoid Deadlock using Banker's Algorithm
7. Write a program that illustrates communication between two process using unnamed pipes.
8. Write C programs to implement the following Memory Allocation Methods

   a. First Fit b. Worst Fit c. Best Fit
9. Write C programs to implement the various Page Replacement Algorithms
10. Write C programs for the implementation of various disk scheduling algorithms

SOFTWARE REQUIRED

1. Linux
2. C

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1 Install and configure Windows and Linux operating systems using virtualization tools, and demonstrate proficiency in UNIX commands and shell programming.

CO2 Develop and execute C programs to implement CPU scheduling algorithms, Linux system calls, and inter-process communication using unnamed pipes.

CO3 Implement process synchronization using semaphores and deadlock avoidance using the Banker's Algorithm.

CO4 Implement and analyse memory management techniques, including memory allocation methods and page replacement algorithms.

CO5 Implement disk scheduling algorithms and apply operating system concepts to analyse and optimize system resource management.

CO–PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	-	1	-	1	-	-	-	-	-	-	1	2
CO2	2	2	1	1	-	-	-	-	-	-	-	1	2
CO3	2	2	1	1	-	-	-	-	-	-	-	1	2
CO4	2	3	1	1	-	-	-	-	-	-	-	1	2
CO5	2	3	1	1	2	-	-	-	-	-	-	1	2
AVG	2	2	1	0.8	0.6	-	-	-	-	-	-	1	2

1–Low, 2–Medium, 3–High, '-' –No correlation

PERSONALITY DEVELOPMENT SKILLS			
(Common to All Branches of UG Engineering Programs)			
Course Code:	25UPCE31	**Course Type:**	EEC
Teaching Periods / Week (L:T:P):	0:0:2	**Credits:**	0
Total Teaching Periods:	48	**Evaluation**	CAM
Teaching Department:	PLACEMENT		

Course Objectives:

Enable students to develop a well-rounded personality by enhancing essential personal and professional skills. The course aims to foster self-awareness, effective communication, interpersonal abilities, emotional intelligence, confidence, leadership, and goal-setting strategies.

Unit 1	**WORKPLACE AND EMAIL ETIQUETTE**	**Periods: 10**

Workplace and Email Etiquette: Professional Behavior and Dress Code – Email and Meeting Etiquette
Microsoft office suite:MS Word(Document Creation and Formatting) - MS Excel (Data Analysis and Functions) - MS PowerPoint (Creating Effective Presentations)

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT
	RBT Level: Apply

Unit 2	**BASIC COMMUNICATION**	**Periods: 10**

Business Communication: Verbal and Non - Verbal Communication – Written Communication in Business.
Sales and Negotiations: Sales Techniques and Strategies – Negotiation Tactics and Styles.
Customer Service: Effective Communication Skills- Customer support channels and Tools.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT
	RBT Level: Apply

Unit 3	**DECISION MAKING AND PROBLEM SOLVING**	**Periods: 10**

Decision Making: Types of Decision Making – Decision Making models and Techniques – Cognitive Biases and Risk Assessment

Problem Solving: Problem Identification and Analysis – Creative and Critical Thinking techniques – Implementation and Evaluation techniques.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT
	RBT Level: Apply

Unit 4	**INTERVIEW SKILLS, RESUME BUILDING AND BEHAVIORAL SKILLS**	**Periods: 10**

Interview Skills: Preparation and Research – Effective Communication and Presentation

Resume Building: Resume Formats and Structure – Tailoring Resumes for Specific Jobs

Mannerism: Body Language – Respect and Courtesy in Interactions

Behavioral skills: Emotional Intelligence – Adaptability and flexibility

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT	
	RBT Level: Apply	
Unit 5	**GROUP DISCUSSION**	**Periods: 8**
Group Discussion: Effective communication and Active Listening – Leadership and Participation skills – Critical Thinking and Topic Analysis **Monk Interview**: Common Interview Questions and Ideal Responses – Feedback and Self Assessment		
Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT	
	RBT Level: Apply	
Total		**Periods: 48**

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study, Students' performance in continuous Assessment / Student Presentations, Model Exam.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Apply workplace etiquette and use Microsoft Office tools effectively for professional communication and documentation.

CO2: Demonstrate effective communication skills in business contexts, including sales, negotiation, and customer service scenarios.

CO3: Apply structured decision-making and problem-solving techniques in professional and organizational settings.

CO4: Prepare for interviews and present oneself professionally with an effective resume, proper mannerisms, and behavioral skills.

CO5: Demonstrate confidence and clarity in group discussions and interviews through guided practice and feedback.

Textbooks:

1. Personal Development and Soft Skills By BARUNKMITRA, Oxford Higher Education.
2. Seven Habits of Highly Effective People by STEPHENCOVEY.

References:

1. Communication Skills by SANJAY KUMAR, PUSHP , Oxford Higher Education
2. Communication Skills for Professionals by NIRAKONAR, PHI learning Pvt. Ltd.

CO-PO& PSO Mapping													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**
CO1	-	-	-		2	-	-	-	2	2	-	-	-
CO2	-	-	-	-	-	-	-	2	2	2	-	-	-
CO3	2	-	-	2	-	-	-	-	-	-	2	-	-
CO4	-	-	-	-	-	-	-	-	2	2	2	-	-
CO5	-	-	-	-	-	-	-	-	2	2	2	-	-
AVG	0.4	-	-	0.4	0.4	-	-	0.4	1.6	1.6	1.2	-	-
1 – Low, 2 – Medium, 3 – High, '-' – No correlation													

INDIAN CONSTITUTION AND HUMAN RIGHTS			
(Common to All Branches of UG Engineering Programs)			
Course Code:	25UMCC31	**Course Type:**	Mandatory Course (Audit)
Teaching Periods / Week (L:T:P):	2:0:0	**Credits:**	0 (Zero)
Total Teaching Periods:	30	**Evaluation**	CAM
Teaching Department:	General Engineering		

Course Objectives:

To impart knowledge on:

1. Historical background, Preamble, and salient features of the Indian Constitution
2. Fundamental Rights, Directive Principles of State Policy, and Fundamental Duties
3. Structure and functioning of Union, State, and Local Self Governments
4. Universal Human Rights principles and international protection frameworks
5. Contemporary human rights issues and remedial mechanisms in India

UNIT 1	INTRODUCTION TO INDIAN CONSTITUTION	6

Historical Background: Making of the Constitution - Constituent Assembly and its key members - Draft Committee. Preamble: Philosophy and Core Values - Sovereign, Socialist, Secular, Democratic, Republic - Justice, Liberty, Equality, Fraternity. Salient Features of Indian Constitution: Written Constitution - Lengthy document - Blend of Rigidity and Flexibility - Federal Structure with Unitary Bias - Parliamentary System.

Instructional Activity

Timeline Activity on Constitutional History (or) Preamble Analysis Worksheet

Teaching Learning Process	Pedagogy: Interactive Lecture, Think-Pair-Share, Video-based Learning (Documentary on Constituent Assembly), Group Discussion
	RBT Level: Understand

UNIT 2	FUNDAMENTAL RIGHTS AND DUTIES	6

Fundamental Rights (Articles 12-35): Right to Equality (Art. 14-18) - Right to Freedom (Art. 19-22) - Right Against Exploitation (Art. 23-24) - Right to Freedom of Religion (Art. 25-28) - Cultural and Educational Rights (Art. 29-30) - Right to Constitutional Remedies (Art. 32): Writs - Habeas Corpus, Mandamus, Prohibition, Certiorari, Quo Warranto.

Directive Principles of State Policy (Articles 36-51): Classification - Socialistic, Gandhian, Liberal-Intellectual Principles. Fundamental Duties (Article 51A): Citizen Responsibilities - 11 Duties. Relationship and Conflict between Fundamental Rights and Directive Principles.		
Instructional Activity		
Case Study Analysis on Landmark Supreme Court Judgments (or) Mock PIL Filing Exercise (or) Rights Violation Scenario Analysis		
Teaching Learning Process	Pedagogy: Case Study Method, Role Play (Mock Court), Jigsaw Activity, Debate Session (FR vs DPSP), Scenario-based Learning, Problem-Based Learning	
	RBT Level: Understand	
UNIT 3	**UNION AND STATE GOVERNMENT STRUCTURE**	**6**
Union Executive: President - Election, Powers, Position - Vice-President - Prime Minister and Council of Ministers - Cabinet Committees. Union Legislature: Parliament - Lok Sabha and Rajya Sabha - Composition, Functions - Legislative Process - Bill to Act. State Executive: Governor - Chief Minister - State Council of Ministers. State Legislature: Legislative Assembly and Council - State Law-making Process. Centre-State Relations: Legislative, Administrative, and Financial Relations - Role of Finance Commission. Local Self Government: 73rd Amendment (Panchayati Raj) - 74th Amendment (Urban Local Bodies) - Three-tier System.		
Instructional Activity		
Flowchart Creation (Bill to Law) (or) Field Visit Report on Local Panchayat/Municipality		
Teaching Learning Process	Pedagogy: Simulation Exercise, Collaborative Learning, Comparative Analysis (Venn Diagrams), Field Visit/Virtual Tour, Guest Lecture by Government Official	
	RBT Level: Understand	
UNIT 4	**HUMAN RIGHTS: CONCEPTS AND FRAMEWORKS**	**6**
Evolution of Human Rights: Historical Development - Natural Rights Theory - Magna Carta - French Declaration - American Bill of Rights. Universal Declaration of Human Rights (UDHR) 1948: 30 Articles - Civil, Political, Economic, Social, Cultural Rights. International Human Rights Instruments: ICCPR - ICESCR - CEDAW - CRC - CAT - CERD. Human Rights in Indian Constitution: Part III and Part IV Provisions. National Human Rights Commission (NHRC): Composition - Functions - Powers - Procedure. State Human Rights Commissions - National Commission for Women, SC, ST, Minorities.		
Instructional activities		

NHRC Case Study Analysis		
Teaching Learning Process	Pedagogy: Video Case Study, Seminar Presentation	
	RBT Level: Apply	
UNIT 5	**CONTEMPORARY HUMAN RIGHTS ISSUES**	**6**
Rights of Vulnerable Groups: Women (POSH Act, Domestic Violence Act) - Children (POCSO, JJ Act) - Elderly (Maintenance Act) - Persons with Disabilities (RPWD Act 2016). Rights of Marginalized Communities: SC/ST (Prevention of Atrocities Act) - Minorities - LGBTQ+ (Navtej Singh Johar Case). Right to Information (RTI Act 2005): Provisions and Application. Right to Education (RTE Act 2009). Environmental Rights: Right to Clean Environment - Sustainable Development - PIL on Environmental Issues. Digital Rights: Right to Privacy (Puttaswamy Case) - Data Protection - Cyber Rights. Human Rights Violations and Remedies: Legal Aid - Grievance Redressal Mechanisms.		
Instructional activities		
RTI Application Drafting Workshop (or) Case Study on HR Violations		
Teaching Learning Process	Pedagogy: Problem-Based Learning, Panel Discussion, RTI Workshop	
	RBT Level: Apply	
		Total Periods: 30
Suggested Activities and Evaluation Methods:		
Active Learning: Case Studies, Role Play, Mock Court/Parliament, Group Discussions, Debates, Panel Discussions Practical Activities: RTI Application Drafting, Field Visits to Panchayat/Municipal Offices, Digital Tools: Kahoot Quizzes, Mentimeter Polls, Online Discussion Forums, Digital Portfolios Assessment Methods: Entry/Exit Tickets, One-Minute Papers, Peer Review, Reflective Journals, Group Presentations Evaluation: CAT, Model Exam, Continuous Assessment through Formative Activities, End-Semester Viva-voce/Written Test		
Course Outcomes: After successful completion of this course, the student should be able to: **CO1** Understand the historical background of the Indian Constitution, the role of the Constituent Assembly and Drafting Committee, the philosophy and core values of the Preamble, and the salient features of the Indian Constitution. [K2: Understand]		

CO2 Describe the Fundamental Rights, Directive Principles of State Policy, and Fundamental Duties, including constitutional remedies and writs, and explain their relationship through judicial interpretations. [K2: Understand]

CO3 Understand the structure, powers, and functions of the Union, State, and Local Self Governments, including legislative processes and Centre–State relations under the Indian Constitution. [K2: Understand]

CO4 Apply the concepts and principles of human rights to identify international human rights frameworks and analyze the role of constitutional and statutory bodies in human rights protection in India. [K3: Apply]

CO5 Apply constitutional provisions, laws, and remedial mechanisms to analyze contemporary human rights issues, including those related to vulnerable groups, digital rights, environmental rights, and grievance redressal systems. [K3: Apply]

Textbooks:

T1: D.D. Basu, "Introduction to the Constitution of India", 24th Edition, LexisNexis, 2020.

