AD

VIMAL JYOTHI
ENGINEERING COLLEGE (AUTONOMOUS)
CHEMPERI - KANNUR I WWW.VJEC.AC.IN

VJEC B. Tech. Syllabus 2024

Semester III

Artificial Intelligence and Data Science
Branch Code: AD

SEMESTER S3

MATHEMATICS FOR COMPUTER SCIENCE – 3

Common to Group A

Course Code	**GAMAT301**	**CIE Marks**	**40**
Teaching Hours/Week (L: T:P: R)	**3:0:0:0**	**ESE Marks**	**60**
Credits	**3**	**Exam Hours**	**2 Hrs. 30 Min.**
Prerequisites (if any)	**Basic calculus**	**Course Type**	**Theory**

Course Objectives:

1. To familiarize students with the foundations of probability and analysis of random processes used in various applications in engineering and science.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Random variables, Discrete random variables and their probability distributions, Cumulative distribution function, Expectation, Mean and variance, the Binomial probability distribution, the Poisson probability distribution, Poisson distribution as a limit of the binomial distribution, Joint pmf of two discrete random variables, Marginal pmf, Independent random variables, Expected value of a function of two discrete variables. [Text 1: Relevant topics from sections 3.1 to 3.4, 3.6, 5.1, 5.2]	**9**
2	Continuous random variables and their probability distributions, Cumulative distribution function, Expectation, Mean and variance, Uniform, Normal and Exponential distributions, Joint pdf of two Continuous random variables, Marginal pdf, Independent random variables, Expectation value of a function of two continuous variables. [Text 1: Relevant topics from sections 3.1, 4.1, 4.2, 4.3, 4.4, 5.1, 5.2]	**9**
3	Limit theorems : Markov's Inequality, Chebyshev's Inequality, Strong Law of Large Numbers (Without proof), Central Limit Theorem (without proof), Stochastic Processes: Discrete-time process, Continuous-time process, Counting Processes, The Poisson Process, Interarrival times (Theorems without proof) [Text 2: Relevant topics from sections 2.7, 2.9, 5.3]	**9**

4	Markov Chains, Random Walk Model, Chapman–Kolmogorov Equations, Classification of States, Irreducible Markov chain, Recurrent state, Transient state, Long-Run Proportions. (Theorems without proof) [Text 2: Relevant topics from sections 4.1, 4.2, 4.3, 4.4]	**9**

Course Assessment Method (CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	**Assignment/ Microproject**	**Internal Examination -1 (Written)**	**Internal Examination- 2 (Written)**	**Internal Examination- 3 (Written)**	**Total**
5	15	5	10	5	40

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	**Part B**	**Total**
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24 marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)	Assessment tool
CO1	Understand the concept, properties and important models of discrete random variables and to apply in suitable random phenomena.	**K3**	Written Examination/ Assignment
CO2	Understand the concept, properties and important models of continuous random variables and to apply in suitable random phenomena.	**K3**	Written Examination/ Assignment
CO3	Familiarize and apply limit theorems and to understand the fundamental characteristics of stochastic processes.	**K3**	Written Examination/ Assignment
CO4	Solve problems involving Markov Chains, to understand their theoretical foundations and to apply them to model and predict the behaviour of various stochastic processes.	**K3**	Written Examination/ Assignment

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Probability and Statistics for Engineering and the Sciences	Devore J. L	Cengage Learning	9th edition,2016
2	Introduction to Probability Models	Sheldon M. Ross	Academic Press	13th edition,2024

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Probability and Random Processes for Electrical and Computer Engineers	John A. Gubner	Cambridge University Press	2012
2	Probability Models for Computer Science	Sheldon M. Ross	Academic Press	1st edition,2001
3	Probability, Random Variables and Stochastic Processes	Papoulis, A. & Pillai, S.U	Tata McGrawHill.	4th edition,2002
4	Probability, Statistics and Random Processes	Kousalya Pappu	Pearson	2013

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://onlinecourses.nptel.ac.in/noc22_mg31/preview
2	https://archive.nptel.ac.in/courses/108/103/108103112/

SEMESTER S3
FOUNDATIONS OF ARTIFICIAL INTELLIGENCE

Course Code	**PCADT302**	**CIE Marks**	**40**
Teaching Hours/Week (L: T:P: R)	3:1:0:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. Introduce the fundamental principles of intelligent systems.
2. Impart a good insight into the characteristics of intelligent systems, knowledge representation schemes, logic and inference mechanisms.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Artificial intelligence:- AI definition - Foundations of AI, History and applications of AI; Intelligent agents - Agents and Environments, The concept of rationality, The nature of environments, Structure of agents.	**7**
2	Problem Solving by Searching:- Problem Solving Agents and examples - Searching for Solutions; Uninformed Search strategies - Breadth First Search, Uniform Cost Search, Depth First Search, Depth Limited Search, Iterative deepening DFS; Heuristic function; Informed Search Strategies - Greedy Search, A* Search, AO* Search.	13
3	Advanced Search and Game Playing:- Adversarial Search - Games, Optimal decisions in Games, MinMax algorithm, Alpha_Beta pruning; Constraint Satisfaction Problems- Constraint Propagation, Inferences in CSP's, Backtracking Search for CSP's.	10
4	Knowledge, Logic, and Reasoning Patterns:- Knowledge Based Agents - The Wumpus World; Logic - Propositional Logic; First order logic - Syntax and Semantics, Using First Order Logic, Knowledge Engineering in First order logic, Inference in first order logic; Propositional vs. first order inference; Unification & Lifting; Forward chaining; Backward chaining.	14

Course Assessment Method (CIE:

40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Micro-project	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Internal Examination- 3 (Written)	Total
5	15	5	10	5	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
● 2 Questions from each Module. ● Total of 8 Questions, each carrying 3 marks **(8x3 =24 marks)**	● Each question carries 9 marks. ● Two questions will be given from each module, out of which 1 question should be answered. ● Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	60

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		**Bloom's Knowledge Level (KL)**	**Assessment Tools**
CO1	Explain the fundamental concepts of intelligent systems.	K2	Written Exam
CO2	Apply searching strategies for real time scenarios.	K3	Written Exam & Assignment
CO3	Apply Constraint satisfaction problems for real time scenarios.	K3	Written Exam & Assignment
CO4	Apply methods of knowledge representation and processing within expert systems.	K3	Written Exam

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Artificial Intelligence – A Modern Approach	Stuart Russel, Peter Norvig	Pearson Education	4/e, 2021

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Artificial Intelligence: A new Synthesis	J. Nilsson	Elsevier Publishers.	1/e, 1998
2	Computational Intelligence : A logical approach	David Poole, Alan Mackworth, Randy Goebel	Oxford University Press	1/e, 2004
3	Artificial Intelligence: Structures and Strategies for Complex Problem Solving	George F. Luger	Pearson Education	6/e, 2009

Video Links (NPTEL, SWAYAM...) and Online Resources	
Module No.	**Link ID**
1	https://onlinecourses.nptel.ac.in/noc21_ge20/preview
2	https://onlinecourses.swayam2.ac.in/cec21_cs08/preview
3	https://www.w3schools.com/training/aws/introduction-to-artificial-intelligence.php
4	https://www.coursera.org/courses?query=artificial%20intelligence

DATA STRUCTURES AND ALGORITHMS

(Common to Group A)

