

SEMESTER 3

**COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE)**

SEMESTER-SI

MATHEMATICS FOR COMPUTER AND INFORMATION SCIENCE-I

(Group A)

Course Code	GAGAT311	CH Marks	42
Teaching Hours/Week (L- T- P- S)	140.0	Ex Marks	40
Credit	3	Exam Hours	2 hrs 10 min.
Prerequisites (if any)	Basic calculus	Course Type	Theory

Course Objectives:

- 2. To familiarize students with the fundamentals of probability and analysis of random processes used in various applications in computing and science.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	<p>Discrete random variables and their probability distributions: Cumulative distribution function, Disposition, Mean and variance, the Binomial probability distribution, the Poisson probability distribution; Product distribution as a limit of the binomial distribution. Marginal pdf of two discrete random variables, Marginal pdf, Independent random variables, Disjoint sets of outcomes of two discrete random variables.</p> <p>[Text to be referred topics from chapters 1.1 to 1.4, 3.4, 4.1, 4.2]</p>	8
2	<p>Continuous random variables and their probability distributions: Cumulative distribution function, Disposition, 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.</p> <p>[Text to be referred topics from chapters 4.1, 4.2, 4.3, 4.4, 4.5, 4.6]</p>	8

3	<p>Lewis theorem : Minkov's Inequality, Chebychev's Inequality, Strong Law of Large Numbers (Vil'koor proof), Central Limit Theorem (Wald-Wolfowitz proof), Martingale Processes, Discrete-time process, Continuous-time process, Occupancy Measures, The Poisson Process, Interrelated times (Theorem without proof)</p> <p>(This is: Subsequent topics from sections 1.7, 1.8, 1.9)</p>	8
4	<p>Martingale Chain, Random Walk Model, Chapman-Kolmogorov Equations, Classification of States, Irreducibility, Stationary States, Transient state, Recurrent state, Long-Run Proportions (Theorem without proof)</p> <p>(This is: Subsequent topics from sections 4.2, 4.3, 4.4)</p>	8

Courses Assessment Method:
(CTE = all marks, EAS = all marks)

Continuous Internal Examination Marks (CIE):

Academic	Assessment/Marking	Internal Examination (Written)	Internal Examination-1 (Written)	Total
I	12	24	12	48

End Semester Examination Marks (ESE):

In Sem-A, all questions will be common and in Sem-B, each student will answer any two full questions out of four questions.

Part A	Part B	Total
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 2 Questions, each carrying 3 marks (All - Unmarked)	<ul style="list-style-type: none"> • Each question carries 2 marks. • Two questions will be given from each module, one of which 1 question should be answered. • Each question can have a maximum of 3 sub-questions. (Half - 25 marks)	48

Course Outcomes (COs)

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

Course Outcomes		Blooms's Knowledge Level (KL)
CO1	Understand the concept, properties and important models of discrete random variables and to apply in suitable random phenomena.	K1
CO2	Understand the concept, properties and important models of continuous random variables and to apply in suitable random phenomena.	K2
CO3	Familiarise and apply joint densities and to understand the bivariate distributions of continuous processes.	K3
CO4	Solve problems involving Joint Densities, to understand joint normal distributions and to apply them in model real problem for behaviour of various stochastic processes.	K3

Note: K1-Knowledge; K2-Understanding; K3-apply; K4-Analyse; K5-Evaluate; K6-Creatve

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	1	1	+	2	-	-	-	-	-	1	-	-	1
CO2	1	1	+	2	-	-	-	-	-	1	-	-	1
CO3	1	1	+	1	+	+	-	-	+	+	-	-	1
CO4	3	3	+	3	1	4	-	-	+	+	-	-	1

Text Books				
SLN	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Probability and Statistics for Engineering and the Sciences	Ronald L. E. Walpole	Prentice Hall	8 th edition, 2012
2	Introduction to Probability Models	Sheldon M. Ross	Academic Press	10 th edition, 2014

Reference Books				
SL.No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Probability and Statistics Inference for Discrete and Continuous Distributions	John E. Dickinson	Cambridge University Press	2011
2	Probability Methods for Complex Systems	Matthew J. Klass	John Wiley Press	1 st edition, 2009
3	Probability, Random Variables and Stochastic Processes	Hughes, J. R. M., E.J.	Tata McGraw-Hill	4 th edition, 2009
4	Probability, Statistics and Random Processes	Rossouw Groene	Pearson	2013

Video Links (GOTEL SWAYAM...)	
Module No.	Link ID
1	https://www.swayam.gov.in/module_english/presentation/
2	https://www.swayam.gov.in/module_english/pdf/print/
3	https://www.swayam.gov.in/module_english/1X/10/010111
4	https://www.swayam.gov.in/module_english/1X/10/010111

SEMESTER-5
THEORY OF COMPUTATION

(Common to CS/CA/CACE/CM/CC)

Course Code	Prerequisites	CIE Marks	AC
Teaching Hours/Week (L: T: P: R:)	3:1:0:0	TSE Marks	40
Credit:	4	Exam Marks	1.00x 10.00m
Pre-requisite (if any)	CCC7004	Course Type	Theory

Course Objectives:

1. To understand the concept of formal language.
2. To discuss the Chomsky classification of formal languages with reference to grammar and automata (Regular, context-free, context-sensitive, and unrestricted languages).
3. To discuss the notion of decidability and halting problem.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Foundation (Lec, Report) Motivation for studying computability, need for mathematical modelling - automata, Decidability, undecidability through simple models - On-DFA model, off-line reading machine. Three basic strings: Alphabets, strings, and Languages. Finite Automata (Lec, Report) Formal definition of a finite automaton. Deterministic Finite Automata (DFA), Regular language, Non-deterministic (push and pull) machines, Formal definition of a non-deterministic finite automaton (NFA) with epsilon transitions. Eliminating epsilon transitions (pull and expand), Equivalence of NFA's and DFA's (Proof not required) - The subset construction DFA from NFA's. Application of finite automata - run analysis, tag and recognition.	20
2	Regular Expressions (Lec) The formal definition of a regular expression. Building Regular Expressions, Expressions with their properties (Proof not required).	

	<p>Converting FA to Regular Expressions; Converting Regular Expressions to FA; Finite Matching and Regular Expressions, Regular grammar equivalence with FA, Conversion to finite automata</p> <p>Properties of Regular Languages (List)</p> <p>Closure and Decidability 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 language</p> <p>Context-Free Grammars and Applications (List)</p> <p>Formal definition of a context-free grammar, Deriving strings from grammar, Leftmost and Rightmost Derivations Using a Grammar, Pump Test, Ambiguity Grammars, Deriving ambiguity, Minimal ambiguity, CFGs and programming languages</p> <p>Pushdown Automata (List)</p> <p>Formal definition of a pushdown automaton, PDA's and NPDAs, Strategies of pushdown acceptors</p> <p>Equivalence of NPDAs and PDAs (Proof not required) – user proves in both directions</p> <p>Simplification of Context-Free Languages (List)</p> <p>Elimination of useless symbols and productions, Eliminating epsilon productions, Eliminating unit productions, Chomsky normal form, Greibach normal form.</p> <p>Properties of Context-Free Languages (List)</p> <p>The Pumping Lemma for Context-Free Languages (with formal proof), Closure and Decidability Properties of Context-Free Languages (with formal proofs)</p>	21
4	<p>Turing Machines (List)</p> <p>The Formal Definition of a Turing machine, Examples of Turing machines – Turing machines as language acceptors, “Turing machines as computers of functions”, Versions of Turing Machines (check the equivalence with basic model (not required)), Languages and recursively enumerable languages</p> <p>Computable Functions (List)</p> <p>Church-Turing thesis, Recursiveness of C.F.s, Uncomputable Functions and Undecidable Problems, Decidable and Undecidable Problems, Reducibility, Non-Computable Functions and the grounds for their undecidability</p>	21

Examination Method
(CE: 40 marks, ESE: 40 marks)

Continuous Internal Evaluation Scheme (CIE):

Assessment	Assessment/Marking	Internal Examination-I (Written)	Internal Examination-II (Written)	Total
4	16	28	28	48

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any two self-prompted subjective questions.

Part A	Part B	Total
<ul style="list-style-type: none"> • 7 Questions from each module. • Total of 14 Questions, each carrying 2 marks <p>(Total = 28 marks)</p>	<ul style="list-style-type: none"> • Each question carries 2 marks • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 2 sub-questions <p>(Total = 16 marks)</p>	48

Course Outcomes (COs)

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

	Course Outcomes	Student's Knowledge Level (SKL)
CO1	Classify formal languages into regular, context-free, recursive, and non-recursive languages.	K1
CO2	Design finite state machines, regular grammar, regular expression, and NFA-Normal form representations for regular languages	K2
CO3	Design push-down automata and context free grammar representations for non-regular languages	K3
CO4	Design Turing Machines to solve recursive and non-recursive computable languages	K3
CO5	Understand the notions of decidability and undecidability of problems, Reducibility	K2

Note: K1-Knowledge; K2-Understanding; K3-Apply; K4-Analyze; K5-Evaluate; K6-Creative

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

	KO1	KO2	KO3	KO4	KO5	KO6	KO7	KO8	KO9	KO10	KO11	KO12
CO1	1	1	1	1								1
CO2	1	1	1	1								1
CO3	1	1	1	1								1
CO4	1	1	1	1								1
CO5	1	1	1	1								1

Note: 1-Easy; 2-Medium; 3-Hard; 4-Advanced; 5-Creative

Text Books

SL No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	An Introduction to Formal Languages and Automata Introduction to Automata Theory, Languages and Computation	John E. Hopcroft, Jeffrey D. Ullman	Prentice Hall Publications, Inc.	7th, 2007
2	Automata and Computability	Douglas C. Erwin	Springer	1st, 2007

Reference Books				
SL.No.	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Introduction to the Theory of Categories	Umesh Agarwal	Cambridge University Press	2nd, 2014
2	Introduction to Languages and its Theory of Computation	John C. Martin	McGraw-Hill Education	3rd, 2013
3	Theory of Computation: A Computability-Driven Approach	Klaus Jansen	Wiley	2nd, 2013
4	Elements of the Theory of Computation	Ram P. Singh, Orissa Publications	Prakash Publications	2nd, 2012

Value Lenses (SOPTEL, VRVAVAM...)	
Module No.	Lens ID
1	https://tinyurl.com/y6w19445 https://tinyurl.com/y6w19449
2	https://tinyurl.com/y6w19446 https://tinyurl.com/y6w19448
3	https://tinyurl.com/y6w19445 https://tinyurl.com/y6w19448
4	https://tinyurl.com/y6w19445 https://tinyurl.com/y6w19449

SEMESTER-5
DATA STRUCTURES AND ALGORITHMS

(Common to CS-C-A/CMCC-DK/AC/AM/AD/CS/CD/CC/CD/CG)

Course Code:	PGCST505	CIE Marks:	40
Teaching Hours/Week (L.T.P.R.)	1.0.0.0	L.E.C Marks:	10
Credit:	4	Exam Hours:	2 hrs. 24 min.
Prerequisites (if any):	UCC5010	Course Type:	Theory

Course Objectives:

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

SYLLABUS

Module e.No.	Syllabus Description	Costa of Hour
1	Basic Concepts of Data Structures Definitions, Data Abstraction, Performance Analysis - Time & Space Complexity, Asymptotic Notations, Polynomial representation using Array, Sparse matrix (Right representation), Stack and Queue - Simple, Multilevel, Circular Queue, Double Ended Queue, Evaluation of Expressions - Left to Right, Evaluating Prefix Expression	11
2	Linked List and Memory Management Singly Linked List - Operations on Linked List, Stack and Queue using Linked List, Polynomial representation using Linked List, Doubly Linked List, Circular Linked List, Memory Allocation - Heap, LRU, Random, and Worst-fit allocation schemes, Garbage collection and compression	11
3	Trees and Graphs Trees - Representation Of Trees, Binary Trees - Types and Properties, Binary Tree Representation, Tree Operations, Tree Traversals, Representing Trees - Binary Search Trees + Binary Search Tree Operations, Binary Graphs - Binary Tree Operations, Forest, Queue	11

	Single - Depth First Search, Depth First Search and Breadth First Search, Applications of Graphs - Single Source All Destination Sorting and Searching Sorting Techniques - Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Radix Sort, Radix Sort Searching Techniques - Linear Search, Binary Search, Hashing - Hashing Function, Collision, Division, Rolling, Digit Analysis, Collision Resolution Linear probing, Quadratic Probing, Double hashing, Open hashing	11
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Course Assessment Method
(ECE - 40 marks, EEE - 40 marks)

Continuous Internal Evaluation Marks (CIE):

Achievement:	Assessment/ Milestone	Desired Examination-1 (Written)	Desired Examination-2 (Written)	Total
E	12	18	18	48

End Semester Examination Marks (ESI):

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

Part A	Part B	Total
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 12 Questions, each carrying 3 marks (Total = 36 marks)	<ul style="list-style-type: none"> • Each question carries 3 marks. • Ten questions will be given from each module, out of which 4 questions should be answered. • Each question can have a maximum of 3 sub divisions. (Total = 24 marks)	60

Course Outcomes (COs)

After the refresher course students should be able to:

Course Outcomes		Knows Knowledge Level (KL)
CO1	Identify appropriate data structures for solving real world problems.	IC
CO2	Describe and implement basic data structures such as arrays, linked lists, stacks, and queues.	IC
CO3	Describe and implement basic data structures such as trees and graphs.	IC
CO4	Select appropriate searching and sorting algorithms to be used in problem environments.	IC

Ref: IC- Introduces; IC- Understands; IC- Applies; IC- Analyses; IC- Evaluates; IC- Creates

CO-PO Mapping Table: Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	1	3								1
CO2	4	4	3								1
CO3	1	4	3								1
CO4	1	4	3								1

1=Low, 2=High, 3=Moderate, 4=Advanced (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	Elliott Bavaogi, Sung Joon and James Jambor, Prentice	Universal Press	1st, 2007
2	Introduction to Algorithms	Thomas H Cormen, Charles Leiserson, Ronald L Rivest, Clifford Stein	MIT	2nd, 2009

References Books:				
No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Classical Data Structures	Gomber D.	Pearson Education	1/e, 2011
2	Data Structures and Algorithms	Aho A.V., J.E. Hopcroft and J.D. Ullman	Pearson Education	1/e, 2008
3	Introduction to Data Structures with Applications	Trevor J.P. and F.O. Jelani	Tata McGraw-Hill	2/e, 2007
4	Theory and Practice of Data Structures	Lipmaa E.	Khanna & Sons	2/e, 2011

Video Links (GATE, IIT-JEE, NEET, IIT)	
Module No.	Link ID
1	https://gate.iitm.ac.in/module/1000000004
2	https://gate.iitm.ac.in/module/54114/module/1000000004/gate-2010

SEMESTER-SI

OBJECT ORIENTED PROGRAMMING

(Common to DS CA ED AM/CB-CM CU CS)

Course Code	PREREQUISITE	CIE Marks	AC
Practical Hours/Week	140.1	ESK Marks	40
Credit	4	Exam Marks	120x 100m
Prerequisite (Theory)	None	Course Type	Theory

Course Objectives:

1. To introduce the object oriented principles such as inheritance, encapsulation, abstraction, and polymorphism, object handling using exception mechanism to reuse, program reusability.
2. To equip the learner in writing object oriented programs incorporating Inheritance, abstraction, encapsulation, and its efficient utilization of data types, arrays, strings, operators, and control statements for program flow in Java.
3. To enable the learner to design and develop distributed graphical user interface (GUI) windows applications using Swing and socket connection components.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	<p>Introduction to Java:</p> <p>Structure of a simple Java program; Java programming Environment and Syntax Environment (Comment Lines & DOB); Java example; Java Virtual Machine; Primitive Data types and Wrapper Types; Casting and Converting; Integer, String, Vector class; Operator - Assignment, Arithmetic, Equality, Relational, Boolean Logical, Assignment, Conditional (Ternary); Operator Overloading; Control Statement - Selection Statement, Iteration Statement and Loop Statement; Parameter; Comment Line Argument; Variable Length Argument; Class; Almost Check Interface. (The paper coming soon).</p> <p>OOP Concepts -</p> <p>Data Abstraction, encapsulation, Inheritance, polymorphism, Finalized and</p>	30

	<p>Static Method Programming paradigm, Abstraction Object Oriented Programming in Java -> Defining Classes, Object Reference, Inheritance & Overriding, Constructors, Access Modifiers, this keyword.</p>	
3	<p>Polymorphism - Method Overloading, Using Objects as Parameters, Returning Objects, Exceptions, Static Variables, Final Variables, Inner Classes Abstraction - Super Class, Sub Class, Types of Abstraction: The implementation provided Methods, Calling Overload of Constructors. Method Overriding, Dynamic Method Dispatch, Using final with Methods.</p>	8
4	<p>Exception handling - Exceptions, Catching Exceptions, CATCH BLOCKS, throws Directive, Implementing Exceptions, Assertions vs Assertions classes, defining an interface, implementing methods, creating implementation, defining interface (interface overriding interface) Exception Handling - Checked Exceptions, Unchecked Exceptions, try Block and catch Block, finally, catch Clause, throw by Statement, throw AssertionError, Java Built-in Exceptions, Custom Exceptions Introduction to design patterns in Java : Singleton and Adapter</p>	8
5	<p>SOLOD Principles in Java code (http://www.javaworld.com/article/2071803)</p> <p>ArrayList fundamentals - Overview of API, ArrayList via API, ArrayList Key Features, Hold Your Collections (HOC), ArrayList Controls, Comparisons and Differences, ArrayList, Iterating ArrayLists = Iterating, Using ArrayLists, Implementing Iterable<T>, Extends, ToString, Iterator</p> <p>Queue handling - From Stack, Deque, Collections, Deque from Stack, Queue Classes, Issues w/ Stack, Queue Listener Interface, Using the DequeFrom Stack</p> <p>Developing Desktop Applications using EJB - JDBC interface, Types, Maps, Common EJB Components, Session Beans, Stateless, Local Persistence, JPA, program subj - Creating and Running their JSP, Quicks, Working with Each One, Relational DB, Oracle, MySQL via EJB</p>	10

Suggestion on Project Topic:

Student should identify a project to be implemented or propose having the following feature:

- 1. A user storage a considerable amount of information from the user for processing.
- 2. A user have a considerable amount of data to be stored permanent in which the computer •
will just file writing database.
- 3. A user processes the user provided data and the stored data to generate some output to
be displayed in the user.

Example :-

1. Design and implement the Librarian function in a Library Management System using Object Oriented Programming (OOP) principles in Java and Database of SQL. The system should manage the operations of a Library, such as book & user management, borrowing and returning books.

Requirements:

- 1. **User Design**
 - Book, Author, Publication, ISBN, price, and name (predefined)
 - User Accounts like user ID, name, contact information, and a list of borrowed books.
 - Library: Contains like a list of books and a list of users.
 - Library: Details from User, with additional information like returning/borrowing books and managing users.
 - Borrow/Return: Associate the borrowed ID, book, user, borrow date, and return date.
- 2. **Functionalities**
 - a. **Book Management**
 - Add, remove, and update book details.
 - Search books by title, author, ISBN, and genre.
 - b. **User Management**
 - Register new users.
 - Logout users by user ID and name.
 - c. **Borrowing and Returning**
 - Borrow a book: Check if the book is available and if the user can borrow more books.
 - Return a book: Update the book's status and remove it from the user's borrowed list.
 - d. **Information**
 - 1. Design Document: Describes the classes, their interfaces, methods and relationships.
 - 2. Source Code: Full implementation for a code implementing the associated functionality.
 - 3. User Manual: Instructions for how to set up, run and use the system.
 - 4. Test Cases: A suite of test cases demonstrating the functionality of the system.
- 3. Design and implement an Online Payment Processing System using Object Oriented Programming (OOP) principles in Java, with a focus on domain polymorphism. The system

should support different types of payment methods and demonstrate polymorphism by processing payments.

Requirements

- a. **Class Diagram**
 - Payment: An abstract base class with common attributes and an abstract method for processing payments.
 - CreditCardPayment: Inherited from Payment, with specific implementation for processing credit card payments.
 - PayPalPayment: Inherited from Payment, with specific implementation for processing PayPal payments.
 - BankTransferPayment: Inherited from Payment, with specific implementation for processing bank transfer payments.
 - PaymentProcessor: A class to manage and process different types of payments.
- b. **Functionalities**
 - Add Payment Methods: Add new payment methods (CreditCardPayment, PayPalPayment, BankTransferPayment) to the system.
 - Process Payment: Demonstrate dynamic polymorphism by processing payments using different methods.
- c. **Deliverables**
 - Design Document: Describe the classes, their attributes, methods and relationships.
 - Source Code: The implementation for a code implementing the design.
 - Use Manual: Instructions on how to setup, test and use the system.
 - Test Cases: A suite of test cases demonstrating the functionality of the system.

Course Assessment Method:
(CII - 40 marks, EEE - 80 marks)

Continuous Interval Evaluation Matrix (CIE):

Attendance	Project	Interval I+I	Interval II+II	Total
7	36	12.5	41.3	58

End Semester Examination Matrix (ESM):

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

Part A	Part B	Total
4. 2 Questions from each module. • Total 12 Questions, each carrying 2 marks (8.0 - 16 marks)	4. 2 questions will be given from each module, one of which 1 question should be selected. Each question can have a maximum of 2 sub-questions. Total questions carries 8 marks. (4x - 24 marks)	48

Course Objectives (COs)

At the end of this course student should be able to:

Course Outcomes		Student's Knowledge Level (KL)
CO1	Explain the process of writing, compiling, and executing basic Java programs, including class definition and components, to demonstrate proficiency.	K1
CO2	Understand object-oriented programming principles in the design and implementation of Java applications.	K2
CO3	Design and manage Java packages and interfaces, emphasizing reusability and modularity.	K2
CO4	Implement error handling using basic exception mechanisms and strategic interfaces for modular applications.	K3
CO5	Design, construct, test, and evaluate Java applications with security considerations using Java and JDBC.	K3

Note: KL: Knowledge; K1: Understanding; K2: Applying; K3: Analysing; K4: Evaluating; K5: Creating

EI1101 Slipping Table

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1										1
CO2	1	1	1									1
CO3	1	1	1		1							1
CO4	1	1	1		1							1
CO5	1	1	1		1							1

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	Sunil Srivastava	Tata McGraw Hill	13/e, 2014
2	Introduction to Java Programming, Comprehensive Version	V. Samuel Liang	Tata McGraw	10/e, 2013
3	Real Time Design Patterns	Eric Freeman, Ryan Bates, Nat Pryor, Ted Neward	O'Reilly Media	1/e, 2004

Books from Books				
Sr. No.	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Agile Principles, Patterns & Tools (Prag) Guide	Kathy Sierra & Bert Bates	O'Reilly	1st 2002
2	DATA™ for Programmers	Tal Gross	PRE	11/11/2011
3	Code Complete : A Practical Handbook of Agile Software Construction	Steve C. McConnell	Microsoft	1st, 2004
4	Programming with Java	E Balasubramanian	McGraw-Hill Education	6th 2014
5	Java For Dummies	Barry S. Burd	Wiley	3rd 2011
6	Effective Java	Joshua Bloch	Prentice	3rd 2011

File List (OPTEL_SWATAM...)	
Name	Link ID
1 large_ipg1_swatam190200.R [Lecture no. 1, 13, 1, 2, 3, 4]	
2 large_ipg1_swatam190300.R [Lecture no. 1, 4, 5, 11, 12, 14, 15, 16]	
3 large_ipg1_swatam190400.R [Lecture no. 17, 18, 19, 20, 21, 22, 24-26, 28]	
4 large_ipg1_swatam190500.R [Lecture no. 42, 44, 45, 47, 50, 51-52, 54, 55]	

FEL Course Details:

1. Lecture (1 Hrs)	2. Project (FRL, L2 Project Manager)		
	Tutorial	Practical	Examination
Locate defect	Project Initiation	Software Laboratory Work Methodology	Examination (Program and Final Examination)
Object oriented Design and Balancing System	Project Analysis	Code Defense	Examination
Object oriented Design and Balancing System	Analytical thinking and problem solving	Testing	Design: Mission Systems, Toolkit, Design: enterprise (1 project)
Open System Object Model (OSOM)	Code Review, Peer Review Report	Presenting	Design: Functional, User Documentation, Design presentation (each 10-15 minutes each)

Assessment and Evaluation for Project Activity

E. No.	Evaluation for	Allocated Marks
1	Project Planning and Proposal	1
2	Evaluation in Project Progression and Outcome Analysis	4
3	Development in the project Work and Team Work	3
4	Execution and Implementation	10
5	Final Presentation	2
6	Overall Quality, Innovation and Creativity	3
	Total	30

1. Project Planning and Proposal (6 Marks)

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

2. Contribution in Project Progression and Outcome Analysis (4 Marks)

- Dedicated contributions to the progression
- Effectiveness in assessing outcomes and handling feedback

3. Development 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 domain knowledge and problem-solving
- Final Result

5. Final Presentation (2 Marks)

- Quality and clarity of the final presentation
- Dedicated contributions to the progression
- Effectiveness in assessing outcomes

b. Project Quality, Innovation, and Creativity (3 themes)

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

SEMESTER SE
DIGITAL ELECTRONICS AND LOGIC DESIGN

(Common to Oneug A)

Course Code	GAEE5005	CIE Marks	40
Teaching Hours/Week (L.T.P.R)	3100	CIE Marks	80
Credit:	4	Exam Marks	25%: 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 make the learner to design simple sequential 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 electronics Number Systems - Binary, Unsigned, grouping bits, Base conversion Binary Arithmetic - Addition and subtraction, Unsigned and Signed numbers. Fixed Point (Binary) Systems, Floating Point Number Systems Basic gate- Operation of a Logic circuit, Buffer, Gate - Invertor, AND gate, OR gate, NOR gate, NOT gate, XNOR gate, XOR gate, XNOR gate, Digital system operation- logic levels, output as specifications, input as specifications, noise margins, power supplies, Timing terms - driving time gate, response time and LED. Timing Diagram - ECL, Alphanumeric, Modern digital design for - Timing parameters, data types, data sheets, Timing equations	11
2	Combinational Logic Circuits - Boolean Algebra - Operations, Laws, Theorems, Combinational logic	11

	<p>Ways to - Consider ESD and RDS, Distance and Distance requirement, Logic minimization, Algebraic minimization, K-map minimization, Don't care, Cost optimization.</p> <p>Building successive invertability in Verilog -</p> <p>Common assignments - Common assignments with logical operators,</p> <p>Common assignments with conditional operators, Common assignments with delay.</p> <p>MIS Logic and Digital Building Blocks</p> <p>MIS logic - Decoder (One-bit decoder, T-egress, MUX, encoder), Encoder, Multiplexer, Demultiplexer, Digital Building Blocks - Arithmetic Circuits (full adder, full subtractor, half adder, half subtractor), Comparators, Sequential designs and memories - basic level models maximization, gate level procedures, word oriented procedures, seeking delay or procedures</p> <p>Sequential Logic Design - Latches and Flip-Flops, D flip-flop, D2latch with enable, T flip-flop, D flip flop, Asynchronous Ripple-Adder, Asynchronous Ripple-Carry Adder, Shift registers.</p> <p>Finite State Machines -</p> <p>Finite State Machines - Implementations for an FSA, FDDI design process and example, Embedded Sequential Circuits - Counter</p> <p>Verilog (Part 2) -</p> <p>Procedural assignments, Conditional Programming constructs, Text blocks, Modelling a D flip-flop in Verilog, Modeling an FDDI in Verilog.</p>
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Course Assessment Method
(CPT: 4 weeks; TSP: 5 weeks)

Santorum Journal Entomology 2010; 1(2):

Wiederholer	Antiquitäts- Wissensfrage	Innen- Erinnerung-1 (Wieder- holer)	Innen- Erinnerung-2 (Wieder- holer)	Test
5	33	13	16	49

Total Semester Transformation Matrix (TST)

In Part A, all questions need to be answered and in Part B, each student can choose any one (but not both) questions out of two questions.