T3: S.K. Kapoor, "Human Rights Under International Law and Indian Law", Central Law Agency, 2018.

References:

R1: Granville Austin, "The Indian Constitution: Cornerstone of a Nation", Oxford University Press, 2019.

R2: J.N. Pandey, "Constitutional Law of India", 57th Edition, Central Law Agency, 2020.

R3: P.M. Bakshi, "The Constitution of India", Universal Law Publishing, 2020.

Web Links and Video Lectures (e-Resources):

1. Constitution of India - https://legislative.gov.in/constitution-of-india
2. National Human Rights Commission - https://nhrc.nic.in
3. SWAYAM Course on Indian Constitution - https://swayam.gov.in
4. NPTEL Course on Constitution of India - https://nptel.ac.in

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	2	2			-	1	-	-
CO2	-	-	-	-	-	3	3	1	1	-	2	-	-
CO3	-	-	-	-	-	2	2	1		-	1	-	-
CO4	-	-	-	-	-	3	2		2	-	2	-	-
CO5	-	-	-	-	-	3	3	2	2	-	2	-	-
AVG	-	-	-	-	-	2.6	2.4	1.3	1.7	-	1.6	-	-

1 - Low, 2 - Medium, 3 - High

SEMESTER IV

DISCRETE MATHEMATICS			
(Common to all)			
Course Code:	25UMAT41	**Course Type:**	Theory
Teaching Periods / Week (L:T:P):	3:1:0	**Credits:**	4
Total Teaching Periods:	60	**CAM+ESE Mark:**	40+60=100
Teaching Department:	MATHS		

Course Objectives:

- To introduce the fundamental concepts of propositional and predicate logic for mathematical reasoning and proof techniques.
- To develop skills in combinatorial analysis and problem-solving using counting principles, permutations, combinations and recurrence relations.
- To provide knowledge of graph theory concepts and their applications in modelling and solving real-world problems.
- To examine algebraic structures including groups, rings, and fields, and their fundamental properties.
- To familiarize students with lattice theory and Boolean algebra for applications in computer science and digital logic design.

Unit 1	**LOGIC AND PROOFS**	**Periods:12**

Propositional Logic–Propositional Equivalences–Normal Forms–Predicates and Quantifiers–Nested Quantifiers–Rules of Inference–Introduction to Proofs–Proof Methods and Strategy

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT
	RBT Level: Analyze

Unit 2	**COMBINATORICS**	**Periods:12**

Mathematical Induction –Strong Induction and Well Ordering–The Basics of Counting–The Pigeonhole Principle–Permutations and Combinations–Recurrence Relations–Solving Linear Recurrence Relations Using Generating Functions –Inclusion-Exclusion Principle and its Applications.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT
	RBT Level: Apply

Unit 3	**GRAPHS**	**Periods:12**

Graphs and Graph Models –Graph Terminology and Special types of Graphs –Matrix Representation of Graphs and Graph Isomorphism –Connectivity–Euler and Hamiltonian Paths.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT
	RBT Level: Analyze

Unit 4	**ALGEBRAIC STRUCTURES**	**Periods:12**

Groups–Subgroups – Homomorphisms – Normal Subgroups and Cosets – Lagrange's Theorem – Rings and Fields (Definitions and Examples only).

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT
	RBT Level: Analyze

Unit 5	LATTICES AND BOOLEAN ALGEBRA	Periods:12
Partial Ordering – Posets – Lattices as Posets– Properties of Lattices –Lattices as Algebraic Systems– Sub lattices –Direct Product and Homomorphism – Some Special Lattices– Boolean Algebra.		
Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Problem Solving	
	RBT Level: Analyze	
Total		**Periods: 60**

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study, Students' performance in continuous Assessment / Student Presentations, Model Exam.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Apply propositional and predicate logic to construct valid arguments and develop mathematical proofs using various proof techniques.

CO2: Solve counting problems using mathematical induction, pigeonhole principle, permutations, combinations, and recurrence relations.

CO3: Analyze graph properties, determine connectivity, and identify Eulerian and Hamiltonian paths in various graph models.

CO4: Apply the concepts of groups, subgroups, homomorphisms, and verify properties of rings and fields.

CO5: Apply lattice theory and Boolean algebra concepts to solve problems in computer science and digital circuit design.

Textbooks:

T1: Kenneth H.Rosen, "Discrete Mathematics and its Applications", Tata Mc Graw Hill Pub. Co. Ltd., Seventh Edition, Special Indian Edition, New Delhi, 2011.

T2: Tremblay J.P. and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd., Third Edition, New Delhi,2013.

References:

R1: Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing CompanyLimited, New Delhi, 2017.

R2: Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", 5th Edition, Pearson Education Asia, Delhi, 2019.

R3: Thomas Koshy," Discrete Mathematics with Applications", Elsevier Publications, Boston, 2004

R4: Grimaldi R.P., "Discrete and Combinatorial Mathematics", Pearson Education Pvt.Ltd.,5th Edition, Singapore,2004.

Web links and Video Lectures (e-Resources):

1. https://www.researchgate.net/publication/1922282_Discrete_Mathematics_for_Computer_Science_Some_Notes
2. https://nptel.ac.in/courses/111/107/111107058/
3. https://nptel.ac.in/courses/106/106/106106183/
4. https://www.pdfdrive.com/discrete-mathematics-for-computer-science-e17017833.html
5. https://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf

CO-PO& PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	-	1	-	-	-	1	-	1	-	-
CO2	3	2	2	-	1	-	-	-	1	-	1	-	-
CO3	3	2	2	-	1	-	-	-	1	-	1	-	-
CO4	3	2	2	-	-	-	-	-	1	-	-	-	-
CO5	3	2	2	-	-	-	-	-	1	-	-	-	-
AVG	3	2	2	-	0.6	-	-	-	1	-	0.6	-	-

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

COMPUTER NETWORKS			
Course Code:	25UAIT41	**Course Type:**	Theory
Teaching Periods/Week (L:T:P):	3:0:0	**Credits:**	3
Total Teaching Periods:	45	**CAM+ESE Mark:**	40+60=100
Teaching Department:	AI&ML		

Course Objectives:

- To describe the Network Architecture and the performance metrics of switched networks.
- To demonstrate the various Link layer services.
- To explain the concepts of subnetting and routing mechanisms.
- To illustrate the process-to-process delivery models and congestion control principles.
- To summarize the services of various protocols in Application layer.

Unit1	**PHYSICAL LAYER**	**Periods: 9**

Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit2	**DATA LINK LAYER**	**Periods: 9**

Introduction – Link-Layer Addressing – Error Detection and Correction– DLC Services-Framing – Data Link Layer Protocols – HDLC – PPP - Media Access Control –Random access- Wired LANs: Ethernet - Wireless LANs –IEEE 802.11- Connecting Devices.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit3	**NETWORK LAYER**	**Periods: 9**

Network Layer Services– IPV4 Addresses-Classful Addressing-Classless Addressing-Dynamic Host Configuration Protocol (DHCP)- Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms and Protocols- IPV6 Addressing.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit4	**TRANSPORT LAYER**	**Periods: 9**

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol – SCTP.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit5	**APPLICATION LAYER**	**Periods: 9**

World Wide Web and HyperText Transfer Protocol – File Transfer Protocol – Electronic Mail –Telnet – Secure Shell – Domain Name System – Simple Network Management Protocol.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Total	**Periods: 45**

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study, Students' performance in continuous Assessment / Student Presentations, Model Exam

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Make use of evaluation metrics to measure the performance of packet switched network.

CO2: Utilize the Link layer services for various IEEE standards.

CO3: Experiment with subnetting to optimize network configuration and various routing algorithms for unicast routing

CO4: Choose protocols for Process to Process communication in various applications.

CO5: Utilize application layer protocols for real time Scenario.

Textbooks:

1. Behrouz A. Forouzan, "Data Communications and Networking", 5 th Edition, Tata McGraw Hill.
2. William Stallings, "Data and Computer Communication", 10th Edition, Pearson Education, 2022.
3. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", 6th Edition, Morgan Kaufmann Publishers Inc., 2017.

References:

1. Nader F. Mir, "Computer and Communication Networks", 2 nd Edition, Prentice Hall, 2015.
2. James F. Kurose, Keith W. Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", 8th Edition, Pearson Education, 2022.

Web links and Video Lectures (e-Resources):

1. Computer Networks: https://nptel.ac.in/courses/106105080
2. Emergence of Networks & Reference Models: https://nptel.ac.in/courses/106105081
3. Introduction on Computer Networks: https://nptel.ac.in/courses/106106091

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	1	-	-	-	-	-	-	2	2
CO2	3	3	2	1	2	-	-	-	-	-	-	2	2
CO3	3	3	2	1	2	-	-	-	-	-	-	2	2
CO4	3	2	2	-	2	-	-	-	-	-	-	2	2
CO5	3	2	2	-	3	-	-	-	-	1	-	2	2
AVG	3	2	1.8	0.4	2	-	-	-	-	0.2	-	2	2

1 – Low, 2 – Medium, 3 – High,'-' – No correlation

MACHINE LEARNING			
Course Code:	25UAIT42	**Course Type:**	Theory
Teaching Periods / Week (L:T:P):	3:0:0	**Credits:**	3
Total Teaching Periods:	45	**CAM+ESE Mark:**	40+60=100
Teaching Department:	AI&ML		

Course Objectives:

To learn the basic concepts and the applications of database systems, SQL Queries and Normalization.

Unit 1	**INTRODUCTION TO MACHINE LEARNING WITH PYTHON**	**Periods:9**

INTRODUCTION TO PYTHON: DataTypes, Variable, Operators, Expression, Indexing & Slicing, Strings, Functions, Control Flow, Nested Loops. Python libraries suitable for Machine Learning: Pandas, Numpy, Scikit-learn, visualization libraries: matplotlib, seaborn. Introduction to artificial intelligence and machine learning, Types of machine learning-Supervised, Unsupervised, Semi Supervised , Reinforcement learning, machine learning workflow and its applications.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 2	**REGRESSION**	**Periods:9**

Hypothesis space and Inductive Bias, Linear and Non Linear Models, Training and test set, model Evaluation techniques, Cross validation methods, overfitting and underfitting, Bias and variance trade off, Introduction to regression analysis, Linear regression, Multiple linear regression, Bayesian Linear regression.

TeachingLearning Process	**Pedagogy:** Chalk and Talk, PPT
	RBT Level: Analyze

Unit 3	**CLASSIFICATION**	**Periods:9**

Introduction to classification, Binary classification, Multi-class classification, Multi- Label classification, Linear and Non- linear classification model, Logistic regression, Maximum margin classifier, SVM, Naïve bayes classifier, Knn, Decision tree learning, Random Forest algorithm, Comparison of classification model.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT
	RBT Level: Analyze

Unit 4	**CLUSTERING**	**Periods:9**

Introduction to unsupervised learning, clustering concepts and applications, similarity and distance measures, k-means clustering algorithm, hierarchical clustering techniques, density-based clustering (DBSCAN), cluster validation and evaluation methods, challenges in clustering, introduction to dimensionality reduction, need for dimensionality reduction, feature selection and feature extraction, principal component analysis (PCA), linear discriminant analysis (LDA).

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT	
	RBT Level: Apply	
Unit 5	**REINFORCEMENT LEARNING**	**Periods:9**
Basic of RL, RL Framework, Markov Decision Process, Exploration Vs Exploitation- Polices, Value functions and Bellman Equations, Solution methods, Q learning.		
Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT	
	RBT Level: Apply	
Total		**Periods: 45**

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study, Students' performance in continuous Assessment / Student Presentations, Model Exam.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Demonstrate the basic elements of a relational database management system

CO2: Understand to identify the data models for relevant problems

CO3: Understand to design entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries on the respect data.

CO4: Apply normalization for the development of application softwares.

CO5: Ability to design and develop a large database with optimal query processing.

Textbooks:

1. Database System Concepts, Silberschatz, Korth, McGraw hill, Sixth Edition.(All UNITS except III)
2. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, TATA McGrawHill 3rd Edition.

References:

1. Fundamentals of Database Systems, Elmasri Navathe Pearson Education.
2. An Introduction to Database systems, C.J. Date, A.Kannan, S.SwamiNadhan,Pearson, Eight Edition for UNIT III.

Web links and Video Lectures (e-Resources):

1. https://www.geeksforgeeks.org/dbms/
2. https://onlinecourses.nptel.ac.in/noc22_cs51/preview

CO-PO& PSO Mapping

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

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

ARTIFICIAL INTELLIGENCE			
Course Code:	25UAIT43	**Course Type:**	Theory
Teaching Periods / Week (L:T:P):	3:0:0	**Credits:**	3
Total Teaching Periods:	45	**CAM+ESE Mark:**	40+60=100
Teaching Department:	AI&ML		

Course Objectives:

To apply heuristic concepts to design an efficient algorithms, planning and knowledge representation schemes for typical AI problems.

