CS

VIMAL JYOTHI

ENGINEERING COLLEGE (AUTONOMOUS)

CHEMPERI - KANNUR I WWW.VJEC.AC.IN

VJEC B. Tech. Syllabus 2024

Semester III

Computer Science and Engineering

Branch Code: CS

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
THEORY OF COMPUTATION
(Common to CS, CN, and CC)

Course Code	**PCCST302**	**CIE Marks**	**40**
Teaching Hours/Week(L: T:P: R)	**3:1:0:0**	**ESE Marks**	**60**
Credits	**4**	**Exam Hours**	**2 Hrs 30 Mins**
Prerequisites (if any)	**PCCST205**	**Course Type**	**Theory**

Course Objectives:

1. To introduce the concept of formal languages.
2. To discuss the Chomsky classification of formal languages with a discussion on grammar and automata for regular, context-free, context-sensitive, and unrestricted languages.
3. To discuss the notions of decidability and the halting problem.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Foundations (Linz, Hopcroft)** Motivation for studying computability, need for mathematical modeling - automata, Introducing automata through simple models - On/Off switch, coffee vending machine. Three basic concepts: Alphabet, Strings, and Languages **Finite Automata (Linz, Hopcroft)** Formal definition of a finite automaton, Deterministic Finite Automata (DFA), Regular languages, Nondeterminism (guess and verify paradigm), Formal definition of a nondeterministic finite automaton, NFA with epsilon transitions, Eliminating epsilon transitions (Proof not expected), Equivalence of NFAs and DFAs (Proof not expected) - The Subset Construction. DFA State Minimization, Applications of finite automata - text search, keyword recognition	11
2	**Regular Expressions (Linz)** The formal definition of a regular expression, Building Regular Expressions, Equivalence with finite automata (Proof not expected) - Converting FA to Regular Expressions, Converting Regular Expressions to FA, Pattern Matching and Regular Expressions, Regular grammar, Equivalence with FA - Conversion in both directions **Properties of Regular Languages (Linz)** Closure and Decision Properties of Regular Languages (with proofs), The Pumping Lemma for Regular Languages (with formal proof), Pumping lemma as a tool to prove non regularity of languages **Context-Free Grammars and Applications (Linz)** Formal definition of a context-free grammar, Designing context-free grammars, Leftmost and Rightmost Derivations Using a Grammar, Parse Trees, Ambiguous Grammars, Resolving ambiguity, Inherent ambiguity, CFGs, and programming languages	11

3	**Pushdown Automata (Linz)** Formal definition of a pushdown automaton, DPDA and NPDA, Examples of pushdown automata Equivalence NPDAs and CFGs (Proof not expected) - conversions in both directions **Simplification of Context-Free Languages (Linz)** Elimination of useless symbols and productions, Eliminating epsilon productions, Eliminating unit productions, Chomsky normal form, Greibach normal form. **Properties of Context-Free Languages (Linz)** The Pumping Lemma for Context-Free Languages (Proof not expected), Closure and Decision Properties of Context-Free Languages (Proof not expected)	**11**
4	**Turing Machines (Kozen)** The formal definition of a Turing machine, Examples of Turing machines - Turing machines as language acceptors, Turing machines as computers of functions, Variants of Turing Machines (Proofs for equivalence with basic model not expected), Recursive and recursively enumerable languages Chomskian hierarchy, Formal definition of a Context-Sensitive Grammar, Linear bounded automaton as a restricted TM. **Computability (Kozen)** Church Turing thesis, Encoding of TMs, Universal Machine and Diagonalization, Reductions, Decidable and Undecidable Problems, Halting problem, Post Correspondence Problem and the proofs for their undecidability.	**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) and Assessment Tools