Part A	Part B	Total
<ul style="list-style-type: none"> • 2 Questions from each module • Total of 3 Questions, each carrying 1 mark (by 3 = 3 marks)	<ul style="list-style-type: none"> • Each question carries 3 marks • One question will be given from each module, and if both 2 questions should be answered. • Each question must have a maximum of 3 subquestions. (1x3 = 3 marks) 	18
	Course Outcomes (COs)	

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

	Course Outcome	Student's Knowledge Level (SKL)
CO1	Summarise the basic concepts of different number systems and problem conversion and arithmetic operations between different bases	EI
CO2	Develop a combinational logic circuit to determine its logic expression, truth table, and timing information and to synthesise a sequential logic circuit through algebraic manipulation or with a Karnaugh map.	EI
CO3	Illustrate the fundamental role of traditional programming languages in modern digital design and be able to describe the limitations resulting the difficulties digital designers	EI
CO4	Develop VHDL logic circuit using both the classical digital design approach and the modern PDL-based approach.	EI
CO5	Develop synchronous circuits based on sequential storage devices, including counters, shift registers and L State state machine using the classical digital design approach and an HDL-based structural approach.	EI

Skills: E1-Elementary, EI- Understanding, EI- Apply, EI- Analyse, EI- Evaluate, EI- Create

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

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
C01	3	1	3									3
C02	3	1	3	3								3
C03	3	1	3	3	3							3
C04	3	1	3	3	3							3
C05	3	1	3	3	3							3

Note: P - Significant (Core), I - Intensive (Elective), C - Elective (Major), - No Correlation

Text Books

No.	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Introduction to Large Scale & Large Design with Verilog	Book 1. Lehman	Springer International Publishing	1st, 2017
2	Digital Design and Computer Architecture - RISC-V 2nd edn	Sanchit Bhattacharya, Debolina Bhattacharya	Morgan Kaufmann	1st, 2021

Reference Books

No. Ref	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1.	Digital Design with an Introduction to the Verilog HDL, VHSIC and System Verilog	M. Morris Mano, Michael D. Ciletti	Prentice	8th, 2018
2.	Digital Fundamentals	Thomas Head	Prentice	11th, 2011
3.	Fundamentals of Digital Logic with Verilog Design	Stephen Brown, Zvi Goren	McGraw-Hill	3rd, 2014
4.	Verilog and VHDL: A Survey Theory	Zvi Kohavi, Sung L. Sung	Cambridge University Press	3rd, 2018

Video Links (NPTEL, SWAYAM...)

Module No.	Link ID
1	https://opt.ee.iitm.ac.in/moodle/10710460
2	https://moodle.ee.iitm.ac.in/mod_resource/view.php?id=10710460
3	https://moodle.ee.iitm.ac.in/mod_resource/view.php?id=10710460

SEMESTER-SI
ECONOMICS FOR ENGINEERS
(Common to All Branches)

Course Code	UG010104	CIE Marks	42
Teaching Hours/Week (L- T- P- S)	2-0-0-0	TSE Marks	30
Content	2	Exam Hours	2hrs 10 min
Prerequisites (if any)	N/A	Course Type	Theory

Course Objectives:

1. Understanding of finance and costing for manufacturing operation, inventory planning and control.
2. Provide fundamental concepts of markets and microeconomics related to engineering industry.
3. Introduce basic concepts of Macroeconomics.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Micro Economics Concepts – Basic economic problems – Production Possibility Curve (PPC) – Law of diminishing marginal utility – Law of Demand – Law of supply – Elasticity – measurement of elasticity and its applications – Equilibrium-Change in demand and supply and its effects Production Function – Law of variable proportion – Economics of Scale – Internal and External economies – Long-Run Cost Function	4
2	Cost concepts – Fixed cost, variable cost – Explicit and Implicit cost – Opportunity cost – Absorption costing – Marginal costing Firms and their objectives – Types of firms – Markets – Perfect Competition – Monopoly – Oligopolistic Competition – Oligopoly (Features and applications of a firm)	4

	<p>Monetary System - Money - Finance - Central Banking - Inflation - Prices and Output - Measures to Control Inflation - Monetary and Fiscal policies - Deflation</p> <p>Debtors - Direct and Indirect taxes (main and secondary) - GST</p> <p>External borrow - Orange - Circular flow - Methods of Repayment and Deflation - Gold Market - Transaction Functions Society and International market function - Current Account and Banking System - Basic market functions - M2MIDI and MDTIV</p>	
4	<p>Value Analysis and value Engineering - Cost Value, Economic Value, Life Value, Return Value - Aim, Advantages and Application areas of Value Engineering - Value Engineering Processes - Break-even Analysis - Cost-Benefit analysis - Capital Budgeting - Present value,</p>	

Course assessment Method
(CIE- 48 marks, ECE- 64 marks)

Continuous Interval Evaluation Marks (CIE):

Activities	Assignment Case and Microcase (2)	Internal Examination 1 (Written)	Internal Examination 2 (Written)	Total
38	18	12.4	12.4	48

End Semester Examination Marks (EAM)

In Term 4, all questions need to be answered and in Term 5, each student can eliminate one full question out of four questions.

Part A	Part B	Total
<ul style="list-style-type: none"> • Maximum 1 mark Maximum 2 Questions • Assessable module • Total 6 Questions, each carrying 1 mark (not -1 marks) 	<ul style="list-style-type: none"> • 2 questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 2 sub-questions • Each question carries 2 marks $(1+1=2)$ marks 	24

Course Outcomes (COs)

All the set of the course outcomes should be visible.

Course Outcomes	Assessment Knowledge Level (KL)
CO1: Understand the fundamentals of financial management skills using basic and basic financial concepts of demand, supply, elasticity and production function.	K1
CO2: Develop decision making capability by applying concepts relating to costs and revenues and acquisition of knowledge regarding the functioning of firms in different market situations.	K2
CO3: Define the measurement and principles of monetary and fiscal systems, taxation, interest and stock markets.	K3
CO4: Use one of the processes of value analysis and engineering, and solve simple business problems using break-even analysis, cost benefit analysis and capital budgeting techniques.	K3

Note: K1: Knowledge; K2: Understanding; K3: Applying; K4: Evaluating; K5: Creating

EE-PO Mapping Table:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	-	-	-	-	-	1	-	-	-	-	1	-
C02	+	+	+	+	-	1	1	-	+	-	1	-
C03	+	-	+	-	1	-	-	-	-	-	2	-
C04	+	-	+	-	1	1	-	-	-	-	2	-

Text Books

SL No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Engineering Economics	Guria, Piyal Chakraborty and Chaudhury	Tata McGraw Hill	2017
2	Engineering Economy	H. D. Thamme, R. J. Fearey	NIL	12th
3	Engineering Economics	R. Srinivasan	NIL	2012

Reference Books

SL No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Engineering Economy	Lester Mandel J. K., Jeffrey Savage P. R.	Mc Graw Hill	17th Edition
2	Indian Financial System	Shiv M. Y.	Sai Mc Graw Hill	2011
3	Engineering Economics and analysis	Donald G. Marman, James F. Lovell	Prentice Hall of India	2006
4	Comprehensive Engineering Economics	Chai L. Park	Spectrum Books Ltd.	2006

SEMESTER 5&5A
ENGINEERING ETHICS AND SUSTAINABLE DEVELOPMENT

Course Code	UG/B.Tech	Credit Marks	12
Teaching Hours/Week (L-T-P-Wk)	20.00	240 Marks	10
Credit:	2	Exam Hours	100x 100m
Prerequisites (if any)	Data	Course Type	Theory

Course Objectives:

1. Equip with the knowledge and skills to make ethical decisions and implement sustainable practices in their professional lives.
2. Develop a holistic and comprehensive interdisciplinary approach to engineering, emphasizing values grounded from a perspective of environmental protection and sustainable development.
3. Develop the ability to find strategies for implementing sustainable engineering solutions.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
I	<p>Fundamentals of Ethics - Personal vs professional ethics, Civic Virtue, Design for virtue, Discretion and Professionalism, Integrity, Allegiance and responsibility, Integrity in design, development and research domains. Reputation, a balanced solution vs best - challenges - case studies, Technology and digital revolution-Data, information, and knowledge, Cybersecurity and cyberethics, Data utilization & management, High technology innovation, people and place accountability and social impacts, Misappropriation, Collision: transparency, Confidentiality, Right of confidentiality in medical context, Codes of Ethics.</p> <p>Basic concepts in Gender Studies - sex, gender, sexism, gender equality, beyond the binary; gender identity, gender expression, gender categories, Gender, inequality and discrimination in education,</p>	8

	<p>Engagement and everyday life; Choice of career in Science & Technology; Different methodologies & theories; Ethical values and practices in association with gender equality, diversity & gender justice; Gender policy and non-discriminatory requirements addressed.</p>	
3	<p>Innovation in Environmental Ethics: Definitions, approaches and historical development of environmental ethics, i.e., philosophical theories (utilitarianism, deontology, careism); Sustainable Development Principles: Definitions and scope; triple bottom line (economics, social and environmental sustainability); life cycle analysis and sustainability metrics; Ecosystems and Biodiversity: Basics of ecosystems and their functions; Impression of biodiversity and its conservation; Human impact on ecosystems and Biodiversity loss; An overview of climate change impacts to Ecosystems, and its mitigation; Landscapes and Urban Ecology: Strategies of landscape ecology; Definitions and its environmental impact; Sustainable urban planning and green infrastructure;</p>	4
3	<p>Hydrology and Water Management: Basics of hydrology and water cycle; Water quality and pollution issues; Sustainable water management practices; Environmental flow, management and studies; 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: Implications to the circular economy model; Differences between linear and circular economies; aspects of degrowth; Strategies for implementing circular economy processes and principles in engineering; Reliability and Sustainability; Transportable: Impact of transportation on the environment and climate; Basic types of a sustainable transportable design; Sustainable urban mobility solutions; Integrated mobility systems; E-Mobility; Driving and operating models of sustainable mobility solutions.</p>	4
4	<p>Sustainable Energy and Sustainable Technologies: Overview of renewable energy sources (solar, wind, tidal, biomass); Sustainable technologies in energy production and consumption; Challenges and opportunities in renewable energy adoption; Climate Change and Engineering Solutions: Basics of climate change causes; Impact of climate change on natural and human systems; Resilience and the Climate crisis; Engineering solutions to mitigate, adapt and build resilience to climate change; Environment</p>	4

Policies and Regulations: Overview of key environmental policies and regulations (national and international), Role of diplomats in policy implementation and compliance, Ethical considerations in environmental policy-making. Case Studies and Policy Briefcase: Analysis of multi-level studies. Emerging trends and future directions in environmental ethics and sustainability. Discussion on the role of diplomats in promoting a sustainable future.

Educational Assessment Method
(CIE: 20 marks, TAE: 20)

Continuous Internal Evaluation Marks (CIE):

Continuous internal evaluation will be based on individual and group assignments undertaken throughout the course and the portfolio assessed demonstrating 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 in it at the beginning of the semester. These groups can be the same ones they have formed in the previous semester.
- Activities are set in the third week from 2 days/week and 1 half-day/ week.
- The portfolio and reflective journal should be passed forward and displayed during the 7th Semester Lecture session on a year of the organization showing regarding the skills developed through various activities.

No.	Item	Description	Concept Activities 1 (G)	Mark
1.	Kuwait Journal	Weekly review reflecting on what has learned, personal insights, and how it can be applied in local contexts	1	2
2.	Home project (Detail of documentation of the project, including outcomes, findings, and reflections)	1 a) Summarise the Kuwait Clean Beach study, analyse and propose a way forward 1 b) Conduct a classroom survey on "Code of Ethics for Respondents" and propose a sample code of ethics 1 c) Learn from a CSR case on a Gender-related topic, do a literature survey on that topic and make a presentation for the others 1 d) Write a qualitative analysis of the Kuwait case 1 e) Undertake a project study based on the concepts of "sustainable development". (Module 1, Module 2 & Module 3)	10	8
3.	Assessments	3. One activity,* mark from Module 1, Module 2 & Module 7	10	10
4.	Final Documentation	A summary presentation summarising the key outcomes from the course, personal reflections, and proposed future actions based on the learning.	10	8
Total Marks				28

*Can be taken from the given sample writing project

Evaluation Criteria:

- Depth of Analysis: Quality and depth of reflection and analysis in project reports and class studies
- Application of Concepts: Ability to apply course principles 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

Course Outcomes (COs)

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

	Course Outcomes	Student's Knowledge Level (SLL)
CO1	Develop the ability to apply the principles of engineering ethics in their professional lives.	K1
CO2	Develop the ability to practice good-quality practices in their professional lives.	K1
CO3	Develop the ability to identify contemporary environmental issues and sustainable processes.	K2
CO4	Develop the ability to analyze the role of engineers in promoting environmental and climate resilience.	K2
CO5	Develop issues and skills in addressing potential environmental and climate-change challenges through a sustainable engineering approach.	K2

Note: E1-Elementary; E2-Understanding; E3-apply; E4-Analyze; E5-Evaluate; K1-Cross

CO-PO Mapping Table

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1						1	1	1	1	1			1
CO2		1				1	2	1	1	1			1
CO3						1	1	1	1	1			1
CO4		1				1	1	1	1	1			1
CO5						1	1	1	1	1			1

Reference Books				
SL No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Skills in Sustainability Business and Research	Cecilia Richetti	Cambridge University Press & Assessment	International & Regional 2021
2	Local, Global and International Roles	Judith Dahlby	Cambridge University Press & Assessment	International 2020
3	Sustainability Science	Bernard M. de Vos	Cambridge University Press & Assessment	International & Domestic 2021
4	Sustainable Engineering Principles and Practice	Ahmed S. El-Safty	Cambridge University Press & Assessment	2022
5	Engineering Ethics	M. Grosswiler, J. Zimmerman and V. S. Smith & Kumar	Wiley Learning Partner Ltd, New Delhi	2021
6	Professional ethics and human values	R.K. Pragyaan	Wiley-Liss International (India) Pvt. Ltd, New Delhi	2009
7	Skills in Engineering	Mike R. Martin and Richard Schenkman	Elsevier Inc./BSC Publishing Company Pte. Ltd, New Delhi	4 th edition, 2021

Supplied Activities/Projects:

Module-B

- Plan a collection on a local environmental issue (e.g., plastic waste in Kerala) involving at least three different ethical perspectives (environmental, economic, community).
- Plan a life cycle analysis report of a common product sold in Kerala (e.g., a mosquito lantern 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.
- Plan/visit an biodiversity in a nearby area (e.g., a 'bird park', a visited,莽莽的 village, campus etc.) and prepare conservation strategies to protect it.
- Develop a conservation plan for an endangered species found in Kerala.
- Identify the green spaces in a local urban area and propose a plan to enhance urban settings using native plants and sustainable designs.
- Create a model of a sustainable urban landscape for a given locality in Kerala.

Module III

- Study a local timber study (e.g., a tree or block) for signs of pollution or related tree diseases and suggest sustainable management and restoration processes.
- Analyse the effectiveness of water management in the village: design and propose improvements + calculate the water footprint, how to reduce the footprint, how to increase supply through surface harvesting, and how to decrease the supply-demand mismatch.
- Implement a new forest rotation on the village sample for one cycle and document the challenges and successes.
- Develop a村村 audit report for the village. Suggest a plan for a participative approach.
- Create a circular economy model for biomass products used in Kuselka (e.g., biomass oil, charcoal).
- Design a production or service based on circular economy and suggest processes and present a business plan.
- Develop a plan to improve production and cycling infrastructure in a chosen locality in Kuselka.

Module IV

- Evaluate the potential for building pilot projects on the village sample including socio-economic analysis and feasibility study.
- Analyse the energy consumption patterns of the village sample and propose sustainable alternatives to reduce consumption - "What policies are being used? How can we reduce demand using corresponding policies?"
- Analyse a local infrastructure project for its climate influence 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 regeneration project in Kuselka (e.g., sustainable building design, waste management project, infrastructure project).
- Research and present a case study of an unsuccessful regeneration project in Kuselka, highlighting design and implementation flaws and provide recommendations (e.g., a housing complex with tree logging, a water management project causing frequent floods, infrastructure project that affects surrounding landscapes or ecosystems).

SEMESTER 5

DATA STRUCTURES LAB

(Common to CS CAGD/CSE/ALAM/AD/CS/CSOC/CUSOC)

Course Code	PERIODS	CSE Marks	EE
Tracing Gauss-Wronski (L+T P R)	08:00	THE Marks	10
Credit	3	Exam Hours	12 hrs. 10 min
Prerequisites (Any)	07EST014	Course Type	Lab

Course Objectives:

1. To give practical experience to students on implementing different linear and non-linear data structures and algorithms for searching and sorting.

Expt. No	Experiments
1	Find the sum of two square polynomials using arrays.
2	Find the transpose of a square matrix and sum of two square matrices.
3	Convert infix expression to postfix (or prefix) and then evaluate using stack.
4	Implement Queue, STACK, and Circular Queue using arrays.
5	Implement addressed and linked approach of linked list (page or a node) because (a) node and header pointer (very directly related to operations).
6	Implement addition and multiplication of polynomials using singly linked lists.
7	Create a system for a pure single dimension expression and find the prefix - postfix conversion.
8	Implement a dictionary of root meaning words using binary search tree.
9	Find the shortest distance of cities with their a landmarks using a tree.
10	We have three dictionaries which stores 1000, 7000, and 4000 terms, respectively. The 7000 and 4000 dictionaries uses one file of word, but the 1000 dictionary is initially empty. We can download any type of synonym grouping the synonym of one dictionary together, mapping only when the source dictionary is empty or the destination dictionary is full. We need to learn if there are sequences of pairings that have exactly 2 terms in the first 4000 entries. Model this to a graph problem and solve.

11	Implement insertion and explore deletion as a constraint.
12	Given a list of sorted items, implement an efficient algorithm to search for specific items in the array.
13	Implement Bubble sort, Insertion sort, Selection sort, Quick sort, and Merge sort and compare the number of steps involved.
14	The General practitioner wishes to give professional treatment to his customers. They have categorized their customer categories as Different gendered, Different colored, Lower income, Old/young. The customers are to be given profession in the decreasing order - Different gender, Lower income, Different gendered, Different gender. Determine the possible sequence of treatment.
15	Implement a spell checker using a hash table to store a dictionary of words for fast lookup. Implement functions to check if a word is valid and to suggest corrections for misspelled words.
16	Implementation of a basic memory allocator and garbage collector using doubly linked list.
17	The CSR App is organizing a walk that will be held on many running routes. So participating in an event, you can claim the activity points as calculated by CSR. Each event gives you 400 activity points. Where it is necessary, if you are not allowed to participate in more than one route, what's the maximum number of points that you can earn?
18	Design a control logic for a single terminal for moving a heap. Use a menu having following menu and the smallest distance from next list. Representatively increase the medium distance and insert the next element from the corresponding list until all boxes are empty.

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation Pre-Lab Work assignments Time and Turn-in Completion of Lab Reports / Board (Continuous Assessment)	Internal Examination	Total
4	12	18	48

End Semester Examination Marks (ESE):

Practices: Preparation: work Design: Algorithms	Context of application Essence of work knowledge Expectations	Results with valid Information Quality of Output	Time use	Board	Total
10	12	10	18	2	40

- Submission of Handwritten staff is encouraged for the end semester examination subj. upon minimizing the daily required amount.
- Furthermore by External Examiner: The student can receive a "partial fail" score

Course Outcomes (COs)

As defined in the course syllabus, these outcomes:

Course Outcomes	Smart's Ko-Hu- Level (SH)
CO1 Model a real world problem using suitable data structures and logic to find its solution.	10
CO2 Compare efficiency of different data structures in terms of time and space complexity.	14
CO3 Evaluate the time complexities of various searching and sorting algorithms.	12
CO4 Differentiate various and erroneous data structures in terms of their advantages and disadvantages.	13

Note: E=Excellent; D=Unsatisfactory; P=Pass; F=Failure; NS=Overset

KO-PG Mapping (Mapping of Course Outcomes with Program Outcomes)

	KO1	KO2	KO3	KO4	KO5	KO6	KO7	KO8	KO9	KO10	KO11	KO12
KO1	4	0	1	1				4				1
KO2	3	0	1	1				3				1
KO3	3	0	1	1				3				1
KO4	1	0	1	1				1				1

/: High; 0: Medium; 1: Low/Med; -: No Correlation

Text Books

SL. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Principles of Data Structures in C	Eliezer Rabinovitz, Samy John and Sameer Jackson (Free)	Galaxy Books	2nd 2017
2	Introduction to Algorithms	Thomas H Cormen, Charles Leiserson, Ronald L Rivest, Clifford Stein	MIT	3rd, 2009

Reference Books

SL. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Data Structures	Sartaj D.	Premier Galgotias	2nd 2018
2	Data Structures and Algorithms	Arun K. V., J. K. Rajpoot and T. S. Ullah	Samsam Publication	3rd, 2014
3	Introduction to Data Structure w/o Applications	Thimmapa J. R., P. G. Somayaji	Tata McGraw-Hill	2nd 2017
4	Theory and Problems of Data Structures	Lipshutz S.	Schaum's Series	2nd 2014

Vídeo Links (OPTEL_SWATAM_...)

No.	Link ID
1	https://repositorio.unisinos.br/123456789/101
2	https://repositorio.unisinos.br/123456789/102

Continuous Assessment (25 Marks)

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

- Pre-Lab Assessments: Assessment of pre-lab assignments to evaluate the basic understanding of the upcoming experiment.
- Understanding of Theory: Evidence based on student' preparation and understanding of the theoretical background related to the experiments.

2. Conduct of Experiments (7 Marks)

- Standard and Efficiency: Adherence to correct procedures, correct execution of experiments, and following safety protocols.
- Skill Proficiency: Proficiency in handling equipment, accuracy of observations, and understanding skills during the experiments.
- Teamwork: Collaboration and participation in group investigations.

3. Lab Reports and Reward Keeping (8 Marks)

- Quality of Reports: Clarity, completeness and consistency of lab reports. Includes documentation of experiments, data analysis and conclusions.
- Team - Collaboration: Adherence to guidelines for submitting lab reports through reward and maintaining a well-organized teamwork.

4. Viva Voce (5 Marks)

- Oral Communication: Ability to explain the experiments, results and underlying principles during viva voce examination.

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

Evaluation Pattern for End Semester Examination (50 Marks)

1. Problematic Preliminary Work Design Algorithm (10 Marks)

- Problem Understanding and Description: Clarity in explaining the problem and understanding each step involved.
- Preliminary Plan and Planning: Thoroughness in planning and organizing requirements.
- Algorithm Development: Correctness and efficiency of the algorithm used to solve problems.
- Creativity and logic in algorithm or organizational design.

2. Creation of Requirements Execution of Work Programming (20 Marks)

- Using and Formulating: Implementation and accurate execution of the requirement or programming tasks.

3. Sound and Valid (Unbiased) Quality of Output (10 Marks)

- Accuracy of Results: Precision and correctness of the results displayed.
- Analysis and Interpretation: Validity of Inferences drawn from the output in quality of program output.