Course Code	**PCCST303**	**CIE Marks**	**40**
Teaching Hours/Week (L: T:P: R)	**3:1:0:0**	**ESE Marks**	**60**
Credits	**4**	**Exam Hours**	**2 Hrs. 30 Min.**
Prerequisites (if any)	**UCEST105**	**Course Type**	**Theory**

Course Objectives:

1. To provide the learner a comprehensive understanding of data structures and algorithms.
2. To prepare them for advanced studies or professional work in computer science and related fields.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Basic Concepts of Data Structures** Definitions; Data Abstraction; Performance Analysis - Time & Space Complexity, Asymptotic Notations; Polynomial representation using Arrays, Sparse matrix (Tuple representation); Stacks and Queues - Stacks, Multi-Stacks, Queues, Circular Queues, Double Ended Queues; Evaluation of Expressions - Infix to Postfix, Evaluating Postfix Expressions.	**11**
2	**Linked List and Memory Management** Singly Linked List - Operations on Linked List, Stacks and Queues using Linked List, Polynomial representation using Linked List; Doubly Linked List; Circular Linked List; Memory allocation - First-fit, Best-fit, and Worst-fit allocation schemes; Garbage collection and compaction.	**11**
3	**Trees and Graphs** Trees :- Representation of Trees; Binary Trees - Types and Properties, Binary Tree Representation, Tree Operations, Tree Traversals; Expression Trees; Binary Search Trees - Binary Search Tree Operations; Binary Heaps - Binary Heap Operations, Priority Queue. Graphs :- Definitions; Representation of Graphs; Depth First Search and Breadth First Search; Applications of Graphs - Single Source All Destination.	**11**
4	**Sorting and Searching** Sorting Techniques :- Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Radix Sort. Searching Techniques :- Linear Search, Binary Search, Hashing - Hashing functions : Mid square, Division, Folding, Digit Analysis; Collision Resolution : Linear probing, Quadratic Probing, Double hashing, Open hashing.	**11**

Course Assessment Method (CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination -1 (Written)	Internal Examination - 2 (Written)	Internal Examination -3 (Written)	Total
5	15	5	10	5	40

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24 marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 subdivisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)	Assessment Tool
CO1	Identify suitable data structures for solving real-world problems and evaluate their performance using time and space complexity.	K3	Written Examination /Assignment
CO2	Describe and implement linear data structures, including arrays, linked lists, stacks, queues, sparse matrices, and polynomial representations.	K3	Written Examination /Assignment
CO3	Describe and implement non-linear data structures such as trees and graphs.	K3	Written Examination /Assignment
CO4	Select and implement appropriate searching and sorting techniques, including hashing, for various applications.	K3	Written Examination /Assignment

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fundamentals of Data Structures in C	Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed,	Universities press,	2/e, 2007
2	Introduction to Algorithms	Thomas H Cormen, Charles Leisesrson, Ronald L Rivest, Clifford Stein	PHI	3/e, 2009

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Classic Data Structures	Samanta D.	Prentice Hall India.	2/e, 2018
2	Data Structures and Algorithms	Aho A. V., J. E. Hopcroft and J. D. Ullman	Pearson Publication.	1/e, 2003
3	Introduction to Data Structures with Applications	Tremblay J. P. and P. G. Sorenson	Tata McGraw Hill.	2/e, 2017
4	Theory and Problems of Data Structures	Lipschuts S.	Schaum's Series	2/e, 2014

Video Links (NPTEL, SWAYAM…)	
Sl No.	**Link ID**
1	https://nptel.ac.in/courses/106102064
2	https://ocw.mit.edu/courses/6-851-advanced-data-structures-spring-2012/

SEMESTER S3

INTRODUCTION TO DATA SCIENCE

Course Code	PBADT304	CIE Marks	60
Teaching Hours/Week (L: T:P: R)	3:0:0:1	ESE Marks	40
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To understand the basic concepts of data science

2. To understand data representation, data pre-processing, data classification and model evaluation techniques

SYLLABUS

Module No	Syllabus Description	Contact Hours
1	**Introduction to data** :– Structured, Unstructured, Semi-structured, Data sets & Patterns; Brief history of Data Science; Introduction to Data Science; Importance of Data Science; Differences between AI, ML, DL, Data Science & Data Analytics; Real world applications of data science; Steps in data science process. Ethical and privacy implications of Data Science; Tools and Skills Needed – Introduction of platforms, Tools, Frameworks, Languages, Databases and Libraries, Current trends & Major research challenges in data science	9
2	Matrices to represent relations between data, and necessary linear algebraic operations on matrices -Approximately representing matrices by decompositions (SVD and PCA); Statistics: Descriptive Statistics: distributions and probability – Statistical Inference: Populations and samples – Statistical modeling – probability distributions – fitting a model – Hypothesis Testing	10
3	Data pre-processing: Data cleaning – data integration – Data Reduction Data Transformation and Data Discretization.- Evaluation of classification methods – Confusion matrix, Students T-tests and ROC curves-Exploratory Data Analysis – Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA	13
4	Basic Machine Learning Algorithms- Linear Regression- Logistic Regression – Classifiers - Feature Generation and Feature Selection – Feature Selection algorithms – Filters- Wrappers-Decision Trees-Random Forests	11

Suggestion on Project Topics

● Students can implement various data related projects, from any domain, using the techniques studied in the syllabus. It may contain sections for data storage, data pre-processing and small levels of data mining to recognize patterns in the data. Socially relevant project domains are highly appreciated. Check the datasets available at https://www.kaggle.com/datasets/ and perform data pre-processing operations such as data cleaning, missing value management and mine useful information from the dataset.

Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Project	Internal Examination-1	Internal Examination- 2	Internal Examination- 3	Total
5	35	5	10	5	60

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 2 marks **(8x2 =16marks)**	• Each question carries 6 marks. • Two questions will be given from each module, out of which l question should be answered. • Each question can have a maximum of 2 sub divisions. **(4x6 = 24 marks)**	40

Course Outcomes (COs)

At the end of the course students should be able to:

CO	Course Outcome	Bloom's Knowledge Level (KL)	Assessment Tool
COl	Recall the fundamental concepts and applications of data science, and make inferences on key important points.	K2	Written Exam
CO2	Comprehend the various methods of data representation	K3	Written Exam and Project
CO3	Analyse the different steps in data pre-processing and model evaluation	K3	Written Exam Project
CO4	Perform feature generation and feature selection for classification	K3	Written Exam Project

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

Note: *1.' Slight (Low), 2.- Moderate (Medium), 3. Substantial (High), - No Correlation*

Text Books

SI. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Data mining Concepts and Techniques	Jiawei Han, Michelin Kamber, Jian Pei	Morgan Kaufmann Publishers	3/e, 2011
2	Fundamentals of Data Science	Sanjeev J. Wagh, Manisha S. Bhende, and Anuradha D. Thakare	CRC Press	1/e, 2021
3	Data Mining and Analysis: Fundamental Concepts and Algorithms	Mohammed J. Zaki and Wagner Miera Jr	Cambridge University Press	1/e2014.