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

Course Outcome		Bloom's Knowledge Level (KL)	Assessment Tools
CO1	Classify formal languages into regular, context-free, context-sensitive, and unrestricted languages.	**K2**	Written Exam
CO2	Develop finite state automata, regular grammar, and regular expression.	**K3**	Written Exam, Assignment
CO3	Model push-down automata and context-free grammar representations for context-free languages.	**K3**	Written Exam, Assignment
CO4	Construct Turing Machines to accept recursive and recursively enumerable languages.	**K3**	Written Exam
CO5	Describe the notions of decidability and undecidability of problems, the Halting problem.	**K2**	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	PO 10	PO 1 1
CO1	3	2	1	2	-	-	-	-	-	-	2
CO2	3	2	2	2	-	-	-	-	-	-	2
CO3	3	2	2	2	-	-	-	-	-	-	2
CO4	3	2	2	2	-	-	-	-	-	-	2
CO5	3	2	1	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	An Introduction to Formal Languages and Automata	Peter Linz and Susan H. Rodger	Jones and Bartlett Publishers, Inc	7/e, 2022
2	Introduction to Automata Theory Languages And Computation	John.E.Hopcroft, Jeffrey D.Ullman	Rainbow Book Distributors	3/e, 2015
3	Automata and Computability	Dexter C. Kozen	Springer	1/e,2007

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Introduction to the Theory of Computation	Michael Sipser	Cengage India Private Limited	3/e, 2014
2	Introduction to Languages and the Theory of Computation	John C Martin	McGraw-Hill Education	4/e, 2010
3	Theory of Computation: A Problem-Solving Approach	Kavi Mahesh	Wiley	1/e, 2012
4	Elements of the Theory of Computation	Harry R. Lewis, Christos Papadimitriou	Pearson Education	2/e, 2015

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/106/104/106104148/ https://nptel.ac.in/courses/106106049
2	https://archive.nptel.ac.in/courses/106/104/106104148/ https://nptel.ac.in/courses/106106049
3	https://archive.nptel.ac.in/courses/106/104/106104148/ https://nptel.ac.in/courses/106106049
4	https://archive.nptel.ac.in/courses/106/104/106104148/ https://nptel.ac.in/courses/106106049

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
OBJECT ORIENTED PROGRAMMING

(Common to CS, CU& CN)

Course Code	**PBCST304**	**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 teach the core object-oriented principles such as abstraction, encapsulation, inheritance, and polymorphism, robust error-handling using exception mechanisms to ensure program reliability.
2. To equip the learner to develop object oriented programs encompassing fundamental structures, environments, and the effective utilization of data types, arrays, strings, operators, and control statements for program flow in Java.
3. To enable the learner to design and develop event-driven graphical user interface (GUI database applications using Swing and database connection components.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Introduction to Java:** Structure of a simple java program; Java programming Environment and Runtime Environment (Command Line & IDE); Java compiler; Java Virtual Machine; Primitive Data types and Wrapper Types; Casting and Autoboxing; Arrays; Strings; Vector class; Operators - Arithmetic, Bitwise, Relational, Boolean Logical, Assignment, Conditional (Ternary); Operator Precedence; Control Statements - Selection Statements, Iteration Statements and Jump Statements; Functions; Command Line Arguments; Variable Length Arguments; Classes; Abstract Classes; Interfaces**. [Use proper naming conventions]** **OOP Concepts :-** Data abstraction, encapsulation, inheritance, polymorphism, Procedural and object oriented programming paradigm.. **Object Oriented Programming in Java :-** Declaring Objects; Object Reference; Introduction to Methods; Constructors; Access Modifiers; ***this*** keyword.	**10**

2	**Polymorphism :-** Method Overloading, Using Objects as Parameters, Returning Objects, Recursion. Static Members, Final Variables, Inner Classes. **Inheritance -** Super Class, Sub Class, Types of Inheritance, The super keyword, protected Members, Calling Order of Constructors. Method Overriding, Dynamic Method Dispatch, Using final with Inheritance.	**8**
3	**Packages and Interfaces –** Packages - Defining a Package, CLASSPATH, Access Protection, Importing Packages. **Interfaces -** Interfaces v/s Abstract classes, defining an interface, implementing interfaces, accessing implementations through interface references, extending interface(s). **Collections framework** - Collections overview, Collections Interfaces-Collection Interface, List Interface. Collections Class – ArrayList class. Accessing a Collection via an Iterator. **Exception Handling -** Checked Exceptions, Unchecked Exceptions, try Block and catch Clause, Multiple catch Clauses, Nested try Statements, throw, throws and finally, Java Built-in Exceptions, Custom Exceptions. **Multithreaded Programming** - The Java Thread Model, The Main Thread, Creating Thread, Creating Multiple Threads, Synchronization. **Introduction to design patterns in Java :** Singleton and Adaptor.	**12**
4	**SOLID Principles in Java** **Swings fundamentals –** Overview of AWT, Swing v/s AWT, Swing Key Features, Model View Controller (MVC), Swing Controls, Components and Containers, Swing Packages, Event Handling in Swings, Swing Layout Managers, Exploring Swings–JFrame, JLabel, The Swing Buttons, JTextField. **Event handling –** Event Handling Mechanisms, Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces, Using the Delegation Event Model. **Developing Database Applications using JDBC –** JDBC overview, Types,Steps, Common JDBC Components, Connection Establishment, SQL Fundamentals [For projects only] - Creating and Executing basic SQL Queries, Working with Result Set, Performing CRUD Operations with JDBC.	**10**