4. Viva Voice (10 Marks)

- Ability to explain the requirement, processes used and answer related questions.
- Relevancy in answering questions related to theoretical and practical aspects of the subject.

5. Report (2 Marks)

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

SEMESTER-5
PYTHON PROGRAMMING LAB
 (Common to C.A / AI)

Course Code	POCAL018	CSE Marks	50
Teaching Hours/Week (Ex-T.D, L.E)	3.5/1.5	EE Marks	50
Credit	2	Exam Hours	2 hrs. 20 min.
Prerequisites (if any)	SECRET018	Course Type	Lab

Course Objectives:

1. To apply the basic concepts of Python and structures like List, Tuple, Sets, and Dictionaries in solving problems and also implement code in String, Functions, Modules, Regular Expressions, turtle, and Classes.
2. To introduce the fundamentals of data structures using heapq, Deque, and OrderedDict.

Topic No.	Objectives
1	Write a Python program to read a file and replace a character with its reverse character in each tuple.
2	Write a Python program to assess the occurrences of each word in a given text and store the results in a dictionary.
3	Write a Python program to find all unique characters in a file.
4	Write a Python program to assess a set of sequence of all given numbers between required range using set comprehension.
5	Write a Python program using sets to find all unique characters in a given string.
6	Write a Python program that takes a file of numbers and counts them by considering only the even numbers from the original file.
7	Write a Python program to draw an equilateral triangle fractal, the program is done through a different class.
8	Write a Python program to store a dictionary a specified number of words.
9	a) Write a calculator that can perform addition, subtraction, multiplication, and division using Tkinter. b) A digital clock that displays the current time and system error, second using Tkinter.
10	Write a Python program to copy the contents of one file to another.
11	Write a Python program to merge the contents of two text files and write the combined contents into file.
12	Write a Python program using NumPy to create an array of 10 random numbers and calculate the mean and standard deviation.
13	Write a Python program using Numpy to create a 10x10 matrix of integers. Range is from 1D array and then flatten it back to a 1D array.

12	Write a Python program using Pandas to parse raw CSV messages and perform matrix multiplication.
13	Write a Python program using Pandas to read a CSV file from a GoogleSheet, display the first five rows, and calculate the mean of a specified column.
14	Write a Python program using Pandas to read a CSV file and perform basic data analysis like finding the sum, mean, min, max and deviation of a specified column.
15	Write a Python program using Pandas to read a CSV file from a Database, Run SQL queries and display the returned DataFrame.
16	Write a Python program using Matplotlib to plot a bar graph of a dataset representing monthly sales figures.

Course Assessment Method (CIE: 80 marks, ESE: 90 marks)

Continuous Internal Evaluation Marks (CIE):

Assessment	Progression Pre-Lab Work requirement, Viva and Tardy completion of Lab Reports : Based (Continuous Assessment)	Journal Examination	Total
3	15	18	33

End Semester Examination Marks (ESE):

Practical Implementation Work/Design/ Algorithm	Quality of experiments Execution of work: methodologies/ Programmes	Results with valid inference Quality of Output	Viva voce	Based	Total
20	12	12	36	2	40

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

Course Outcomes (COs)

A total of 6 course outcomes should be addressed:

Course Outcome		Learning Objectives Level (LO)
CO1	Create Control Structures and Functions in Python to solve complex problems.	LO1
CO2	Utilize Python Libraries for Data Manipulation and analysis	LO1
CO3	Develop Statistical Scripts Using Tools and Libraries such as SciPy Applications Using Them	LO1
CO4	Make use of File Handling and Handle Data Visualization in Python	LO1

LO1=1. Remember; LO2=Understand; LO3=Apply; LO4=Analyze; LO5=Evaluate; LO6=Create

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1							1
CO2	1	1	1	1	1							1
CO3	1	2	1	1	1							1
CO4	1	2	1	1	1							1

1. High (H); 2. Moderate (M); 3. Low (L) = Co-Correlation

Text Books

SL. No.	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Learning Python	Matt Lutz	O'Reilly Media	2e, 2013
2	Python Crash Course: A Hands-On, Project-Based Introduction to Programming	Eric Matthes	No Starch Press	1e, 2013
3	Python for Everyone	Charles E. Severance, Bevan D. Hodder	Wiley	2e, 2014

Reference Books				
S. No.	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Automate the Boring Stuff with Python: Practical Programming for Total Beginners	Al Sweigart	No Starch Press	3rd, 2018
2	Python for Data Analysis: Data Cleaning with Pandas, NumPy, and Dask	Wes McKinney	O'Reilly Media	3rd, 2017
3	Python Cookbook: Recipes for Mastering Python 3	David Beazley and Brian K. Jones	O'Reilly Media	3rd, 2013
4	Fluent Python: Clear, Concise, and Effective Programming	Lennart Regehr	O'Reilly Media	3rd, 2014
5	Core Python Programming	E. Lippert et al.	Download	2nd, 2011

Videos Links (NPTEL, MITAYAM...)

Module No.	Link ID
1	https://nptel.ac.in/courses/114_102/program
1	https://nptel.ac.in/courses/114_102/program
2	https://nptel.ac.in/courses/114_102/program
3	https://nptel.ac.in/courses/114_102/program

Continuous Assessment (25 Marks)

1. Programs and Pre-Lab Works (7 Marks)

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

1. Conduct of Experiments (7 Marks)

- **Procedure and Execution:** Ability to carryout a. accurate execution of experiments, and following safety protocols.
- **Lab Performance:** Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
- **Teamwork:** Collaboration and participation in group experiments.

2. Lab Reports and Record Keeping (3 Marks)

- **Quality of Reports:** Clarity, completeness and accuracy of lab reports. Project documentation of experiments, data analysis and conclusions.
- **Testify Submission:** Adhering to guidelines for submitting laboratory reports through correct and maintaining a self-explained file record.

3. New Term (3 Marks)

- **Oral Examination:** Ability to explain the objectives, results and underlying principles during a 10 minutes examination.

Final Marks Awarding: The final marks for experiments, 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. Problem/Preliminary Work/Design Algorithm (10 Marks)

- **Problem Understanding and Description:** Clarity in explaining the problem and understanding task being carried out.
- **Preliminary Work and Planning:** Thoroughness in planning and preparing necessary algorithms.
- **Algorithm Design:** Correctness and efficiency of the algorithm related to the assignment.
- Creativity and logic in algorithm or experimental design.

1. Content of Experiments Overview of World Programming (24 Weeks)

- Long and Duration: Preparing and assessing assessment of the supervisor in programming tasks.

2. Results with Valid Testimony-Quality of Charger (24 Weeks)

- Accuracy of Results: Precision and consistency of the obtained results
- Analysis and Interpretation: Validity of evidence drawn from the examination quality of program design

3. Visa Visa (24 Weeks)

- Ability to judge the argument, problem results and error related questions
- Proficiency in answering questions related to theoretical and practical aspects of the subject

4. Standard (5 Months)

- Completeness, clarity, and accuracy of the thesis must submitted

SEMESTER 4

**COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE)**

SEMESTER 5th
MATHEMATICS FOR COMPUTER AND INFORMATION SCIENCE-4
(Group A)

Course Code:	GAGATHI	CIE Marks:	42
Teaching Hours/Week (L-100; S-0)	140.0	TIE Marks:	10
Classes:	3	Exam Hours:	2 hrs 120m
Prerequisites (if any):	ME	Course Type:	Theory

Course Objectives:

- To provide a comprehensive understanding of fundamental concepts of graph theory including paths, cycles, trees, graph algorithms, graph coloring and matrix representations emphasizing their applications across various disciplines.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	<p>Introduction to Graphs - Basic definitions, Applications of graphs, basic and interior graphs, Isomorphism and Graph, Adjacent vertex, Incident vertex and Null graph, Isomorphism, Sub-graph, Walks, Paths and circuits, Connected graphs, Disconnected graphs and components.</p> <p>[Total 8. Reference topics from sections 1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 2.4, 2.5. Results of chapters 2.6, 2.7 are excluded.]</p>	8
2	<p>Tree graphs, Spanning tree graphs, Minimum path and circuits, Travelling Salesman Problem, Connectivity, Edge-connectivity, Vertex-connectivity, Connected graphs, Types of connected graphs</p> <p>[Total 8. Reference topics from sections 1.6, 1.7, 1.8, 1.9, 1.10, 4.1, 4.2, 4.3, 4.4, 5.2. Results of chapters 4.5, 4.11, 4.12 are excluded.]</p>	8
3	<p>Planar graphs, Jordan curve theorem, Eulerian and non-eulerian graphs, 4-color theorem, Graphs and spanning trees, Planar graphs and Kuratowski's algorithm, Dirac's theorem, Petersen's algorithm, Harary-Kuratowski theorem, graph algorithms</p>	8

	[Test 3: Address topics from sections 3.1, 3.2, 3.3, 3.4, 3.6, 3.8, 3.9, 3.10, 3.11, 3.12. Fresh air discuss 3.13, 3.14 are excluded.]	
4	<p>Mass representation of graphs, Adjacency matrix, Isomorphic graphs, Class Matrix, Path Matrix, Colouring, Chromatic number, Chromatic polynomial, Graph colouring algorithms.</p> <p>[Test 4: Address topics from sections 3.1, 3.5, 3.6, 3.8, 3.11, 3.12. Fresh air discuss 3.13, 3.14 are excluded.]</p>	8

Course Assessment Marks
(25E: 40 marks, EEE: 60 marks)

Common Internal Evaluation Marks (CIE):

Achievement	Assessment Work product	Internal Evaluation-I (Written)	Internal Evaluation-II (Written)	Total
I	EE	10	10	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
<ul style="list-style-type: none"> + 2 Questions from each module. + Total of 3 Questions, each carrying 4 marks 	<ul style="list-style-type: none"> • Each question carries 2 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 12 sub-questions 	40
EE: 10 marks	10E = 16 marks	

Course Outcomes (CO)

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

Course Outcomes		Student's Knowledge Level (K1)
CO1	Understand the fundamental concepts of graph theory such as types of graphs, degree of a vertex, path, connectedness, components.	K2
CO2	Understand the concept of Euler graphs. Students: graph and connectivity.	K2
CO3	Apply Farnes and Kosaraju's algorithm for finding minimum cost spanning tree and Dijkstra's and Floyd-Warshall algorithms for finding shortest paths.	K3
CO4	Illustrate various representations of graphs using matrices and apply them solving several life problems.	K3

Note: K1-Knowledge; K2-Understanding; K3-Application; K4-Analyses; K5-Evaluates; K6-Creates

ECS-601 Mapping Table

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13
CO1	1	1	1	-	-	-	-	-	-	-	-	-	2
CO2	1	1	1	-	+	+	-	-	-	+	+	-	2
CO3	1	1	1	1	0	0	0	0	0	0	0	0	2
CO4	1	1	1	1	0	0	0	0	0	0	0	0	2

Text Books

S.No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Graph Theory with Applications in Engineering and Computer Science	Vishvajeet Desai	Pratice Hall India Learning Division Limited	1st edition, 2013

Reference Books

Sl. No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year of release
1	Introduction to Graph Theory, 2e	Douglas B. West	Prentice-Hall of India India	2nd edition, 2017
1	Introduction to Graph Theory	Rajesh T. Muni	Lamgupha Group Ltd.	16 edition 2019
2	Graph Theory with Applications	J.J. Keagy and L.R.B. Velasco	Elsevier Science Publishing Co., Inc.	1279

Title Data (NPTEL, SWAYAM...)

Module No	Link ID
1	https://www.nptel.ac.in/courses/101/101/101010012
2	https://www.nptel.ac.in/courses/101/101/101010013
3	https://www.nptel.ac.in/courses/101/101/101010014
4	https://www.nptel.ac.in/courses/101/101/101010015

SEMESTER S4

DATABASE MANAGEMENT SYSTEMS

(Common to CS-CO-CS-CV-AQ-HG-CS-YO-CU-CI-GG)

Course Code:	POCIT401	CIE Marks:	40
Teaching Hours/Week (L-T-P-R-S)	3-1-00	TBE Marks:	40
Credit:	4	Exam Hours:	100+100
Prerequisites/Strength:	POCIT100	Course Type:	Theory

Course Objectives:

- Equip the students with a comprehensive understanding of fundamental DBMS concepts as well as the principles and applications of MySQL database.
- Enable students to design, implement, and manage relational and MySQL databases.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	<p>Introduction to Database - Database System Concepts and Architecture; Data Models; Columns and Instances; Data, Schema, Instances and Data Interpretation; Database Language and Structure; Constraints and Data Quality; Characteristics of DBMS.</p> <p>Concepts Data Modelling and Database Design - Data Modeling Using ER Model; Normalization; 3NF; Normal Forms; Functional and Non-Functional Requirements; Relational Algebra; Data and Relational Operations; Weak Entity Types; Refining the ER Design for 4th Normality Database.</p>	32
2	<p>Relational Data Model and SQL - The Relational Model; Relational Data Model; Relational Languages; Relational Algebra; Relational Calculus; Relational Integrity Constraints; SQL; Relational Calculus; Relational Algebra; SQL; Relational Calculus.</p>	32
3	<p>Relational Database Theory & Normalization - Functional Dependencies; Basic definitions; Normalization; First, Second, and Third normal forms; Transaction management - Transaction Processing: transaction problems and failures in transaction; Database properties of transaction; Concurrency control based on serializability and consistency; Commitment; Conflict</p>	32

	<ul style="list-style-type: none"> - with Team-Based Learning Techniques, Distance Learning management - External option-institutional option-Auditor piping <p>Invitation To M&OL Courses - types of M&OL courses: C&D Themes, E&S programs, Geographical Invitations of M&OL.</p> <p>M&OL educational Programs + Key roles: Staff, Coach, Tutor, Advisor, Faculty mentor and Committee Member</p>	11
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Exterior Assessment Method
(CE: 40 marks, CEI: 10 marks)

Continuous Internal Evaluation Marks (CEI):

Assessment	Assigned Value points	Target Examination I (Written)	Target Examination II (Written)	Total
E	12	10	10	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 four questions:

Part A	Part B	Total
<ul style="list-style-type: none"> + 2 Questions from each module + Total of 4 Questions, each carrying 3 marks <p>(Total = 12 marks)</p>	<ul style="list-style-type: none"> - Each question carries 2 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-questions. <p>(Total = 10 marks)</p>	22

Course Outcomes (COs)

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

Course Outcomes		Student's Knowledge Level (SKL)
CO1	Understand and apply the functional areas and characteristics of Database systems	E2
CO2	Identify and design solutions for efficiently representing data using the relational model or non-relational model	E2
CO3	Distinguish between the regions of Concurrency Control and Recovery in Transaction systems	E2
CO4	Compare different RDB queries to efficiently extract, store, and manipulate data from relational databases	E2
CO5	Implement various RDBMS mechanisms to handle concurrent access	E2

Note: E1-Explain; E2-Understand; E3-Apply; E4-Analyze; E5-Evaluate; E6-Creative.

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

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
CO1	1	1	1									1
CO2	1	1	1	1						1	1	1
CO3	1	1	1	1								1
CO4	1	1	1	1								1
CO5	1	1	1	1								1

Note: 1-Algo Lang, 2-Milestone Summary, 3-Relational Algebra, 4-Concurrent

Text Books

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Fundamentals of Database Systems (Pearson IIT/AJC)	Elliott, Nav拉	Pearson	T-9
2	Managing the Storage of Relational Data (Morgan-kaufmann)	Don McCreary and Ann Dally	Morgan	2014

Reference Books				
S.No	Title of the Book	Name of the Authors	Name of the Publisher	Date and Year
1	A. M. F. Koch and S. Subrahmanian, Database System Concepts	Abraham A., M. F. Koch and S. Subrahmanian, Database Systems Concepts, 4th Edn., McGraw-Hill, 2013, 2013.	McGraw-Hill	1st, 2013
2	Beginning Database Design	David Stephens	Wiley	Dec, 2002
3	MySQL Design Ref	Ronald T. Sanderson, Glenn Strode	Addison Wesley	Oct, 2012
4	MySQL Data Models: Trends and Challenges (Managing Enterprise Databases and Big Data)	Oliver Küller	Wiley	2013

Value Lists (OPTEL, SWAVAIL...)	
Module No.	Link ID
1	http://www.optel.com/swavail_valgen.htm
2	http://www.optel.com/swavail_valgen.htm
3	http://www.optel.com/swavail_valgen.htm
4	http://adobeoptinoptinlist.com/367364004115

SEMESTER 5H

OPERATING SYSTEMS

(C00006-C0007-C0008-C0009-C0010-C0011-C0012)

Course Code:	POCST405	CIE Marks:	40
Teaching Hours/Week (L.T.D.B)	2.1.3.0	ESE Marks:	40
Credits:	4	Exam Hours:	2 Hrs 100m.
Prerequisites (if any):	N/A	Course Type:	Theory

Course Objectives:

1. To introduce the concepts of a typical operating system and its various functions.
2. To expose the students, especially undergraduate, to OS implementation issues from the Linux operating system.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	<p>Introduction to Operating Systems (Book 1 Ch 1-7 Incompatibility, 2009; Operating System Services (Book 1 Ch 2); Overview of Operating Systems and its role, Linux, Various Class Use Examples (Book 1 Ch 1))</p> <p>Process management: Process Creation, Process States, Deadlock, Processes, Shared Address Space (Book 1 Ch 4, 5); Synchronizing among processes – mutex and shared media, process switching (Book 1 Ch 6); Synchronization requests (Book 1 Ch 7).</p> <p>Case study: Linux kernel process management (Book 1 Ch 6)</p> <p>Threads and Concurrency: Concept of a thread, Multithreading techniques, Multithreading models (Book 2 Ch 4)</p> <p>Case study: The Linux Implementation of Threads (Book 2 Ch 4)</p> <p>Process scheduling: Concepts and basic algorithms (Book 1 Ch 7), The Multi-Level Feedback Queue, Basic Rules (Book 1 Ch 8)</p> <p>Case study: The Linux, Completely Fair Scheduler (CFS) (Book 1 Ch 7); Synchronization and CFS (not compulsory). The Linux Scheduling Requirements, Priority-based CPU Scheduling (Book 1 Ch 8)</p>	32
2	<p>Consistency and Distribution: Basic principles (Book 2 Sections 1.1, 4.1), Interprocess Communication, The Peer-to-Peer Building Upon Lecture Note Two.</p>	

	<p>read list, Compare and Swap, Young Zweave, Sliding Window Diff Splicing (Book 1 Ch 10); Strengths - Definitions, Binary Searchtrees, The Red-Black-Tree; Standard Bubble Problem and its solution using merge sort, Bubble-Sieve Lecture (Book 1 Ch 2)</p> <p>Case study: Linux Kernel: Spacemarines Mission - [you look] (daughter, Master) (Book 1 Ch 11)</p> <p>Contemporary: Database and Databases - Database Characteristics, Database Transactions and Atomicity, Database Concurrency and Recovery (Book 1 Ch 12); Oracle Transactions; Fuzzy Data Mining (Book 1 Ch 13)</p>	11
1	<p>Memory management : Address Space, Memory, MMU, Virtual Addresses - An Example, Systems (Hierarchical), Relocation, Implementation of Bus Boundaries, Address translation, its implementation, Support for Sharing (Book 1 Ch 14 to 16)</p> <p>Virtual memory - Segregate Information, page tables and basic are supported, TLB, Paging, Compacting by copying, - 1GB free and major, Sharding 1GB minor, TLB miss rate; Reclaiming the pages with xmr (Book 1 Ch 17 to 20)</p> <p>Using beyond physical memory - Using sparse page table and its removal from page replacement policies, Threading (Book 1 Ch 21, 22)</p>	11
	<p>IO system: Modern System architecture, Represented IO, Interrupts, DMA, Device handles and tasks, The Device Driver (Book 1 Ch 26)</p> <p>Hard disk: Geometry (Book 1 Ch 27), disk scheduling (Book 1 Section 11.2)</p> <p>Case study: Linux PV architecture - Clustered Computing Part Quality (Book 2 Ch 14)</p>	10
4	<p>File and Databases: The File System Interface - File description, reading and writing file (sequential and random access), Removing file, file links and symbolic links, Creating, reading and deleting directories, Permissions file and Access Control Lists, Unsharing a file system (Book 1 Ch 40)</p> <p>File Organization: The blocks, The Multi-Level index (Book 1 Ch 40)</p> <p>Case study: File sharing over Network storage - The Network File System Operations (Book 1 Ch 41)</p>	10

Courses Assessment Method
(CE: 44 marks, ESE: 56 marks)

Continuous Internal Evaluations Marks (CIE):

Assessments	Assignment Maze project	Internal Examination 1 (Written)	Internal Examination 2 (Written)	Total
1	22	16	16	44

End Semester Examination Marks (ESE):

In Year 4, all questions need to be answered and in Year 5, each student can choose any two out of four questions.

Total	Part A	Part B	Total
+ 2 Questions from each module: Total of 8 Questions, each carrying 4 marks (8x4 = 32marks)	<ul style="list-style-type: none"> • Each question carries 2 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 2 sub-questions. <p style="text-align: right;">(8x2 = 16 marks)</p>		48

Course Outcomes (CO's)

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

Course Outcomes	Student's Knowledge Level (SKL)
CO1 Apply the concepts of process management and process reengineering techniques in operating systems.	K3
CO2 Demonstrate process reengineering techniques applied in operating systems.	K3
CO3 Use methods processes and continuous improvement in operating systems.	K3
CO4 Adapt various inventory management techniques in operating systems.	K3
CO5 Calculate the savings management in operating systems.	K3

Note: K1-Learner; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Creative

EDD-001 Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
CO1	1	1	1									1
CO2	1	1	1									1
CO3	1	1	1									1
CO4	1	1	1									1
CO5	1	1	1									1

Note: 1. Align; 2. Matched; 3. Mismatched; 4. Non-matched

Text Books

Sl.No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Operating Systems: Theory and Practice	Ashok Agarwal, Dinesh Agarwal, Praveen	Oxford Space	2/e, 2018
2	Linux Kernel Development	Rajendra Lakkad	Praveen	2/e, 2018
3	Operating System Design	Andrew S. Tanenbaum, David K. Stevens, Greg Gagne	Wiley	2/e, 2018

Reference Books

Sl.No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Modern Operating Systems	Andrew S. Tanenbaum, Robert E. Watson	Pearson	2/e, 2018
2	The Design of the OS/360 Operating System	Warren J. Teitelman	Prentice Hall of India	1/e, 1999
3	The Unix Book of Programming	Allyn R. Swanson	Prentice Hall Press	1/e, 2003

Videos Links (YouTube, YouTube-UC, etc.)

No.	Link ID
1	https://www.youtube.com/watch?v=LWfW0w698f4
2	https://www.youtube.com/watch?v=HD7752730Q4&t=2s#t=0D427s2s

SEMESTER-SI
COMPUTER ORGANIZATION AND ARCHITECTURE

(Offered in CSE/CE/CS/CA/AD/CH/EE/CC/EU/OD)

Course Code:	PCST404	CIE Marks:	40
Teaching Hours/Week (L.T.D.B)	2.0.0.1	EAK Marks:	40
Credits:	4	Exam Hours:	2 Hrs 100m
Prerequisites (if any):	DISCRETE	Course Type:	Theory

Course Objectives

- 1. Introduce principles of computer organization and the basic architecture concepts using RISC.
- 2. Introduce the concepts of microarchitectures, memory hierarchy, and I/O systems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Basic Structure of computers - Functional units - Basic operations concepts, memory map, bus system. CISC vs RISC architectures - RISC Instruction - Assembly Language, Assembler directives, Assembling Programming concepts - Program flow, branching, Conditional constructs, Loops, Arrays, Functions, Iteration/Control cycle. Machine language - Instructions, addressing modes, linked program concept, Evolution of the RISC Architecture.	12
2	Microarchitectures - Translation, Performance analysis, Single-Cycle Processors - Single Cycle Design, Single Cycle Control, Pipelined Processors - Pipelined Data Path, Pipelined Control, Branches, Slicing Data/Control Issues, Performance Analysis	11
3	Memory Systems - Interconnection, performance analysis, Cache - basic concepts, Cache mapping, Cache replacement, Multi-Level Cache, Evicting the Line, Write Policy, Virtual Memory - Address Translation, Page Table, Translation Lookaside Buffer, Virtual Protection	11
4	Input / Output - External Devices, I/O Modules - Programmed I/O, Interrupt Driven I/O, Direct Memory Access, Embedded I/O Systems - Embedded I/O, Direct Programmed I/O, Shared I/O, Other Platforms	11

Suggested Project Topics

Use simulation tools or logic design synthesis toolkits (e.g., QSIM (<http://www.qsim.org>), implement components of computer systems such as Virtual Earth approximation and verify the effects. Delays in a hazard, TLDs.