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Data Science for Business	Foster Provost, Tom Fawcett	O'Reilly Media	1/e, 2013
2	Data Science from Scratch: First Principles with Python".	Joel Grus	O'Reilly Media	1/e, 2015
3	Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython".	Wes McKinney	O'Reilly Media	1/e,2012

Video Links (NPTEL, SWAYAM...) and Online resources

Sl No	Link ID
1	https://nptel.ac.in/courses/106106179
2	https://onlinecourses.swayam2.ac.in/imb23_mg64/preview
3	https://www.w3schools.com/datascience/ds_introduction.asp
4	https://www.udemy.com/topic/data-science/free/?srsltid=AfmBOoqhWqxgZv5gsL3KSqj_u5AKXHldDJWOWdAwrJnfBJTnoBOqiJk-
5	https://www.simplilearn.com/

PBL Course Elements

L: Lecture (3 Hrs.)	R: Project (1 Hr.), 2 Faculty Members		
	Tutorial	Practical	Presentation
Lecture delivery	Project identification	Simulation/ Laboratory Work/ Workshops	Presentation (Progress and Final Presentations)
Group discussion	Project Analysis	Data Collection	Evaluation
Question answer Sessions/ Brainstorming Sessions	Analytical thinking And self-learning	Testing	Project Milestone Reviews, Feedback, Project reformation (If required)
Guest Speakers (Industry Experts)	Case Study/ Field Survey Report	Prototyping	Poster Presentation/ Video Presentation: Students present their results in a 2 to 5 minutes video

Assessment and Evaluation for Project Activity

SI. No	Evaluation for	Allotted Marks
1	Project Planning and Proposal	5
2	Contribution in Progress Presentations and Question Answer Sessions	4
3	Involvement in the project work and Team Work	3
4	Execution and Implementation	10
5	Final Presentations	5
6	Project Quality, Innovation and Creativity	3
Total		**30**

Project Assessment and Evaluation criteria (35 Marks)

1. Project Planning and Proposal (5 Marks)

- Clarity and feasibility of the project plan
- Research and background understanding
- Defined objectives and methodology

2. Contribution in Progress Presentation and Question Answer Sessions (4 Marks)

- Individual contribution to the presentation
- Effectiveness in answering questions and handling feedback

3. Involvement in the Project Work and Team Work (3 Marks)

- Active participation and individual contribution
- Teamwork and collaboration

4. Execution and Implementation (10 Marks)

- Adherence to the project timeline and milestones
- Application of theoretical knowledge and problem-solving
- Final Result

5. Final Presentation (5 Marks)

- Quality and clarity of the overall presentation
- Individual contribution to the presentation
- Effectiveness in answering questions

6. Project Quality, Innovation, and Creativity (3 Marks)

- Overall quality and technical excellence of the project
- Innovation and originality in the project
- Creativity in solutions and approaches

EVALUATION RUBRICS FOR PROJECT EVALUATION

No.	Parameters	Marks	Poor	Fair	Very Good	Outstanding
1	Project Planning and Proposal	5	No clear plan; vague objectives and poor organization	Basic plan with limited clarity or feasibility	Well-structured plan with clear goals and reasonable feasibility	Exceptionally clear, detailed, and feasible plan with strong vision
			(0 – 1 Marks)	**(2 – 3 Marks)**	**(4 Marks)**	**(5 Marks)**
2	Contribution in Progress Presentation and Question Answer Sessions	5	Rarely contributes; avoids questions or gives incorrect information	Minimal contribution; struggles to answer questions	Regular contributor; answers most questions confidently	Actively participates; provides clear, insightful answers and leads discussion
			(0 – 1 Marks)	**(2 – 3 Marks)**	**(4 Marks)**	**(5 Marks)**
3	Involvement in the Project Work and Team Work	5	Little to no contribution; negatively impacts team	Limited involvement; inconsistent participation	Regular involvement; cooperates and fulfils role	Fully engaged; highly collaborative and often leads or supports peers
			(0 - 1 Marks)	**(2 -3 Marks)**	**(4 Marks)**	**(5 Marks)**
4	Execution and Implementation	10	Fails to identify meaningful application of knowledge and problem-solving skill.	Only a few of the expected outcomes are achieved	Identifies some criteria but lacks strong justification.	Clearly identifies and justifies relevant application of theoretical knowledge and problem-solving skill
			(0 - 3 Marks)	**(4 - 7 Marks)**	**(8 Marks)**	**(10 Marks)**
5	Final Presentation (Panel and Students Deliver effective presentation, and able to answer all queries)	5	Disorganized, unclear, or off-topic; unable to respond	Basic structure but lacks confidence or clarity; weak Q&A	Clear presentation, mostly confident and accurate in answers	Highly polished, confident, and engaging presentation with excellent handling of questions
			(0 - 1 Marks)	**(2 - 3 Marks)**	**(4 Marks)**	**(5 Marks)**
6	Project Quality, Innovation, and Creativity	5	Lacks originality or relevance; poor quality	Basic project with limited originality	Good quality; shows creative approach or practical value	Innovative, original, and high-quality; stands out in design and thinking
			(0 - 1 Marks)	**(2 - 3 Marks)**	**4 Marks)**	**(5 Marks)**

SEMESTER S3

DIGITAL ELECTRONICS AND LOGIC DESIGN

(Common to Group A)

Course Code	**GAEST305**	**CIE Marks**	40
Teaching Hours/Week(L: T:P: R)	3:1:0:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. To familiarize the basic concepts of Boolean algebra and digital systems.
2. To enable the learner to design simple combinational and sequential logic circuits which is essential in understanding organization & design of computer systems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Introduction to digital Systems** :- Digital abstraction Number Systems – Binary, Hexadecimal, grouping bits, Base conversion; Binary Arithmetic – Addition and subtraction, Unsigned and Signed numbers; Fixed-Point Number Systems; Floating-Point Number Systems. Basic gates- Operation of a Logic circuit; Buffer; Gates - Inverter, AND gate, OR gate, NOR gate, NAND gate, XOR gate, XNOR gate; Digital circuit operation - logic levels, output dc specifications, input dc specifications, noise margins, power supplies; Driving loads - driving other gates, resistive loads and LEDs. **Verilog (Part 1) :-** HDL Abstraction; Modern digital design flow - Verilog constructs: data types, the module, Verilog operators.	**11**

2	**Combinational Logic Design: –** Boolean Algebra - Operations, Axioms, Theorems; Combinational logic analysis - Canonical SOP and POS, Minterm and Maxterm equivalence; Logic minimization - Algebraic minimization, K-map minimization, Dont cares, Code convertors. **Modeling concurrent functionality in Verilog:-** Continuous assignment - Continuous Assignment with logical operators, Continuous assignment with conditional operators, Continuous assignment with delay.	**11**
3	**MSI Logic and Digital Building Blocks** MSI logic - Decoders (One-Hot decoder, 7 segment display decoder), Encoders, Multiplexers, Demultiplexers; Digital Building Blocks - Arithmetic Circuits - Half adder, Full adder, half subtractor, full subtractor; Comparators. Structural design and hierarchy - lower level module instantiation, gate level primitives, user defined primitives, adding delay to primitives.	**8**
4	**Sequential Logic Design:-** Latches and Flip-Flops - SR latch, SR latch with enable, JK flip-flop, D flip-flop, Register Enabled Flip-Flop, Resettable Flip-Flop. Sequential logic timing considerations; Common circuits based on sequential storage devices - toggle flop clock divider, asynchronous ripple counter, shift register. **Finite State Machines :-** Finite State Machines - logic synthesis for an FSM, FSM design process and design examples; Synchronous Sequential Circuits - Counters; **Verilog (Part 2) : -** Procedural assignment; Conditional Programming constructs; Test benches; Modeling a D flip-flop in Verilog; Modeling an FSM in Verilog.	**14**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Micro project	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Internal Examination-3 (Written)	Total
5	15	5	10	5	40