Unit 1	**INTRODUCTION**	**Periods:9**

Overview of AI, Problems, Problem space and searching techniques, Definition production system, Control strategies, Heuristic search techniques Game Playing- Minmax search procedure-Adding alpha-beta cutoff Intelligent agents Agents and environment– structure of agents and its functions- simple reflex agent- goal based agent– utility based agent– learning agents, Knowledge Based Agent.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 2	**KNOWLEDGE REPRESENTATION AND REASONING**	**Periods: 9**

Approaches and issues in knowledge representation, Predicate logic, propositional logic, Forward and backward reasoning- Unification Resolution- Weak slot-filler structure– Strong slot-filler structure. Ontologies and Classes.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Problem Solving
	RBT Level: Apply

Unit 3	**QUANTIFYING UNCERTAINTY**	**Periods: 9**

Acting under Uncertainty, Conditional Independence- Bayes Rule –Naïve Bayes Classifier - Bayesian Belief Network- Inference in Bayesian Belief Network- Making Decisions in Complex Environments- Markov Decision Processes.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Problem Solving
	RBT Level: Apply

Unit 4	**PLANNING**	**Periods: 9**

Planning- Planning problems, Simple planning agent, Planning languages, Blocks world ,Goal stack planning, Mean Ends Analysis, Non-linear Planning, Conditional planning, Reactive planning, Implementation of block world problem.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 5	**AI-APPLICATIONS**	**Periods :9**

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Robot – Hardware – Perception – Planning – Moving.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply
Total	**Periods: 45**

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study Students' performance in continuous Assessment / Student Presentations, Model Exam

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: To understand AI & its types, Problem space, its searching and implement heuristic concepts in real time applications.

CO2: To familiarize with knowledge representation schemes for typical AI problems.

CO3: To understand the concept of basics of reasoning under uncertainty and rule based system .

CO4: Develop planning and apply algorithms on real world problems.

CO5: Design and develop Artificial Intelligence applications.

Textbooks:

1. Russell, S. and Norvig, P, "Artificial Intelligence -A Modern Approach", 3rd Edition, Prentice Hall, 2015.
2. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", McGraw Hill, 2008.

References:

1. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", 4th Edition, Pearson Education, 2002
2. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc.; First Edition, 2008.
3. N.P. Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press, 2nd Edition, 2005.

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/106106184

CO-PO& PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	-	-	1	3	3
CO2	3	3	2	2	1	-	-	-	-	-	1	3	3
CO3	3	3	2	2	1	-	-	-	-	-	1	3	3
CO4	3	3	2	2	1	-	-	-	-	-	1	3	3
CO5	3	3	2	2	1	-	-	-	-	-	1	3	3
AVG	3	3	2	2	1	-	-	-	-	-	1	3	3

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

PRINCIPLES OF MANAGEMENT			
Course Code:	25UHST41	**Course Type:**	Theory
Teaching Periods / Week (L:T:P):	3:0:0	**Credits:**	3
Total Teaching Periods:	45	**CAM+ESE Mark:**	40+60=100
Teaching Department:	MBA		

Course Objectives:

- To provide a foundational understanding of Management principles and practices.
- To introduce the field of management, its historical development and its importance in organizations.

Unit 1	**INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS**	**Periods:9**

Definition of Management - Science or Art, Manager Vs Entrepreneur, types of managers managerial roles and skills, Evolution of Management - Scientific, human relations, system and contingency approaches, Types of Business organization - Sole proprietorship, partnership, company, public and private sector enterprises, Organization culture and Environment - Current trends and issues in Management.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 2	**PLANNING**	**Periods: 9**

Nature and purpose of planning - Planning process, Types of planning, Objectives - Setting objectives, Policies, Planning premises, Strategic Management, Planning Tools and Techniques, Decision making steps and process- types of decisions and decision making conditions, Decision making styles, Effective decision making.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 3	**ORGANISING**	**Periods: 9**

Nature and purpose - Formal and informal organization, Organization chart, Organization structure, Types, Line and staff authority - Departmentalization, delegation of authority, Centralization and decentralization, Job Design, Human Resource Management - HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 4	**LEADING**	**Periods: 9**

Foundations of individual and group behaviour - Motivation, Motivation theories, Motivational techniques, Job satisfaction - Job enrichment, Leadership, types and theories of leadership, Communication - Process of communication, Barrier in communication, Effective communication, Communication and IT.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 5	CONTROLLING	Periods :9
System and process of controlling - Budgetary and non, Budgetary control techniques, Use of computers and IT in Management control, Productivity problems and management, Control and performance, Direct and preventive control, Reporting.		
Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz	
	RBT Level: Remember, Understand, Apply	
Total		**Periods: 45**

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study / Students' performance in continuous Assessment / Student Presentations, Model Exam

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: To understand the introductory management concepts.

CO2: To understand the basic knowledge on international aspect of management.

CO3: To understand the organization structure and Human resource management.

CO4: To understand motivation theories leadership and communication process.

CO5: To understand the controlling concept of management.

Textbooks:

1. Stephen A. Robbins and David A. Decenzo and Mary Coulter, "Fundamentals of Management", Pearson Education, 11th Edition, 2019.
2. Stephen P. Robbins and Mary Coulter, "Management", Prentice Hall India Pvt. Ltd., 13th Edition, 2017.

References:

1. PC Tripathy, PN Reddy and Ashish Bajpai, "Principles of Management", Tata Mcgraw Hill, 7thEdition, 2021.
2. Harold Koontz and Heinz Weihrich, "Essentials of management", Tata McGraw Hill, 11thEdition, 2020.
3. Robert Kreitner and Mamata Mohapatra, "Management", Biztantra, 2008.

Web links and Video Lectures (e-Resources):

1. Management Information System: https://onlinecourses.nptel.ac.in/noc23 mg87
2. Management Information System: https://nptel.ac.in/courses/110105148

CO-PO & PSO MAPPING

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

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

DATABASE MANAGEMENT SYSTEMS			
Course Code:	25UAII41	**Course Type:**	Integrated Course
Teaching Periods / Week (L:T:P):	2:0:4	**Credits:**	4
Total Teaching Periods:	60	**CAM+ ESE Mark:**	50+50
Teaching Department:	AI&ML		

Course Objectives:

To impart knowledge on starting with Python programming and the fundamentals of artificial intelligence and machine learning.

Unit 1	**DATABASE SYSTEM & NORMALIZATION**	**Periods: 12**

Applications, Purpose of Database Systems, View of Data – Data Abstraction –Instances and Schemas – Database Languages – database Access for applications Programs –Database Users and Administrator – Transaction Management – Database Architecture – Storage Manager – the Query Processor. Data Models: Introduction to the Relational Model – Structure. Introduction, Non loss decomposition and functional dependencies, First, Second, and third normal forms – dependency preservation, Boyce/Codd normal form. Higher Normal Forms - Introduction, Multi-valued dependencies and Fourth normal form, Join dependencies and Fifth normal form

Practicals:

1. Concept design with E-R Model: Apply cardinalities for each relationship, identify strong entities and weak entities for relationships Like generalization, aggregation, specialization.
2. Study and Develop by Practicing DDL, DML & DCL commands
3. Given the sample forms and description below, create the un-normalized form of the data and transform through the steps needed to move into 3NF. Finally, merge the two views into a unified schema.
4. Study trigger to a set of SQL statements that is invoked automatically when a change is made tothe data on the associated table. A trigger can be defined to be invoked either before or after the data ischanged by INSERT, UPDATE or DELETE statement.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT
	RBT Level: Apply

Unit 2	**RELATIONAL ALGEBRA AND SQL**	**Periods: 12**

Selection and projection set operations – renaming – Joins – Division – Examples of Algebra overviews – Relational calculus – Tuple Relational Calculus (TRC) – Domain relational calculus (DRC). Overview of the SQL Query Language – Basic Structure of SQL Queries, Set Operations, Aggregate Functions – GROUPBY – HAVING, Nested Sub queries, Views, Triggers, Procedures.

Practicals:

1. Querying Using aggregate functions COUNT, SUM using GROUPBY, HAVING and Creation and Dropping of Views.

2. Study Procedures: Creation of stored procedures, Execution of procedure and modification of procedures.
3. Create a Cursor to get the Emp Name and Salary from Employee table

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT
	RBT Level: Apply

Unit 3	**TRANSACTION STATE & RECOVERY AND ATOMICITY**	**Periods: 12**

Transaction State- Implementation of Atomicity and Durability – Concurrent Executions – Serializability- Recoverability – Implementation of Isolation – Testing for serializability- Lock –Based Protocols – Timestamp Based Protocols Validation- Based Protocols – Multiple Granularity. Log – Based Recovery – Recovery with Concurrent Transactions – Check Points - Buffer Management – Failure with loss of nonvolatile storage.

Practicals:

1. Study & Implementation of different types of constraints.
2. Study & Implementation of PL/SQL
3. Study & Implementation of Sub queries &Views.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT
	RBT Level: Apply

Unit 4	**No SQL Databases**	**Periods: 12**

Introduction to NoSQL- Types of NoSQL Databases- Key-Value Databases- Document Databases- Column-Family Databases- Graph Databases- NoSQL Data Modeling- NoSQL Querying and Applications- Comparison of SQL and NoSQL.

Practicals:

1. Implement NOSQL QUERIES to understand the concept of Open Source Database Management System such as Mongo DB.
2. Develop a Query for MySQL Database Creation, Table Creation and Some other Queries Execution.
3. Study and implement Partial data storage and retrieval in MYSQL.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 5	**MongoDB**	**Periods: 12**

Introduction to MongoDB- MongoDB Basics- CRUD Operations- Querying Documents- Indexing- Aggregation Framework- Data Modeling- Replication and Sharding- MongoDB Security.

Practicals:

1. Install MongoDB, Start the MongoDB server, Connect using MongoDB Compass and create a database named CollegeDB**.**

2. Study and implement to Develop a MongoDB-based Student Management System.
3. Implement Projection and Filtering and Display documents excluding the _id field.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT
	RBT Level: Apply
Total	**Periods: 60**

Suggested Activities and Evaluation Methods:
Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study Students' performance in continuous Assessment / Student Presentations, Model Exam

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: To introduce the fundamentals of Python programming and its libraries for data handling, visualization, and machine learning.
CO2: To understand the theoretical foundations of machine learning including hypothesis space, inductive bias, and model evaluation.
CO3: To implement and analyze regression and classification algorithms for supervised learning tasks.
CO4: To explore unsupervised learning, clustering techniques, and dimensionality reduction methods for data analysis.
CO5: To understand the basics of reinforcement learning, Markov decision processes, and value-based learning methods.

Textbooks:

T1: Andreas C. Miller and Sarah Guido**,** "Introduction to Machine Learning with Python: A Guide for Data Scientists", O'Reilly Media, Second Edition, 2020.

T2: Martin Fowler and Pramod J. Sadalage, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional 1st Edition 2012.

T3: Kristina Chodorow and Shannon Bradshaw, "MongoDB: The Definitive Guide", 3rd Edition, 2019.

References:

R1: David Brown, "Artificial Intelligence", Kindle Edition, 17 Books Ltd., 2020.

R2: Martin Fowler, Pramod J. Sadalage,"NoSQL Distilled", Addison-Wesley Professional 1st Edition, 2012.

R3: Kristina Chodorow and Shannon Bradshaw, "MongoDB: The Definitive Guide**",** 3rd edition, 2019.

Web links and Video Lectures (e-Resources):

1. David Brown, "Artificial Intelligence", Kindle Edition, 17 Books Ltd., 2020.
2. https://archive.nptel.ac.in/courses/106/106/106106139

CO-PO & PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	2	-	-	-	-	-	1	3	3
CO2	3	3	2	2	2	-	-	-	-	-	1	3	3
CO3	3	3	3	2	3	-	-	-	-	-	1	3	3
CO4	3	2	2	2	2	-	-	-	-	-	1	2	3
CO5	3	2	2	2	2	-	-	-	-	-	1	2	3
AVG	3	2.4	1.8	1.6	2.2	-	-	-	-	-	1	2.6	3

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

MACHINE LEARNING LAB			
Course Code:	25UAIP41	**Course Type:**	Practical
Teaching Periods/Week(L:T:P):	0:0:2	**Credits:**	1
Total Teaching Periods:	45	**CAM+ESE Mark:**	60+40=100
Teaching Department:	AI&ML		

Course Objectives:

To impart knowledge on starting with Python programming and the fundamentals of artificial intelligence and machine learning.