Cover Assessment Method
(CIE, 30 marks, ECE, 40 marks)

Continuous Internal Evaluation Marks (CIE):

Assessment	Project	Internal Level	External Level	Total
2	20	12.0	12.0	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
<ul style="list-style-type: none"> • 10 questions from each module • Total 10 Questions, each carrying 2 marks (Total = 20 marks) 	<ul style="list-style-type: none"> • 2 questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub-questions • Each question carries 3 marks (Total = 12 marks) 	42

Course Outcomes (COs)

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

	Course Outcomes	Educational Knowledge Level (EKL)
CO1	Identify the basic structures and functional units of a digital computer and its features of RISC architecture.	E2
CO2	Program with the single cycle processor: ppc050pp, for the selected problem.	E3
CO3	Understand memory organization of modern computer systems.	E3
CO4	Program with the I/O operations of a digital computer.	E3

Note: E1-Knowledge; E2- Understanding; E3- Application; E4- Analysis; E5- Evaluation; E6- Creation

FD-302 (Rev. 5-22-79)

Page Footer

SL.No	Title of the Book	Name of the Authors	Type of the Publication	Date and Year
1	Design, Design and Computer Architecture - B.Sc.C.V Edition	Kunal L. Sane, Devak Shetty	Lamiga Konkanna	Jan, 2023
2	Computer Organization and Architecture Designing In Performance;	T. Wilson & C. Ray	Primer	Jan, 2023

Notizien Berlin

No.	Title of the Book	Name of the Author's	Name of the Publisher	Date and Year
1	Computer Organization and Design: The Hardware/Software Interface RISC/V Edition	David A. Patterson John L. Hennessy	Morgan Kaufman	1/e, 2004
2	Computer Organization and Embedded Systems	David V. House John Troyer David Maziarski	McGraw-Hill	4/e, 2011
3	Modern Computer Architecture and Organization	Jon Louis	Prentice Publishing	1/e, 2009

Table 1 from *ORTELIUS* - *NEAYAH* - 1

No.	Link ID
1	https://www.google.com/search?rlz=1.38.0.100-100111111111
2	https://www.google.com/search?rlz=1.38.0.100-100111111111

PBL Content Elements

1. Lessons (3 hrs)		2. Project (2 hrs), 11 Weeks Maximum	
	Total	Process	Products
Lesson delivery	Topic presentation	Curriculum Laboratory Work Workshop Data Collection	Presentations Progress and Final Presentation Evaluation Project Milestone Review Feedback Project submission (if required)
Giving Assessment	Project Analysis		
Question Answer Sessions	Analytical thinking and problem solving	Training	
Communication Session			
Other Outputs (Industry Report)	Case Study, Field Survey Report	Reporting	Project Progress Value Generation: Assess project over results in a 1 to 3 success ratio

Assessment and Evaluation for Project Activity

No.	Evaluation Per	Allocated Marks
1	Project Planning and Proposal	1
2	Communication, Designers Dimension and Question Answer Session	4
3	Assessments in the present work and Team Work	1
4	Assessments and Design process	1
5	Final Presentations	1
6	Project Quality, Innovation and Creativity	1
	Total	10

1. Project Planning and Proposal (2 Marks)

- ✓ Clarity and feasibility of the project plan
- ✓ Research and background understanding
- ✓ Unique approach and methodology

2. Communication in Progress Presentation and Question Answer Session (4 Marks)

- ✓ Well-rehearsed contributions in the presentation
- ✓ Effectiveness in answering questions and handling feedback

3. Assessments in the Project Work and Team Work (2 Marks)

- Autonomy, originality and individual contributions
- Teamwork and collaboration

4. Execution and Implementation (10 Marks)

- Achievement in the project timeline and milestones
- Application of theoretical knowledge and problem solving
- Final output

5. Final Presentation (2 Marks)

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

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

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

SEMESTER-SI

SOFTWARE ENGINEERING

(Codes: M-ESCD-CH-13 CAASIAN CRIC/CT)

Course Code:	RECITATION:	CIE Marks:	AI
Teaching Hours/Week (L.T.F.R.)		EIE Marks:	II
Crédits:	1	Total Hours:	12x 30 Min
Prerequisites (if any):	None	Course Type:	Theory

Course Objectives:

- 1. To provide fundamental knowledge in the Software Development Process including Software Configuration, Object Oriented Design, Project Management concepts and interacting models.
- 2. To enable the learners to apply most of the six industry processes in Software development.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	<p>Introduction to Software Engineering and Project Method - Software engineering, Software characteristics and types, Levels of Software Engineering-Process, Methods, Tools and Quality Assurance. Software Process models - Waterfall, Prototypic, Agile, Incremental, Agile model - Values and Principles.</p> <p>Requirement engineering - Functional, Non-functional, System and User requirements. Requirements elicitation techniques, Requirements validation, Feasibility analysis and its types, ER diagram characteristics and its structures.</p> <p>Case study: KSL Institute College Library Management System</p>	8
2	<p>Software Design - Software architecture and its importance, Software architecture problems, Design and Construction, Layered, Repository, Client Server, Parallel-Subscript, Functional integration - Coupling and Cohesion</p> <p>Case study: Asian Land Solutions</p> <p>Object Oriented Software Design - UML, Diagrams and relationships - Class and dynamic models, Class Diagram, State Diagram, Use case Diagram, Sequence Diagram</p> <p>Case Studies: Train rail system, ATM Example</p> <p>Software process - Model View Controller, Conventional Design Patterns -</p>	8

	<p>Testing methods: Acceptance testing method; Regression testing; Coverage testing; Black box method; Structural Design Pattern and its types - Adaptive, Bridge, Decorator, Composite, Container, Factory, Flyweight, Behavioral Design Pattern</p> <p>Code Review, Testing and Maintenance:</p> <p>Code guidelines - Code review, Code walk-through and Code inspection, Code refactoring and its methods.</p> <p>Testing - Unit testing, Integration testing, System testing and its types: Black box testing and White box testing, Regression testing</p> <p>Overview of DevOps and Code Management - Code management, DevOps automation, Continuous Integration, Delivery, and Deployment (CI/CD/CD), Container - Docker.</p> <p>Business maintenance and its types: Adaptive, Innovative, Generative and Predictive maintenance. Business maintenance models (Fault Inquery and non-fault).</p>	
4	<p>Business Project Management - Project life process - LSC, Feature gates and Sprints process. One year project using Scrum (OOCDAO).</p> <p>Risk management: Risk and its types, Risk monitoring and management model.</p> <p>Software Project Management - Planning, Tracking, Configuration management, Scheduling, using Gantt chart, Software Configuration Management and its phases. Software Quality Management - ISO 9000, CMMI, Six Sigma for software engineering</p> <p>Cloud-based Software - Virtualization and container, Decoupling as a service model, Docker, Infrastructure as a services (Infrastructure-as-a-Service), Microservices, Monolithic architecture, Microservices deployment.</p>	8

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

Continuous Internal Evaluation Marks (CIE):

Assessments	Assignment Micro project	Internal Examination-I (Written)	Internal Examination-II (Written)	Total
4	14	28	28	60

End Semester Examination Matrix (ESM)

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

Part A	Part B	Total
<ul style="list-style-type: none"> + 2 questions from each module. + Total of 3 Questions, each carrying 2 marks (Total = 6 marks)	<ul style="list-style-type: none"> + Each question carries 2 marks. + Two questions will be chosen from each module, out of which 1 question should be answered. + Each question can have a maximum of 3 sub-questions. (Total = 16 marks)	22

Course Performance (CPA)

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

Courses Objectives	Elaborate Knowledge Level (EKL)
CO1: Explain system requirements and recommended a suitable software process model.	EKL3
CO2: Model various software problems based on system requirements.	EKL3
CO3: Apply various and recommended strategies for the developed software products to enhance quality.	EKL3
CO4: Develop a software product based on user need, schedule and risk management.	EKL3

Date: 01. December, 2012, Understrand: E1 , Apply, Wk. Number: Wk. 14, Session: E1, Created: Al. Chessa

CO-PD Mapping Table: Mappings of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	0									0
CO2	1	1	3									3
CO3	2	1	2									2
CO4	2	2	2									2

Note: 1. 20% Credit, 2. Matrix: Maximum, 3. Submatrix: Minimum, -10% Correlation

Title Details				
SL.No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Software Engineering: A practitioner's approach	Roger S. Pressman	McGraw-Hill, 2011	7/e, 2011
2	Software Engineering	Tommy Kruchten	Addison Wesley	1/e, 2002
3	Design Patterns: Elements of Reusable Object-Oriented Software	Ernest Gamma, Richard Helm, Ralph Johnson, John Vlissides	Prentice Hall, Addison Wesley	1/e, 2000

Reference Books				
S.No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Pradyumn's Software Engineering: With Open Source and Java.	Pradyumn	Wiley India	1/e, 2004
2	Software Engineering, A Process Approach	Tamara J. Ionnova	Tata McGraw-Hill	1/e, 2000
3	Object-Oriented Modeling and Design with UML	Robert E. Koenig, James Rumbaugh	Pearson Education	1/e, 2007
4	Software Engineering Foundations - A Software Systems Perspective	Vinayak Wang	Auerbach Publications	1/e, 2009
5	Object-Oriented Design and Patterns	C.J. Rossenberry	Wiley India	1/e, 2005
6	Engineering Software Processes: An Introduction to Metrics Before Engineering	Tom Mazzoni & C.R.	Prentice Hall	1/e, 2002

Video Links (DSTTELL, SRIVASAM...)	
Module No.	Link ID
1	http://www.youtube.com/watch?v=31Rq4ZBNC
2	http://www.youtube.com/watch?v=7zLwqj417Q
3	http://www.youtube.com/watch?v=3810018LJUk
4	http://www.youtube.com/watch?v=7002A2d8M

SEMESTER-SI

PATTERN RECOGNITION

(COURSE IN COMPUTER ENGINEERING)

Course Code:	PECST411	CIE Marks:	40
Teaching Hours/Week (L.T.D.B)	2-0-0-0	EE Marks:	40
Credits:	3	Total Hours:	120±10hrs.
Prerequisites (if any):	DISCRETE MATHEMATICS CALCULUS LINEAR ALGEBRA	Course Type:	Theory

Course Objectives:

1. To develop a fundamental understanding of the theoretical principles, models, and methods used in pattern recognition.
2. To develop practical skills in implementing pattern recognition algorithms and techniques.

SYLLABUS :

Module No.	Syllabus Description	Contact Hour
1	Foundation of Pattern Recognition Introduction to Pattern Recognition : Definition and applications of pattern recognition, Overview of pattern recognition systems (Text 1, Chapter 1).	
2	Statistical Pattern Recognition - Bayes decision theory, Parameter estimation, Maximum Likelihood estimation, Bayesian estimation (Text 1, Chapters 1,2) Non-Parametric Methods - k-Nearest neighbor, Parzen windows (Text 1, Chapter 4)	8
3	Feature Extraction and Selection Feature Extraction : Importance of feature selection, Techniques for feature extraction: PCA, LDA, Feature extraction in image and signal processing (Text 1, Chapter 2) Feature Selection : Importance of feature selection, Techniques for feature	8

	softmax loss methods, margin methods, Precision-recall curves (Text 3, Chapter 6)	
3	Supervised and Unsupervised Learning: Supervised Learning - Basics of supervised learning, linear classifiers, perceptrons, logistic regression, support vector machines (SVM) (Text 4, Chapter 4) Unsupervised Learning - Basics of unsupervised learning, clustering techniques (k-means, hierarchical clustering), principal component analysis (PCA) (Text 5, Chapter 9)	9
4	Advanced Topics and Applications: Matrix Factorization (MF) / Matrix Factorization (MF) for implicit modeling, Applications of MF in speech and language processing (Text 1, Chapter 10) Ensemble Methods - Basics of ensemble methods, Bagging, boosting, and random forests, Applications across areas (Text 1, Chapter 10) Applications and Case Studies - Real-world applications of pattern recognition, Case studies in image and speech recognition, Future trends in pattern recognition (Text 1, Chapter 10)	9

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

Continuous Internal Evaluation Marks (CIE):

Assessment	Assignment/ Home work	Central Examination-I (Written)	Central Examination-II (Written)	Total
5	25	30	30	85

End Semester Examination Matrix (ESEM)

In Term A, all questions need to be answered and in Term B each student can choose any two Full questions out of four questions.

Part A	Part B	Total
<ul style="list-style-type: none"> * 1 Question from each module. * Total of 10 Questions, each carrying 1 marks <p>(All - Unmarked)</p>	<ul style="list-style-type: none"> * Each question carries 2 marks. * Two questions will be given from each module, out of which 1 question should be answered. * Each question can have a maximum of 2 sub-questions. <p>(Half - 20 marks)</p>	30

Course Outcomes (COs)

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

Course Outcomes			Student's Knowledge Level (SKL)
CO1	Understand and Explain Measurement Concepts of Water Resources	CO2	K2
CO3	apply Classification and Clustering Techniques	CO4	K2
CO5	Implement Feature Selection and Dimensionality Reduction Techniques	CO6	K2
CO7	Apply Statistical and Non Parametric Methods for Water Resources	CO8	K2
CO9	Develop Solutions to Real-World Water Resources Problems and Justify Case Studies	CO10	K2

Here K1-Knowledge, K2-Understanding, K3-Apply, K4-Analyse, K5-Evaluate, K6-Creativity

LOs-PO-Mapping Table

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2									1
CO2	1	1	1		1							1
CO3	1	1	1		1							1
CO4	1	1	1		1							1
CO5	1	1	1			1	1					1

Text Books				
S.No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Pattern Recognition and Machine Learning	Christopher M. Bishop	Springer	1/e, 2006
2	Pattern Classification	Richard O'Donnell, John D. Stachowski, David J. Donoho	Wiley	2/e, 2007

Reference Books				
S.No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	The Nature of Statistical Learning Theory	Vladimir Vapnik	Springer-Verlag New York Inc.	2/e, 2002
2	The Elements of Statistical Learning	Trevor Hastie, Robert Tibshirani, Jerome Friedman	Springer-Verlag New York Inc.	2/e, 2011
3	Pattern Recognition	J. Theodorou and K. Koutroumpos	Academic Press	4/e, 2009

Value Lists (PPTTEL, SWAYAM...)	
Module:	Link/ID
1	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1710017/
2	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1710017/
3	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1710017/
4	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1710017/

SEMESTER-SI

FUNCTIONAL PROGRAMMING

(Common to CSE-CIVIL-ECE-ELE-ELECTRONICS)

Course Code:	PGCST4011	CH Marks:	40
Teaching Hours/Week L:T:P:S:	1003	TSE Marks:	03
Credit:	3	Total Weeks:	15Wks. 10 Wks.
Prerequisites (if any):	Object-Oriented	Course Type:	Theory

Course Objectives:

- To enable the learners who programme in a functional style and make them fully aware of functional programming.
- To provide concepts of polymorphism and higher-order functions in Haskell to students.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introducing Functional Programming: Getting Started with Haskell and GHCi. Basic Types and Definitions: Declaring and Using Functions, Data Types, Higher-order Functions. [Text Ch. 1, 2, 3, 4, 5]	8
2	Recomputing with Lists: Declaring Functions over Lists, Recursion in Lists; IO in Haskell, Reasoning about Programs. [Text Ch. 6, 1, 4, 6]	8
3	Generalisation: Patterns of Computation, Higher-order Functions Describing Higher-order Functions; Overloading, Type Classes and Type Checking. [Text Ch. 10, 11, 12, 13]	8
4	Algebraic Types, Case Study - Huffman Code, Almost Data Types, Lazy Programming, Time and Space Behaviour. [Text Ch. 15, 16, 17, 18]	8

Courses Assessment Method
(CE: 44 marks, ESE: 56 marks)

Continuous Internal Evaluations Marks (CE):

Assessment	Assignment/Shortpaper	Second Examination 1 (Written)	Second Examination 2 (Written)	Total
1	12	36	18	46

End Semester Examinations 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
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 3 Questions, each carrying 3 marks (Total = 9 marks)	<ul style="list-style-type: none"> • Each question carries 3 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 subquestions (Total = 18 marks)	46

Courses Outcomes (COs)

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

Course Outcomes	Minimally Knowledge Level (M.L.)
CO1 Define singular programs in a functional style	K1
CO2 Define iteratively about functional programs and develop programs using lists.	K1
CO3 Differences of imperative and higher-order functions	K1
CO4 Present informally the concept of open completeness of programs	K3

Note: K1: Knowledge; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating

ED-20 Mapping Table (Mapping of Course Outcomes to Program Courses)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
C01	1	1										1
C02	1	1	1									1
C03	1	1	1									1
C04	1	1	1				1					1

(See 1: Align Comp. 2: Outcome Statement, 3: Assessment Objts., 4: Conclusion)

Text Books				
S.L.No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	MANZEL: The Central American Programming	James Thompson	Addison Wesley	3rd, 2011

Reference Books				
S.L.No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Thinking Financially with Radford	Ronald Radford	Cambridge University Press	1st, 2011
2	Investing in Radford	Graham Wilson	Cambridge University Press	2nd, 2011
3	Excel Financial Models	Bryan O'Farrell, John Courtney, Dennis Briggs, Robert	O'Reilly	1st, 2004

Value Locus (OPTL, UPVALU..)	
No.	Link ID
1	http://bit.ly/2gqjzjw (courses/138/180/3610611/1/)

SEMESTER-SI
NATURE INSPIRED COMPUTING TECHNIQUES
 (Common to CA, AI)

Course Code:	EE-CA-01	CSE Marks:	41
Teaching Hours/Ticks (L-T-P-Q-R)	3-0-0-0	ECE Marks:	41
Credit:	1	Total Hours:	120+30hr
Prerequisites (if any):	None	Course Type:	Elective

Course Objective:

- To provide the knowledge and skills required to design and implement Biological optimization techniques in problems using evolutionary algorithms like Genetic Algorithms and various Swarm Optimization techniques such as ABC, ACO, and PSO.

SYLLABUS

Module No.	Aim/Outline Description	Credit Hours
1	Introduction - Optimization Techniques, Heuristics vs Optimisation Problems, Single and Multi-objective Optimisation: Classical Techniques, Overview of various Optimisation methods, Evolutionary Computing, Genetic Algorithms and Genetic Programming - Basic concepts, Real-world Computing (RWC) - Classification, Overview of RWC, Usage of RWC, Needs and Applications of RWC.	8
2	Smart Robotics - Biological Inspiration of Smart Intelligent Systems for Optimisation	8
3	Ant Colonies : Ant Foraging Behaviour, Termites, Artificial Ants, Ant Colony Optimisation (ACO) - 1-ACO, Ant Colony Optimisation Mechanism, Continuous Optimisation, ACO Variations, Problem solving using ACO, Local search methods, Usage of ACO algorithm	16
4	Smart Robotics - Foraging for Food, Cleaning of Areas, Collective Problem solving, Study of Smart Robotics, Social Adaptation of Knowledge - Termites, Bacteria Swarm Optimisation (BSO), Particle Swarm for Dynamic Optimisation Problems, Artificial Bee Colony (ABC) Optimisation, biologically inspired algorithms in engineering	16

	<p>Intelligent Traveler Deep Algorithms: Applications of heuristically improved algorithms in sequencing.</p> <p>Case Studies:- ACO and TSO for 10-Trip problem , Routing problem, Assignment problems, Scheduling problems, Linear problems, Machine Learning Problems, Traveling Salesman Problem.</p>	
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Course Assessment Model
(CIE: 40 marks, EST: 8 weeks)

Continuous Internal Evaluation Marks (CIE):

Assessment	Assignment/ Milestone	Internal Evaluation-I (Written)	Internal Evaluation-II (Written)	Total
I	cI	20	18	38

End Semester Examination Marks (ESE):

In Sem-A, all questions have to be answered and in Sem-B, each student can choose any one full question out of four present.

Test A	Test B	Total
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 3 Questions, each carrying 3 marks <p>Ques - 12 marks</p>	<ul style="list-style-type: none"> • Each question carries 3 marks. • Two questions will be given from each module, but of which 1 question should be answered. • Each question can have a maximum of 3 sub-questions. <p>Ans - 36 marks</p>	36

Course Outcomes (COs)

All the tool of the course students should be able to:

	Course Outcomes	Student Knowledge Level (KL)
CO1	Describe the Applications of Fuzzy logic optimization techniques which influences computing.	K1
CO2	Illustrate the concept of Genetic algorithms in various domains.	K1
CO3	Compare the concept of Genetic Intelligence and intelligent systems such as ACO, ABC, and PSO.	K1
CO4	Illustrate the concept of biologically inspired algorithms.	K1

Note: 25% Questionnaire X3-Discuss and X3-Apply, 25% analysis X2-Evaluate, X3-Creat

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1										1
CO2	3	1										1
CO3	3	1	3									1
CO4	1	1										1

Note: 1-Right CO, 2-Moderate Relation, 3-Additional (Not)- 10 Correlation

Text Books

S. No	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Introduction to Evolutionary Computing	A. K. Elbeltagi, I. S. Hanafi	Springer	2/e, 2017
2	Artificial Intelligent, Intelligent Theory, Methods, and Technologies	Fernando D. Melo, Jose C. Almeida	MIT Press	1/e, 2000
3	Fundamentals of Neural Computing: Basic Concepts, Algorithms and Applications	Luisa M. Patrao de Castro	Dagmar & Wolf CRC	1/e, 2007

Reference Books				
Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Smart Intelligence from Manufacturing Systems	Eric Bonabeau, Steven Dorigo, Odile Theraulaz	Oxford University Press	1st 2000
2	Art Colony Optimization	Mario Dorigo and Thomas Stützle	ACM Press	1st, 2004
3	Smart Intelligence Implementation and Application	Chittaranjan Bhattacharya and Sudipta Mukherjee	Springer	1st 2005

Video Links (NPTEL, SWASTAK,..)	
Module No.	Link ID
1	http://www.acmıklan.edu.tr/2017/11/27/smart_intelligence_implementing_and_applications/
2	http://www.acmıklan.edu.tr/2017/11/27/
3	http://ijcais.org/index.php?journal=IJCAI-15&cat_id=151&aid=1
4	http://www.acmıklan.edu.tr/2017/11/27/smart_intelligence_implementing_and_applications/

SEMESTER 5th

SIGNALS AND SYSTEMS

(Common to CSE/CIVIL/Electrical/Electronics)

Center Code:	TECST440	CTE Marks:	45
Teaching Status/Week (L-T-R-S)	3-3-3	ECE Marks:	45
Credits:	3	Exam Marks:	30+30+15
Prerequisites (if any):	None	Course Type:	Theory

Course Objectives:

- To teach the concept of a Discrete Time (DT) signal.
- To enable the learner to analyse the spectral information of any DT signal and its instantaneous version.
- To provide the learner the example of a DT system, how it behaves to an arbitrary signal, and also to analyse the behaviour of a given DT system based on a waveform.

SYLLABUS

Module No.	Syllabus Description	Costs of Hours
1	1.1 Signals - A general introduction to continuous signals - CT and ST signals. Discrete-time signals representation. Sampling and Aliasing. Convolution, scaling, frequency and Digital Frequency. 1.2 Discrete sequences - Real, Discrete-time sequences. Graphic Representation, Impulse, Unit impulse, unit step and ramp sequences, Representation of discrete-time signals (Impulse), convolution, Periodic convolution, Sequence approximation. 1.3 Properties of DT Signals - Even and Odd, Periodic and non periodic signals. Energy and Power signals. Periodicity and Symmetry property of DT signals, support of sequence, Bi-periodic sequences. 1.4 Operations on Signals - Time shifting (Translation), Time reversal (Reflection), Time scaling - Decimation and Interpolation 1.5 DFT - Determining the Fourier-series Representation of a Sequence. Properties of Discrete-Time Fourier Series - Linearity, Translation (Time Shifting), Modulation (Frequency Shifting), Radiation (Time Reversal), Convolution, Duality, Discrete-time Fourier's Series, Convolution summation, Radarsystems.	2

	Topics of Visualisation of a discrete time signal and operations on the DT signal using graphs. Consideration of sampling and reconstruction using Frequency Shifting	
1	Difference-Time Fourier Transform for Discrete-time Signals - Properties of the Difference-Time Fourier Transform (Equality, Linearity, Translation (Time Shifting), Convolution (Frequency-Domain Shifting), Conjugation, Time Reversal, Convolution, Multiplication, Frequency-Domain Differentiation, Differentiating, Parseval's theorem, Even/Odd symmetry, real sequences)	10
	DST of periodic signals - Frequency spectra of sequences, Relationship of Impulse Response and spectra, Characterizing LTI Systems Using its Frequency Spectrum.	
3	Discrete-time system - Block diagram representation and mathematical representation of discrete-time systems. General structure elements of Discrete-time systems (pole, zeros, poles, eigen values, eigen vectors, unit delay, unit advance). Relationship DT systems and the resulting discrete-time systems. Related systems, Linear and time-invariant properties of a DT system.	8
	Discrete-time LTI systems - Discrete-time convolution, Properties of Convolution, Characterizing LTI Systems and Convolution - Impulse response of an LTI system, Difference equation, Properties of an LTI system - Stability, Memory, Invertibility, Z-transform, Eigen functions, digitization for Discrete-Time LTI Systems.	
4	Z-transform - motivation for a transform, Relationship Between a Transform and Discrete-Time Fourier Transform, Range of Convergence for the Z -Transform. Properties of a transform - Translation (Time Shifting), Complex Modulation (z-Domain Shifting), Conjugation, Time Reversal, Upshifting (Zero Insertion), Decimation, Convolution, z-Domain Differentiation, Differentiating, Initial and Final Value Theorems Determinants of the Zeros & Poles	9
	LTI systems and difference equations. Characterizing LTI systems using a transform, Transfer function of an LTI system, Solving Difference Equations Using the Orthogonal Z -Transform	
	Block Diagram Representation of Discrete-Time LTI Systems Implementation of LTI systems	

Course Assessment Method
(CIL: 40 marks, EIL: 60 marks)

Continuous Internal Testmarks Marks (CIL):

Achievement	Assessment Strategy	Second Examination 1 (Written)	Second Examination 2 (Written)	Total
E	12	38	18	48

End Semester Examination Marks (EIL):

In Term A all questions need to be answered and in Term B each student can choose any two of the four questions and answer them.