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks. **(8x3 =24 marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 subdivisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)	Assessment Tool
CO1	Summarize the basic concept of different number systems and perform conversion and arithmetic operations between different bases.	**K2**	Written exam & Assignment
CO2	Interpret a combinational logic circuit to determine its logic expression, truth table, and timing information and to synthesize a minimal logic circuit through algebraic manipulation or with a Karnaugh map.	**K2**	Written exam & Assignment
CO3	Illustrate the fundamental role of hardware description languages in modern digital design and be able to develop the hardware models for different digital circuits.	**K3**	Written exam
CO4	Develop MSI logic circuits using both the classical digital design approach and the modern HDL-based approach.	**K3**	Written exam
CO5	Develop common circuits based on sequential storage devices including counter, shift registers and a finite state machine using the classical digital design approach and an HDL-based structural approach.	**K3**	Written exam & Assignment

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

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

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Introduction to Logic Circuits & Logic Design with Verilog	Brock J. LaMeres	Springer International Publishing	2/e, 2017
2	Digital Design and Computer Architecture - RISC-V Edition	Sarah L. Harris, David Harris	Morgan Kaufmann	1/e, 2022

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Digital Design with an Introduction to the Verilog HDL, VHDL, and System Verilog	M Morris Mano, Michael D Ciletti	Pearson	6/e, 2018
2	Digital Fundamentals	Thomas Floyd	Pearson	11/e, 2015
3	Fundamentals of Digital Logic with Verilog Design	Stephen Brown, Zvonko Vranesic	McGrawHill	3/e, 2014
4	Switching and Finite Automata Theory	Zvi Kohavi Niraj K. Jha	Cambridge University Press	3/e, 2010

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://nptel.ac.in/courses/117105080
2	https://onlinecourses.nptel.ac.in/noc21_ee39/
3	https://onlinecourses.nptel.ac.in/noc24_cs61/

SEMESTER S3/S4

ECONOMICS FOR ENGINEERS

(Common to All Groups)

Course Code	**UCHUT346**	**CIE Marks**	**50**
Teaching Hours/Week (L: T:P: R)	**2:0:0:0**	**ESE Marks**	**50**
Credits	**2**	**Exam Hours**	**2 Hrs. 30 Min.**
Prerequisites (if any)	**None**	**Course Type**	**Theory**

Course Objectives:

1. Understanding of finance and costing for engineering operation, budgetary planning and control
2. Provide fundamental concept of micro and macroeconomics related to engineering industry.
3. Deliver the basic concepts of Value Engineering

SYLLABUS

Module No	Syllabus Description	Contact Hours
1	Basic Economics Concepts - Basic economic problems – Production Possibility Curve – Utility – Law of diminishing marginal utility – Law of Demand - Law of supply – Elasticity - measurement of elasticity and its applications – Equilibrium- Changes in demand and supply and its effects Production function - Law of variable proportion – Economies of Scale – Internal and External Economies – Cobb-Douglas Production Function	**6**
2	Cost concepts – Social cost, private cost – Explicit and implicit cost – Sunk cost - Opportunity cost - short run cost curves - Revenue concepts Firms and their objectives – Types of firms – Markets – Perfect Competition – Monopoly - Monopolistic Competition - Oligopoly (features and equilibrium of a firm) Behavioral Economics – Decision-making biases, bounded rationality, and engineering applications.	**7**
3	Monetary System – Money – Functions - Central Banking – Inflation - Causes and Effects – Measures to Control Inflation - Monetary and Fiscal policies – Deflation Taxation – Direct and Indirect taxes (merits and demerits) – GST, National income – Concepts - Circular Flow – Methods of Estimation and Difficulties - Stock Market – Functions- Problems faced by the Indian stock market – Demat Account and Trading Account – Stock market Indicators SENSEX and NIFTY	**6**

4	Value Analysis and value Engineering - Cost Value, Exchange Value, Use Value, Esteem Value - Aims, Advantages and Application areas of Value Engineering - Value Engineering Procedure - Break-even Analysis – Cost Benefit Analysis - Capital Budgeting - Process planning	**6**

Course Assessment Method
(CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Micro Project	Internal Examination-1	Internal Examination- 2	Internal Examination- 3	Total
5	25	5	10	5	50

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• Minimum 1 and Maximum 2 Questions from each module • Total of 6 Questions, each carrying 3 marks **(6x3 =18 marks)**	• Two questions will be given from each module, out of which l question should be answered. • Each question can have a maximum of 2 sub divisions. • Each question carries 8 marks **(4x8 = 32 marks)**	50

Course Outcomes (COs)

At the end of the course students should be able to:

CO	Course Outcome	Bloom's Knowledge Level (KL)	Assessment Tool
CO l	Understand the fundamentals of various economic issues using laws and learn the concepts of demand, supply, elasticity and production function.	K2	Internal Exams and Micro Project
CO 2	Develop decision making capability by applying concepts relating to costs and revenue, and acquire knowledge regarding the functioning of firms in different market situations.	K3	
CO 3	Outline the macroeconomic principles of monetary and fiscal systems, national income and stock market.	K2	
CO 4	Make use of the possibilities of value analysis and engineering, and solve simple business problems using break even analysis, cost benefit analysis and capital budgeting techniques.	K3	

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

Note: *1.' Slight (Low), 2.- Moderate (Medium), 3. Substantial (High), - No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Managerial Economics	Geetika, Piyali Ghosh and Chodhury	Tata McGraw Hill	2015
2	Engineering Economy	H. G. Thuesen, W. J. Fabrycky	PHI	1966
3	Engineering Economics	R. Paneerselvam	PHI	2012
4	Thinking, Fast and Slow	Daniel Kahneman	Farrar, Straus and Giroux	2011
5	An Introduction to Behavioral Economics (3rd ed.)	Wilkinson, N., & Klaes M	Macmillan International Higher Education	2018

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Engineering Economy	Leland Blank P.E, Anthony Tarquin P. E	Mc Graw Hill	7TH Edition
2	Indian Financial System	Khan M. Y.	Tata McGraw Hill	2011
3	Engineering Economics and analysis	Donald G. Newman, Jerome P. Lavelle	Engg. Press, Texas	2002
4	Contemporary Engineering Economics	Chan S. Park	Prentice Hall of India Ltd	2001

SEMESTER S3/S4

ENGINEERING ETHICS AND SUSTAINABLE DEVELOPMENT

(Common to All Groups)

Course Code	**UCHUT347**	**CIE Marks**	50
Teaching Hour/Week (L:T:P:R)	2:0:0:0	**ESE Marks**	50
Credits	2	**Exam Hours**	2Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. Equip with the knowledge and skills to make ethical decision and implement gender-sensitive practices in their professional lives.

2. Develop a holistic and comprehensive interdisciplinary approach to understanding engineering ethics principles from a prospective of Environment Protection and sustainable development.