Suggestion on Project Topics

Student should identify a topic to be implemented as project having the following nature:

i. It must accept a considerable amount of information from the user for processing.
ii. It must have a considerable amount of data to be stored permanently within the computer as plain files / using databases.
iii. It must process the user provided data and the stored data to generate some output to be displayed to the user.

Examples : -

1. Design and implement the Circulation function in a Library Management System using Object-Oriented Programming (OOP) principles in Java and limited use of SQL. The system should manage the operations of a library, such as book & user management, borrowing and returning books. Requirements
    a. Class Design
        i. Book: Attributes like title, author, ISBN, genre, and status (available/borrowed).
        ii. User: Attributes like user ID, name, contact information, and a list of borrowed books.
        iii. Library: Attributes like a list of books and a list of users.
        iv. Librarian: Inherits from User, with additional functionalities like adding/removing books and managing users.
        v. BorrowTransaction: Attributes like transaction ID, book, user, borrow date, and return date.
    b. Functionalities
        i. Book Management:
            1. Add, remove, and update book details.
            2. Search books by title, author, ISBN, and genre.
        ii. User Management:
            1. Register new users.
            2. Search users by user ID and name.
        iii. Borrowing and Returning:
            1. Borrow a book: Check if the book is available and if the user can borrow more books.
            2. Return a book: Update the bookâ€™s status and remove it from the userâ€™s borrowed list.
    c. Deliverables
        i. Design Document: Describe the classes, their attributes, methods and relationships.
        ii. Source Code: Well-documented Java code implementing the described functionalities.
        iii. User Manual: Instructions on how to set up, run and use the system.
        iv. Test Cases: A suite of test cases demonstrating the functionality of the system.

2. Design and implement an Online Payment Processing System using Object-Oriented Programming(OOP) principles in Java, with a focus on dynamic polymorphism. The system should support different types of payment methods and demonstrate polymorphism in processing payments. Requirements
    a. Class Design
        i. Payment: An abstract base class with common attributes and an abstract method for processing payments.
        ii. CreditCardPayment: Inherits from Payment, with specific implementation for processing credit card payments.
        iii. PayPalPayment: Inherits from Payment, with specific implementation for processing PayPal payments.
        iv. BankTransferPayment: Inherits from Payment, with specific implementation for processing bank transfer payments.
        v. PaymentProcessor: A class to manage and process different types of payments.
    b. Functionalities
        i. Add Payment Method: Add new payment methods (CreditCardPayment, PayPalPayment, BankTransferPayment) to the system.
        ii. Process Payment: Demonstrate dynamic polymorphism by processing payments using different methods.
    c. Deliverables

i. Design Document: Describe the classes, their attributes, methods and relationships.
ii. Source Code: Well-documented Java code implementing the described functionalities.
iii. User Manual: Instructions on how to set up, run and use the system.
iv. Test Cases: A suite of test cases demonstrating the functionality of the system.