Practical Exercises:	**Periods: 45**

LIST OF EXPERIMENTS

1. Environment setup: Python, Anaconda, Jupyter Notebook, and basic library usage
2. Data handling using NumPy and Pandas (loading, cleaning, preprocessing datasets)
3. Data visualization using Matplotlib and Seaborn.
4. Study of hypothesis space and inductive bias, implementation of linear and non-linear regression models, dataset splitting into training and test sets, and analysis of overfitting and underfitting using evaluation techniques.
5. Implementation of linear and multiple linear regression models and analysis of bias–variance trade-off using suitable model evaluation methods.
6. Implementation of Bayesian linear regression with cross-validation techniques and comparative performance evaluation of regression models.
7. Implement classification including binary, multi-class, and multi-label classification, and implementation of linear and non-linear classification models.
8. Implementation of logistic regression, maximum margin classifier, support vector machine, naïve Bayes classifier, and k-nearest neighbors for classification problems.
9. Implementation of decision tree learning and random forest algorithms with performance evaluation and comparison of classification models.
10. Study and implementation of unsupervised learning concepts including clustering applications, similarity and distance measures, and k-means clustering algorithm with cluster evaluation techniques.
11. Implementation of hierarchical clustering and density-based clustering (DBSCAN) methods and analysis of clustering challenges using validation and evaluation measures.
12. Implementation of dimensionality reduction techniques including feature selection, feature extraction, principal component analysis (PCA), and linear discriminant analysis (LDA) for high-dimensional data analysis.
13. **S**tudy of Reinforcement Learning basics and framework including agent, environment, states, actions, rewards, and formulation of Markov Decision Process (MDP).
14. Implementation of value functions and Bellman equations and analysis of exploration versus exploitation strategies using different policies.
15. Implementation of Q-Learning algorithm for solving reinforcement learning problems and performance evaluation of learned policies.

SOFTWARE REQUIRED

1. Python 3.x with Anaconda Distribution
2. Jupyter Notebook / Google Colab
3. Libraries: NumPy, Pandas, Matplotlib, Seaborn, Scikit-learn

References:

1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 3rd Edition, O'Reilly Media, 2022.
2. Tom M. Mitchell, "Machine Learning", 1st Edition, McGraw-Hill Education, 1997.
3. Sebastian Raschka and Vahid Mirjalili, "Python Machine Learning", 3rd Edition, Packt Publishing, 2019.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Set up the Python programming environment and perform data handling, cleaning, preprocessing and visualization using NumPy, Pandas, Matplotlib and Seaborn.

CO2: Implement and evaluate linear, multiple linear and Bayesian regression models using cross-validation, and analyze bias–variance trade-off, overfitting and underfitting.

CO3: Implement and compare classification algorithms such as logistic regression, support vector machine, naïve Bayes, k-nearest neighbors, decision tree and random forest.

CO4: Implement unsupervised learning techniques including k-means, hierarchical and density-based (DBSCAN) clustering, and dimensionality reduction using PCA and LDA.

CO5: Formulate and solve reinforcement learning problems using the Markov Decision Process, value functions, Bellman equations and the Q-Learning algorithm.

CO–PO & PSO Mapping

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

1–Low, 2–Medium, 3–High, '-' –No correlation

COMPUTER NETWORKS LAB			
Course Code:	25UAIP42	**Course Type:**	Practical
Teaching Periods/Week(L:T:P):	0:0:2	**Credits:**	1
Total Teaching Periods:	45	**CAM+ESE Mark:**	40+60=100
Teaching Department:	AIML		

Course Objectives:

To provide practical, hands-on experience in implementing, configuring, and analyzing network protocols, architectures, and services.

Practical Exercises:	**Periods: 45**

LIST OF EXPERIMENTS

1. Make use of various networking commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine.
2. Design a topology using PCs and Switch with configuration of IP address and Observe the flow of data from host to host by creating network traffic
3. Create a Network scenario and examine dynamically learning configured Switch MAC address table and ARP Cache table using simulation tool.
4. Simulation of Error correction and detection techniques
5. Create a Network Scenario and assign subnet IP Addresses to various Network Devices and Verify the Connectivity using simulation tool.
6. Create a Network scenario with multiple routers and configure using RIP Routing in simulation tool.
7. Create a Network scenario with multiple routers and configure using OSPF Routing in simulation tool.
8. Create a Network scenario and generate the network traffic to examine the TCP/UDP communication using Simulation tool.
9. Implement the applications using TCP /UDP sockets like: • Chat • File transfer
10. Setting up DNS, HTTP, DHCP and E-mail server using simulation tool.

SOFTWARE REQUIRED

1. Java
2. C

References:

1. Tanenbaum A.S. and David J. Wetherall "Computer Networks", 5th edition Prentice Hall, 2011.
2. Stallings, W., "Data and Computer Communications", 10th Edition, Prentice Hall Int. Ed., 2013.
3. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Pearson Education, Third edition, 2006.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: To understand components of computer networks, its protocols, modern technologies and their applications

CO2: To analyzing channel characteristics, access mechanism and data link protocols to design a network.

CO3: To understand the network and IPV protocols

CO4: Knowledge of network traffic conditions, transport protocols and QoS.

CO5: To learn the usage of application layer with security

CO–PO & PSO Mapping

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

1–Low, 2–Medium, 3–High, '-' –No correlation

ARTIFICIAL INTELLIGENCE LAB			
Course Code:	25UAIP43	**Course Type:**	Practical
Teaching Periods/Week(L:T:P):	0:0:2	**Credits:**	1
Total Teaching Periods:	45	**CAM+ESE Mark:**	60+40=100
Teaching Department:	AI&ML		

Course Objectives:

To enable the students to analyze and interpret large amounts of data quickly.

Practical Exercises: **Periods: 45**

LIST OF EXPERIMENTS

1. Develop a python program to simulate the agent with suitable environment to decide the numbers of papers to be purchased by observing the stock history and prize.
2. Write a python program to represent a priority queue environment and agent to support the following searching strategies.
    a. A* Search
    b. Best- First search
    c. Depth First Search.
3. Write a python Program to Implement Tic-Tac-Toe game.
4. Write a python Program to Implement 8-Puzzle problem.
5. Write a python Program to Implement Water-Jug problem
6. Write a Python Program to Implement Travelling Salesman Problem.
7. Write a python Program to Implement Tower of Hanoi.
8. Write a python Program to Implement Monkey Banana Problem.
9. Write a python Program to Implement Alpha-Beta Pruning.
10. Write a python Program to Implement 8-Queens Problem.
11. Write a python program to simulate the crossword puzzle problem with 10 words that satisfy suitable constraints in a domain.
12. Write a python program to solve the blocks world problem robot moment planning problem using the following algorithms.

a. Forward planning
b. Regression planning
c. Constrain satisfaction planning
d. Partial order planning

SOFTWARE REQUIRED

1. IDE Python, Pycharm

References:

1. Kevin Night and Elaine Rich, Nair B, “Artificial Intelligence (SIE)”, McGraw Hill, 2008.
2. Russell, S. and Norvig, P, “Artificial Intelligence -A Modern Approach”, 3rd Edition, Prentice Hall, 2015.
3. M. Tim Jones, “Artificial Intelligence: A Systems Approach (Computer Science)”, Jones and Bartlett Publishers, Inc.; First Edition, 2008.

Course Outcomes:

After Successful completion of this course, the student should be able to

- Identify the scope for agent-based engineering solutions using AI based tools.
- To understand and predict the optimal conditions for an experiment.
- Master the knowledge representation, reasoning and planning based AI solutions.
- To understand and analyze historical data in predicting future trends and patterns, allowing for better decision-making in the lab.
- Solve Complex Decision-Making problems by planning techniques.

CO–PO & PSO Mapping

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

1–Low, 2–Medium, 3–High, '-' –No correlation

MINI PROJECT-I			
Course Code:	25UAIW41	**Course Type:**	PC
Teaching Periods / Week (L:T:P):	0:0:2	**Credits:**	1
Total Teaching Periods:	30	**CAM+ESE Mark:**	60+40=100
Teaching Department:	AI&ML		

Course Objectives:

To design and develop software application using software engineering principles.

Practical Exercises: **Periods : 30**

STEPS TO BE FOLLOWED

1. Select a relevant and feasible problem statement based on real-world applications or current technologies.
2. Conduct a brief literature survey to understand existing systems and identify gaps.
3. Define clear objectives and scope for the project before starting development.
4. Prepare functional and non-functional requirements along with software/hardware needs.
5. Design system architecture and flow diagrams such as DFD, UML, and ER diagrams.
6. Follow modular design principles to divide the project into independent, manageable modules.
7. Use standard coding practices with proper naming conventions and documentation in code.
8. Maintain version control using GitHub or similar platforms throughout the development process.
9. Implement the system step-by-step, testing each module after development.
10. Perform testing to ensure reliability and accuracy.
11. Document test cases and results with screenshots, tables, and performance metrics.
12. Prepare a structured project report with all required sections (Abstract to References).
13. Create a concise and professional PPT highlighting objectives, design, methodology, and results.
14. Demonstrate the working model effectively during evaluation and be ready to answer technical questions.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Identify and analyze real-world problems by gathering requirements and performing feasibility studies to formulate an appropriate mini project problem statement.

CO2: Design effective system architecture, models, and workflows using suitable engineering tools, diagrams, and design methodologies.

CO3: Develop functional modules using appropriate programming languages, frameworks, hardware components, or tools while applying engineering and domain knowledge.

CO4: Perform testing, validation, analysis, and evaluation of the developed system to ensure functionality, accuracy, performance, and reliability.

CO5: Prepare project documentation and deliver an effective presentation demonstrating teamwork, problem-solving skills, professionalism, and ethical responsibility.

CO-PO MAPPING : MINI PROJECT-I

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

1–Low, 2–Medium, 3–High, '-' –No correlation

PROFESSIONALISM AND BASIC APTITUDE			
(Common to all Branches)			
Course Code:	25UPCE41	**Course Type:**	EEC
Teaching Periods / Week (L:T:P):	0:0:2	**Credits:**	0
Total Teaching Periods:	48	**CAM+ESE Mark:**	Internal Assessment
Teaching Department:	PLACEMENT		

Course Objectives:

This course helps students improve communication, teamwork, and time management. It teaches how to behave professionally and work well with others. Students will learn problem-solving and leadership skills

Unit 1	**ATTITUDE, ADAPTABILITY AND PERCEPTION LEARNING**	**Periods: 10**

Attitude: Positive thinking and optimism - Growth mindset vs. fixed mindset - Self-motivation and initiative - Managing negative attitudes and stress

Adaptability: Change management - Cognitive flexibility - Continuous learning - Workplace diversity adjustment

Values: Personal vs. professional values - Integrity and honesty - Respect and empathy - Ethical decision-making

Perception and learning: Sensory perception and attention - Factors affecting perception - Types of learning - Learning styles and strategies

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Remember, Understand, Apply

Unit 2	**LEADERSHIP AND CREATIVITY**	**Periods: 8**

Leadership: Leadership styles-Effective communication-Decision-making-Team motivation

Creativity: Brainstorming-Innovation-Problem-solving-Imagination

Reaching your potential: Self-awareness - Goal setting - Time management - Continuous improvement

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Remember, Understand, Apply

Unit 3	**GENERAL APTITUDE**	**Periods: 10**

Number System: Types of Numbers - Prime and Composite Numbers -Place Value and Face Value - Conversions between Number Bases

HCF & LCM: Prime Factorization Method - Division Method - Relationship between HCF and LCM - Word Problems on HCF and LCM

Factorial Concepts: Definition and Notation of Factorial - Factorial Identities - Factorial in Permutations and Combinations - Trailing Zeros in Factorials.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Remember, Understand, Apply

Unit 4	QUANTITATIVE APTITUDE - I	Periods: 10

Profit and Loss: Cost Price and Selling Price - Profit and Loss Percentage - Marked Price and Discount - Successive Transactions

Percentage, Ratio and Proportion: Percentage Basics and Calculations - Ratio Simplification and Comparison - Direct and Inverse Proportion - Percentage to Ratio Conversions

Simple Interest and Compound Interest: Simple Interest Formula and Calculation - Compound Interest Basics - Difference between SI and CI - Time and Rate-Based Problems

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Remember, Understand, Apply

Unit 5	PERMUTATION AND COMBINATION	Periods: 10

Probability: Basic Probability - Sample Space - Independent and Dependent Events - Complementary Events

Permutation and Combination: Fundamental Principle of Counting - Permutations - Combinations - Circular Permutations

Pipe and Cistern: Inlet and Outlet Pipes - Filling and Emptying Time - Pipes Working Together - Alternate Inlet–Outlet Problems

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Remember, Understand, Apply

Total	Periods: 48

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study, Students' performance in continuous Assessment / Student Presentations, Model Exam.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Apply positive attitude, adaptability, ethical values, and effective perception and learning strategies for personal and professional development.