3. Develop the ability to find Strategies for implementing sustainable Engineering solutions.

SYLLABUS

Module No.	Syllabus Description	Contact Hour
1	**Fundamentals of ethics** – personal vs professional ethics, civic virtue, Respect for others, **Profession and professionalism** ingenuity, diligence and responsibility, integrity in design, development, and Research domains, Plagiarism, a balanced outlook on law - challenges - case studies, **Technology and digital revolution –** data, information and knowledge, Cybertrust and cybersecurity, data collection and Management, **High Technologies: connecting people and places** – accessibility and social impacts, **managing conflict**, Collective bargaining, **Confidentiality**, role of confidentiality in moral integrity, **Codes of Ethics.** **Basic concepts in Gender Studies** – sex, gender, sexuality, gender spectrum: beyond the binary, gender identity, gender expression, gender stereotypes, Gender Disparity and discrimination in education, employment and everyday life, History of women in science and technology, Gendered technology and innovations, Ethical value and practices in connection with gender – equity diversity & gender justice, **Gender policy and women/transgender empowerment initiatives**.	**6**
2	**Introduction to Environmental Ethics:** Definition, importance and historical development of environmental ethics, key philosophical theories (anthropocentrism, biocentrism, ecocentrism). **Sustainable Engineering Principles:** Definition and scope, triple bottom line (economic, social and environmental sustainability), life cycle analysis and sustainability metrics. **Ecosystems and Biodiversity:** Basics of ecosystems and their functions, Importance of biodiversity and its conservation, Human impact on ecosystems	**6**

	and biodiversity loss, An overview of various ecosystems in Kerala/India, and its significance. **Landscape and Urban Ecology:** Principles of landscape ecology, Urbanization and its environmental impact, Sustainable urban planning and green infrastructure.	
3	**Hydrology and Water Management:** Basics of hydrology and water cycle, Water scarcity and pollution issues, Sustainable water management practices, Environmental flow, disruptions and disasters. **Zero Waste Concepts and Practices:** Definition of zero waste and its principles, Strategies for waste reduction, reuse, reduce and recycling, Case studies of successful zero waste initiatives. **Circular Economy and Degrowth:** Introduction to the circular economy model, Differences between linear and circular economies, degrowth principles, Strategies for implementing circular economy practices and degrowth principles in engineering. **Mobility and Sustainable Transportation:** Impacts of transportation on the environment and climate, Basic tenets of a Sustainable Transportation design, Sustainable urban mobility solutions, Integrated mobility systems, E-Mobility, Existing and upcoming models of sustainable mobility solutions.	**6**
4	**Renewable Energy and Sustainable Technologies:** Overview of renewable energy sources (solar, wind, hydro, biomass), Sustainable technologies in energy production and consumption, Challenges and opportunities in renewable energy adoption. **Climate Change and Engineering Solutions:** Basics of climate change science, Impact of climate change on natural and human systems, Kerala/India and the Climate crisis, Engineering solutions to mitigate, adapt and build resilience to climate change. **Environmental Policies and Regulations:** Overview of key environmental policies and regulations (national and international), Role of engineers in policy implementation and compliance, Ethical considerations in environmental policy-making. **Case Studies and Future Directions:** Analysis of real-world case studies, Emerging trends and future directions in environmental ethics and sustainability, Discussion on the role of engineers in promoting a sustainable future.	**6**

Course Assessment Method
(CIE: 50 marks, ESE: 50)

Continuous Internal Evaluation Marks (CIE):

Attendance	Portfolio	Internal Examination-1	Internal Examination- 2	Internal Examination- 3	Total
5	**25**	**5**	**10**	**5**	**50**

Continuous internal evaluation will be based on individual and group activities undertaken throughout the course and the portfolio created documenting their work and learning. The portfolio will include reflections, project reports, case studies, and all other relevant materials.

- The students should be grouped into groups of size 4 to 6 at the beginning of the semester. These groups can be the same ones they have formed in the previous semester.
- Activities are to be distributed between 2 class hours and 3 Self-study hours.
- The portfolio and reflective journal should be carried forward and displayed during the 7th Semester Seminar course as a part of the experience sharing regarding the skills developed through various courses.

Sl No	Item	Particulars	Group/Individual (G/I)	Marks
1	Reflective Journal	Weekly entries reflecting on what was learned, personal insights, and how it can be applied to local contexts.	I	5
2	Micro Project (Detailed documentation of the project, including methodologies, findings and reflections)	1 a) Perform an Engineering ethics Case Study analysis and prepare a report 1 b) Conduct a literature survey on 'Code of Ethics for Engineers' and prepare a sample code of ethics	G	8
		2. Listen to a TED talk on a Gender-related topic, do a literature survey on that topic and make a report citing the relevant papers with a specific analysis of the Kerala context	G	5
		3. Undertake a project study based on the concepts of sustainable development* - Module II, Module III & Module IV	G	12
3	Activities	One activity* each from Module II, Module III & Module IV	G	15
4	Final Presentation	A comprehensive presentation summarising the key takeaways from the course, personal reflections, and proposed future actions based on the learnings.	G	5
		Total Marks		**50**

*Can be taken from the given sample activities/projects

Evaluation Criteria:

- **Depth of Analysis:** Quality and depth of reflections and analysis in project reports and case studies.
- **Application of Concepts**: Ability to apply course concepts to real-world problems and local contexts.
- **Creativity**: Innovative approaches and creative solutions proposed in projects and reflections.
- **Presentation Skills**: Clarity, coherence, and professionalism in the final presentation.

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• Minimum of one question from each module. • Total of 6 questions, each carrying 3 marks. **(6 x 3 = 18 marks)**	• Each question carries 8 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 subdivisions. **(4 x 8 = 32 marks)**	**50**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcomes		Bloom's Knowledge Level (KL)	Assessment Tool
CO1	Develop the ability to apply the principles of engineering ethics in their professional life.	K3	Written exam, Portfolio and course end survey
CO2	Develop the ability to exercise gender-sensitive practices in their professional lives	K4	
CO3	Develop the ability to explore contemporary environmental issues and sustainable practices.	K3	
CO4	Develop the ability to analyse the role of engineers in promoting sustainability and climate resilience.	K4	
CO5	Develop interest and skills in addressing pertinent environmental and climate-related challenges through a sustainable engineering approach.	K3	

Note: K1- Remember, K2 - understand, K3 – Apply, K4 – Analysis, K5 – Evaluate, K6 – Create

CO-PO Mapping Table:

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

Note: *1.' Slight (Low), 2.- Moderate (Medium), 3. Substantial (High), - No Correlation*

Reference Books				
Sl No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition & Year**
1	Ethics in Engineering Practice and Research	Caroline Whitbeck	Cambridge University Press & Assessment	2nd edition & August 2011
2	Virtue Ethics and Professional Roles	Justin Oakley	Cambridge University Press & Assessment	November 2006
3	Sustainability Science	Bert J. M. de Vries	Cambridge University Press & Assessment	2nd edition & December 2023
4	Sustainable Engineering Principles and Practice	Bhavik R. Bakshi	Cambridge University Press & Assessment	2019
5	Engineering Ethics	M Govindarajan, S Natarajan and V S Senthil Kumar	PHI Learning Private Ltd, New Delhi	2012

6	Professional ethics and human values	RS Naagarazan	New age international (P) limited New Delhi	2006
7	Ethics in Engineering	Mike W Martin and Roland Schinzinger,	Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi	4" edition, 2014

Suggested Activities/Projects:

Module-II

- Write a reflection on a local environmental issue (e.g., plastic waste in Kerala backwaters or oceans) from different ethical perspectives (anthropocentric, biocentric, ecocentric).
- Write a life cycle analysis report of a common product used in Kerala (e.g., a coconut, bamboo or rubber-based product) and present findings on its sustainability.
- Create a sustainability report for a local business, assessing its environmental, social, and economic impacts
- Presentation on biodiversity in a nearby area (e.g., a local park, a wetland, mangroves, college campus etc) and propose conservation strategies to protect it.
- Develop a conservation plan for an endangered species found in Kerala.
- Analyze the green spaces in a local urban area and propose a plan to enhance urban
- ecology using native plants and sustainable design.
- Create a model of a sustainable urban landscape for a chosen locality in Kerala.