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Project	Internal Examination - 1 (Written Examination)	Internal Examination -2 (Written Examination)	Internal Examination- 3 (Written Examination)	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 =16 marks)**	• 2 questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 2 subdivisions. • Each question carries 6 marks. **(4x6 = 24 marks)**	**40**

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)	Assessment Tool
CO1	Write, compile, and execute basic Java programs to demonstrate proficiency in programming concepts and structure.	**K3**	Written Exam
CO2	Apply object-oriented programming principles to design and implement modular and reusable Java applications.	**K3**	Written Exam and Project

CO3	Develop and manage Java packages, and interfaces to ensure modularity and reusability in code development.	**K3**	Written Exam and Project
CO4	Implement multithreading and error-handling techniques, along with interfaces, to design robust Java applications.	**K3**	Written Exam and Project
CO5	Develop event-driven Java GUI applications with database connectivity using Swing and JDBC.	**K3**	Written Exam and Project

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
CO2	3	3	3	-	-	-	-	-	-	-	3
CO3	3	3	3	-	3	-	-	-	-	-	3
CO4	3	3	3	-	3	-	-	-	-	-	3
CO5	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	Java: The Complete Reference	Herbert Schildt	Tata McGraw Hill	13/e, 2024
2	Introduction to Java Programming, Comprehensive Version	Y Daniel Liang	Pearson	10/e, 2014
3	Head First Design Patterns	Eric Freeman, Elisabeth Robson, Bert Bates, Kathy Sierra	O'Reilly Media	1/e, 2004
4	SOLID Principles in Java (Topic)	(https://www.javatpoint.com/solid-principles-java)		

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Head First Java: A Brain Friendly Guide	Kathy Sierra & Bert Bates	O'Reilly	3/e, 2022
2	JAVA™for Programmers	Paul Deitel	PHI	11/e, 2018
3	Clean Code : A Handbook of Agile Software Craftsmanship	Robert C. Martin	Prentice Hall	1/e, 2008
4	Programming with Java	E Balagurusamy	McGraw Hill Education	6/e, 2019
5	Java For Dummies	Barry A. Burd	Wiley	8/e.2022
6	Effective Java	Joshua Bloch	Pearson	3/e, 2018

Video Links (NPTEL, SWAYAM…) and Online Resources	
Module No.	**Link ID**
1	https://nptel.ac.in/courses/106105191 (Lecture no: 9, 10, 1, 2, 3, 4)
2	https://nptel.ac.in/courses/106105191 (Lecture no: 1, 7, 8, 11, 12, 13, 14, 15, 16)
3	https://nptel.ac.in/courses/106105191 (Lecture no: 17, 18, 19, 20, 21, 22, 23, 24, 25, 26)
4	https://nptel.ac.in/courses/106105191 (Lecture no: 43, 44, 45, 46, 47, 50, 51, 52, 53, 54, 55)
5	https://youtu.be/s7ZLgRpdGLU?si=jG-A4BDC8Knb7ab_

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

Sl. No	Evaluation for	Allotted Marks
1	Project Planning and Proposal	5
2	Contribution in Progress Presentations and Question Answer Sessions	5
3	Involvement in the project work and Team Work	5
4	Execution and Implementation	10
5	Final Presentations	5
6	Project Quality, Innovation and Creativity	5
Total		**35**

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 (5 Marks)
    - Individual contribution to the presentation
    - Effectiveness in answering questions and handling feedback
3. Involvement in the Project Work and Team Work (5 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
- Implement modular and reusable GUI Java applications using packages, interfaces and error-handling techniques.
- 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 (5 Marks)
    - Overall quality and technical excellence of the project
    - Innovation and originality in the project
    - Creativity in solutions and approaches

Evaluation Rubrics for Course Project

Criteria	**Max Marks**	**High (Full Marks)**	**Medium (Partial Marks)**	**Low (Minimal or No Marks)**
1. Project Planning and Proposal	5	Clear, detailed plan; realistic timeline; excellent background research; well-defined objectives and methods.	Some clarity in plan; basic timeline; moderate research and objective definition.	Vague or no plan; unclear objectives; lacks research or methodology.
2. Contribution in Progress Presentation & Question Answer Sessions	5	Clear role in presentation; confidently answers questions; integrates feedback effectively.	Moderate participation; answers basic questions; limited handling of feedback.	Minimal contribution; avoids questions or gives incorrect answers; dismisses feedback.
3. Involvement in Project Work and Team Work	5	Actively involved throughout; contributed significantly; excellent collaboration and communication.	Inconsistent participation; some contribution; average collaboration.	Passive or absent; minimal or no contribution; poor team interaction.
4. Execution and Implementation	10	Meets all milestones; Java code is robust, modular, and well-documented; strong application of concepts and problem-solving.	Meets most milestones; functional code with some issues; average application of concepts.	Missed milestones; incomplete or non-functional code; lacks application of theoretical knowledge.
5. Final Presentation	5	Clear, professional, and engaging; excellent visual aids; confidently answers questions.	Adequate presentation; minor issues in clarity or delivery; answers some questions.	Disorganized or unclear; poor delivery; fails to answer questions effectively.
6. Project Quality, Innovation, and Creativity	5	High technical quality; novel features or approach; creative solution	Moderate quality; some originality; mostly standard implementation.	Low quality; lacks innovation; poor or copiedideas.