CO2: Build leadership, creativity, and self-awareness to communicate effectively, solve problems, and achieve continuous growth

CO3: Apply number system concepts, HCF & LCM methods, and factorial principles to solve quantitative problems efficiently

CO4: Calculate profit/loss, percentage, ratio, proportion, and interest problems to make informed financial and quantitative decisions.

CO5: Solve problems on probability, permutations, combinations, and pipe-cistern scenarios using logical and mathematical reasoning

Textbooks:

1. Quantitative aptitude for competitive exams by S.Chand, Dr.R.S.Aggarwal
2. Quantitative aptitude for CAT by Arun Sharma, Tata McGrew Hill

References:

1. Rapid Quantitative Aptitude by Er.Deepak Agarwal and Mr.D.PGupta.
2. Numerical Ability and Quantitative aptitude for Competitive examinations by P.K.Mittal.

CO-PO& PSO Mapping													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	-	3	-	-	-	3	2	2	2	2	2	-	-
CO2	2	1	1	1	1	1	1	1	-	-	-	-	-
CO3	2	2	2	-	-	-	-	-	-	-	2	-	-
CO4	2	-	2	-	-	-	-	2	-	-	2	-	-
CO5	2	2	2	-	-	-	-	-	2	-	2	-	-
AVG	2	2	1.8	1	1	2	1.5	1.8	2	2	2		
1 – Low, 2 – Medium, 3 – High, '-' – No correlation													

ENTREPRENEURIAL SKILLS AND CONCEPTS			
Common to all branches			
Course Code:	25UMCC41	**Course Type:**	MCC
L : T : P:	2 : 0 : 0	**Credits:**	0 (Zero Credit)
Total Periods:	30 Hours	**Evaluation:**	CAM
Teaching Department:	MBA		
Prerequisite:	Knowledge in Computing Skills		

Course Objectives:

1. To create a learning experience to enable the students to face the challenges of starting new ventures.
2. To prepare the students for starting new businesses and the skills for managing existing family businesses.
3. To gain knowledge in business plan preparation by using various sources of finance and to become entrepreneurs in different fields.

UNIT 1	**6**

Introduction to Entrepreneurship: Concept, Significance, Theories and Models of Entrepreneurship Development - Traits and Characteristics, Functions, Types - Entrepreneurial Processes - Problems - Capacity building - Risk Analysis - Scope of Entrepreneurship in India.

UNIT 2	**6**

Entrepreneurial Environment for Start-up Enterprises: Significance - Internal and External Environment forces - Entrepreneurial Culture and Society - EDP: Objectives, Features, Steps and Issues in EDP Process - Role of Institutions and Government in EDP.

UNIT 3	**6**

Developing Start-up Enterprises: Developing a Business Idea: Opportunity, Methods, and Creativity - Deciding to setup a Start-up Enterprise: Effectual Reasoning, Forms, Size and Location - Entrepreneurial skills and Competences - Feasibility Study: Market Survey, Techno-Economic feasibility and Preparing Project Report - Financial Requirements.

UNIT 4	**6**

Steps in Promoting Start-up Micro-Enterprises: Entrepreneurial Success in Rural Areas - Establishing Entrepreneurial System - Assistance and Sickness - Institutions Supporting and providing Financial Assistance: SSI, KVIC, MSME-DO, NSIC, NIESBUD, IIE, SIDC, SDIs, DICs NGOs, Industry Association, SIDBI and SFCs - Self-help Groups - Technological Up-gradation - Challenges.

UNIT 5	**6**

Managing a New or Start-up Enterprise: Management - HRM, Marketing, Financial Management, Production and Operations Management in a New or Start-up Enterprise

Total Periods: 30 Hrs

Course Outcomes:

After successful completion of this course, the student should be able to:

CO1: Explain the concepts, theories, characteristics, and scope of entrepreneurship.

CO2: Analyze the entrepreneurial environment, EDP process, and institutional support for start-up enterprises.

CO3: Develop business ideas and prepare feasibility studies and project reports for start-up enterprises.

CO4: Examine the promotion and support systems available for micro and rural enterprises.

CO5: Apply management principles in HRM, marketing, finance, production, and operations for start-up enterprises.

Textbooks:

T1: Saravanavel, P, "Entrepreneurial Development", Margham Publication, 2020.

T2: Prasanna Chandra, "Protect Preparation, Appraisal, Implementation", Tata McGraw Hill, 2019.

References:

R1: Srinivasan, N.P. & Gupta, C.B, "Entrepreneurial Development", Sultan Chand & Sons, 2017.

R2: Barringer, Bruce R, "Entrepreneurship: Successfully launching new ventures", Pearson Education, 2018.

R3: Drucker, Peter F. and Peter Ferdinand Drucker, "Innovation and Entrepreneurship: Practice and Principles", 2017.

HONOR DEGREE COURSES

S.No	Course Code	Course Title	Category	L	T	P	Credits
THEORY							
1	25UAIH01	Data Visualization Tools	PC	3	1	0	4
2	25UAIH02	Advanced Artificial Intelligence	PC	3	1	0	4
3	25UAIH03	Data Science and Analytics	PC	3	1	0	4
4	25UAIH04	Transfer Learning	PC	3	1	0	4
5	25UAIH05	Large Language Models	PC	3	1	0	4

AI&ML - MINOR DEGREE COURSES

Offered to other departments applicable for CSE, ECE, EEE, MECH, RA,FT, CSE(ICB)

S.No	Course Code	Course Title	Category	L	T	P	Credits
THEORY							
1	25UAIM01	Artificial Intelligence	PC	3	1	0	4
2	25UAIM02	Machine Learning	PC	3	1	0	4
3	25UAIM03	Foundation of Data Science	PC	3	1	0	4
4	25UAIM04	Data Visualization	PC	3	1	0	4
5	25UAIM05	Business Intelligence	PC	3	1	0	4

SYLLABUS FOR HONOR DEGREE COURSES

DATA VISUALIZATION TOOLS			
Course Code:	25UAIH01	**CourseType:**	PC
Teaching Periods / Week (L:T:P):	3:1:0	**Credits:**	4
Total Teaching Periods:	60	**CAT+ ESE Marks:**	40+60=100
Teaching Department:	AI&ML		

Course Objectives

To create beautiful, interactive, browser-based data visualization using using Tableau, Qlik and D3 tools.

Unit1	**INTRODUCTION**	**Periods: 12**

Introduction to Data Visualization Tools - Benefits of Data Visualization Tools - Data Visualization Tools - Google Data Studio - Qlikview - Tableau - Power BI - Features of Data Visualization Tool - Salient features of tools - Data Access from Data Sources - Data Transformation - Extraction, Transformation and Load (ETL) - Messy data - Data formats and schemas - Data blending or fusion - Methods for data cleansing - Data profiling - Open source data-cleansing tools.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT
	RBTLevel: Apply

Unit2	**VISUALIZATION TOOLS**	**Periods: 12**

Basic Visualization Tools – Area Plots – Histograms – Bar charts – Specialized Visualization Tools: Pie charts – Box plots – Scatter Plots – Bubble plots – Advanced Visualization Tools: Waffle charts – Word Clouds – Seaborn and Regression plots. Microsoft Power BI: Importing data from Excel, CSV, SQL Server, Web, and Cloud services - Connecting to multiple data sources - Data refresh options.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT
	RBT Level: Apply

Unit3	**DATA MANAGEMENT**	**Periods: 12**

Handling Filter Data - Discovering Context Filter - Implementing Sorting - Nested Sort - Understanding Grouping of Data - Manipulating Sets - Creating Parameters - Working with Dates: Discrete and Continuous.

Handling and Filtering Data - Context Filters and Order of Operations - Sorting, Grouping, and Hierarchies.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit4	**TABLEAU**	**Periods: 12**

Introduction to Tableau - Tableau Products Suite - Tableau File Types - Connecting to Data Sources: Working on Excel Data – Connecting to a Text Data Source - Handling R Data - Connecting to MS Access Database - Creating Basic Charts and Graphs: Creating a Pie Chart - Creating a Bar Chart - Creating a Line Graph - Discovering Scatter Plot.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Quiz

	RBT Level: Apply	
Unit5	**DATA VISUALIZATION AND D3**	**Periods: 12**
Introduction to D3 - The Basic Setup - The New York Metropolitan Transit Authority Data Set - The Enter Selection - Building a Simple Subway Train Status Board - Graphing Mean Daily Plaza Traffic – Scales, Axes, and Lines - Bus Breakdown, Accident, and Injury - Graphing Turnstile Traffic - Interaction and Transitions - A Subway Wait Assessment UI Interactions - Subway Wait Assessment UI Transitions - Layout - Subway Connectivity - Scheduled Wait Time Distribution.		
Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz	
	RBT Level: Apply	
Total		**Periods : 60**

Suggested Activities and Evaluation Methods:
Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study / Students' performance in continuous Assessment / Student Presentations, Model Exam

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: To understand data analysis and visualizations.

CO2: To understand professional data visualization techniques.

CO3: To build interactive Dashboards and Visualizations.

CO4: To learn the dataset with elements of a webpage, and modify the elements based on the data.

CO5: To Create a dynamic dashboard combining multiple worksheets.

Textbooks:

T1: Shai Vaingast, "Beginning Python Visualization - Crafting Visual Transformation Scripts", Apress, 2nd Edition, 2014.

T2: Matthew O.Ward,"Interactive Data Visualization: Foundations, Techniques, and Applications", AK Peters / CRC Press.

T3: Seema Acharya, "Data Visualization with Tableau", Packt Publishing, 2018.

References:

R1: Andrew Rininsland and Swizec Teller, "D3.js 4.x Data Visualization", 3rd Edition, Kindle, 2017.

R2: Wes Mc Kinney, "Python for Data Analysis", O'Reilly Media,2012.

Web links and Video Lectures (e-Resources):

1. https://archive.nptel.ac.in/courses/106/106/106106212/

CO-PO& PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO 2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2
CO2	3	-	-	1	-	-	-	-	-	-	-	-	2
CO3	3	-	-	-	1	-	-	-	-	-	-	-	2
CO4	3	2	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	3	3	2	-	-	-	-	-	-	-	2
AVG	3	0.8	0.6	0.8	0.6	-	-	-	-	-	-	-	2

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

ADVANCED ARTIFICIAL INTELLIGENCE			
Course Code:	25UAIH02	**Course Type:**	PC
Teaching Periods / Week (L:T:P):	3:1:0	**Credits:**	4
Total Teaching Periods:	60	**CAT+ ESE Marks:**	40+60=100
Teaching Department:	AI&ML		

Course Objectives: To provide students with the knowledge of advanced Artificial Intelligence concepts, techniques, intelligent systems, reinforcement learning, generative AI, and their applications in solving real-world problems.

Unit 1	**INTRODUCTION**	**Periods:12**

Artificial Intelligence and its applications, Artificial Intelligence Techniques, Level of models, criteria of success, Intelligent Agents, Nature of Agents, Learning Agents. AI Techniques, advantages, and limitations of AI, Impact and Examples of AI, Application domains of AI. The AI Ladder- The Journey for Adopting AI Successfully, Advice for a career in AI, Hotbeds of AI Innovation.

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 2	**Searching and Optimization Techniques:**	**Periods:12**

Resolution method, First order logic, Second order logic, Genetic algorithms, Travelling sales man problem, Neural networks, Emergent systems, Ant colony optimization, Generate and search, Beam search ,Peak to peak methods. Decision networks-sequential decision problems-Partially Observable MDPs, Game Theory.

Teaching Learning Process	**Pedagogy:**
	RBT Level: L3

Unit 3	**Agent Systems:**	**Periods:12**

Architecture for intelligent agents, Agent communication, Negotiation, Bargaining, Argumentation, Agents, Trust, Reputation, Multi agent systems, AI applications, Language Models, Information Retrieval, Information extraction, Natural language processing, Machine translation, Speech recognition, Intelligent Agents - Robot Perception - Robot Localization and Mapping (SLAM) - Motion Planning - Autonomous Navigation.

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 4	**Reinforcement and Generative AI:**	**Periods:12**

Reinforcement Learning: Passive RL, Active RL, Generalization in RL, Policy Search. Generative AI: Large Language Models (LLMs) - Generative Adversarial Networks (GANs) - Diffusion Models - Prompt Engineering - Retrieval-Augmented Generation (RAG).

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 5	**CASE STUDIES, ISSUES, CHALLENGES AND APPLICATIONS**	**Periods:12**

Healthcare: Diagnosis, treatment, and medical imaging; Finance: Fraud detection, algorithmic trading, and risk assessment - Transportation: Autonomous vehicles and traffic optimization-

Customer service and chatbots - Education: Personalized learning and intelligent tutoring systems.	
Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply
Total	**Periods: 60**

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study, Students' performance in continuous Assessment / Student Presentations, Model Exam.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Explain the advanced concepts, techniques, intelligent agents, and application domains of Artificial Intelligence, along with recent trends and career opportunities in AI.