Part A	Part B	Total
<ul style="list-style-type: none"> • 1 Question from each module. • Total of 4 Questions, each carrying 3 marks (Total = 12 marks)	<ul style="list-style-type: none"> • Each question carries 2 marks. • Two questions will be chosen from each module, out of which 1 question should be answered. • Each question can have a maximum of 2 sub-questions. (Total = 10 marks)	42

Course Outcomes (COs):

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

Course Outcomes	Competence Knowledge Level (EIL)
CO1: Demonstrate the concept and different types of DT signals and the effect of different operations on the signals	82
CO2: Explain how DTFT can be used to represent a periodic DT signal	82
CO3: Apply the concept of DTFT for an aperiodic signal to determine the frequency spectrum	33
CO4: Discuss the properties of a DT system based on an impulse response and a transfer function	33
CO5: Identify the response of a DT LTI system to an arbitrary input response	66

Note: E1. Evaluate; E2. Understand; E3 - Apply; E4 - Analyse; E5 - Evaluate; E6 - Create

EE210 Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
CO1	3	3	3									3
CO2	2	2	2	2								2
CO3	2	2	2	2								2
CO4	1	1	1	1								1
CO5	1	1	1	1								1

Note : 1. Digit 1, 2, 3, 4, 5, 6, 7, 8 denotes Maximum, 1 denotes Minimum - In Correlation

Text Books				
S.No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Signals and Systems	Michael D. Johnson	University of Tennessee, English Collection, Canada	1st 2000
2	Signals and systems	Berry, Ven, Nam, Simon Shabot	Wiley	2nd, 2007
3	Signals and systems	A. Nagur Das	McGraw Hill	2nd, 2002

Reference Books				
S.No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Fundamentals of Signals and Systems Using the MATLAB	Ronald W. Esman, Steven L. Elliot	Prentice	2nd, 2003

Video Links (NPTEL, YouTube...)	
No.	Link ID
1	https://www.youtube.com/watch?v=1M013W30384900
2	https://www.youtube.com/watch?v=1M013W30384900

SEMESTER S4

SOFT COMPUTING

(Common to CIVCD/CMCR/DA/AD/NA/NC/CS/CNC)

Course Code:	FDCS7417	CBE Marks:	41
Teaching Hours/Week (L.T.P. H)	3000	EIE Marks:	31
Credits:	3	Total Hours:	120 hrs. 30 Mins.
Prerequisites (if any):	None	Course Type:	Theory

COURSE OBJECTIVES:

1. To give exposure to soft computing, various types of soft computing techniques, and applications of soft computing.
2. To imparts solid foundation on Neural Networks, its architecture, functions and various algorithms involved; Fuzzy Logic, various fuzzy systems and their functions, and Genetic algorithms, its applications and advantages.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Soft Computing, Difference between Hard Computing & Soft Computing, Applications of Soft Computing, Artificial Neuron, V/S Biological Neuron, Basic models of artificial neural networks - Connections, Learning, Activation Functions, McCulloch and Pitts Neuron, Multi neurons, Perceptron Neuron- Learning rule, Training and testing algorithm, Adaptive Linear Neuron- Architecture, Training and testing algorithm.	14
2	Fuzzy logic: Fuzzy sets - Properties, Fuzzy membership functions, Truth value of Fuzzy membership functions, operations on fuzzy sets, Linguistic variables, Linguistic hedge, Fuzzy Relation, Fuzzy Rule, Rule Base, Fuzzification, Defuzzification, Linguistic variable, Defuzzification methods, Fuzzy inference mechanism, Max-min and Average-type.	9
3	Evolutionary Computing, Introduction of Evolutionary Computing, Coverage of genetic algorithm, Operator in genetic algorithm - coding, selection, crossover, mutation, stopping condition for genetic algorithm.	3

4	<p>Mathematical Optimisation problem. Examples of Multi-objective optimisation. Dominance and Pareto-optimality. Optimality conditions.</p> <p>Calculus based. Statistical 3D-Optimisation. Particle Swarm Optimisation, Ant Colony Optimisation, Genetic Algorithms.</p>	5
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Course Assessment Method
(EIL- 40 marks, ESS- 60 marks)

Continuous Internal Evaluation Marks (CIE):

Achievement:	Assignment Marking	Internal Evaluation-I (Written)	Internal Evaluation-II (Written)	Total
4	14	14	14	42

End Semester Examination Marks (ESS):

In Term A, all questions need to be attempted and in Term B each student can choose any two full questions out of four questions.

Term A	Term B	Total
<ul style="list-style-type: none"> * 1 Question from each module. * Total of 2 Questions, each carrying 3 marks <p>(Total = 6 marks)</p>	<ul style="list-style-type: none"> * Each question carries 3 marks. * Two questions will be given from each module, one of which 1 question should be answered. * Each question can have a maximum of 3 sub-questions. <p>(Total = 18 marks)</p>	24

Course Outcomes (CO)

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

Course Outcomes		Student's Knowledge Level (KLL)
CO1	Describe the techniques used in soft computing and outline the fundamental models of soft-computing works.	K1
CO2	Define general problem solving using neural networks.	K2
CO3	Illustrate the operations, model, and applications of fuzzy logic.	K2
CO4	Illustrate the concept of evolutionary algorithms used in Genetic Algorithm.	K3
CO5	Describe the concept of multi-objective optimization models and multi criteria systems.	K2

Dear UG Students, PG Students, ST - Appd., FD - Appd., M.Tech., Ph.D., Professors, XL - Cores,

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1									1
CO2	1	1	1	1								1
CO3	1	1	1	1								1
CO4	1	1	1	1								1
CO5	1	1	1									1

Note : 1-Aligned; 2-Limitedly Aligned; 3-Minimally Aligned; 4-Not Aligned

Text Books

No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Principle of Soft Computing	ED. Pradevi, A. S. Sugeno	Saxi Publications	3rd, 2013
2	Multi-expert Optimization using Evolutionary Algorithms: Computational intelligence techniques of fuzzy logic, neural networks and evolutionary computing	Kalyanmoy Deb	John Wiley & Sons	1st, 2001
3	Evolutionary Computation in Engineering Optimization: An Introduction with MATLAB Applications	Abdullah H. Abdo, Z. Z. Khatib	John Wiley & Sons	1st, 2012
4	Non-invasive soft-computing methods, robotics, and mechatronics	Premto, Mattoo C.	WBT press, 2008	Aug 21

Reference Books				
No.	Title of the Book	Name of the Author/s	Name of the Publisher	Ed. date and time
1	Fuzzy Logic with Engineering Applications	Tanmoy Bhattacharya	John Wiley & Sons	1st, 2011
2	Smart Structures, Fuzzy Logic & Genetic Algorithms: Dynamics and Applications	J.A. Rodríguez, G.A. López-Gómez, R.M. Martínez-Pérez	Springer-Verlag Berlin	1st, 2013
3	Smart Structures - II: Computational Foundations	James Dugdale	Springer Berlin Heidelberg	2nd, 2007
4	Fuzzy Set Theory & its Applications	Zadeh, Zadeh L.A.	Allied Publishers Ltd.	4th, 2001

Video Links (NPTEL SWAYAM...)	
No.	Link ID
1	https://nptel.ac.in/polytechnics/nptel/10100100179

SEMESTER 4
CYBER ETHICS, PRIVACY AND LEGAL ISSUES
 (Reference: C1/C6/C4/MH)

Course Code	EDUC4003	CSE Status	A
Teaching Hours/Week (L, T, P, R)	3/0/0/0	ECE Status	B
Credits	9	Exam Status	2 hrs. 30 min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To provide a comprehensive understanding of the fundamental concepts of cyberspace and cyber law, enabling students to analyze and address the challenges of regulating and managing the digital world.
2. To explore cyberspace, intellectual property, cyber crime, and related issues in emerging technologies, enabling them to tackle related challenges effectively.
3. To gain knowledge on data protection and privacy in cyberspace, and to learn legal frameworks protecting privacy, enabling them to address and manage privacy-related challenges effectively.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction of Cyber Law and Cyber Space: Introduction to cyber law; Constitutional aspects of cyber law; Security aspects of cyber law; Intellectual property aspects in cyber law and Information aspects in cyber law; General aspects in cyber law; Need for Indian cyber law. Cyber-space - Web space, WWW, Internet and various telecommunication systems: Legal and Technological Significance of domain Names, Internet as a real life global network.	9
2	Cyber crimes and Cyber Attacks: Cyber crimes and Cyber Attacks- Definition, Classification of Cybercrimes; Cyber Offences- Computer Attacks, Digital Intrusion, Security Challenges Posed by Mobile Devices, Organised	9

	Understand the Emerging Cyber Threats Cyber Threats: The Importance of Cyber Law; Significance of Cyber Threats Need for Cyber legislation Based on Cyber Threats, Threat in Information society; Artificial Intelligence Ethics; Threats due to AI and IoT; Principles Based upon Cyber Definitions and Categories.	
7	Data Protection and Privacy Concerns in Cyberspace: Need to protect data in cyberspace, Types of data, Legal framework of data protection, Data protection Bill-in progress, GDPR, Concept of privacy, Privacy concerns of cyberspace, Classification framework of privacy, Impact of regulation of privacy in India, Privacy Law and Regulation, Departmental Regime, Privacy and Data Sufficiency.	9
4	Security Policies and Information Technology Act Need for an Information Security policy, Information Security Standard ISO, Monitoring various security policies and their review process, Information Technology Act 2000, Penalties, Adjudication and appeal under the IT Act 2000, Offences under IT Act, 2000, Right to Information Act, 2005, IT Am.2005 and its amendment.	8

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

Continuous Internal Evaluation Marks (CIE):

Assessments	Assignment/ Migraines	Internal Examination I (Written)	Internal Examination II (Written)	Total
5	17	36	36	49

End Semester Examination Marks (EAM)

In Part A, all questions need to be answered and in Part B, mark scheme can choose any two full questions out of four questions.

Part A	Part B	Total
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 10 Questions, each carrying 3 marks <p>(Total - 30 marks)</p>	<ul style="list-style-type: none"> • Both questions carries 2 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Both questions can have a maximum of 3 sub-questions. <p>(Total - 20 marks)</p>	50

Course Outcomes (COs)

Learning outcomes students should be able to:

	Course Outcomes	Class's Knowledge Level (KL)
CO1	Describe the concepts of cyber law and the various responses and challenges associated with technologies.	K1
CO2	Describe the concepts of cyberspace and cybergovernance, the challenges faced by law enforcement, and the importance of intellectual property in the digital age.	K2
CO3	Explain the responses of various laws and ethics, the need for regulation, and the ethical considerations in emerging technologies like AI and Blockchain.	K2
CO4	Identify data protection and privacy issues in cyberspace and describe various laws and regulations to address these challenges in the digital age, requiring comprehensive privacy protection and compliance.	K2

Class - K1. Semester - K2. Undergrad - K3. Applic. K4. Analytics - K5. Database - K6. Cloud

EII-JII Mapping Table (Migrating of Course Outcomes to Program Outcomes)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13
O01	1	2											1
O02	2	2											2
O03	2	1											1
O04	1	2											1

Note: 1. Only 2 Closely Related Outcomes, 2. Additional Outpt., - No Correlation

Reference Books:

No. /Ref.	Title of the Book	Name of the Author/s	Name of the Publisher	Date and Year
1	Cyber Security and Cyber Laws	Mohanta Jain, Sumanta Mitra	TMH	ca. 2011
2	Cyber Security understanding Cyber Crimes, Computer Forensics and Legal Perspectives	Debraj Bhattacharya, Nitin Chakrabarty	Wiley India Pvt Ltd	ca. 2011
3	Cyber Ethics & IT Society: Security with Values	Christopher Hadnagy, Brian Dye	Shambhavi	ca. 2012
4	Cyber Laws (Intellectual property, A & B Dimension, Security)	S. Kumar	Universal Publishers	ca. 2011
5	Investigations in Information Security and Cyber Laws	Suresh Prakash, Venkatesh Raghav, Ravinder Kumar Singh	Dreamscape Books	ca. 2014
6	Cyber Law: The Law of the Internet and Information Technology	Suraj S	Ramanathan	First Edition, 2011

Video Links (DSTTEI, VRAYAM...)

No.	Link ID
1	https://www.videoshare1000.com/doc/mbo_xsecu_and
2	https://www.videoshare1000.com/doc/mbo_xsecu_and
3	https://www.videoshare1000.com/doc/mbo_xsecu_and
4	https://www.videoshare1000.com/doc/mbo_xsecu_and

SEMESTER-SI

ALGORITHM ANALYSIS AND DESIGN

Course Code:	FEC47405	CIE Marks:	40
Teaching Hours/Week (L-T-P-R)	1-0-0-0	EIR Marks:	40
Credit:	3.0	Exam Marks:	100+100
Prerequisites (if any):	PCIT401	Course Type:	Theory

Course Objectives:

1. To impart the concept of time complexity, space complexity, and asymptotic analysis for performance of algorithms.
2. To equip the learners to design and implement efficient algorithms using various techniques such as divide and conquer, dynamic programming, and greedy algorithms.
3. To teach the complexity classes and the limitations and capabilities of different algorithmic approaches.

SYLLABUS

Module No.	Syllabus Description	Credit Hours
1	Introduction to Algorithm Analysis: Characteristics of Algorithms, Criteria for Analyzing Algorithms, Time and Space Complexity - Best, Worst and Average Case Complexity, Asymptotic Notations - Big-O(O), Big - Omega (Ω), Big-Theta (Θ), Little-o (o) and Little-Omega (ω) and their properties. Classifying functions by their asymptotic growth rate, Time and Space Complexity - Analysis of simple algorithms, Analysis of Recursive Algorithms - Recursion Equations, Solving Recurrence Equations - Iteration Method, Substitution Method, Master method and Matrix Method, Probabilistic analysis).	8
2	Divide & Conquer and Greedy Strategy: General method, Linear search, Recursive approach for divide and conquer, Finding the maximum and minimum, Merge sort, Dijkstra's shortest-path problem, knapsack problem and Greedy strategy w.r.t. divide and conquer, Diverse and Greedy Approach - Topological sort.	8

	The Lowest Cost Method, Simulated Annealing, Antecedent Based, Minimum Cost Spanning Tree Computation - Kruskal's Algorithm, analysis; Single Source Shortest Path Algorithm - Dijkstra's Algorithm, analysis	
3	Dynamic Programming - General method with Examples: Knapsack Simple Travelling Salesman - Held-Karp's Algorithm, All-Pairs Shortest Path - Floyd's Algorithm, Optimal Binary Search Tree, Knapsack problem, Bellman-Ford Algorithm, Travelling Salesperson Problem, Shortest Path design.	8
4	Backtracking and Branch & Bound: Backtracking - General method, N-queens problem, Sum of subsets problem, Implementation, Backtracking system Branch and Bound - General method, Travelling Salesperson Problem, 0-1 knapsack problem, LCP search and bound solution, AHP branch and bound solution	8
	Course Assessment Method (CTE = 40 marks, ECE = 40 marks)	

Continuous Internal Evaluation Marks (CIE):

Achievement	Internal Std	Assessment	Analysis	Total
1	12	18	18	48

Criteria for Evaluation (Evaluation and Analysis): 20 marks:

For this project, you'll apply algorithms like Divide & Conquer, Greedy Strategy, and Dynamic Programming to a scenario such as optimizing delivery routes for a logistics company. You'll implement these algorithms to find the most efficient paths, balancing factors like distance, time, and cost. By analyzing their time and space complexities, you'll compare how well each algorithm performs under different conditions, determining the most efficient solutions for minimizing overall delivery time and expenses. The project will provide insights into the practical applications and efficiencies of each algorithm in real-world situations.

End Semester Examination Marks (2022)

In Term 1, all questions need to be answered and in Term 2, each student can choose any two (2) questions to answer.

Part A	Part B	Total
<ul style="list-style-type: none"> • 2 Questions from each module. • Total 07 Questions will carry 2 marks each (14 marks in total). 	<p>1. Students will be given three tasks below. The first task must be completed in part A. Each question can have a maximum of 3 subquestions. Each question carries 1 mark.</p> <p>(a) write down:</p>	14

Course Outcomes (COs)

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

	Course Outcome	Student's Knowledge Level (SKL)
CO1	Explain the characteristics of algorithms and apply various methods to problem solve, including time and space complexity and asymptotic notations.	LO1
CO2	Implement divide and conquer algorithms such as binary search, merge sort, and Strassen's matrix multiplication, and analyze their recursive properties and performance.	LO2
CO3	Design greedy algorithms to optimize problems, such as the fractional knapsack problem and minimum cost spanning tree using Kruskal's algorithm, and evaluate their efficiency.	LO3
CO4	Develop dynamic programming solutions for various problems, including knapsack problem, shortest path algorithms, and the traveling salesperson problem, and analyze their computational complexities.	LO4
CO5	Solve complex computational problems using backtracking and branch-and-bound techniques, including the n-queens problem, sum of subset problem, and 0-1 knapsack problem.	LO5

Data: E1-Essential E2-Universal E3-apply E4-analyze E5-Design E6-Creat

EII-301 Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
O01	1	1	1	1								1
O02	1	1	1	1								1
O03	2	2	2	2								1
O04	1	1	1	1								1
O05	1	1	1	1								1

Note : 1=High Cred., 2=Moderate Cred., 3=Additional Mgt., - No Correlation

Text Books

SL. No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Introduction to Algorithms	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein	MIT Press	3rd, 2009
1	Fundamentals of Computer Algorithms	Ellis Horowitz, Sarai Sahni, Sanguthewar Rajaraman	Oxford University Press	2nd, 2008
1	Design & Algorithms, Introduction to Design and Analysis	Sanjoy Dasgupta and Christos Papadimitriou	Pearson Education	3rd, 2008

Reference Books

SL. No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
0	Design & Algorithms, Manual	Armen L. Shiranyan	Apress	2nd, 2004
1	Algorithms	Robert Sedgewick, Kristin Wayne	Pearson	4th, 2011
3	Algorithm Design	Jeff Edmonds, Dieter Scharf	Pearson	1st, 2008
4	Fundamentals of Algorithms	Giuseppe F. Italiano, Fabrizio Grandoni	Pearson	1st, 2008

Video Links (VTELE, SWAT ADL...)	
Module No.	Links ID
1	https://www.vtele.com/2018/07/14/c-100-malware/ https://www.vtele.com/2018/07/14/malware-c-100/ https://www.vtele.com/2018/07/14/c-100-malware-c-100/ https://www.vtele.com/2018/07/14/c-100-malware-c-100/
2	https://www.vtele.com/2018/07/14/c-100-malware-c-100/ https://www.vtele.com/2018/07/14/c-100-malware-c-100/
3	https://www.vtele.com/2018/07/14/c-100-malware-c-100/
4	https://www.vtele.com/2018/07/14/c-100-malware-c-100/ https://www.vtele.com/2018/07/14/c-100-malware-c-100/

SEMESTER S4

ADVANCED DATA STRUCTURES

(Common to CSE/CDT/CSE-AI/CS/CE/CE-AI/CE-CSE)

Course Code:	FEE20745	LTE Marks	40
Teaching Hours/Week (L : T : P : E)	80 : 0 : 0	ECE Marks	40
Credit:	4.0	Exam Hours	2 hrs + 10 min.
Prerequisite (if any)	POSITIVE		

Course Objectives:

1. To equip students with comprehensive knowledge of advanced data structures relevant to modern day needs of computer systems, including database management, expert systems, information retrieval, and networked systems.
2. To prepare students to address challenges in emerging fields of computer science by applying advanced data structures to practical, real-world problems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Translational Data Structures - Overview of Arrays and Linked List implementation algorithms and repairs, Implementing stacks, queues, Using - Read Tools, Read Functions, Cache Writing, Block Write - Cache Block Based Applications in Various - Disk, Screen Processing using Disk File, applications in Disk System - Story, File and cache-block Management	8
2	Advanced Tree Data Structures - Balanced Trees - AVL Trees (insertion), Red-Black Trees, Self-Balancing Trees and Arrays, Segment Trees, Heaps and Thread Structures - Binomial heap, Fibonacci Heaps, Heaps, Thread Trees, Applications in Information Retrieval and BPPV - Incomplete using Data	8

4	Specialized Data Structures - Special Data Structures - Queues, K-D Tree (k-dimensional tree), Avl-tree; Trigonometric Data Structures; Priority Queue; Insertion and Deletion; Insert - Big O, Large Data Applications in Data Structure - Applications range from sorting search, applications in Mathematics, Artificial and Fuzzy Logic Inference.	8
4	Data Structures Applications - Disjointed and Parallel Data Structures; Distributed Hash Tables (DHTs); Consensus Routing; Distributed DHT; Data Compression and Transformation - Secure File Transfer; Encryption; Secure Tree; Cryptographic Applications - Decoding	8

Course Assessment Method

KCE: 40 marks ESE: 60 marks

Continuous Internal Evaluation Marks (CIE)

Achievement	Intermediate	Endorse	Analyses	Total
4	18	18	18	54

Criteria for Evaluation (Evaluation and Analysis) - 20 marks

Implement, analyse and visual problems using multiple variable data structures and interpret the problem.

End Semester Examination Marks (ESE)

In Part A, all questions need to be attempted and in Part B, only question you choose any one, rest all questions are compulsory.

Part A	Part B	Total
<ul style="list-style-type: none"> + 2 Questions have each 2 marks + Total of 3 Questions, each carrying 2 marks (6.0 × 3 marks) 	<ul style="list-style-type: none"> + 2 questions will be given from each module, out of which 1 question should be answered + Each question can bear a maximum of 2 marks. + Each question carries 2 marks. (4.0 × 2 marks) 	#

Course Outcomes (COs)

Learning outcome of the course students should be able to:

Course Outcome		Elective Requirement Unit (ERU)
CO1	Implement and use arrays, linked lists, stacks, trees and hashing techniques to handle programming processes.	E1
CO2	Design and implement efficient tree data structures for information retrieval.	E1
CO3	Use spatial and temporal data structures in data structure problems.	E2
CO4	Analyze data structures in spatial structures such as disk-based, parallel and distributed systems.	E4

Note: E1-Easy; E2-Demand; E3-Moderate; E4-Difficult; X5-Cross

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

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
CO1	1	3	2	2	1						2	2
CO2	1	3	1	1	1						1	1
CO3	1	3	1	1	1						1	1
CO4	1	3	2	2	1						2	1

Note: 1-Easy; 2-Moderate; 3-Demand; 4-Difficult; -No Correlation

Reference Books				
No.	Title of the Book	Name of the Authors	Name of the Publisher	Date and Year
1	Advanced Data Structures: Theory and Applications	Ivan B. Damgård Mads	CSC Press	09, 2018
2	Advanced Data Structures	Dinesh Manocha	Cambridge University Press	04, 2004
3	Introduction to Algorithms	Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein	MIT Press	4/E, 2009
4	Foundations of Computer Algorithms	Risto Mišković, Jerzy Szabot and Slobodan Čimić	University Press	20, 2008
5	Advanced Data Structures	Sandeep Bhagat, & Sameer Kulkarni	Colgate University Press	09, 2018
6	Data Structures and Algorithms: Analysis and C++, 2/e	Abraham A. Levin	Burrus	2/E, 2009
7	Design and Analysis of Algorithms	V.T. Gokhale, Nitin Ganesh	Wiley	04, 2021

Web Links (STEL SWAYAM)

Module No	Link ID
1	https://studytube.lnu.ac.in/

SEMESTER S4
ECONOMICS FOR ENGINEERS
(Common to All Branches)

Course Code	SCHU1248	CIE Marks	20
Teaching Hours/Week (L T P R)	20:00	TUT Marks	10
Credits	2	Exam Hours	2hrs, 30 Min
Prerequisites (If any)	N/A	Course Type	Theory

Course Objectives:

1. Understanding of finance and costing for manufacturing operations, inventory planning and control.
2. Develop fundamental concepts of money and mathematics relevant to engineering industry.
3. Define the basic concepts of Title Engineering.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Basic Economic 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 Functions - Law of Variable Production - Economics of Scale - Internal and External Economies - Cobb-Douglas Production Function	8
2	Cost concepts - Fixed cost, variable cost - Explicit and Implicit cost - Break even - Opportunity cost - short-run cost curves - Revenue concept Types and their objectives - Types of Costs - Various Cost Functions - Monopoly - Monopolistic Competition - oligopoly (Nature and equilibrium of a firm)	8
3	Money System - Money - Functions - Central Banking - Inflation -	8

	<p>Course and Others - Univers in Context: Definition - History, and Financial System - Definition</p> <p>Financial - Given and Indirect - Money, Interest and Banking - CIBT</p> <p>Systemic Income - Concepts - Circular Flow - Methods of Payments - and Difficulties - Bank Market - Functions, Problems faced by the Banks - Current-Demand Account and Trading Account - Bank market Institutions - BANKS, and NBFC</p>	
4	<p>Value Analysis and Value Engineering - Cost Value, Exchange Value, Life Value, Economic Value - Costs, Characteristics and Applications areas of Value Engineering - Value Engineering Examples - Breakdown Analysis - Cost Analysis - Capital Budgeting - Project planning</p>	8

Course Assessment Method
(CIE: 40 marks, ESE: 80 marks)

Common Internal Examination Marks (CIE):

Attendance	Assignments Marks passed	Internal Examination 1 (Written)	Internal Examination 2 (Written)	Total
10	25	12.5	12.5	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/few questions out of the questions.