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	7^{TH} 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).

SEMESTER S3
DATA STRUCTURES LAB
(Common to CS, CN, CC, CU and AD)

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 a 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	Implement stack using linked list.	**1**
5	Implement addition of polynomials using singly linked lists.	**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.

Students are required to complete one of the ten listed course projects in groups of up to three members. Each project shall be designed, implemented, and executed using the data structures and algorithms specified in the project description. A comprehensive report is to be prepared for the selected project, which will be presented and evaluated as part of the course assessment.

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 linear data structures and implement the solution.	**K3**
CO2	Design a real-world system using appropriate non-linear data structures and implement an efficient solution.	**K4**
CO3	Analyze the time complexities of various searching and sorting algorithms.	**K4**
CO4	Implement dynamic memory allocation and garbage collection to understand basic memory management concepts.	**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	3	-	-
CO2	3	3	3	3	-	-	-	3	3	-	-
CO3	3	3	3	3	-	-	-	3	3	-	-
CO4	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.

SEMESTER S3

DIGITAL LAB

Common to CS & CN

Course Code	PCCSL308	CIE Marks	50
Teaching Hours/Week (L: T:P: R)	0:0:3:0	ESE Marks	50
Credits	2	Exam Hours	2 hrs. 30 minutes
Prerequisites (if any)	GXEST104	Course Type	Lab

Course Objectives:

1. To enable the learner to design and implement basic digital logic circuits using logic gates and ICs.
2. To familiarize with digital system design using HDL.

SYLLABUS

Exp No.	EXPERIMENTS (All HDL-based experiments should be done using Verilog HDL. At Least three experiments of PART A & B together should be implemented on a breadboard. Use any open-source circuit simulation software or web-based logic simulator software for the rest of the experiments (refer to https://circuitverse.org, https://simulator.io,https://www.logiccircuit.org)
	Part A (All experiments in this part are mandatory. These experiments give an introduction to the digital design by familiarizing the basic gates and combinational circuits on breadboard /circuit simulation software, along with their HDL-based realization.)
A1.	Study of basic digital ICs and verification of Boolean theorems using digital logic gates.

A2.	Familiarization of the working of circuit simulation software. a. Realize the basic logic gates and analyze their waveforms. b. Realize a given Boolean function using basic gates and verify the waveform with the truth table.
A3.	Familiarization of Verilog HDL - Modelling of the basic gates using a. Gate-level modelling b. Behavioural modelling c. Structural modelling d. dataflow modelling
A4.	Realization of an SOP and its corresponding POS expression using NAND gates alone and NOR gates alone (to be done on breadboard and simulated using software).
A5.	Model a given Boolean function (SOP and POS) in Verilog using a. continuous assignment with logical operators b. continuous assignment with conditional operators c. using gate-level primitives
	Part B **(All experiments are to be done using any circuit simulation software.)**
B1.	Design and implement a combinational logic circuit for arbitrary functions (any two) a. Code converters b. Half adder, full adder, half subtractor, full subtractor c. Multiplexer, Demultiplexer, Encoder, Decoder
B2.	Design and implement combinational circuits using MSI devices: (any three) a. 4-bit adder and subtractor using MSI device IC 7483. b. Parity generator/checker using MSI device IC 74180 c. Magnitude Comparator using MSI device IC 7485 d. Implement a Boolean function using MUX IC
B3.	Study of D flip-flop and JK flip-flops using ICs.
B4.	To design and implement the following shift registers using D flip-flops: a. Serial in serial out b. Serial in parallel out c. Parallel in serial out d. Parallel in parallel out
B5.	Design and implement an asynchronous counter - 3-bit up counter, 3-bit down counter, 3-bit up-down counter with mode control, mod-N counter.