CO2: Apply search, optimization, logical reasoning, and decision-making techniques to solve complex Artificial Intelligence problems.

CO3: Analyze intelligent agent architectures, multi-agent systems, natural language processing techniques, and robotic perception for AI-based applications.

CO4: Evaluate reinforcement learning and generative AI techniques, including Large Language Models (LLMs), GANs, diffusion models, prompt engineering, and Retrieval-Augmented Generation (RAG), for intelligent system development.

CO5: Assess AI-based solutions for real-world applications in healthcare, finance, transportation, education, and customer service, while identifying associated challenges and emerging issues.

Text Books:

T1:S.Russel, P.Norvig, "Artificial Intelligence – A Modern Approach," Forth Edition, Pearson Education, 2021.

T2: Patrick Henry Winston, "Artificial Intelligence", Third Edition, Addison-Wesley Publishing Company, 2004.

T3: Nils J. Nilsson," Principles of Artificial Intelligence", Illustrated Reprint Edition, Springer Heidelberg, 2014

T4: Artificial Intelligence, Elaine Rich, Kevin Knight, and Shivashankar B. Nair, Third Edition, McGraw-Hill Education, 2009.

T5: Artificial Intelligence: Foundations of Computational Agents, David L. Poole and Alan K. Mackworth, Third Edition, Cambridge University Press, 2023.

References:

R1: Kevin Night, Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Third Edition, McGraw Hill, 2017.

R2: Artificial Intelligence: Structures and Strategies for complex problem solving, G. Luger, 4th Edition, Pearson Education, 2002.

R3:M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones

and Bartlett Publishers, Inc.; First Edition, 2008.

R4:N.P. Padhy, ”Artificial Intelligence and Intelligent Systems”, Oxford University Press, 2nd Edition, 2005

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/106106184
2. https://nptel.ac.in/courses/106105216

CO-PO& PSO Mapping

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

1 – Low, 2 – Medium, 3 – High, ‘-’ – No correlation

DATA SCIENCE AND ANALYTICS			
Course Code:	25UAIH03	**Course Type:**	PC
Teaching Periods / Week (L:T:P):	3:1:0	**Credits:**	4
Total Teaching Periods:	60	**CAT+ ESE Marks:**	40+60=100
Teaching Department:	AI&ML		

Course Objectives:

To gain knowledge in data science fundamentals and process utilizing the Python libraries for Data Wrangling and presenting and interpreting data using visualization libraries in Python

Unit 1	**INTRODUCTION**	**Periods:12**

Need for data science – Benefits and uses – Facets of data – Data science process – Setting the research goal – retrieving data – Cleansing, Integrating, and Transforming data – Exploratory data analysis – Build the models – Presenting and building applications.

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 2	**DESCRIPTIVE ANALYTICS**	**Periods:12**

Frequency distributions – Outliers –interpreting distributions – graphs – averages - describing variability – Interquartile range – Variability for qualitative and ranked data - Normal distributions – z scores –correlation – Scatter plots – Regression – Regression line – least squares regression line – Standard error of estimate – Interpretation of r2 – Multiple regression equations – Regression toward the mean

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 3	**PYTHON FOR DATA HANDLING**	**Periods:12**

Basics of Num Py arrays –aggregations –computations on arrays –comparisons, masks, Boolean logic – fancy indexing –structured arrays –Data manipulation with Pandas – Visualization with mat plot lib – line plots –scatter plots –visualizing errors –density and contour plots –histograms, binnings, and density –three-dimensional plotting –geographic data –data analysis using stats models and sea born – graph plotting using Plotly –interactive data visualization using Bokeh.

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 4	**INFERENTIAL STATISTICS**	**Periods:12**

Populations – samples – random sampling – Sampling distribution- standard error of the mean - Hypothesis testing – z-test – z-test procedure - t-test for one sample – sampling distribution of t – t-test procedure – t-test for two independent samples – p-value – statistical significance – t-test for two related samples. F-test – ANOVA – Two-factor experiments – three f-tests – two-factor ANOVA – Introduction to chi-square tests.

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 5	**PREDICTIVE ANALYTICS**	**Periods:12**

Linear least squares – implementation – goodness of fit – testing a linear model – weighted resampling. Regression using StatsModels – multiple regression – nonlinear relationships – logistic regression – estimating parameters – Time series analysis – moving averages – missing values –

serial correlation – autocorrelation. Introduction to survival analysis.	
Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply
Total	**Periods: 60**

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study, Students' performance in continuous Assessment / Student Presentations, Model Exam.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Apply the skills of data inspecting and cleansing.

CO2: Determine the relationship between data dependencies using statistics.

CO3: Can handle data using primary tools used for data science in Python.

CO4: Represent the useful information using mathematical skills.

CO5: Can apply the knowledge for data describing and visualization using tools.

Text Books:

T1: David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.

T2: Robert S. WiSe and John S. Wise, "Statistics", Eleventh Edition, Wiley Publications, 2017.

T3: Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.

References:

R1: Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014

R2: Sanjeev J. Wagh, Manisha S. Bhende, Anuradha D. Thakare, "Fundamentals of Data Science", CRC Press, 2022.

R3: Chirag Shah, "A Hands-On Introduction to Data Science", Cambridge University Press, 2020.

R4: Vineet Raina, Srinath Krishnamurthy, "Building an Effective Data Science Practice: A Framework to Bootstrap and Manage a Successful Data Science Practice", A press, 2021.

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/106106179

CO-PO& PSO Mapping

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

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

TRANSFER LEARNING			
Course Code:	25UAIH04	**Course Type:**	PC
Teaching Periods / Week (L:T:P):	3:1:0	**Credits:**	4
Total Teaching Periods:	60	**CAT+ ESE Marks:**	40+60=100
Teaching Department:	AI&ML		

Course Objectives:

- To understand the foundations of machine learning and deep learning required for transfer learning.
- To expose students to the domains, tasks and strategies involved in transfer learning.
- To impart knowledge of pretrained CNN architectures for feature extraction and fine-tuning.
- To apply transfer learning techniques across image, text and audio classification problems.
- To understand advanced and generative transfer learning using style transfer, captioning and transformer models.

Unit 1	**INTRODUCTION TO MACHINE LEARNING AND DEEP LEARNING**	**Periods: 12**

Machine Learning fundamentals - ML techniques, CRISP-DM, standard ML workflow - Exploratory Data Analysis - Feature Extraction, Engineering and Selection. Deep Learning essentials - frameworks, GPU-based environments, neural network basics. Deep Learning architectures - Convolutional Neural Networks (CNN), Deep Neural Networks (DNN), Recurrent Neural Networks (RNN), Long Short-Term Memory (LSTM) and Capsule Networks. The universal workflow of machine learning and deep learning from first principles.

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 2	**TRANSFER LEARNING FUNDAMENTALS AND STRATEGIES**	**Periods: 12**

Introduction to Transfer Learning - motivation, domain, task and marginal probability framework. Transfer Learning strategies - Inductive Transfer Learning, Transductive Transfer Learning and Unsupervised Transfer Learning. Transfer Learning and Deep Learning - types of Deep Transfer Learning. Challenges of Transfer Learning - Negative Transfer and Domain Divergence. Foundation models and self-supervised pretraining for downstream fine-tuning.

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 3	**DEEP TRANSFER LEARNING WITH CONVOLUTIONAL NEURAL NETWORKS**	**Periods: 12**

The need for Transfer Learning - building CNN models from scratch. Leveraging pretrained CNN models - VGG-16, Inception and ResNet as feature extractors and fine-tuners. Evaluating deep learning models - model freezing and fine-tuning strategies. CNN architecture design principles - residual connections, batch normalization and depthwise separable convolutions. Vision Transformers versus traditional ConvNets for image classification tasks.

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz	
	RBT Level: Apply	
Unit 4	**TRANSFER LEARNING APPLICATIONS - VISION, TEXT AND AUDIO**	**Periods: 12**
Image recognition and classification using Deep Learning - benchmarking datasets and state-of-the-art models using Transfer Learning. Text document categorization - word representations and CNN document models for text classification. Audio Event Identification and Classification using Transfer Learning - acoustic feature extraction and pretrained audio models. Image segmentation and object detection using pretrained models.		
Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz	
	RBT Level: Apply	
Unit 5	**ADVANCED AND GENERATIVE TRANSFER LEARNING**	**Periods: 12**
DeepDream and Neural Style Transfer - loss functions and custom optimizers for artistic style transfer. Automated Image Caption Generator - encoder-decoder models using Transfer Learning. Image Colorization using Deep Transfer Learning. Transformer architecture and attention mechanisms for Transfer Learning in Natural Language Processing. Text and image generation - building GPT-like language models and diffusion models; scaling and tuning of large pretrained models.		
Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz	
	RBT Level: Apply	
		TotalPeriods: 60
Suggested Activities and Evaluation Methods:		
Tutorials, Mini Projects, Quiz / MCQ (GATE Related Questions), Case Study, Students' performance in continuous Assessment / Student Presentations, Model Exam		
Course Outcomes:		
After Successful completion of this course, the student should be able to **CO1:** Explain the fundamentals of machine learning and deep learning architectures used for transfer learning. **CO2:** Describe the strategies and challenges of transfer learning across domains and tasks. **CO3:** Apply pretrained CNN models such as VGG-16, Inception and ResNet for image classification through fine-tuning. **CO4:** Apply transfer learning techniques to solve problems in vision, text and audio applications. **CO5:** Design generative and advanced transfer learning solutions such as style transfer, caption generation and transformer-based models.		
Textbooks:		
1. Dipanjan Sarkar, Raghav Bali, and Tamoghna Ghosh, "Hands-On Transfer Learning with Python: Implement Advanced Deep Learning and Neural Network Models Using TensorFlow and Keras", 1st Edition, Packt Publishing, 2018. (UNIT I-IV) 2. François Chollet and Matthew Watson, "Deep Learning with Python", 3rd Edition, Manning Publications, 2025. (UNIT V)		

References:

1. Qiang Yang, Yu Zhang, Wenyuan Dai, and Sinno Jialin Pan, "Transfer Learning", 1st Edition, Cambridge University Press, 2020.

2. Lewis Tunstall, Leandro von Werra, and Thomas Wolf, "Natural Language Processing with Transformers", 1st Edition, O'Reilly Media, 2022.

Web links and Video Lectures (e-Resources):

1. Link: https://www.manning.com/books/deep-learning-with-python-third-edition
2. Link:https://subscription.packtpub.com/book/data/9781788831307/4/ch04lvl1sec23/transfer-learning-strategies

ONLINE/NPTEL COURSES:

1. Deep Learning - IIT Ropar

https://onlinecourses.nptel.ac.in/noc25_cs21/preview

2. Deep Learning for Computer Vision - IIT Hyderabad

https://onlinecourses.nptel.ac.in/noc21_cs93/preview

3. Deep Learning for Natural Language Processing - IIT Kharagpur

https://onlinecourses.nptel.ac.in/noc25_cs22/preview

CO-PO Mapping													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO 2**
CO1	3	2	2	1	-	-	-	-	-	-	1	-	2
CO2	3	3	2	1	-	-	-	-	-	-	1	-	2
CO3	3	2	2	2	1	-	-	-	-	-	1	-	2
CO4	3	2	3	2	1	-	-	-	-	-	1	-	2
CO5	3	3	3	2	2	-	-	-	-	-	1	-	2
AVG	3	2.4	2.4	1.6	1.3	-	-	-	-	-	1	-	2
1 – Low, 2 – Medium, 3 – High, '-' – No correlation													

LARGE LANGUAGE MODELS			
Course Code:	25UAIH05	**Course Type:**	PC
Teaching Periods / Week (L:T:P):	3:1:0	**Credits:**	4
Total Teaching Periods:	45	**CAT+ ESE Marks:**	40 + 60 = 100
Teaching Department:	AI&ML		

Course Objectives:

- To understand the fundamentals of large language models (LLMs) and their evolution.
- To explore transformer architectures and attention mechanisms underlying LLMs.
- To analyze training strategies including pretraining, fine-tuning, and curriculum learning.
- To evaluate LLM capabilities in reasoning, generation, and downstream tasks.
- To examine ethical considerations, biases, and safety in LLM deployment and LLM applications.

Unit 1	**INTRODUCTION TO LARGE LANGUAGE MODELS**	**Periods: 12**

Overview of language modeling – N-gram models and neural language models – Word embeddings (Word2Vec, GloVe) – Introduction to transformers – Self-attention and multi-head attention – Positional encoding – Evolution from BERT to GPT series – Scaling laws and emergent abilities – Key LLMs: GPT-3, PaLM, LLaMA, Chinchilla.