Part A	Part B	Total
<ul style="list-style-type: none"> * Maximum 1 and Maximum 2 Questions from each module * Total of 4 Questions, worth carrying 2 marks (4x2 = 8 marks) 	<ul style="list-style-type: none"> * 4 questions will be given from each module, out of which 1 question should be answered. * Each question can have a maximum of 2 sub-questions * Each question carries 2 marks (4x2 = 8 marks) 	16

Course Outcomes (CO)

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

Course Outcomes		Sloven's Knowledge Level (KL)
CO1	Understand the fundamentals of various economic issues using tools and know the concepts of demand, supply, elasticity and production function.	E1
CO2	Develop decision making capability by applying concepts relating to costs and revenues, and acquire knowledge regarding the functioning of firms in different market situations.	E1
CO3	Outline the macroeconomic principles of money and fiscal systems, national income and wealth creation.	E1
CO4	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.	E1

TM: A.L. Ramachandran, P.C. Chakravarthy, C.V. Arun, P.A. Jayaram, P.C. Bhattacharya, CO: Chandra

CO-PO Mapping Table:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	
CO1	—	—	—	—	—	1	—	—	—	—	1	—
CO2	—	—	—	—	—	1	1	—	—	—	1	—
CO3	—	—	—	—	1	—	—	—	—	—	2	—
CO4	—	—	—	—	1	1	—	—	—	—	2	—

Text Books				
SL.No	Title of the Book	Name of the Authors	Type of the Textbook	Editor and Year
1	Managerial Economics	Ghosh, Prabhulal and Chaudhury	Text Book	2011
2	Engineering Economy	K. G. Thacker, R. J. Patwardhan	Text Book	2008
3	Engineering Economics	S. Venkatesan	Text Book	2012

Reference Books				
SL No.	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Engineering Economy	Leland Blank F.I.E., Anthony Tarquin C.P.E.	Mc Graw Hill	7 th Edition
2	Julian Financial System	Khan M. Y	Tata McGraw Hill	2001
3	Engineering Economics and analysis	Donald G. Newnan, James D. Lewis	Prentice Hall, India	2000
4	Contemporary Engineering Economics	Clayton R. Lewis	Business Hall of India, Ltd	2001

SEMESTER 53/54
ENGINEERING ETHICS AND SUSTAINABLE DEVELOPMENT

Course Code	UGHUT547	CIE Marks	30
Teaching Hours/Week (L: T: P: R)	2:2:0	ESE Marks	30
Credit:	3	Exam Hours	2 hrs. 29 Min.
Prerequisite (File)	Sem.	Course Type	Theory

Course Objectives:

1. Equip with the knowledge and skills to make ethical decisions and implement professional ethics in their professional lives.
2. Develop a holistic and comprehensive multidisciplinary approach to understanding engineering ethics principles from a perspective of environment protection and sustainable development.
3. Develop the ability to find strategies for implementing sustainable engineering solutions.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	<p>Fundamentals of Ethics - Basics of professional ethics. Civic Virtues, Integrity for others, Resilience and Professionalism, Integrity, Integrity and responsibility; Integrity in design, development and research domains. Plagiarism, A historical review on law - challenges - case studies, Technology and digital revolution-Data, Information, and Interchange, Cyberlaws and cybersecurity, Data collection & management, High technologies connecting people and places sustainability and social impacts, Managing conflicts, Collective bargaining, Dissemination, Data & Accountability, in moral integrity, Codes of Ethics.</p> <p>Basic concepts in Gender Studies - incl. gender equality, gender</p>	8

	<p>gender beyond the family, gender identity, gender expression, gender stereotypes, Gender diversity and discrimination in education, employment and everyday life; History of women in Science & Technology, General technologies & innovation, Ethical values and practices in association with gender equality, Diversity & gender justice, Gender policy and communication gender empowerment initiatives.</p>	
3	<p>Introduction to Environmental Ethics: Definitions, 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), LCA, cycle analysis and sustainability matrix. Landscape and Biodiversity: Basics of ecosystems and their functions, Significance of biodiversity and its conservation, Human impact on ecosystems and biodiversity loss, An overview of various responses to Conservation, and its significance. Landscape and Urban Ecology: Principles of landscape ecology, Urbanization and its environmental impacts, Sustainable urban planning and green infrastructures.</p>	8
3	<p>Hydrology and Water Management: Basics of hydrology and water cycle, Freshwater and pollution sources, freshwater water management practices, Environmental Law, Sanitation and Diseases: Zero Waste Campaign 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, Circular principles, strategies for implementing circular economy; practices and principles in engineering. Sustainable Transport: Impacts of transportation on the environment and climate, Short forms of a Sustainable Transportation design, Sustainable urban mobility solutions, Intelligent mobility systems, Circularity, Circular and upcycling models of sustainable mobility solutions.</p>	8
1	<p>Renewable Energy and Sustainable Technologies: Overview of renewable energy sources (solar, wind, hydro, biomass), Sustainable technologies in</p>	8

energy production and consumption, Challenges and opportunities in renewable energy integration, Climate Change and Engineering Solutions: State of climate change science, Impact of climate change on natural and human systems, Key institutions and the climate issue, Implementing solutions to mitigate, adapt and build resilience to climate change, Environmental Policies and Responses: Overview of key environmental policies and regulations (national and international), Role of responses 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 responses in promoting a sustainable future.

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

Continuous Internal Evaluation Matrix (CIE):

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

- The students should be grouped into groups of size 4-6 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 2 laboratory hours.
- The portfolio and reflective journal should be maintained five-a-week and displayed during the “Teach-in” Session (one in a year) of the cognitive strategy exposing the skills developed through various sessions.

No.	Name	Particulars	Group Evaluation (Q3)	Marks
1	Refresher Journal	Study various influencing theories on research, general insights, and how it can be applied to local contexts	1	3
2	Mass project (Detailed documentation of the project, including methodology, findings, and references)	1.4. Perform an Empirical Data Case Study analysis and prepare a report: 1.4.1. Conduct a literature survey on "Code of Ethics for Engineers" and prepare a rough draft of notes 1.4.2. Listen to a TED talk on a Quantitative topic, do a literature survey on that topic and make a report citing the relevant papers with a specific analysis of the Kardia section. 1.4.3. Undertake a project study based on the concept of "responsible development". Modules 11, Module 12 & Module 17	2	11
3	Assessment	1. One activity* each from Module 11, Module 12 & Module 17	2	11
4	Final Presentation	A comprehensive presentation summarizing the key influences from the course, general reflections, and progress from actions based on the learning.	2	1
Total Marks				23

*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 learnt concepts in real-world problems and local contexts
- **Creativity:** Creative approaches and original solutions proposed in projects and reflections
- **Communication Skills:** Clarity, coherence, and professionalism in the final presentation

Reference Books				
No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Date
1.	Skills in Beginning Project and Research	Caroline Whistler	Cambridge University Press & Assessment	2nd edition 8 August 2017.
2.	Vision, System and Professional Roles	Sandeep Chaturvedi	Cambridge University Press & Assessment	Version 2006
3.	Sustainability Science	Bon J. M. de Vos	Cambridge University Press & Assessment	2nd edition 4 December 2012
4.	Sustainable Engineering Principles and Practice	Steve R. Barrett	Cambridge University Press & Assessment	2018
5.	Engineering Ethics	J. Derrida, A. Bousquet and V. A. Knobell (Editors)	FBI Learning Project 1st Nov 2011	2011
6.	Practical ethics and business values	R.S. Nagarkar	Preagi International (P) Limited New Delhi	1981
7.	Skills in Engineering	Hilary W. Hart and Roland Schmidgall	Law-Medical Book Publishing Company Pvt Ltd, New Delhi	4th edition 2014

Supervised Activities Projects:

Module-II

- Write a criticism on a local environmental issue (e.g., please write on floods issues seen occurring from different catchment properties (hydrogeology, hydrology, vegetation))
- Write a life cycle analysis report of a common product seen in Kerala (e.g., a tomato, banana or rubber-based product) and present findings on its sustainability
- Create a sustainability report for a local business, focusing in environmental, social, and economic impacts
- Translation of biodiversity in a study area (e.g., a local park, a school, university, college, national park and propose conservation strategies to protect it).
- Develop a conservation plan for an endangered species found in Kerala.
- Analyse the green spaces in a local urban area and propose a plan to enhance urban ecology using their's plants and sustainable design.
- Create a model of a sustainable urban landscape for a chosen locality in Kerala.

Module-II

- Study a local water body (e.g., a river or lake). Review types of pollution in natural flow channels and suggest sustainable management and restoration practices.
- Analyse the effectiveness of water management in the college campus and propose improvements – reduce the water footprint, how to reduce the footprint, how to increase supply through rainwater harvesting, and how to fluctuate the supply-demand ratio.
- Implement a water audit initiative on the college campus for one week and document the challenges and outcomes.
- Develop a water audit report for the campus. Suggest a plan for a case-study approach.
- Create a similar economy model for a common problem faced in India (e.g., wastewater, sludge etc.).
- Design a product or service based on similar economy and develop principles and present a business plan.
- Develop a plan to improve production and recycling of hazardous waste in a chosen locality in India.

Module-IV

- Evaluate the potential for installing wind power on the college campus including cost-benefit analysis and feasibility study.
- Analyse the existing environmental problems of the college campus and propose sustainable alternatives to reduce environmental - What policies are being used? How can we reduce demand using energy-saving gadgets?
- Analyse a local environmental project like a climate resilience and energy improvement.
- 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 environmental improvement project in India (like a community building design, water management project, infrastructure project).
- Research and present a case study of an environmental improvement project in India (like telephone design and implementation, biotic and geobiotic resources alternatives (e.g., a housing complex with tree logging, a water management project raising hygiene levels, infrastructure projects that affects surrounding habitats or ecosystems).

SEMESTER-SI

OPERATING SYSTEMS LAB

(Common to CIVIL & MECHANICAL ACADEMIC COORDINATOR)

Course Code	POCNS4417	CSE Major	II
Teaching Hours/Week (L+T+P+R)	3+0+0	EEB Major	II
Credit	3	Exam Hours	2 hrs 30 min.
Prerequisites (if any)	OSINT204	Course Type	Lab

Course Objectives:

1. To familiarize students about various concepts in Operating systems.
2. To give practical experience for learners in implementing different features of Operating systems such as process management, memory management, and disk management.

Expt. No	Experiments
1	Familiarization with basic Linux programming commands, ps, kill, pkill, rm, cp, mv, cd, cat, tail, head, awk, sort
2	On your own system gather basic information about your machine. <ol style="list-style-type: none">Number of CPU coresTotal memory and the location of free memoryNumber of processes currently runningNumber of processes in the running and blocked statesNumber of processes killed since the last bootup. How do you compare this value with the one in /proc/stat?The number of current sessions present since the last bootup for a particular process
3	Write a single program or group of programs that can run in Threaded environment. Then set the given file system to determine how long this program (in the main thread) has occupied memory in user and kernel mode.
4	Create a new process using a fork system call. Detach the parent and start process. Use the parent command to find the process id for the child process starting from the last process.
5	Write a program to add two integers (two numbers via the command line) and multiply it in an executable named "myadd". Now write another program that creates a new process using a fork system call. Make the child process add two integers by replicating its image with the "myadd" image using execve system call.

6	<p>Create a new process using a task system call. The child process should print the string "POSSUM" and the parent process should print the string "Operating System Lab". Do a task system call to ensure that the output displayed is "POSSUM Operating System Lab".</p>
7	<p>Inter-process Communication (Supplementary LEV assignment level)</p> <ol style="list-style-type: none"> Using Pipe – Evaluate the expression $(a + b) \cdot c$. The first process evaluates a. The second process evaluates $b+c$ and sends it to the first process which evaluates the final expression and displays it. Using Message Queue – The first process creates a string in the second process. The second process receives the received string and sends it back to the first process. The first process respects the original string and its received string modified from the second one and thus prints whether the string is a palindrome or not. Using Shared Memory – The first process sends the string to the second process. The second process concatenates them to a single string (with whitespace being inserted between the two individual strings) and sends it back to the first process. The first process prints the concatenated string in the bigger size, that is if the concatenated string is "Hello hi students", the final output should be "HELLO HI STUDENTS".
8	<p>Write a multithreaded program that maintains the mean, median, and standard deviation for a list of integers. This program should receive a series of integers to the main thread and will then assign these separate various threads. The first thread will calculate the mean value, the second will calculate the median and the third will calculate the standard deviation of the integers. The variables representing the mean, median, and standard deviation values will be shared globally. The <code>main</code> thread will sum these values and the <code>main</code> thread will output the values once the threads have ended.</p>
9	<p>Input a list of processes, then CPU burst times (arrival values), arrival times, and priorities. Use round RO, SJF, non-preemptive priority, or large priority, common implies a higher priority, and RR (quantum = 1 unit) scheduling algorithms on the processes, determining which algorithm results in the minimum average waiting time (overall processes).</p>
10	<p>Use semaphores to reduce the resource contention problem with concurrent program execution.</p>
11	<p>Design a deadlock-free process lock and consider the banker's algorithm to determine a safe execution sequence.</p>
12	<p>Discuss symmetric and distributed file systems & distributed.</p>
13	<p>Implement the deadlock-free longest-job-first solution for the dining philosophers' problem.</p>
14	<p>Allocate the address translation of the paging scheme as follows. The process consists three segmented file segments in the table:</p> <ul style="list-style-type: none"> • size of the virtual address space is roughly 64

	<ul style="list-style-type: none"> ▪ page size (in bytes) ▪ a virtual address (in decimal notation). <p>The output should be the physical address corresponding to the virtual address in either decimal, binary or hex format. You may assume that the page table is implemented as an array indexed by page numbers (like if the page table has no index, the page number determined from the virtual address, you may just consider a page identifier.)</p>
34	<p>Describe the FIFO, LRU, and optimal page replacement algorithms in 10 lines. Then, generate a random page reference string (with page numbers range from 2 to 8). Apply the random page reference string to each algorithm, and record the number of page faults incurred by each algorithm. Assume that demand paging is used. The length of the reference string and the number of page faults (ranging from 1 to 7) are to be recorded as command-line arguments.</p>
35	<p>Implement the EDF, LCFB, and CRRM disk scheduling algorithms in C/C++. Your program will receive as input rank 5,000 cylinders numbered 0 to 4,000. The program will generate a random series of 10 cylinder requests and sort them according to each of the algorithms local policy. The program will be passed the initial position of the disk head (as argument to the command line) and will report the total number of head movements required by each algorithm.</p>

Course Assessment Method (CIE: 81 marks; ESE: 89 marks)

Continuous Internal Evaluation Marks (CIE):

Assessment:	Preparation/Pre-Lab Work requirements Time and Team: Completion of Lab Reports - Standard (Continuous assessment)	Internal Evaluation	Total
9	18	18	45

End Semester Examination Marks (ESE):

Practical: Proprietary mark Design Algorithm	Creation of requirement Execution of work/ Finalization Requirement	Design with valid infrastructure Quality of Output	Very Good	Good	Total
12	18	18	30	4	80

- ✓ Judgements of External Examiner shall be allowed for the final semester examination only upon submitting the duly certified version.
- ✓ Endorsement by External Examiner: The external examiner shall endorse the results.

Course Outcomes (COs)

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

Course Outcomes		Minimun Knowledge Level (OK)
CO01	Evaluate the use of various metrics available in Operating Systems	K3
CO02	Implement process creation and state transition mechanisms in Operating Systems	K3
CO03	Compare the performance of various CPU scheduling algorithms	K4
CO04	Compare the performance of various disk scheduling algorithms	K4

Part A/-: Dimension: K1- Understanding; K2- Application; K3- Analysis; K4- Evaluation; K5- Creativity

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

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO01	1	5	1	1				1				1
CO02	3	5	3	3				3				3
CO03	4	2	2	2				4				2
CO04	4	3	3	3				4				3
CO05	3	5	3	3				3				3

(1=Right Only; 2=Moderately; 3=Sufficiently; 4=Extremely; 5=Excellent)

Text Books				
S.No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Operating System Text Book	Amrit Agarwal Dinesh, Arun Agarwal, Dinesh	Galaxy	3rd, 2011
2	Linux Kernel Development	Rajendra Singh	Pearson	3rd, 2011
3	Unix Network Programming Volume 1 & 2 Interprocess Communications	Richard Stevens	Prentice Hall	3rd, 2009

Reference Books / Websites				
S.No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	The Design of the UNIX Operating System	Michael F. Dabir	Prentice Hall of India	3rd, 1994
1	The Little Book of Linux Games	Allen R. Downey	Green Tea Press	3rd, 2011

Video Links (OSSTEL SWAYAM..)	
Module No	task ID
1	https://www.videolan.org/ogg-player/www/130/1300000000.html
2	https://www.videolan.org/ogg-player/www/130/1300000000.html?fbclid=IwAR0D9TzL7Wjxu4qfK3ja-0YD4Opq3h

Continuous Assessment (25 Marks)

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

- Pre-Lab Assignments / Assessment of your lab assignments or quizzes that test understanding of the operating system.

- Understanding of Theory: Knowledge based on students' preparation and understanding of the theoretical background related to the requirements.

1. Case Study of Requirements (12 Marks)

- Requirements and Requirements: Differences in terms of priorities, sequence, inclusion of assumptions, and defining safety protocols.
- Risk Perception: Perceptions in handling requirements, analysis of dimensions, and risk-taking skills during the requirements.
- Teamwork: Collaboration and participation in group discussions.

2. Log Reports and Record Keeping (8 Marks)

- Quality of Reports: Clarity, completeness and accuracy of the reports. Proper documentation of requirements, assumptions and conclusions.
- Team Collaboration: Ability to collaborate in activities like reporting and record and maintaining a well-organized file record.

3. Time Table (3 Marks)

- Oral Examination: Ability to explain the requirements, risks and underlying principles during a 10 minutes exam.

Final Marks Awarding: The final marks for projective, conduct of experiments, time and extent of knowledge coverage of all the specified requirements in the syllabus.

Evaluation Pattern for End Semester Examination (50 Marks)

1. Problem Preliminary Work Design Algorithm (10 Marks)

- Problem Understanding and Description: Clarity in explaining the problem and understanding each step involved.
- Preliminary Work and Planning: Thoroughness in planning and necessary research required.
- Algorithm Development: Correctness and efficiency of the algorithm related to the requirements.
- Creativity and Logic in algorithm or organizational design.

1. Content of Requirements: Overview of Work Programming (16 Marks)

- Story and Discussion: Preparing and accurate narration of the requirements or programming tasks.

2. Report with Valid Test Cases-Quality of Charger (18 Marks)

- Accuracy of Results: Precision and correctness of the obtained results.
- Analysis and Interpretation: Validation of relevance drawn from the requirements quality of program output.

3. Viva-Voce (18 Marks)

- Ability to explain the requirements, problem solving and answer related questions.
- Re-Presenting in answering questions related to theoretical and practical aspects of the subject.

4. Standard (5 Marks)

- Completeness, clarity, and accuracy of the delivered submitted.

SEMESTER 5

DBMS Lab

(Consentno: CS/CD/CR/CA/AS/A/CB/CT/CC/CI/CO)

Course Code:	POCSL408	CII Marks:	25
Teaching Hours/Week (L:T:P:R):	0:3:0	ESE Marks:	25
Credits:	2	Exam Weeks:	I Sem. 30 Min.
Prerequisites (if any):	None	Course Type:	Lab

Course Objectives:

1. To equip students with comprehensive skills in SQL, PL/SQL, and MySQL database.
2. To make the student to proficiency design, implement, and manage relational and non-relational databases to meet the data management needs.

Lec No.	Topics
1	Design a database schema for an application with ER diagram from a problem statement.
2	Creation of database schema - DDL (Create table, alter table, drop table, truncate, create index, alter and modify table). Export ER diagram from the database and modify relationships to make the ER diagram consistent as in step 1.
3	Database normalization - Data Insert, Data Update in a database (bulk insert using CT and SQL Commands).
4	Perform SQL statements for DML (inserting, updating, deleting, selection of data, and viewing temporary results based on conditions or constraints).
5	Implementation of referential integrity constraints - Order By, Group By & Having clause in SQL.
6	Implementation of an operation named function, and procedure.
7	Function of SQL DCL DCL commands like Rollback, Commit, Snapshot, Series of DCL DCL commands for granting and revoking user privileges.
8	Function of PLSQL: comments & inclusion of --// and /* */.
9	Creation of Procedures, Triggers and Functions.
10	Creation of Partitions and indexes.
11	Design a database application using key functional and non-functional requirements to implement system. The application generated should have the same schema ¹¹ .
12	Update basic CRUD (Create, Read, Update, Delete) operations on a Database table.
13	Write and execute SQL queries to extract specific data from Database table.
14	Create example application using MongoDB with python.

¹¹ The problem must be designed to compare the difference of Oracle SQL from SQL statements.

Course Assessment Method (CIE: 80 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Assessment	Pre-Lab Work requirements Theoretical and Practical compliance of Lab Reports (Based (Continuous Assessment))	Internal Evaluations	Total
1	17	19	36

End Semester Examination Marks (ESE):

Practical Preparation work/Design/ Sign-offs	Content of significant knowledge of work/ practical activities/ Designing	Score with valid evidence Quality of Outputs	Theo retical marks	Based	Total
10	15	15	24	1	36

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

Criteria Outcomes (COs)

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

Course Outcomes		Elaborate Knowledge Level (EKL)
CO1	Develop database schema for a given real world problem domain using standard design and modeling approaches	EKL
CO2	Created queries using SQL for selection, insertion, modification, and update	EKL
CO3	Plan and implement triggers and stored procedures, functions, and control structures using PL/SQL	EKL
CO4	Perform CRUD operations in NoSQL Databases	EKL
CO5	Design database applications using front-end tools and back-end DBMS	EKL

Code: E.I., Streamline, E.I., Undergrad, E.I., Apply, E.I., Analysis, E.I., Business, E.I., Create

KO-KO Mapping (Mapping of Course Outcomes with Program Outcomes)

	KO1	KO2	KO3	KO4	KO5	KO6	KO7	KO8	KO9	KO10	KO11	KO12
CO1	1	2	2	1						1		1
CO2	1	2	2	1						1		1
CO3	1	2	2	2						1		1
CO4	3	3	3	2	1					1		1
CO5	3	3	3	2	1					1	1	1

1. High (4); 2. Moderate (Medium); 3. Sufficient (Slight) - To Corequisite

Text Books

M. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Fundamentals of Database Systems	Elmasri, Navathe	Pearson	7/e, 2017
2	Professional MySQL	Michael Halls	Voice	1/e, 2003

Reference Books

M. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Database System Concepts	Hananukka, Ramachandran Subrahmanian	McGraw Hill	7/e, 2017
1	MySQL for Dummies	Steve Kass	Wiley	1/e, 2014
1	MySQL: Data Models, Trends and Challenges (Computer Engineering Databases and Big Data)	Christos Stavrinos	Wiley	1/e, 2014
2	Making the Best of MySQL: A guide for Managers and Owners	Tom McFarlin and Ann Gaff	McGraw	1/e, 2004

Video Links (NPTEL, SWAYAM...)

Module No.	Link ID
1	https://www.youtube.com/watch?v=weC1_wdIgzw
2	https://www.youtube.com/watch?v=uM1_uf4jyv0
3	https://www.youtube.com/watch?v=weC1_wdIgzw
4	https://www.youtube.com/watch?v=weC1_wdIgzw

Continuous Assessment (25 Marks)

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

- Pre-Lab Assessments: Assessment of pre-lab experiments or processes that are understanding of the upcoming experiments.
- Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

2. Conduct of Experiments (11 Marks)

- Procedures and Logistics: Adherence to safety procedures, accurate execution of experiments, and following safety protocols.
- Data Pre-Selection: Proficiency in handling equipment, accuracy in observations, and manipulating skills during the experiments.
- Teamwork: Collaboration and participation in group experiments.

3. Lab Reports and Record Keeping of Marks

- Quality of Inputs: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
- Timely Submissions: Adhering to deadlines for submitting the report through record and maintaining a well-organized laboratory.

4. Viva Voce (3 Marks)

- Oral Examination: Ability to explain the experiment, results and underlying principles during a live presentation.

Final Marks Awarding: 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 (40 Marks)

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

- Procedure Understanding and Description: Clarity in explaining the procedure and understanding task being involved.
- Preliminary Work and Planning: Thoroughness in planning and preparing materials/equipment.
- Algorithm Development: Completeness and efficiency of the algorithm related to the assignment.

- Comprehensiveness, clarity, and accuracy of the literature submitted.
3. Content of Experiments & Evaluation of Work Programming (16 Marks)
- Using and Interpreting: Designing and executing evaluation of the experiments or programming tasks.
4. Results with Valid Inferences & Analysis of Output (16 Marks)
- Accuracy of Results: Precision and consistency of the data and results.
 - Analysis and Interpretation: Validity of inferences drawn from the experiments or quality of programs output.
5. Viva-Voce (12 Marks)
- Ability to explain the experiments, precision results and answer related questions.
 - Proficiency in answering questions related to theoretical and practical aspects of the subject.
6. Standard (5 Marks)
- Comprehensiveness, clarity, and accuracy of the literature submitted.