B6.	Design and implement a synchronous counter - 3-bit up counter, 3-bit down counter, sequence generator.
	PART C **using Verilog HDL** For all the experiments in part C: a. Write Verilog program code in the IDE/Software (Other open source or online software, such as Icarus Verilog / EDA playground, may be used) b. Simulate the code using a test bench or by giving input values. c. Synthesize the design and verify the waveforms
C1.	Model a 4:1 MUX, 1:4 DEMUX, 4 to 2 encoder, 2 to 4 decoder and a 7-Segment Display Decoder in Verilog using a. continuous assignment with logical operators b. continuous assignment with conditional operators
C2.	Design and synthesize the behavioural model for a D flip-flop in Verilog HDL.
C3.	Design and synthesize the behavioural model for a synchronous counter in Verilog.
C4.	Design a Verilog HDL behavioral model to implement a finite-state machine - a serial bit sequence detector.

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/Records (Continuous Assessment)	Internal Examination	Total
5	25	20	50

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 to take 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)
COl	Model and construct combinational logic circuits.	**K3**
CO2	Develop modular combinational circuits with MUX, DEMUX and decoder.	**K3**
CO3	Experiment with synchronous and asynchronous sequential circuits.	**K3**
CO4	Model and implement FSM.	**K3**

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

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	3	3	-	-	-	-	-	3
CO2	3	3	3	3	3	-	-	-	-	-	3
CO3	3	3	3	3	3	-	-	-	-	-	3
CO4	3	3	3	3	3	-	-	-	-	-	3

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
3	Verilog HDL Synthesis: A Practical Primer	J Bhasker	Star Galaxy Publishing	1/e, 1998

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	Fundamentals of Digital Logic with Verilog Design	Stephen Brown, Zvonko Vranesic	McGrawHill	3/e, 2014

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://nptel.ac.in/courses/117105080
2	https://archive.nptel.ac.in/courses/108/103/108103179/
3	https://www.youtube.com/watch?v=JU0RKPe7AhA (Introduction to CircuitVerse)

Digital Electronics Lab	**Virtual Labs Link**
	https://cse14-iiith.vlabs.ac.in/exp/circuits-verilog/theory.html
	https://de-iitr.vlabs.ac.in :Design of Digital Circuits using Verilog

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 records 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

Continuous Assessment Evaluation Rubrics (Total: 25 Marks)

No.	Performance Criteria	Excellent (100%)	Good (80%)	Satisfactory (50%)	Poor (20%)	Max Marks
1	**Preparation and Pre-Lab Work**	Fully prepared; accurate assignments; strong theoretical understanding **(7 marks)**	Mostly prepared; minor conceptual errors **(5 marks)**	Limited understanding; partially completed work **(3 marks)**	Minimal preparation or incorrect submission **(1 marks)**	**7**
2	**Conduct of Experiments**	Executes procedure correctly; proficient skills; excellent teamwork **(7 marks)**	Good execution and collaboration; minor errors **(5 marks)**	Acceptable performance with some guidance **(3 marks)**	Poor execution or teamwork **(1) marks)**	**7**
3	**Lab Reports & Record Keeping**	Clear, complete, accurate reports; well-organized and timely **(6 marks)**	Mostly clear and organized; minor issues or late **(5 marks)**	Incomplete or delayed; some disorganization **(3 marks)**	Disorganized or very late/missing **(1 marks)**	**6**
4	**Viva Voce**	Confident explanation of experiment, principles, and results **(5 marks)**	Mostly correct responses with minor hesitation **(4 marks)**	Limited understanding; basic responses **(3 marks)**	Inadequate or no response **(1 mark)**	**5**
Total		**/25**				

CERTIFICATE OF APPROVAL

This is to certify that the syllabus for the courses of **Semester 3 of the B.Tech Programme in Computer Science and Engineering** 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**.

HOD/Program Coordinator

Dean Academics

Principal

VIMAL JYOTHI ENGINEERING COLLEGE
Dated.....
CHEMPERI-670 632