Module-III

- Study a local water body (e.g., a river or lake) for signs of pollution or natural flow disruption and suggest sustainable management and restoration practices.
- Analyse the effectiveness of water management in the college campus and propose improvements - calculate the water footprint, how to reduce the footprint, how to increase supply through rainwater harvesting, and how to decrease the supply-demand ratio.
- Implement a zero waste initiative on the college campus for one week and document the challenges and outcomes.
- Develop a waste audit report for the campus. Suggest a plan for a zero-waste approach.
- Create a circular economy model for a common product used in Kerala (e.g., coconut oil, cloth etc)
- Design a product or service based on circular economy and degrowth principles and present a business plan.
- Develop a plan to improve pedestrian and cycling infrastructure in a chosen locality in Kerala

Module-IV

- Evaluate the potential for installing solar panels on the college campus including cost-benefit analysis and feasibility study.
- Analyse the energy consumption patterns of the college campus and propose sustainable alternatives to reduce consumption - What gadgets are being used? How can we reduce demand using energy-saving gadgets?
- Analyse a local infrastructure project for its climate resilience and suggest improvements.
- Analyse a specific environmental regulation in India (e.g., Coastal Regulation Zone) and its impact on local communities and ecosystems.
- Research and present a case study of a successful sustainable engineering project in Kerala/India (e.g., sustainable building design, water management project, infrastructure project).
- Research and present a case study of an unsustainable engineering project in Kerala/India highlighting design and implementation faults and possible corrections/alternatives (e.g., a housing complex with water logging, a water management project causing frequent floods, infrastructure project that affects surrounding landscapes or ecosystems).

DATA STRUCTURES LAB

Course Code	**PCCSL307**	**CIE Marks**	**50**
Teaching Hours/Week (L: T:P: R)	**0:0:3:0**	**ESE Marks**	**50**
Credits	**2**	**Exam Hours**	**2 Hrs. 30 Min.**
Prerequisites (if any)	**GYEST204**	**Course Type**	**Lab**

Course Objectives:

To give practical experience for learners on implementing different linear and non linear data structures, and algorithms for searching and sorting.

Expt. No.	Experiments	Lab Sessions
1	Given an array of sorted items, implement an efficient algorithm to search for specific item in the array.	1
2	Convert infix expression to postfix (or prefix) and then evaluate using stack.	1
3	Implement queue, and circular queue using arrays.	1
4	Circular queue using arrays.	1
5	Implement stack using linked list	1
6	Implement backward and forward navigation of visited web pages in a web browser (i.e. back and forward buttons) using doubly linked list operations.	1
7	Implement a dictionary of word-meaning pairs using binary search trees.	1
8	Find the shortest distance of every cell from a landmine inside a maze.	1
9	Implement Bubble sort, Insertion Sort, Radix sort, Quick Sort, and Merge Sort and Compare the number of steps involved.	2
10	Simulation of a basic memory allocator and garbage collector using doubly linked list	1

All experiments are mandatory.

No.	Course Project
1	**E-Commerce Cart system:** Design and implement a console-based E-Commerce Cart System using arrays, stacks, and queues. Use an array to store and display products, a stack to manage the cart with "undo last item" functionality, and a queue to simulate order processing. The system should allow product selection, cart management, and order placement in a menu-driven format.
2	**Student Registration System:** Design and implement a console-based Student Registration System using arrays and linked lists. Use an array to store and display the list of students enrolled in a particular course, and a linked list to manage the dynamic enrollment and withdrawal of students from the courses. The system should allow adding new students, viewing registered students, and withdrawing students from courses in a menu-driven format.

3	**Browser History Management:** Design and implement a console-based Browser History Management System using stacks and queues. Use a stack to manage the user's browsing history (allowing the user to go back to previously visited sites), and a queue to simulate navigating forward to sites after using the "back" button. The system should allow the user to navigate between websites, "undo" the last visit, and simulate "back" and "forward" actions in a menu-driven format.
4	**Library Management System:** Design and implement a console-based Library Management System using queues and binary search trees. Use a binary search tree (BST) to store and manage the books available in the library, allowing for fast searching and sorting. Use a queue to simulate a waiting list for popular books that are currently checked out. The system should allow users to check out books, check in books, view available books, and manage the waiting list in a menu-driven format.
5	**Hospital Appointment System:** Design and implement a console-based Hospital Appointment System using linked lists and stacks. Use a linked list to store the appointments, including patient details (name, contact info, appointment time), and a stack to manage canceling the most recent appointment. The system should allow users to book new appointments, view existing appointments, cancel appointments, and undo the last cancellation in a menu-driven format.
6	**Movie Ticket Booking System:** Design and implement a console-based Movie Ticket Booking System using arrays and queues. Use an array to store and display the available movies and show times, and a queue to manage the ticket booking requests, ensuring first-come-first-served processing. The system should allow users to view available movies, book tickets, and manage the queue for customers waiting to book tickets in a menu-driven format.
7	**Restaurant Order Management System**: Design and implement a console-based Restaurant Order Management System using queues and stacks. Use a queue to manage the order queue for customers, ensuring that orders are processed in the order they are received (FIFO). Use a stack to manage completed orders so that the most recent completed order can be retrieved easily. The system should allow customers to place orders, view the status of orders, and retrieve completed orders in a menu-driven format.
8	**Inventory Management System**: Design and implement a console-based Inventory Management System using binary search trees (BST) and linked lists. Use a binary search tree to store and manage product inventory, allowing efficient searching, adding, and removing of items based on product IDs. Use a linked list to track the transaction history of inventory changes (such as purchases and sales). The system should allow users to add new products, search for products, update stock levels, and view transaction history in a menu-driven format.
9	**Social Media Friend Recommendation System:** Design and implement a console-based Social Media Friend Recommendation System using graphs and arrays. Use a graph to model users as nodes and friendships as edges between them. Use arrays to store users' profile information such as name, interests, and recent activity. The system should allow users to find mutual friends, view their friend network, and get friend recommendations based on common interests or friends

	of friends. Implement graph traversal algorithms (such as BFS or DFS) to find the shortest path to potential new friends.
10	**Computer Network Simulation:** Design and implement a console-based Computer Network Simulation System using graphs and stacks. Use a graph to model the computer network, where each node represents a computer or network device, and edges represent network connections between them. Use a stack to simulate network packet flow, where packets are pushed onto the stack as they are transmitted through the network, and popped off when received. The system should allow users to simulate data transmission, view network topology, and track the path of packets through the network.