SEMESTER 5

**COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE)**

SEMESTER SE

COMPUTER NETWORKS

(Common to ECE, Electrical & Electronics Engineering)

Course Code	POINT	CIE Marks	AI
Teaching Hours/Week (L T P A)	3 1 2 0	ESE Marks	60
Prerequisite (if any)	None	Exam Week	3 Dec 2016
		Course Type	Theory

Course Objectives:

1. To introduce the core concepts of computer networking.
2. To develop a big picture of the important working mechanisms in Computer networks.
3. To impart an overview of network management concepts.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Overview of the Internet Protocol Layering (Book 1 Ch 1) Application Layer - Application Layer Protocols, Client server applications - World Wide Web and HTTP, FTP, Download, Mail, DNS, Peer-to-peer paradigm (Book 1 Chapter 1, Summary Reference Book 1 Ch 2)	6
2	Transport Layer Services, Protocols, UDP, TCP (Book 1 Ch 3) End-to-end Connection, Elementary TCP Sockets, TCP Connection Example, TCP Stateless Flow Control and poll Function (Book 1 Ch 4 to 6), Elementary TCP Sockets (Book 1 Ch 8, Advanced TCP Functions (Book 1 Ch 24)	18
3	Network Layer Function, Network layer protocols, Distance routing Metrics metrics - Multicasting, Routing, Area division and hierarchical routing, Cost propagation (Book 1 Ch 8), Quality of Service (Book 1 Ch 9) Routers, Local Level Implementation of Routing Tables and Cache Routing Cache Implementation Overview, Adding new entry in the Routing	18

	Data Link Layer : Data Link control (DLC), Multiple access protocols (MAC), Link layer addressing, Router port, Concentrating devices (Book 1 Ch 5) Windows LANx, Modem IP (Book 1 Ch 6) Modems: Demand Priority Queuing, DQDB, SPB IEEE 802.6 and IEEE 802.11 (Book 2 Ch 28)	11
8	Physical Layer : Data and signals, Digital transmission, Analog transmission, Bandwidth utilization, Translators module (Book 1 Ch 7)	8

Course Assessment Matrix
(ECE: 40 marks, EEE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Acknowledges	Assessment: Micro-project	Internal Evaluation 1 (Written)	Internal Evaluation 2 (Written)	Total
5	10	10	10	40

End Semester Examination Marks (ESE):

In Part A, all questions will be in structured and in Part B, each student can choose any one full question out of two questions.

Part A	Part B	Total
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 8 Questions, worth carrying 1 mark (do - 24 marks)	<ul style="list-style-type: none"> • Each question carries 2 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 2 sub-questions. (and - 16 marks)	40

Course Outcomes (COs)

Learning outcome of the course students should be able to:

Course Outcomes		Student's Knowledge Level (SKL)
CO1	Describe the basic working design in terms of protocol stack and layers of various application layer protocols	K2
CO2	Describe the functions of the transport layer from communication and connection-oriented perspective	K2
CO3	Identify how the network layer achieves local connectivity and routes to the direct service requirements of the host applications	K2
CO4	Explain the functions of the data link layer design and summarize the various data link layer protocols	K2
CO5	Describe the functional characteristics of the physical layer and understand how the physical layer supports the functioning of the network	K2

Note: K1-Knowledge; K2-Discernment; K3-Application; K4-Analyse; K5-Evaluation; K6-Creativity

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

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

Note: 1=High; 2=Moderate; 3=Low; -=No Correlation

Text Books				
Sl. No.	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Computer Networks: A Top-Down Approach	Ronald S. Jaitlyne	McGraw Hill	2013, 2017
2	Unix System Programming, Volume 1: The Toolkit (Berkeley Books)	W. Richard Stevens, Andrew M. Rumsby, Robby Ross	Pearson Education	2013, 2014
3	TCP/IP Architecture, Design, and Implementation in Linux	Santanu Sen	Prentice Hall	2009
4	Linux Administration	M. Asghar Ali, Venkateswaran	Wiley	2013

Reference Books				
Sl. No.	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Computer Networking: A Top-Down Approach (Focusing on Protocols)	J. F. Kurose and K. W. Ross	Pearson Education	5th, 2012
2	Computer Networks: A Systems Approach	L. L. Peterson and B. S. Davie	Morgan Kaufmann	5th, 2013

Value Links (OPTED, SWAYAM...)	
Sl.	LINK
1	http://opted.iitk.ac.in/OPTEL/OPTEL.html

SEMESTER SE**INTRODUCTION TO ARTIFICIAL INTELLIGENCE**

Course Code:	POC40101	CIE Marks:	40
Teaching Hours/Week (L, T.D, A)	3,1,0	Exam Marks:	00
Duration:	2	Exam Hours:	1.5hr - 1.5hr
Prerequisites (if any):	NA	Course Type:	Theory

Course Objectives:

1. To understand the Principles of Artificial Intelligence and Intelligent Systems.
2. To identify the Application of AI Techniques in Problem Solving and Decision Making.
3. To understand the concepts of learning methods and expert systems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Foundation of AI and Intelligent Agents Definitions w.r.t AI and its sub-fields: Definitions and usage. General milestones in AI development. Intelligent Agents: Concepts of agents and environments. Rationality and the nature of environments. Features of agents: Single agent, world-based, goal-based, utility-based. Problem-solving Agents: Problem formulation and approaches problem solving. Examples of problem-solving scenarios	18
2	Search Strategies and Game Playing Search Strategies for Games: Uninformed search strategies: Breadth-first search (BFS), Depth-first search (DFS), Uniform-cost: Hill climbing, A* algorithm, Problem reduction techniques Game Playing and Advanced Search: Concepts of informed search and game theory. Minimax algorithm for optimal decision-making. Challenges in game playing and problem-solving in multi-player games. Optimizing game play: efficient game tree exploration; Tractable functions and heuristics in game playing.	18

3	Knowledge Representation and Reasoning Knowledge Representation Techniques: Predicate logic and logic programming, Semantic networks, frames, and inheritance systems, Rule-based systems and constraint propagation. Reasoning Under Uncertainty: Basics of probability theory and Bayesian reasoning, Dempster-Shafer theory for managing uncertainty, Aggregation of knowledge under uncertainty in AI systems.	16
4	Learning Methods and Expert Systems Learning from Observations: Inductive learning and decision trees. Explanation-based learning: Statistical learning methods and reinforcement learning Expert Systems: Domains and basic concepts of expert systems, Structure and functioning of expert systems, Knowledge engineering and acquisition methods, Formal logics and rules, representations w.r.t. knowledge techniques: Rule-based, frame-based, object-based, case-based, knowledge representation in expert systems.	16

Course Assessment Method
(CIE- 40 marks, ESE- 40 marks)

Continuous Internal Evaluation Marks (CIE):

Assignment	Continuous Assessment (Assess Evaluation of Engineering Tasks)	Internal Evaluation-1 (Viva)	Internal Evaluation-2 (Viva)	Internal Evaluation-3 (Lab Evaluation)	Total
7	7	10	10	10	40

End Semester Examination Matrix (ESM)

In Part A, all questions need to be answered and in Part B, mark indicate how many may have full answers out of four questions.

Part A	Part B	Total
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks <p>(Total - 24 marks)</p>	<ul style="list-style-type: none"> • Both questions carries 2 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Both questions can have a maximum of 3 each 3 marks <p>(Total - 12 marks)</p>	36

Course Outcomes (COs)

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

Course Outcomes	Student's Knowledge Level (SKL)
CO1 Explain the fundamental concepts and historical milestones of artificial intelligence, mentioning the roles and contributions of leading experts.	S2
CO2 Apply reinforcement and informed search strategies, including BFS, DFS, and A* algorithms, to solve complex problems and game scenarios.	S3
CO3 Identify different knowledge representation techniques such as predicate logic, semantic networks, and rule-based systems and use reasoning methods to handle uncertainty.	S3
CO4 Implement learning techniques such as inductive learning, decision trees, and reinforcement learning for developing intelligent systems.	S3
CO5 Develop expert systems, representing basic knowledge, learning by acquisition methods, and ethical implications in AI applications.	S3

Note: S1-Remember, S2-Understand, S3-Apply, S4-Analyze, S5-Evaluate, P5-Create

EII-JII Mapping Table (MAPPING OF CURRICULUM DOCUMENTS TO PROGRAM OUTCOMES)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13
O01	1	1	1										1
O02	1	1	1										1
O03	1	1	1										1
O04	1	1	1										1
O05	1	1	1										1

Note: 1. High; 2. Moderate; 3. Low; 4. Very Low; 5. Absent (N/A); - No Evidence

Text Books

S.No.	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	An Introduction to Machine Learning	Stuart Russell, Peter Norvig	Prentice	4/e, 2019
1	An Introduction to Statistical Relational Learning and Reasoning	Daniel L. Dene, Alan K. Hartemink	Cambridge University Press	1/e, 2017

Reference Books

S.No.	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	An Introduction to Statistical Relational Learning and Reasoning for Complex Problem Solving	Berney F. Cooper	John Wiley	1/e, 2018
2	Relational Reasoning and Statistical Learning	Christopher M. Bishop	Springer	3/e, 2006
3	Statistical Learning	Trevor H. Hastie	McGraw-Hill	1/e, 2009
4	Project System: Processes and Programming	Joseph E. Gonzalez and Gary D. Rizzo	Cengage Learning	4/e, 2004

Value Links (XTEL_SWAVAH..)

Model No.	LinkID
1	http://www.telitv.com/13 http://www.lavish16742001 http://www.telitv.com/13 http://www.telitv.com/13 http://www.telitv.com/13
2	http://www.telitv.com/20-8272001 http://www.telitv.com/2001 http://www.telitv.com/2001 http://www.telitv.com/2001 http://www.telitv.com/2001
3	http://www.telitv.com/2001 http://www.telitv.com/2001 http://www.telitv.com/2001 http://www.telitv.com/2001 http://www.telitv.com/2001
4	http://www.telitv.com/2001

SEMESTER SE
MACHINE LEARNING
(Common to CS-AD-CV-CA-CC-CD)

Course Code:	SCC53108	Credit Marks:	45
Teaching Hours/Week (L+T+S+R)	3+0+0	TSE Marks	45
Course	I	Exam Marks	20% 10% 60%
Prerequisites (if any)	Theory	Course Type	Theory

Course Objectives:

1. To impart the fundamental principles of machine learning in computer science.
2. To provide an understanding of the concepts and algorithms of supervised and unsupervised learning.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to ML : Naive Bayes -> Decision Programming, Naive Bayes paradigm - Bayesian, non-Bayesian, unsupervised, reinforcement learning. Parameter Estimation :- Maximum Likelihood estimation (MLE) and maximum a posteriori estimation (MAP), Bayesian Inference. Supervised Learning :- Linear Representation and Feature Translation. Role of bias feature and overfitting. Regression - Under regression with one variable, Linear regression with multiple variables - solutions using gradient descent, regularized and multi-varied.	8
2	Classification - Logistic regression, Naive Bayes, SVM, Decision Tree + Bag	8

	<p>Dimensionality reduction - Idea of dimension, L1,L2 and SVD for reduction, idea of Principal Component, Variance</p> <p>Inductive measure - Classification - Naive Bayes, kNN, J48, C4.5 Linear, Logistic, Optimal Classification, Decision Tree, Ada-Boost Curves (ADC)</p> <p>Regression - Least Absolute Regression (LASSO), Least Mean Squared Error (RMSE), Ridge/Soft-Decision of Classification.</p>	
3	<p>DTM - Linear DTW, Idea of Hypothesis, Measures based on Hypothesis Similarity DTW, Methods for learning non-linear Functions</p> <p>Visual Similarity (VS) - Perceptual, Visual, Visual + Multimodal Similarity measures, Active learning (Supervised, semi-sup), Deep representation algorithms.</p>	9
4	<p>Unsupervised Learning</p> <p>Clustering - Similarity measure, Unsupervised Clustering - Agglomerative Clustering, partitional clustering, K-means clustering</p> <p>Dimensionality reduction - Principal Component Analysis, Multidimensional scaling</p> <p>Anomaly detection - Isolation, Isometry, Ensemble methods - Bootstrapping, One-Window, Recycled agents - Non-Parametric methods</p>	8

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

Continuous Internal Evaluations Marks (CIE):

Assessment	Examiner/ Marker/Grader	Internal Evaluation-I (Written)	Internal Evaluation-II (Written)	Total
I	24	24	24	48

End Semester Examination Marks (EAS)

In Term A, all questions need to be answered and in Term B each student can choose any two full questions out of four questions.

Part A	Part B	Total
<ul style="list-style-type: none"> • 1 Question from each module. • Total of 12 Questions, each carrying 2 marks <p>(Total = 24 marks)</p>	<ul style="list-style-type: none"> • Each question carries 2 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-questions. <p>(Total = 12 marks)</p>	36
		Course Outcome (CO) 6

All the students of the course should clearly understand:

	Course Outcome	Student's Knowledge Level (SKL)
CO1	Understand Learning concepts and their practical relevance.	K2
CO2	Demonstrate supervised learning concepts (regression, classification).	K2
CO3	Illustrate the concepts of Unsupervised learning (clustering) and Deep learning.	K2
CO4	Describe unsupervised learning concepts and dimensionality reduction techniques.	K3
CO5	Use appropriate performance measures to evaluate machine learning models.	K4

Note: K1-Descriptive, K2-Understanding, K3-apply, K4-Analyse, K5-Predictive, K6-Creative

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	3									1
CO2	1	1	3									3
CO3	3	1	3									3
CO4	3	1	3									3
CO5	2	1	3									1

Note: 1=High, 2=Moderate, 3=Additional depth, -=No Correlation

Text Books				
S.L. No.	Title of the Books	Name of the Authors	Name of the Publisher	Edition and Year
1	Introduction to Machine Learning Data Mining and Analysis	Ethem Alpaydin	MIT Press	4th, 2020
2	Fundamental Computer and Algorithms	Mohammed J. Zaki, Wagih M. Karim	Cambridge University Press	1st, 2018
3	Handwritten Character Recognition	Christopher Bishop	Oxford University Press	1st, 2006

Reference Books				
S.L. No.	Title of the Books	Name of the Authors	Name of the Publisher	Edition and Year
1	Applied Machine Learning	U.Gupta	McGraw Hill	1st, 2012
2	Machine Learning using Python	Josephine Franklin, L. Seth Karow	Wiley	1st, 2013
3	Machine Learning: Theory and Practice	MLK Murty V.S. Ananthanarayanan	Universities Press	1st, 2014

Video Links (NPTEL, SWAYAM -)	
No.	Link ID
1	https://nptel.ac.in/courses/101.02/00047121
2	https://swayam.nic.in/course/101.02/00000012
3	https://nptel.ac.in/courses/101.02/00047121

SEMESTER SE
ADVANCED GRAPH ALGORITHM

Course Code	FBCAT04	CSE Marks	40
Teaching Hours/Week (L T P R)	3 1 0 0	ECE Marks	40
Credit	4	Exam Marks	100% (10 MCA)
Prerequisites (if any)	DATA340	Course Type	Theory

Course Objectives:

1. To provide a comprehensive understanding of the fundamental concepts of graphs and trees.
2. To learn searching and traversing algorithms, connectivity and path efficiency.
3. To equip the learner to apply various coloring, planar graph, tree, graph and edge coloring effectively.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	<p>Introduction to Graph & its Applications, Basics of Paths, Cycles, and Trees, Connected, Bipartite Graphs, Minimum Spanning Tree, Degree and Centrality, Degreeless formula, Tie Distance, Partition Division and Graphs Isomorphism.</p> <p>Trees and Distance, Properties of Trees, Spanning Trees and Transversals, Minimum Spanning, Cayley's Formula, Prüfer code.</p>	41
2	<p>Matchings and Cover, Gallai Conjecture, Vertex Cover, Independence Set, Clique and Maximum Bipartite Matching, Augmenting Path Algorithm, Hungarian Algorithm, Hungarian Algorithm.</p> <p>Stable Matchings and Perfect Bipartite Matching, Perfect & Perfect Matching in General Graphs, Matching in General Graphs, Max-flow Min-cut Algorithm.</p>	22
3	<p>Community and Links, Cox and Community, Unbalanced Graph, Network Flow and Minimum Length Algorithm, Max-Flow Min-Cut.</p>	16

	<p>Diagrams, Allegory's Deadlocking Dead-Plus Model Theory;</p> <p>Matrix Coloring and Tigris Islands, Brooks' Theorem and Color-Critical Graphs, Chromatic Graph Theory;</p>	
4	<p>Planar Graphs, Classification of Planar Graphs, Kuratowski's Theorem, Wagner's Theorem;</p> <p>List Graphs and Bipartite Graphs, Partition Scheme Problem and NP-Completeness, Dominating Set.</p>	10

Suggestions on Project Topics:

- Applications of advanced graph theory in solving network analysis, decision supporting models etc.

Course Assessment Method

(ETE - 44 marks, ESE - 46 marks)

Continuous Internal Evaluation Marks (CIE):

Assessment	Project	Internal Examination I	Internal Examination II	Total
I	26	32.2	32.2	80

End Semester Examination Marks (ESE):

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

Part A	Part B	Total
<ul style="list-style-type: none"> • 20 questions from each module. • Total of 20 Questions, marking every 2 marks (80L = 16 marks) 	<ul style="list-style-type: none"> • 2 questions will be given from each module and of which 1 question should be answered. • Each question can have a maximum of 2 sub questions. • Each question carries 1 mark (total = 14 marks) 	49

Course Outcomes (COs)

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

	Course Outcomes	Student's Knowledge Level (SLL)
CO1	Explain fundamental graph concepts and algorithms to analyze and solve problems involving paths, cycles, trees, and network optimization.	S2
CO2	Solve modeling and solving problems in graphs using algorithms and theorems, including Menger's Condition, the Min-Max Theorem, and Kruskal's Algorithm.	S3
CO3	Apply connectivity and paths including Network Flow, Ford-Fulkerson Matching Algorithms, MaxFlow-MinCut Theorem, Minimum Spanning Tree using Kruskal's/Metric Minimum Spanning Tree.	S3
CO4	Illustrate Vertex Colouring and Upper Bound, Ramsey Theorem and Gallai-Gyarfas Conjecture, Crossing Number Conjecture.	S2
CO5	Apply concepts of planar graphs, including Euler's formula and Vizing's Theorem, to analyze graph planarity and edge-coloring, while solving complex problems related to Hamiltonian graphs, the Traveling Salesman Problem, and dominoes tiling.	S3

Note: S1-Knowledge; S2-Understanding; S3-Application; S4-Evaluation; S5-Creation

CO-PO Mapping Table:

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

Note: 1-Digital Circuits; 2-Memory Systems; 3-Sequential Logic; - DC Circuits

Text Books

SL. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Introduction to Graph Theory	D.J. Vazirani	Pearson Publication	2/e, 2011
2	Introduction to Graph Theory	Ramana Venkata	Lagrange Group Ltd	2/e, 2011
3	Graphs and Applications	J.A. Bondy and U.S.R. Murty	Elsevier Science Publishing Co., Inc	2/e, 1982

References Books				
Sl. No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Graph Theory	G Chartrand	Springer	4th, 2013
2	Graph Theory and its Applications	by William, Jonathan L. Gross, et.al.	Chapman	3rd, 2012
3	Modern Graph Theory	Kunio Ando	Springer	1st, 2000
4	Network Flow Theory, Algorithms and Applications	David S. Johnson, Thomas M. Magnanti, et.al.	Prentice-Hall	1st, 1993

Video Links (NPTEL, VRAYAM...)	
Module 1	Link 1D
1	https://www.youtube.com/watch?v=Jy4dppmIw
2	(1) Graph Theory by Sankha Banerjee - YouTube
3	(2) Graph Algorithms - YouTube
4	(3) Discrete Maths - YouTube

FEL Course Elements

E-Lecture (10hr)	D-Project (3 Wks, 12 hours Students)		
	Total	Practical	Theoretical
Lecture Activity	Project identification	Individual Labs/Work Technology	Supervision (Program and Real Applications)
Group Discussions Guided Reviews Debating Sessions	Project review	Data Collection	Review
	Analytical thinking and Planning	Testing	Project Review Reports (1 project)
Open Projects (Industry Report)	Case Study/ Field Survey Report	Presenting	Poster Presentation Video Presentation. Student present their results in a 2 to 3 minutes video

Assessment and Evaluation for Project Activity

No.	Evaluation Item	Allocated Marks
1	Project Planning and Proposal	1
2	Contribution to Project Progression and Quality Assurance	4
3	Development in the project work and Team Work	1
4	Encoder and Decoder creation	1
5	Total Progression	1
6	Project Quality, Innovation and Creativity	1
Total		16

1. Project Planning and Proposal (6 Marks)

- + Clarity and feasibility of the project plan
- + Research and background understanding
- + Objectives, scope and methodology

2. Contribution to Project Progression and Quality Assurance (4 Marks)

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

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

- + Active participation and maintained communication
- + Teamwork and collaboration

4. Encoder and Decoder (10 Marks)

- + Accuracy in the project encoder and decoder
- + Application of theoretical knowledge and problem solving
- + Final result

4. Final Presentation (8 Marks)

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

5. Project Quality, Originality, and Creativity (12 Marks)

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

SEMESTER SE

SOFTWARE PROJECT MANAGEMENT

(Common to CSE, CLA, CSE, GADAM)

Course Code	EDC20201	CSE Major	45
Teaching Hours/Week (L.T.D.V.S)	3.00.6	ECE Major	60
Credit	3	Semester Hours	3 Ltrs 10 Wks
Prerequisites (if any)	EDC20101	Exam Type	Theory

Course Objectives:

- To learn the techniques to effectively plan, manage, execute, and control projects with due and cost targets related to Information Technology and Service Sector.
- To learn agile project management methodologies such as Scrum and DevOps.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Project Initiation and feasibility study :- Project Charter and Feasibility Study - Identification, Risks and Demand Analysis, Project Cost Estimation, Financial Appraisal, Project Scheduling - Project Scheduling, Interactions w/ PERT and CPM, Data Calculation, Resource Allocation, Differences between PERT and CPM, Data Calculation and its importance, Generalization by Quality of schedule.	3
2	Riskous Scheduling, Cost Control and Project management Techniques :- Cost Control and Scheduling - Project Cost Control (PERT/Cost), Resource Scheduling & Resource Limiting, Project Management Process - Risk Analysis, Project Control, Project Audit and Project Termination	3
3	Agile Project Management :- Agile Project Management - Introduction, Agile Principle, Agile methodologies, Relationship between Agile Method, Lms, DevOps and IT Service Management (ITSM). Other agile methodologies - Introduction to	3

	13, PCD, DSDM, Crystal	
4	<p>Service and DevOps in project management:</p> <p>DevOps - 1 known methodologies used in DevOps, Pipeline, process building, script building, script review, code peerreview, release cycle (Release in hours), live preview of feature, Case Study, DevOps - Overview and its Components, Communication Using Docker, Managing Source Code and Automating Builds, Automated Testing and Test-Driven Development, Continuous Integration, Configuration Management, Continuous Deployment, Automated Monitoring, Case Study</p>	33

Examiner Assessment Method (CE= 40 marks, EST = 80 marks)

Continuous Internal Examinations Marks (CE):

Assessment	Assessment/ Management	Total Examination 1 (Written)	Total Examination 2 (Written)	Total
E	12	36	18	48

End Semester Examination Marks (EST):

In Term 4, all questions need to be answered and in Term 3, each student can choose any two full questions and reflect on them.

Part A	Part B	Total
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 4 Questions, each carrying 3 marks. <p>(Total = 12 marks)</p>	<ul style="list-style-type: none"> • Each question carries 2 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 2 sub-questions. <p>(Total = 10 marks)</p>	22

Course Outcomes (COs)

Learning outcome of the course students should be able to:

Course Outcome		Mark's Excellence Level (SLE)
CO1	Understand how effectively plan and schedule projects within time and cost budgets.	S1
CO2	Apply project resources and measure outcomes to meet market demands.	S3
CO3	Classify different Agile Project Management approaches.	S2
CO4	Apply various SCRUM processes to project management.	S2
CO5	Implement Agile techniques and its DevOps.	S1

Note: S1-Accomplished; S2-Understanding; S3-Applying; S4-Expertise; S5-Proficient; S6-Created

CO-PO Mapping Table:

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

Text Books

SL.No	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Managing with Agile: Delivering Quality Using Scrum	Mike Cohn	Addison Wesley	1st, 2004

Referenz-Daten

No.	Title of the Book	Name of the Author	Name of the Publisher	Date and Time
1	Agile Project Management with Scrum	James Pofahl	Addison Wesley	10.2010
2	Agile Project Management with Scrum	Ken Schwaber	Microsoft Press	10.2004

Video Links (OTTEL SWAYATHI...)