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 2	**TRANSFORMER ARCHITECTURES AND TRAINING**	**Periods: 12**

Transformer encoder-decoder architecture – Decoder-only models (GPT) – Encoder-only models (BERT) – Pretraining objectives: masked language modeling, causal language modeling – Training data curation and tokenization – Byte-pair encoding – Optimization: AdamW, learning rate schedules – Distributed training and parallelism – Model parallelism and pipeline parallelism.

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 3	**CURRICULUM LEARNING FOR LLMS**	**Periods: 12**

LLM - Difficulty metrics: readability, lexical diversity, compression ratio, perplexity – Pacing functions: linear, quadratic, inverse quadratic – Sequence length curriculum – Domain and content complexity curriculum – Curriculum-guided layer scaling

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 4	**FINE-TUNING AND ADAPTATION**	**Periods: 12**

Supervised fine-tuning – Instruction tuning – Curriculum instruction tuning – Reinforcement learning from human feedback (RLHF) – Self-paced reinforcement fine-tuning (SPaRFT) – Domain-specific adaptation – Multi-modal LLMs – Parameter-efficient fine-tuning: LoRA, adapters – Evaluation benchmarks: GLUE, SuperGLUE, MMLU, HumanEval.

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz	
	RBT Level: Apply	
Unit 5	**APPLICATIONS, ETHICS, AND FUTURE DIRECTIONS**	**Periods: 12**

LLM applications: text generation, summarization, translation, code generation – Retrieval-augmented generation (RAG) – Agentic AI systems – Planning and tool use – Safety and alignment – Bias and fairness – Hallucination mitigation – Interpretability – Future trends: efficient training, long-context models, multi-agent systems.

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Total Periods: 60

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (GATE-related questions), Case Study, Continuous Assessment, Student Presentations, Model Exam.

Course Outcomes:

After successful completion of this course, the student should be able to:

CO1: Explain the architecture and training of large language models.
CO2: Implement transformer-based models for language tasks.
CO3: Compare curriculum learning strategies for LLM pretraining.
CO4: Assess fine-tuning methods and their impact on model performance.
CO5: Design a curriculum learning schedule for a specific LLM application.

Text Books:

T1: Tong Xiao & Jingbo Zhu, "Foundations of Large Language Models", 2025.

T2: Wiley Wiley and Tanmoy Chakraborty, "Introduction to Large Language Models", ISBN: 9789363864740, 484 pages.

T3: Jurafsky, D. & Martin, J. H., "Speech and Language Processing", 3rd edition, 2024.

T4: Xiao T, Zhu J,"Foundations of Large Language Models", 2016.

References:

R1: Radford, A. et al., Improving Language Understanding by Generative Pre-Training, OpenAI 2018.

R2: Raffel, C. et al., Exploring the Limits of Transfer Learning with a Unified Text-to-Text Transformer, JMLR 2020.

R3: Ouyang, L. et al., Training language models to follow instructions with human feedback, NeurIPS 2022.

R4: Touvron, H. et al., LLaMA: Open and Efficient Foundation Language Models, arXiv 2023.

R5: Chowdhery, A. et al., PaLM: Scaling Language Modeling with Pathways, JMLR 2023**.**

Web links and Video Lectures (e-Resources):

1. https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs88
2. https://huggingface.co/learn/nlp-course
3. http://introtodeeplearning.com/
4. https://www.coursera.org/specializations/natural-language-processing
5. https://arxiv.org/abs/2005.14165

CO-PO& PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO8	PO9	PO10	PO11	PSO1	PSO 2
CO1	3	2	1	-	-	-	-	-	-	-	3	2
CO2	3	3	2	1	2	-	-	-	-	-	3	2
CO3	2	3	3	2	1	-	-	-	-	-	2	3
CO4	2	3	3	3	2	1	-	-	-	1	2	3
CO5	3	3	3	3	3	2	1	2	1	2	3	3
AVG	2.6	2.8	2.4	2.3	2	1.5	1	2	1	1.5	2.6	2.6

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

SYLLABUS FOR MINOR DEGREE COURSES

Offered to other departments applicable for CSE, ECE, EEE, MECH, RA,FT, CSE(ICB)

<table>
<tr><td colspan="5">ARTIFICIAL INTELLIGENCE</td></tr>
<tr><td colspan="2">Course Code:</td><td>25UAIM01</td><td>Course Type:</td><td>PC</td></tr>
<tr><td colspan="2">Teaching Periods / Week (L:T:P):</td><td>3:1:0</td><td>Credits:</td><td>4</td></tr>
<tr><td colspan="2">Total Teaching Periods:</td><td>60</td><td>CAT+ ESE Marks:</td><td>40+60=100</td></tr>
<tr><td colspan="2">Teaching Department:</td><td colspan="3">AI&ML</td></tr>
<tr><td colspan="5">Course Objectives:</td></tr>
<tr><td colspan="5">To provide students with the knowledge of advanced Artificial Intelligence techniques, intelligent systems, reinforcement learning, generative AI, and their real-world applications.</td></tr>
<tr><td>Unit 1</td><td colspan="3">INTRODUCTION:</td><td>Periods:12</td></tr>
<tr><td colspan="5">INTRODUCTION: Fundamentals of Artificial Intelligence: Definitions, Introduction, key concepts, Evolution, Terminology, Approaches and Goals. Ethical aspects of Artificial Intelligence. Relation between Artificial Intelligence, Machine Learning and Deep Learning. Intelligent Agents: Structure, Types, and interaction with the environment. PLANNING IN ARTIFICIAL INTELLIGENCE:</td></tr>
<tr><td colspan="2" rowspan="2">Teaching Learning Process</td><td colspan="3">Pedagogy:Chalk and Talk, PPT, Quiz</td></tr>
<tr><td colspan="3">RBT Level: Apply</td></tr>
<tr><td>Unit 2</td><td colspan="3">KNOWLEDGE REASONING:</td><td>Periods:12</td></tr>
<tr><td colspan="5">Introduction to Knowledge representation, Building a Knowledge Base: propositional logic, first order predicate logic and inferencing, resolution, representing Knowledge using rules: Procedural versus Declarative Knowledge, Forward versus Backward reasoning. Uncertain Knowledge and Reasoning, Statistical Reasoning: Probability and Bayes theorem, Bayesian Networks and Dempster-Shafer Theory.</td></tr>
<tr><td colspan="2" rowspan="2">Teaching Learning Process</td><td colspan="3">Pedagogy:Chalk and Talk, PPT, Quiz</td></tr>
<tr><td colspan="3">RBT Level: Apply</td></tr>
<tr><td>Unit 3</td><td colspan="3">PROBLEM SOLVING:</td><td>Periods:12</td></tr>
<tr><td colspan="5">State space search; production systems, search space control, Uninformed and Informed Search: depth first search, breadth-first search. Heuristic Search: Best First Search, Hill Climbing, AND/OR Heuristic Search. Game Playing: Minimax, alpha-beta pruning.</td></tr>
<tr><td colspan="2" rowspan="2">Teaching Learning Process</td><td colspan="3">Pedagogy:Chalk and Talk, PPT, Quiz</td></tr>
<tr><td colspan="3">RBT Level: Apply</td></tr>
<tr><td>Unit 4</td><td colspan="3">PLANNING IN ARTIFICIAL INTELLIGENCE:</td><td>Periods:12</td></tr>
<tr><td colspan="5">PLANNING: The Planning problem- Planning with State Space Search- Partial Order Planning- Planning Graphs- Planning with Propositional Logic- Analysis of Planning approaches- Hierarchical planning- Conditional Planning- Continuous and Multi Agent planning.</td></tr>
<tr><td colspan="2" rowspan="2">Teaching Learning Process</td><td colspan="3">Pedagogy:Chalk and Talk, PPT, Quiz</td></tr>
<tr><td colspan="3">RBT Level: Apply</td></tr>
<tr><td>Unit 5</td><td colspan="3">LEARNING IN ARTIFICIAL INTELLIGENCE:</td><td>Periods:12</td></tr>
</table>

LEARNING: Forms of learning- Learning from observation- Inductive learning– Decision trees– Explanation based learning– Statistical Learning methods- Reinforcement Learning- Neural Net learning and Genetic learning.

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Total	**Periods: 60**

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study, Students' performance in continuous Assessment / Student Presentations, Model Exam.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Explain the fundamental concepts, principles, and ethical aspects of Artificial Intelligence, including intelligent agents and AI methodologies.

CO2: Apply knowledge representation and reasoning techniques to represent knowledge and perform logical and probabilistic inference.

CO3: Analyze AI problem-solving techniques using search algorithms, heuristic methods, and game-playing strategies.

CO4: Demonstrate planning techniques for solving complex problems using state space, hierarchical, conditional, and multi-agent planning approaches.

CO5: Examine various artificial intelligence learning techniques, including supervised learning, reinforcement learning, neural networks, and evolutionary learning methods.

Text Books:

T1: S.Russel, P.Norvig, "Artificial Intelligence – A Modern Approach," Forth Edition, Pearson Education, 2021.

T2: Patrick Henry Winston, "Artificial Intelligence", Third Edition, Addison-Wesley Publishing Company, 2004.

T3: Nils J. Nilsson," Principles of Artificial Intelligence", Illustrated Reprint Edition, Springer Heidelberg, 2014

T4: Artificial Intelligence, Elaine Rich, Kevin Knight, and Shivashankar B. Nair, Third Edition, McGraw-Hill Education, 2009.

T5: Artificial Intelligence: Foundations of Computational Agents, David L. Poole and Alan K. Mackworth, Third Edition, Cambridge University Press, 2023.

References:

R1: Artificial Intelligence: Structures and Strategies for Complex Problem Solving, George F. Luger, Sixth Edition, Pearson Education, 2009.

R2: Artificial Intelligence: A New Synthesis, Nils J. Nilsson, Morgan Kaufmann Publishers, 1998.

R3: Kevin Night, Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Third Edition,McGraw Hill, 2017.

R4: Artificial Intelligence: Structures and Strategies for complex problem solving, G. Luger, 4th Edition, Pearson Education, 2002.

R5: N.P. Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press, 2nd Edition, 2005.

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/106106184

2. https://nptel.ac.in/courses/106105216

CO-PO& PSO Mapping

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

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

MACHINE LEARNING			
Course Code:	25UAIM02	**Course Type:**	Theory
Teaching Periods / Week (L:T:P):	3:1:0	**Credits:**	4
Total Teaching Periods:	60	**CAT+ ESE Marks:**	40+60=100
Teaching Department:	AI&ML		

Course Objectives:

To understand the fundamentals of machine learning and apply regression, classification, clustering, model evaluation, and optimization techniques to solve real-world problems.

Unit 1	**INTRODUCTION**	**Periods:12**

Overview of Machine Learning –Types of Learning: Unsupervised Learning– Supervised Learning-Reinforcement Learning–Machine Learning Workflow-Applications of Machine Learning– Banking, Finance,Healthcare, Insurance – Challenges and Issues in Machine learning.

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 2	**REGRESSION**	**Periods:12**

Introduction to Regression – Mathematical Model of Linear Regression – Simple Linear regression – Multiple Linear Regression – Improving Accuracy of Linear Regression Models - Polynomial Regression - Logistic regression – Maximum Likelihood Estimation –Regularization Techniques: Ridge Regression – Lasso Regression – Elastic Net Regression.

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 3	**CLASSIFICATION ALGORITHMS**	**Periods:12**

Introduction to Feature Engineering – Feature construction – Feature extraction – Feature selection – Classification Learning Process - Classification Algorithms: k- Nearest Neighbors – Decision Trees – Random Forest Model – Support Vector Machines.

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 4	**CLUSTERING ALGORITHMS**	**Periods:12**

Clustering - Types of Clustering Techniques: Partitioning methods – k – Medoids Algorithm – Hierarchical Clustering – Density Based Clustering –Association Rule Mining:Association Rules – Apriori algorithm for Association Rule Learning -Expectation Maximization algorithm-Gaussian Mixture Models.

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 5	**MODEL EVALUATION AND OPTIMIZATION**	**Periods:12**

Model Evaluation Metrics: Confusion Matrix, Accuracy, Precision, Recall, F1-Score, ROC Curve, and AUC- Cross Validation Techniques - Bias-Variance Trade-off - Overfitting and Underfitting – Hyperparameter Tuning – Optimization Techniques: Gradient Descent, Stochastic Gradient Descent.

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply
Total	**Periods: 60**

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study, Students' performance in continuous Assessment / Student Presentations, Model Exam.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Understand the fundamental concepts, types, workflow, applications, challenges, and issues of Machine Learning.

CO2: Apply regression techniques and regularization methods for predictive modeling and improved model performance.

CO3: Apply feature engineering techniques and classification algorithms to solve supervised learning Problems.

CO4: Understand clustering and association rule mining techniques for discovering patterns from unlabeled data.