Course Assessment Method

(CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	**Lab Experiments[Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports / Record] (Continuous Assessment)**	**Course Project [Timely submission /Execution/Output/ Presentation/ Report]**	**Internal Examination**	**Total**
5	15	10	20	50

Evaluation Rubrics for Programming Experiments

No	**Performance Criteria**	**Excellent – 5**	**Good – 4**	**Satisfactory – 3**	**Poor – 1**
1	Pre-Lab Preparation	Fully understands problem and logic; well-prepared	Minor conceptual gaps; mostly prepared	Basic understanding; needs clarification	Unprepared; lacks understanding
2	Program Execution	Code is logically sound, well-structured, and gives correct output	Mostly correct logic with minor syntax or runtime errors	Partially working code; logic or syntax needs improvement	Code does not compile/run; incorrect logic
3	Lab Report & Record	Complete, well-documented, includes correct outputs, and submitted on time	Mostly complete with minor errors or late by a short time	Incomplete or late; lacks details or clarity	Disorganized, poor documentation, or very late/missing
4	Time taken	The program was completed within 1 hour.	The program was completed within 90 minutes.	The program was completed within the lab session.	Took more than one lab session to complete.
5	Viva Voce	Confident explanation with deep understanding of code	Can explain most parts; a few uncertainties	Limited explanation; relies on prompting	Cannot explain code or logic

Evaluation Rubrics for Course Project

Criterion	Excellent-5	Good-3	Satisfactory-2
Timely Submission	Submitted on time.	Submitted within 1-2 days late.	Late by more than 2 days or incomplete.
Usage of Data Structures	Appropriate, optimal, fully aligned with the problem.	Correct but with minor issues.	Incorrect or poorly implemented.
Code Quality	Well-structured, readable, meaningful comments.	Functional but minor issues.	Poor coding standards or missing comments.
Execution and Output	Runs without errors, expected results.	Runs with minor issues or partially correct results.	Fails to execute or produces incorrect results.
Report	Well-organized, professional formatting, free of errors, proper headings, figures, and tables.	Mostly well-organized with minor formatting issues.	Some organization and formatting issues.
Presentation	Clear, confident delivery with strong subject knowledge and good pacing.	Generally clear delivery with minor issues in pacing, or explanation.	Unclear or rushed delivery; poor explanation.

End Semester Examination Marks (ESE):

Procedure Preparatory work/Design/ Algorithm	Conduct of experiment/ Execution of work/ troubleshooting/ Programming	Result with valid inference/ Quality of Output	Viva voce	Record	Total
10	15	10	10	5	50

- Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified record.
- Endorsement by External Examiner: The external examiner shall endorse the record.

Course Outcomes (COs)

At the end of the course students should be able to:

CO	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Model a real world problem using suitable data structure and implement the solution.	**K3**
CO2	Compare efficiency of different data structures in terms of time and space complexity.	**K4**
CO3	Evaluate the time complexities of various searching and sorting algorithms.	**K5**
CO4	Differentiate static and dynamic data structures in terms of their advantages and application.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO- PO Mapping (Mapping of Course Outcomes with Program Outcomes)

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

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fundamentals of Data Structures in C	Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed	Universities Press	2/e, 2007
2	Introduction to Algorithms	Thomas H Cormen, Charles Leisesrson, Ronald L Rivest, Clifford Stein	PHI	3/e, 2009

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Classic Data Structures	Samanta D.	Prentice Hall India.	2/e, 2018
2	Data Structures and Algorithms	Aho A. V., J. E. Hopcroft and J. D. Ullman	Pearson Publication.	1/e, 2003
3	Introduction to Data Structures with Applications	Tremblay J. P., P. G. Sorenson	Tata McGraw Hill.	2/e, 2017
4	Theory and Problems of Data Structures	Lipschutz S.	Schaum's Series	2/e, 2014

Video Links (NPTEL, SWAYAM…)	
Sl. No.	**Link ID**
1	https://nptel.ac.in/courses/106102064
2	https://ocw.mit.edu/courses/6-851-advanced-data-structures-spring-2012/

Evaluation Pattern for End Semester Examination (50 Marks)

1. Procedure/Preliminary Work/Design/Algorithm (10 Marks)

- Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
- Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
- Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
- Creativity and logic in algorithm or experimental design.

2. Conduct of Experiment/Execution of Work/Programming (15 Marks)

- Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

3. Result with Valid Inference/Quality of Output (10 Marks)

- Accuracy of Results: Precision and correctness of the obtained results.
- Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

4. Viva Voce (10 Marks)

- Ability to explain the experiment, procedure results and answer related questions.
- Proficiency in answering questions related to theoretical and practical aspects of the subject.

5. Record (5 Marks)

- Completeness, clarity, and accuracy of the lab record submitted.

PYTHON AND STATISTICAL MODELLING LAB

Course Code	**PCADL308**	**CIE Marks**	50
Teaching Hours/Week (L: T:P: R)	0:0:3:0	**ESE Marks**	50
Credits	2	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	UCEST105	**Course Type**	Lab

Course Objectives:

1. The course aims to familiarize students with basic Python concepts and data structures, model graphical representation of data, measures of central tendency and measures of dispersion. The course will also introduce students to use python in solving problems based on statistical distributions, regression analysis and correlation tests

Expt. No.	Experiments
1	Write a program to remove every occurrence of a number from a list.
2	Write a program to confirm the validity of an email id by verifying its format.
3	Write a program to add two matrices.
4	Write a program to read a tuple of numbers and print even tuple and odd tuple.
5	Create a dictionary with a set of book title and corresponding stock. Write a program to update the stock and to add or delete books.
6	A set of numbers are stored in a file. Write a program to print the prime numbers among them.
7	Write a program to count the number of words, sentences, upper case letters, lowercase letters and special symbols in a text stored in file.
8	Plot a graph y = f(x)

9	The areas of the various continents of the world (in millions of square miles) are as follows:11.7 for Africa; 10.4 for Asia; 1.9 for Europe; 9.4 for North America; 3.3 Oceania; 6.9 South America; 7.9 Soviet Union. Draw a bar chart representing the given data.
10	Draw the histogram of the following data:

Height of student(m)	135 - 140	140 - 145	145-150	150-155
No. of students	4	12	16	8

11 Table contains population and murder rates (in units of murders per 100,000 people per year) for different states. Compute the mean, median and variance for the population.