CO5: Evaluate, optimize, and improve machine learning models using performance metrics,validation techniques, and optimization algorithms.

Text Books:

T1: Thomas P. Trappenberg, "Fundamentals of Machine Learning", Oxford University Press, 2020

T2: Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", MIT Press, 2012.

T3: Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, 3rd Edition 2014.

References:

R1: Tom M Mitchell, "Machine Learning", First Edition, McGraw Hill Education, 2013.

R2: Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012.

R3: Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/106106139

CO-PO& PSO Mapping												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO 2**
CO1	3	2	2	-	1	-	-	1	-	1	1	1
CO2	3	2	2	-	1	-	-	1	-	1	1	1
CO3	3	2	2	-	1	-	-	1	-	1	1	1
CO4	3	2	2	-	1	-	-	1	-	1	1	1
CO5	3	2	2	-	1	-	-	1	-	1	1	1
AVG	3	2	2	-	1	-	-	1	-	1	1	1
1 – Low, 2 – Medium, 3 – High, '-' – No correlation												

FOUNDATION OF DATA SCIENCE			
Course Code:	25UAIM03	**Course Type:**	PC
Teaching Periods / Week (L:T:P):	3:1:0	**Credits:**	4
Total Teaching Periods:	60	**CAT+ ESE Marks:**	40+60= 100
Teaching Department:	AI&ML		

Course Objectives:

To gain knowledge in data science fundamentals and process utilizing the Python libraries for Data Wrangling and presenting and interpreting data using visualization libraries in Python

Unit 1	**INTRODUCTION**	**Periods:12**

Need for data science – Benefits and Uses – Facets of Data - Defining Big Data and the Three Vs - Data Science Process –Large Data Set Handling – Techniques for handling Large volumes of Data – Programming tips for handling large data sets.

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 2	**DESCRIBING DATA I**	**Periods:12**

Frequency distributions – Outliers – relative frequency distributions – cumulative frequency distributions – frequency distributions for nominal data – interpreting distributions – graphs –averages – mode – median – mean – averages for qualitative and ranked data – describing variability – range – variance – standard deviation – degrees of freedom – inter quartile range

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 3	**DESCRIBING DATA II**	**Periods:12**

Scatter plots – Regression – Regression line – least squares regression line – Standard error of estimate – Interpretation of r2 – Multiple regression equations – Regression toward the mean - Populations – samples – random sampling – Sampling distribution- standard error of the mean - Hypothesis testing – z-test – z-test procedure

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 4	**PYTHON FOR DATA HANDLING**	**Periods:12**

Basics of Num Py arrays –aggregations –computations on arrays –comparisons, masks, Boolean logic – fancy indexing –structured arrays –Data manipulation with Pandas – Visualization with mat plot lib – line plots –scatter plots –visualizing errors –density and contour plots –histograms, binnings, and density –three-dimensional plotting

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Unit 5	**DATA VISUALIZATION**	**Periods:12**

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

Teaching Learning Process	**Pedagogy:**Chalk and Talk, PPT, Quiz
	RBT Level: Apply

Total	Periods: 60

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study, Students' performance in continuous Assessment / Student Presentations, Model Exam.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Define the data science process

CO2: Understand different types of data description for data science process

CO3: Gain knowledge on relationships between data

CO4: Use the Python Libraries for Data Wrangling

CO5: Apply visualization Libraries in Python to interpret and explore data

Text Books:

T1: David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.

T2: Robert S. WiSe and John S. Wise, "Statistics", Eleventh Edition, Wiley Publications, 2017.

T3: Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.

References:

R1: Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press,2014.

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/106106179

CO-PO& PSO Mapping

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

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

DATA VISUALIZATION			
Course Code:	25UAIM04	**Course Type:**	PC
Teaching Periods / Week (L:T:P):	3:1:0	**Credits:**	4
Total Teaching Periods:	60	**CAT+ ESE Marks:**	40+60=100
Teaching Department:	AI&ML		

Course Objectives:

To understand the basic concepts in Data visualization technique and preparing and Pre-processing data.

Unit1	**INTRODUCTION**	**Periods: 12**

History of Visualization – Need for Visualization - Principles of Data Visualization - Data Visualization Process - Interactive Visualization – Web Specific Components – Common Types of Data Visualization – Data Visualization and Info graphics – Dashboards.

Teaching Learning Process	**Pedagogy:**
	RBTLevel:L3

Unit2	**VISUALIZATION IN PYTHON**	**Periods: 12**

Visualization – Matplotlib package – Plotting Graphs– Controlling Graph – Adding Text – More Graph Types – Getting and setting values – Patches. Visual Encoding Techniques - Colour Theory in Visualization - Chart Selection Techniques - Types of Charts - Interactive Visualization Features.

Teaching Learning Process	**Pedagogy:**
	RBTLevel:L3

Unit3	**DATA ABSTRACTION**	**Periods: 12**

Data Set types – Attribute Types – Semantics. Task Abstraction: Actions – Targets. Charts – Data Pre-processing - Choosing the optimal charts– Making charts effective – Context in Visualization - Analyzing Visual Patterns – Beautiful vs Useful Design - Cognitive Load Theory - Responsive Design principles.

Teaching Learning Process	**Pedagogy:**
	RBTLevel:L3

Unit4	**BIG DATA VISUALIZATION**	**Periods: 12**

Challenges - Real-time visualization - Streaming data visualization - Scalable dashboards - Applications of Data Visualization: Business Intelligence - Healthcare - Finance - Education - Scientific Research - Marketing Analytics - Sports Analytics - Government and Public Policy - Emerging Trends:AI-assisted visualization - Augmented Analytics.

Teaching Learning Process	**Pedagogy:**
	RBTLevel:L3

Unit5	**PERCEPTION AND VISUALIZATION**	**Periods: 12**

Perception and Visualization – Perceptual Processing – Metrics - The Visualization Process – Visual Variables – Taxonomies. Visualization validation: Threats to Validity – Validation approaches.
Popular Data Visualization Libraries: D3.js- Chart.js - Plotly - Google Charts - High charts - Apache E Charts.

Teaching Learning Process	**Pedagogy:**
	RBTLevel:L3
Total	**Periods : 60**

Suggested Activities and Evaluation Methods:
Tutorials, Mini Projects, Quiz / MCQ (Gate Related Questions), Case Study / Students' performance in continuous Assessment / Student Presentations, Model Exam

Course Outcomes:

After Successful completion of this course, the student should be able to
CO1: To understand evolution and significance of data visualization.
CO2: To understand repairing and pre-processing data.
CO3: To understand the Objectives of Data Visualization.
CO4: To understand professional data visualization techniques.
CO5: To understand the fundamentals of Universal design.

Textbooks:

T1: Matthew O.Ward Interactive Data Visualization: Foundations, Techniques, andApplications AK Peters / CRC Press.
T2: Mico Yuk. Data Visualization For Dummies 3. Tamara Munzner. VisualizationAnalysis and Design AK Peters Publications.
T3: Steve Wexler, Jeffrey Shaffer, and Andy Cotgreave : The Big Book of Dashboards, Wiley.

References:

R1: Ben Fry (2008). Visualizing Data. O'Reilly Media. *Covers:* Data visualization process, interactive visualization, visualization techniques.
R2: Steve Wexler, Jeffrey Shaffer, &Andy Cotgreave (2017). The Big Book of Dashboards: Visualizing Your Data Using Real-World Business Scenarios. Wiley.
***R3*:**Colin Ware (2021). Information Visualization: Perception for Design (4th ed.). Morgan Kaufmann. Covers: Human perception, visualization design, interactive visualization.

Web links and Video Lectures (e-Resources):

1. https://archive.nptel.ac.in/courses/106/106/106106212/

CO-PO& PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO 2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2
CO2	3	-	-	1	-	-	-	-	-	-	-	-	2
CO3	3	-	-	-	1	-	-	-	-	-	-	-	2
CO4	3	2	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	3	3	2	-	-	-	-	-	-	-	2
AVG	3	0.8	0.6	0.8	0.6	-	-	-	-	-	-	-	2

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

BUSINESS INTELLIGENCE			
Course Code:	25UAIM05	**Course Type:**	PC
Teaching Periods / Week (L:T:P):	3:1:0	**Credits:**	4
Total Teaching Periods:	60	**CAT+ ESE Marks:**	40+60=100
Teaching Department:	AI&ML		

Course Objectives:

- To understand the changing business environment and the framework for business intelligence and analytics.
- To expose students to artificial intelligence concepts, data preprocessing and big data analytics technologies.
- To impart knowledge of business intelligence tools such as OLAP, dashboards and key performance indicators.
- To apply data mining methods and prescriptive analytics for model-based decision making.
- To understand the fundamentals and business applications of social media analytics.

Unit 1	**INTRODUCTION TO BUSINESS INTELLIGENCE**	**Periods: 12**

An Overview of Business Intelligence - Changing Business Environments and Evolving Needs for Decision Support and Analytics. Decision-Making Processes and Computerized Decision Support Framework. Evolution of Computerized Decision Support to Analytics/Data Science. A Framework for Business Intelligence, Analytics Overview.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Problem Solving
	RBT Level: Apply

Unit 2	**ARTIFICIAL INTELLIGENCE AND DATA ANALYTICS**	**Periods: 12**

Artificial Intelligence: Concepts, Drivers of Artificial Intelligence, Major Technologies of Artificial Intelligence, Business Applications of Artificial Intelligence, Conversational AI, Chatbots. Nature of Data in Analytics, Taxonomy of Data, Data Preprocessing. Definition of Big Data, Fundamentals of Big Data Analytics, Big Data Technologies, Introduction to Statistical Modeling.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Problem Solving
	RBT Level: Apply

Unit 3	**BUSINESS INTELLIGENCE**	**Periods: 12**

Introduction to Business Intelligence, Business Intelligence Opportunity Analysis Overview, Content Management System, End User Segmentation, Basic Reporting and Querying. Online Analytical Processing (OLAP), OLAP Concepts, Dashboard, Key Performance Indicators (KPIs). Advanced and Emerging Business Intelligence Technologies, Future of Business Intelligence, Critical Challenges for Business Intelligence Success.

Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Problem Solving
	RBT Level: Apply

Unit 4	DATA MINING AND PRESCRIPTIVE ANALYTICS	Periods: 12
Introduction to Data Mining, Data Mining Concepts, Data Mining Applications, Data Mining Process, Data Mining Methods. Introduction to Prescriptive Analytics, Model-Based Decision Making, Decision Making under Certainty, Uncertainty and Risk.		
Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Problem Solving	
	RBT Level: Apply	
Unit 5	**SOCIAL MEDIA ANALYTICS**	**Periods: 12**
Introduction to Social Media Analytics, Social Analytics, Social Media Data, Social Media Metrics. Applications of Social Media Analytics, Benefits of Social Media Analytics, Challenges in Social Media Analytics.		
Teaching Learning Process	**Pedagogy:** Chalk and Talk, PPT, Problem Solving	
	RBT Level: Apply	
Total		**Periods: 60**

Suggested Activities and Evaluation Methods:

Tutorials, Mini Projects, Quiz / MCQ (GATE Related Questions), Case Study, Students' performance in continuous Assessment / Student Presentations, Model Exam

Course Outcomes:

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

CO1: Understand the changing business environment, decision-making processes and the framework for business intelligence and analytics.

CO2: Analyze artificial intelligence concepts, nature of data, data preprocessing and big data analytics technologies.

CO3: Understand business intelligence tools and apply OLAP, dashboards and KPIs for reporting and decision support.

CO4: Analyze and apply data mining methods and prescriptive analytics models for decision making under uncertainty and risk.

CO5: Analyze social media data, metrics and analytics applications for business decision making.

Textbooks:

1. Ramesh Sharda, Dursun Delen and Efraim Turban, “Business Intelligence, Analytics, Data Science and AI – A Managerial Perspective”, 5th edition, Global Edition, Pearson Education Limited, 2024.

References:

1. Steve Williams, Business Intelligence Strategy and Big Data Analytics - A General Management Perspective,
Morgan Kaufmann (Elsevier), 2016.
2. Vincent Charles, Pratibha Garg, Neha Gupta and Mohini Agarwal, Data Analytics and Business Intelligence -
Computational Frameworks, Practices, and Applications, CRC Press, 2023.
3. Ira J. Haimowitz, DATA ANALYTICS FOR BUSINESS - Lessons for Sales, Marketing, and Strategy, Routledge
(Taylor & Francis), 2023.

Web links and Video Lectures (e-Resources):

- https://www.tableau.com/business-intelligence/what-is-business-intelligence
- https://onlinecourses.nptel.ac.in/noc24_cs65/preview
- https://onlinecourses.nptel.ac.in/noc21_cs45/preview
- https://cloud.google.com/learn/what-is-business-intelligence
- https://www.geeksforgeeks.org/what-is-data-analytics/

CO-PO Mapping

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