State	Population	Murder
Alabama	4,779,736	5.7
Alaska	710231	5.6
Arizona	6,392,017	4.7
Arkansas	2,915,918	5.6
California	37,253,956	4.4
Colorado	5,029,196	2.8
Connecticut	3,574,097	2.4
Delaware	89,924	5.8

12 Calculate the S.D. and coefficient of variation (C.V.) for the following table:

Class:	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency:	5	10	20	40	30	20	10	5

13 If X is binomially distributed with 6 trials and a probability of success equal to 0.25 at each attempt, what is the probability of:

a) exactly 4 successes b) at least one success

<table>
<tr><td>14</td><td>If the random variable X follows a Poisson distribution with mean 3.4, find P(X=6).</td></tr>
<tr><td>15</td><td>A random sample of 395 people were surveyed and each person was asked to report the highest education level they obtained. The data that resulted from the survey is summarized in the following table. Are gender and education level dependent at 5% level of significance?
<table>
<tr><td></td><td>High School</td><td>Bachelors</td><td>Masters</td><td>Ph.D</td><td>Total</td></tr>
<tr><td>Female</td><td>60</td><td>54</td><td>46</td><td>41</td><td>201</td></tr>
<tr><td>Male</td><td>40</td><td>44</td><td>53</td><td>57</td><td>194</td></tr>
<tr><td>Total</td><td>100</td><td>98</td><td>99</td><td>98</td><td>395</td></tr>
</table></td></tr>
<tr><td>16</td><td>Calculate the correlation coefficient of the two variables shown in the table below.
<table>
<tr><td>Person</td><td>Hand</td><td>Height</td></tr>
<tr><td>A</td><td>17</td><td>150</td></tr>
<tr><td>B</td><td>15</td><td>154</td></tr>
<tr><td>C</td><td>19</td><td>169</td></tr>
<tr><td>D</td><td>17</td><td>172</td></tr>
<tr><td>E</td><td>21</td><td>175</td></tr>
</table></td></tr>
<tr><td>17</td><td>Suppose a sample of 16 light trucks is randomly selected off the assembly line. The trucks are driven 1000 miles and the fuel mileage (MPG) of each truck is recorded. It is found that the mean MPG is 22 with a SD equal to 3. The previous model of the light truck got 20 MPG. Conduct a t- test of the null hypothesis at p = 0.05.</td></tr>
<tr><td>18</td><td>The mean productivity rating for all employees at a company was 3.8 on a five- point scale last year. This year you get ratings from a representative sample of fifteen employees from the Human Research Management. Do the data from this sample provide evidence that employee productivity in the department of Human Resource Management is significantly higher than in the company as a whole? Write the null and alternative hypotheses for this problem. Use statistical analysis software to test the null hypothesis stated above.</td></tr>
</table>

19 Obtain the regression equation for predicting systolic blood pressure from job statistical analysis software. If one knows that a subject in the future has a score on job satisfaction of 15, what is their systolic blood pressure predicted to be? What is the standard error of estimate?

Job Satisfaction	Systolic BP
34	124
23	128
19	157
43	133
56	116
47	125
32	147
16	167
55	110
25	156

20 Write a Python program to implement logistic regression to classify whether a person buys a product based on their age and salary.

Age	Salary	Purchased
22	25000	0
25	32000	0
47	50000	1
52	60000	1
46	58000	1
56	52000	1

	28 | 30000 | 0 35 | 45000 | 1
21	Write a Python program to implement a Decision Tree Classifier using the scikit-learn library. Use the built-in Iris dataset for classification.
22	Write a Python program to implement a Random Forest Classifier using the scikit-learn library. Use the built-in Iris dataset for classification.
23	Write a program to reduce the dimension from 2 to 1 using the Principal Component Analysis (PCA) algorithm. Given the data in table, Feature | Example 1 | Example 2 | Example 3 | Example 4 X1 | 4 | 8 | 13 | 7 X2 | 11 | 4 | 5 | 14

Course Assessment Method

(CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	**Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)**	**Internal Examination**	**Total**
5	**25**	**20**	**50**

Evaluation Rubrics for Programming Experiments

No	**Performance Criteria**	**Excellent – 5**	**Good – 4**	**Satisfactory – 3**	**Poor – 1**

1	Pre-Lab Preparation	Fully understands problem and logic; well-prepared	Minor conceptual gaps; mostly prepared	Basic understanding; needs clarification	Unprepared; lacks understanding
2	Program Execution	Code is logically sound, well-structured, and gives correct output	Mostly correct logic with minor syntax or runtime errors	Partially working code; logic or syntax needs improvement	Code does not compile/run; incorrect logic
3	Lab Report & Record	Complete, well-documented, includes correct outputs, and submitted on time	Mostly complete with minor errors or late by a short time	Incomplete or late; lacks details or clarity	Disorganized, poor documentation, or very late/missing
4	Time taken	The program was completed within 1 hour.	The program was completed within 90 minutes.	The program was completed within the lab session.	Took more than one lab session to complete.
5	Viva Voce	Confident explanation with deep understanding of code	Can explain most parts; a few uncertainties	Limited explanation; relies on prompting	Cannot explain code or logic

End Semester Examination Marks (ESE):

Procedure/ Preparatory work/Design/ Algorithm	Conduct of experiment/ Execution of work/ troubleshooting/ Programming	Result with valid inference/ Quality of Output	Viva voce	Record	Total
10	15	10	10	5	50

- ***Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified record.***
- ***Endorsement by External Examiner:*** *The external examiner shall endorse the record*

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Experiment with concepts of iteration, function, string and list	**K3**
CO2	Identify the importance of tuples, dictionary traversal, dictionary methods, files and operations	**K3**
CO3	Model graphical representation of data, measures of central tendency and measures of dispersion	**K3**
CO4	Solve problems based on Binomial distribution, Poisson distribution, sampling and regression analysis	**K3**
CO5	Make use of various correlation tests and utilize statistical analysis software	**K3**

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO- PO Mapping (Mapping of Course Outcomes with Program Outcomes)

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

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Probability and Statistics for Engineering and Sciences the	Jay L Devore	Cengage Learning India	9/e, 2020

Continuous Assessment (25 Marks)

1. Preparation and Pre-Lab Work (7 Marks)

- Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
- Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

2. Conduct of Experiments (7 Marks)

- Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
- Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
- Teamwork: Collaboration and participation in group experiments.

3. Lab Reports and Record Keeping (6 Marks)

- Quality of Reports: Clarity, completeness and accuracy of lab reports.
  Proper documentation of experiments, data analysis and conclusions.
- Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

4. Viva Voce (5 Marks)

- Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Final Marks Averaging: The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.

Evaluation Pattern for End Semester Examination (50 Marks)

1. Procedure/Preliminary Work/Design/Algorithm (10 Marks)

- Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
- Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
- Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
- Creativity and logic in algorithm or experimental design.

2. Conduct of Experiment/Execution of Work/Programming (15 Marks)

- Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

3. Result with Valid Inference/Quality of Output (10 Marks)

- Accuracy of Results: Precision and correctness of the obtained results.
- Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

4. Viva Voce (10 Marks)

- Ability to explain the experiment, procedure results and answer related questions
- Proficiency in answering questions related to theoretical and practical aspects of the subject.

5. Record (5 Marks)

- Completeness, clarity, and accuracy of the lab record submitted

CERTIFICATE OF APPROVAL

This is to certify that the syllabus for the courses of **Semester 3 of the B.Tech Programme in Artificial Intelligence and Data Science** has been reviewed and duly approved by the following academic bodies of **Vimal Jyothi Engineering College**:

1. The **Board of Studies of Computer Science and Engineering and allied programs**, in its meeting held on **29/04/2025.**
2. The **Academic Council**, in its meeting held on **12/5/2025**.

This syllabus shall be implemented **with effect from the academic year 2025–2026 onwards**.

05/06/2025

HoD/Program Coordinator

Dean Academics

Principal

PRINCIPAL
VIMAL JYOTHI ENGINEERING COLLEGE
CHEMPERI - 670832

VIMAL JYOTHI ENGINEERING COLLEGE
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