No.	Link ID
1	https://www.youtube.com/watch?v=UQJL12mC2qY
1	https://www.youtube.com/watch?v=79RgJ1OHC
3	https://www.youtube.com/watch?v=79RgJ1OHC

SEMESTER 5
ARTIFICIAL NEURAL NETWORKS TECHNIQUES

Course Code	PGCATS21	CIE Marks	40
Teaching Hours/Week (L-T-P-R)	100.0	TSE Marks	60
Credit:	2	Exam Hours	2hrs 10 Mins.
Prerequisite (if any)	None	Course Type	Theory

COURSE OBJECTIVES:

1. To help the learners in recognizing and modelling complex patterns and relationships in data that might be challenging for traditional algorithms to handle.
2. To enable the students to create models that can predict future outcomes based on historical data, which is valuable in various domains such as finance, healthcare, and marketing.
3. To equip the learners to perform classifications tasks in a better way, such as image and speech recognition, where they can categorize input data into predefined classes with high accuracy.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Artificial Neural Networks: Human Brain, Model of an Artificial Neural Network concepts of Neural Networks, Fundamentals of Biological Neural Networks and Artificial Neural Networks. Types of neurons: Activation Functions and Applications of Neural Networks. Learning Methods - Supervised, Unsupervised and reinforcement Learning of Neural Networks: Architecture, Terminologies - weight, bias, forward, learning rule, Applications of Neural Networks.	8
2	Basic of ANN Model: McCulloch-Pitts Neuron, Architecture, algorithm and Applications. Bias and Threshold, Linear Separability, Multi-Valued Logic - Algorithm, Applications. Perceptron - Learning Rule, Convergence Theorem, Adaline - Architecture, Algorithm, Applications.	8
3	Multilayer Perceptrons: Multilayer neural network, Back propagation Algorithm, Applications, XOR problem, Implementing and Modifying Back propagation Algorithm Using MATLAB	10

	<p>Course Themes and Competencies, all students, The Impressionist Period Solid State Physics Networks, Comparison of MLP and RNN Networks Summary</p> <p>MLP and RNN Networks - Generating maps - Building, Training, Evaluating, Interpreting and Visualizing a MNIST-generating Map Applications of Self-Generating Maps</p> <p>Algebra: Roots and Their Stability, Matrix Dimensions, RNNs - Applications, Algorithms, Applications, RNN2 - Applications, Algorithms, Applications</p>	
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Course Assessment Matrix
 (CEI: 40 marks, EEE: 60 marks)

Continuous Internal Evaluation Matrix (CIE):

Achievement	Assessment/Management	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Total
3	15	10	10	40

End Semester Examination Matrix (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
<ul style="list-style-type: none"> + 2 Questions from each module. + Total of 6 Questions, summing 15 marks <p>(All - 25 marks)</p>	<ul style="list-style-type: none"> + Each question carries 1 mark. + Two questions will be given from each module, one which 1 question should be answered. + Both question can have a maximum of 3 sub-questions. <p>(All - 20 marks)</p>	45

Course Outcomes (COs):

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

Course Outcomes		Student's Knowledge Level (KL)
CO1	Demonstrate mastery concepts and the functioning of ATM.	KL1
CO2	Analyze the functional learning algorithms namely, TD-Cohen, Delta Rule, Hebbian and Tolmanic rules and their real world problems.	KL1
CO3	Describe Back propagation Learning Algorithm, Gradient Descent Rule, Functions etc.	KL2
CO4	Demonstrate SOM Dynamics, Maps and Adaptive Resonance Theory.	KL1

Pass: X1-Evaluation X2-Understanding X3-Apply X4-analyze X5-Evaluate X6-Critique

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1										1
CO2	1	1										1
CO3	1	1										1
CO4	1	1										1

Ref : Mgt Grd 1: Managerial Science, 2: Subjective (Eng) - 10 Credits

Text Books

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Artificial neural networks An Introduction	Kurt J. Fausett, Paul E. Kolter	IEE Press	1st, 2002
1	Mixed methods: A Comprehensive Guide	Samantha Cooper	Human Sciences	1st, 2017

Reference Books

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Method Nameless - A classroom approach	Gokul Kumar	Disha Publication Publishing Company Limited	1st, 2017

Video Links (OTTI, SWAYAM...)

Module No.	Link ID
1	Introduction to Artificial Neural Networks https://www.swayam.gov.in/course/11712004
2	Deep Learning https://www.swayam.gov.in/course/11712005
3	Machine Learning And Deep Learning – Fundamentals And Applications, IIIT-Delhi https://www.swayam.gov.in/course/11712010

SEMESTER SE

KNOWLEDGE ENGINEERING

Course Code:	FE 61711	CIT Marks:	41
Teaching Hours/Week (L-T-P-R)	4-0-4-0	ESE Marks:	61
Credits:	3	Exam Hours:	2 hrs 20 min
Prerequisites (if any):	FE61701	Course Type:	Theory

Course Objectives:

- 1. To acquire a comprehensive understanding of knowledge representation, reasoning, and their applications.
- 2. To provide the concept of extracting and applying explicit, implicit, analogies, and rule-based systems.
- 3. To help the learner master problem-solving and fuzzy logic techniques for extracting rules, memory, and designing robust Knowledge-Based systems for specific domains.

SYLLABUS

Module No.	Syllabus Description	Credit Hours
1	Introduction to Knowledge Engineering Definition of knowledge engineering, Role of knowledge in AI, Knowledge representation languages (e.g., semantic networks, ontologies, production rules), Knowledge acquisition techniques (e.g., expert interview, knowledge elicitation), Applications of Knowledge Engineering (Expert systems, Decision support systems, and databases).	3
2	Natural language processing: Rule-based approaches Semantic Networks and Ontologies Semantic networks: structure, properties, and applications, Ontology: Definition, components, and results, Ontology: Ontologies and databases (e.g., ontology engineering, ontology-based systems)	3
3	Production Rules and Rule-Based Systems	3

	<p>Decision-making: Systems, simulation, and inference mechanisms</p> <p>Ad-hoc and system. Addressing, based during belief updating approaches of our belief system (e.g., expert systems, decision support systems). Application in Robotics: Knowledge representation and planning.</p>	
4	<p>Uncertainty and Reasoning under Uncertainty</p> <p>Uncertainty in knowledge representation: Probability theory, fuzzy logic, possibility theory. Reasoning under uncertainty: Bayesian networks, possibilistic reasoning, fuzzy inference. Application of uncertainty reasoning (e.g., medical diagnosis, risk assessment).</p>	8

Course Assessment Method
(EE= 40 marks, ESF= 60 marks)

Continuous Internal Evaluation Marks (CIE):

Assessment	Assignment Management	Internal Examination I (Written)	Internal Examination II (Written)	Total
5	15	18	18	45

End Semester Examination Marks (ESE):

In Part A, all questions need to be attempted and in Part B, each student can choose any two full questions out of four questions.

Part A	Part B	Total
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks <p>(Total = 24 marks)</p>	<ul style="list-style-type: none"> • Each question carries 5 marks. • Two questions will be given from each module, one of which 1 question should be answered. • Each question can have a maximum of 5 marks. <p>and = 10 marks</p>	34

Course Outcomes (COs)

All the test of the course outcomes should be able to:

Course Outcomes		Elaborate Knowledge Level (EKL)
CO1	Define knowledge management, identify knowledge management programs and describe how it helps organization multiply.	E2
CO2	Explain various resources and technologies, and analyze their results.	E2
CO3	Describe various risk-based systems and evaluate their effectiveness.	E2
CO4	Apply governance and quality tools, technologies, and evaluate the effectiveness of assessment measures.	E2

Page 25 | Session 10 | Unit 10 | Application of Knowledge Management

CO-PD Mapping Table: Mapping of Course Outcomes to Program Outcomes

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
CO1	3											1
CO2	3	3										2
CO3	2	2										2
CO4	1	1	3									1

Note: 1=High; 2=Medium; 3=Lowest; N/A= Not Applicable; -=No Correlation

Text Books

No.	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	An Introduction to Knowledge Management: A Practical Guide	David J. Korten and David M. Newell	Prentice-Hall International	4th, 2003
1	An Introduction to Knowledge Engineering	Steve Rasmussen, Steve L. Rasmussen, Michael Cross	Springer London	1st, 2007
1	Managing with Knowledge: Knowledge Engineering	Gregory P. Webster	Springer International Publishing	1st, 2017

Reference Books

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	A Guide to Expert Systems	Winston, William Donald A.	Pearson	1st. 1983
2	Building Expert Systems Examples, Techniques, and Applications	Elliott M. Davis	Prentice Publishing Company	1st. 1998
3	Knowledge Engineering Examples, Methods and Applications	Adrian Duce-Green	Elsevier Science Publishers	2nd. 2001
4	Knowledge Acquisition in Present A. Engineering Data	K. R. Mehta	Springer/ London	1st. 2007

Value Lines (DSTEL, SWAYAM -)

Module No.	Link ID
1	Artificial Intelligence : Knowledge Representation and Reasoning, 1st Edition By Prof. Deependra Kumar (https://www.swayam.gov.in/resource/10103214)
2	Artificial Intelligence : Smart Systems for Personal robots By Prof. Deependra Kumar – 1st Edition https://www.swayam.gov.in/resource/10103215
3	Sudoku: Making Data Encrypted By Prof. P. Sathish : Sathyabama University (https://www.swayam.gov.in/resource/10103217)

SEMESTER SE
HEALTHCARE ANALYTICS

Course Code:	PEAIT525	CIE Marks:	40
Teaching Hours/Week (L-T-R-S)	30-30	TSE Marks:	10
Credit:	3	Exam Hours:	3hrs. 30 min.
Prerequisite (Year):	None	Course Type:	Day

Course Objectives:

1. To teach the health data literacies, health care policy and standards and the significance and role of data privacy and data classification.
2. To make the learner aware of the health data management framework and its help them to use machine learning and deep learning algorithms in healthcare.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Healthcare Analytics - Overview: History of Healthcare Analytics Dimensions in medical care systems. Decision policy- Statistical methods - Data Types - Machine Learning Frameworks: Tree Like structure , Decision tree learning and Bayes Network, Weighted sum approach	8
2	Analysis on Machine Learning - Machine Learning Pipeline - The process - Visualizations - Feature Selection - Creating model (process) - Evaluation model : Sensitivity , Specificity , PPV , NPV, FDR , Accuracy , ROC , Precision Recall Curve , Valued target variables - System Variations and types, Classifications and constraints , Predictive Data Trans. Operations - Scale - Gause - Perceptron , Feature Selection	8
3	Healthcare Management : IoT based Systems - Application of Healthcare Information Systems in HMOs, Cloud Computing - Database System - Matrix, Model, Object System - Semantic Processing Analysis - Bioprinting, Bio-Printing and Cell Engineering - Clinical Decision Models - Visual Analytics for Healthcare	16
4	Healthcare and Deep Learning - Introduction on Deep Learning - DNN networks (DNN, RNN) for Sequence - Unsupervised Images and Signal Analysis	16

- Natural Language Processing und Data Mining der Clinical Data - Clinical
Mining and Analytics - Clinical Decision Support System

Course Assessment Method:
(CE, 40 marks; ELE, 60 marks)

Continuous Internal Evaluation Marks (CIE):

Assessment	Assignment Management	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Total
9	10	81	38	80

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any two out of four questions and answer them.

Part A	Part B	Total
<ul style="list-style-type: none"> + 10 Questions from each module. + Total of 20 Questions, each carrying 2 marks <p>(Total - 20 marks)</p>	<ul style="list-style-type: none"> + Each question carries 2 marks. + Two questions will be asked from each module, but at least 1 question should be answered. + Each question has been a maximum of 3 sub-questions <p>(Total - 20 marks)</p>	60

Course Outcomes (COs):

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

Course Outcome	Element's Knowledge Level (K1)
CO1 Explain the basic data mining, mining methodology concepts	K1
CO2 Identify the significance and need of data analysis and data visualization	K2
CO3 Explain the basic data management framework	K2
CO4 Explain the role of machine learning and deep learning algorithms in healthcare	K2

Note: K1-Knowledge; K2-Understanding; K3-Application; K4-Synthesis; K5-Creativity

III.III Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13
C01	1	1											1
C02	1	1											1
C03	1	1											1
C04	1	1	1										1

Note : 1=Applicable, 0=Inapplicable, 1=Sufficiently App., 2=Completely

Text Books

M. No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Big Data Analysis in Decision	Edmund, James, Singh, Jitender, Singh, Trupti, Edt.	Springer	1st, 2016
2	Machine Learning: Data, Info & Knowledge in Multidisciplinary Applications	Lin Wang and Wei X. Lin	Wiley	1st, 2018
3	Healthcare Data Analytics	Chandru K. Reddy and Chetan C Aggarwal	Taylor & Francis	1st, 2011

Reference Books

M. No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Data Warehousing	Vineet Kumar	Packt	1st, 2014
2	Health Care Data Analysis and Management	Wenyan Du, Junjie Li, Huijun Jiang, Feng Qian, Chenxin Shao	Academic Press	1st, 2014

Video Links (NPTEL, SWAYAM...)

Module No	Link ID
1	Handling Survey Data in R using GSS Database
2	Statistical Image Analysis
3	Lecture 10: Machine Learning for Data Science and Big Data Analysis for Business
4	Big Data Analysis for Business

SEMESTER SE

DIGITAL SIGNAL PROCESSING

(Common to CSE/CIVIL/CE/EE)

Course Code	DECATS16	CSE Marks	40
Teaching Hours/Week (L, T.O, R)	3.880	ESE Marks	00
Credits	1	Exam Hours	2 hrs. 10 Mins.
Prerequisites (if any)	Signals and Systems	Course Type	Theory

Course Objectives:

1. To teach the concept of DFT and apply it for filtering their responses.
2. To review on the algorithms for computation reduction in the computation of DFT.
3. To teach the theory of FIR and IIR filters and to design FIR filters.
4. To get exposure to the basic idea of some of the important techniques for designing efficient VLSI architectures for DCT.

SYLLABUS

Module No.	Syllabus Description	Contact Hour
1	Definition of a digital signal processing system. Sampling, Sampling rate, DFT and IDFT (Properties of DFT). Linear Convolution using Convolution, Decimation of long filter segments, Overlap and method, averaging over window. Linear Filtering methods based on DFT – DTFT, HTF etc. – efficient computation of the DFT of a 2D processed sequence – convolution – use of FFT in linear filtering and correlation. Symmetry in the DFT	6
2	Types of finite filters. Ideal filters. Zeros phase and linear phase: window function. Types of linear phase FIR window functions. Design digital filters using DTK, digital filters (low pass and high pass), Simple IIR digital filters (low pass and high pass). All pass and minimum phase: window function. Design of FIR filter : window based design (Rectangular, Hamming, Butterworth windows). Applications of DCT-based analysis of encoded signals.	8

3	<p>Dedicated memories for FIR filters, stored, recursive, parallel, DIF, Filter coefficient memory (Short term IIR, cascaded and Parallel and transpose structures), Computational complexity in DIF implementation, Number formats for signals and coefficients in DIF systems, Dynamic range and quantizer, Sources of error in DIF implementation - A/D conversion error, DIF truncation and error, D/A Conversion error.</p>	8
4	<p>IFFT and DCT Filter realization in a fixed point processor - Data wordlength effects - Quantization, rounding and truncation, number and scaling DIF algorithm approximations, data flow, round flow, signal flow graph, block diagram - Long burst, location burst, mixed path - Pipelining, parallel processing, low power architectures - Retiming, bitonic and unfolding techniques applications</p> <p>Essentials -</p> <ul style="list-style-type: none"> + FDDI based hardware realization of the FFT algorithm, circular convolution, FIR and IIR filter realization using butterfly + In radix algorithm DIT algorithm realization based on butterfly, convolution and shifting operations in a fixed point processor + Analysis the effect of the finite wordlength by implementing the IFFT algorithm and FIR filters by using fixed point realization approximation in different formats 16c-Q7/Q7.m + Design an IIR low pass filter using BUTTERWORTH and window filter in filter design stage by controlling α and placing the result 	16

Course Assessment Method
(CIE: 40 marks, EST: 80 marks)

Creditable Internal Evaluation Marks (CIE):

Assessment	Assessment Description	Internal Examination-I (Written)	Internal Examination-II (Written)	Total
1	E1	28	28	48

End Semester Examination Marks (EAS)

In Term A, all questions need to be answered and in Term B each student can choose any two full questions out of four questions.

Part A	Part B	Total
<ul style="list-style-type: none"> • 1 Question from each module. • Total of 14 Questions, each carrying 2 marks <p style="text-align: center;">(Total = 28 Marks)</p>	<ul style="list-style-type: none"> • Each question carries 2 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-questions. <p style="text-align: center;">(Total = 10 marks)</p>	38

Course Outcomes (COs)

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

Course Outcomes	Skills & Knowledge Level (SKL)
CO1: understand the concepts of DPL and apply it for implementing the specified information of new systems	SK1
CO2: apply algorithms for completing calculations in the computation of DPL	SK1
CO3: Use the theory of DPL and DPL rules and be able to design DPL rules using the various methods	SK2
CO4: Implement DPL and DPL rules modules functions using suitable environment	SK2
CO5: Identify the effects of these methodologies on DPL algorithm implementation	SK3
CO6: Use the given guidelines for implementing the DPL algorithms	SK3

Score: (S1 - Semester; SKL - Understanding; SK1 - Apply; SK2 - Utilize; SK3 - Evaluate; KC - Create)

EII-0111 Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
C001	1	1	1									1
C002	1	1	1									1
C003	1	1	2	2								1
C004	1	1	1	1								1
C005	1	1	1	1								1
C006	1	1	1					1				1

Step / Edge Gray, 1 - Answer Given, 2 - Answer Omitted, 3 - Subnormal (Neg), - 0 - Correct Answer

Text Books

No. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Digital Signal Processing [Chaitin-Garcia]	S. Chaitin-Garcia	McGraw Hill	1/e, 2011
1	Digital Signal Processing : A Computer-Based Approach [Oppenheim]	Rush H. Lim	McGraw Hill	4/e, 2007
4	VLSI Signal Processing Systems Design and Implementation [Schafer R.]	Kurtz R. Schafer	Wiley	1/e, 2007

Reference Books

No. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Digital Signal Processing	Ram E. Zadeh, Deric W. S. Jones	Prentice	4/e, 2007
2	Introduction to Digital Signal Processing	Allen V. Oppenheim	Prentice	1/e, 2002
	Mathematics of the Discrete Fourier Transform (DFT) - with Audio Applications			
3	Digital Signal Processing: Fundamentals, Techniques and Applications	Tan Dang	Mc Graw Hill Publication	1/e, 2010
2	Fast Fourier Transforms: Algorithms for Parallel Computers (Vol.2)	Durkin Takahashi	Springer	1/e

Video Links (OTEL SWAYAM..)

No.	Link ID
1	https://www.youtube.com/watch?v=13213810000179
1	https://www.youtube.com/watch?v=13213810000179.pdf

SEMESTER SE

COMPUTER GRAPHICS & MULTIMEDIA

(Common to CSE, CIVIL, ECE, EEE)

Course Code	PGCSE207	CSE Marks	40
Teaching Hours/Week (L, T, P, R)	10x3	EIE Marks	60
Prerequisites (if any)	None	Exam Scheme	End Sem. 100% Ex.

Course Objectives:

- To provide strong technological concepts in computer graphics including the two-dimensional environment representation in a computer, basic elements of CG, basic and basic techniques of techniques and algorithms used in its applications.
- To give a good understanding of the mathematical foundations for computer graphics and different rendering algorithms.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Basics of Computer graphics - Basics of Computer Graphics and its applications, Video Display devices - LCD, QLCD, LCD, PCD and PDS and different display, Text and Screen display and types. Line and Circle drawing Algorithms - Line drawing algorithms - Bresenham's algorithm, Liang-Barsky algorithm, Circle drawing algorithms - Midpoint Circle generation algorithm, Bresenham's Circle drawing algorithm.	16
2	Geometric transformations - 2D and 3D basic transformations - Translation, Rotation, Scaling, Reflection and Shearing. Matrix representations and homogeneous coordinates Filled Area Primitives - Area line polygon filling, Boundary Filling and Scan filling	8
3	Compositing and Clipping Algorithms - Union or merge compositing, Color Selection and Adaptive addition for clipping	8

	<p>Algorithms, Hash-based Techniques and Window Advance Techniques</p> <p>Three dimensional graphics - Three dimensional rendering pipeline.</p> <p>Programs: Parallel and Perspective projection. Matrix rotation functions</p> <p>Operations - Such as Anisotropic Depth Buffer algorithm, Line Scan algorithm, Culling algorithm.</p>	
4	<p>Fundamental of Multimedia - Introduction to Multimedia, Authoring and Tools, Graphics and Images Data Representations, Popular File Formats, Fundamental Concepts and types of Videos, Basics of Digital Audio and its types</p> <p>Compression Methods - Lossless Compression Algorithms: Run-Length Coding, Arithmetic Coding, Lossy Compression Algorithms: Transform Coding, JPEG and JPEG-LT based lossy Compression, Wavelet Based Compression Techniques</p>	3

Course Assessment Method

(ETE: 44 marks, ESE: 46 marks)

Continuous Internal Evaluation Marks (CIE):

Assessment	Assignment / Projects	Second Examination I (Written)	Second Examination II (Written)	Total
I	17	14	18	49

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one and all questions must be answered.

Part A	Part B	Total
<ul style="list-style-type: none"> • 1 Question from each module. • Total of 1 Questions, each carrying 3 marks (Total = 18 marks) 	<ul style="list-style-type: none"> • Each question carries 2 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-questions. 	18

Course Outcomes (COs)

Learning outcome of the course students should be able to:

Course Outcome		Student's Knowledge Level (SKL)
CO1	Understand the principles of computer graphics and display.	K1
CO2	Understand scene description, rendering description and polygon rendering algorithms.	K1
CO3	Understand 2D and 3D basic transformations and their implementations.	K1
CO4	Understand different clipping algorithms and 2D viewing pipeline.	K1
CO5	Understand the fundamental features and graphics management algorithms.	K2

Level: K1: Knowledge; K2: Understanding; 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	PO12
CO1	1	1	3									1
CO2	3	1	3	1								1
CO3	1	1	3	3								1
CO4	1	1	3	1								1
CO5	1	1	3									1

Score: 1 = High (Guru); 2 = Moderate (Guru); 3 = Moderate (Avg); ... 12 = Moderate

Text Books

Sl. No	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Computer Graphics - Algorithms and Implementations	D. P. Dobkin, University Texas	PHI	1st 2012
1	Computer Graphics with OpenGL	Donald Bruce, M. Andrea Saltzman Walter Carlson	PHI	4th 2011
3	Fundamentals of Mathematics	Dr. Hema Dwivedi & S. S. Dwivedi	Panam	2006

Reference Books				
No.	Title of the Books	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Introduction to Flat Panel Displays	Han-Chen Lee, S.-Chen Chang, Gang-Ryou Kim, Sung-Jae Kim-Han	Wiley	1st, 2010
2	Computer Graphics and Mathematics	ETL ETS	Pearson	1st, 2010
3	Computer Graphics	Douglas Thrun and Seung-Bum Kim	McGraw Hill	2nd, 2009
4	Principles of Interactive Computer Graphics	William M. Newman and Robert F. Sproull	McGraw Hill	1st, 2011
5	Advanced Elements in Computer Graphics	David F. Rogers	McGraw Hill	2nd, 2017
6	Computer Graphics	Donald D. Kahan, M. Pauline Baker	Pearson	2nd, 2012

Video Links (DSTVLL, VRAYAM...)	
Module No.	Link ID
1.1.1	Computer Graphics By Prof. Isuru Gunawardena at ST (Kandy) https://www.youtube.com/watch?v=6mZJ_ydUgjw
4	VR Based Technologies and Mathematics Applications by Prof. S. V. Sankar, IIT Madras National Open University https://www.youtube.com/watch?v=6mZJ_ydUgjw

SEMESTER SE

ADVANCED COMPUTER ARCHITECTURE

Course Code	EC020208	CIE Marks	40
Teaching Hours/Week (L T P R S)	3.0.0.8	ESE Marks	60
Credit	1	Exam Hours	2 hrs 12 min.
Prerequisite Class(es)	EDC17404	Course Type	Theory

Course Objectives:

- To introduce the advanced processor architecture including pipeline concepts in programming of multiprocessors and multicores.
- To provide detailed understanding about data flow in computer architectures.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	<p>Introduction – The origins of business and perform benchmarking; trends & technologies – Instruction set Architecture, Memory hierarchy, addressing modes</p> <p>Class of Computer, Concept of Computer Structures and Organization [2.4],</p> <p>Memory Management, Register and Segmenting, Protection.</p> <p>Architecture – Disney and Pixar Animation's Law, Business Performance System</p> <hr/> <p>Super Scalar – What contemporary engines do high performance computing breakthroughs test compete the results submitted by different engines for the same instructions. Are you able to appreciate the need for benchmarks in engine performance? What are related benchmarks? Can you write a paper and publish results based on related benchmarks?</p>	8
2	<p>Learn the basic Concepts of Branch Prediction and Pipelining Instructions</p> <p>Level Decisions, time dependencies and handle Different types of Pipelines: Compiler Techniques for DR, Branch Prediction – Crisscross</p>	8

	Recent progress Deep Dive Learning - like, Invention or Transformational: Super-Accuracy, Better Speciation, Model Safety, Diagnoses and auto-repairing, MLK	
3.	Deep Dive Prediction Model Process - How do they work, Memory Banks, Data, Data, Data. DOD-compliant with some CPU. Comparison of Ings in C vs CUDA, Numba, CPU, Memory transfer from Processor to CPU. Multicore SIMD compute vs GPU. Multicore Application, Crossload shared memory achieves Cache coherence and memory access (Implementation details - not required). Performance of Symmetric Shared-Memory Processes. Distributed Shared Memory and Directory based protocol - Issues, Synchronizations - like Reducer Problem. Memory Consistency Models - Sequential consistency	9
4.	Review Basic Computer - Goals and approaches. Programming Languages for Basic processing - High level and Low-level Computer architecture of Microcontroller computers Moore's Law, Demand Scaling, Data Silos and its limitation towards Unsupervised Learning. Machine learning techniques - basic and Deep learning (ConvNets etc., example: processing Functional Neurological Mission architecture - GPUs, Accelerators, Compute Grids Computing beyond the evidence - Model) the process and in your PC and mobile phone. Body about AI applications as it leverages AI technologies, does it use GPUs, what information can you gather about it from the manufacturer's website - Details in the class	9

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

Course Internal Evaluation Marks (CIE)-

Assessment	Computer Architecture	Internal Evaluation-I (Written)	Internal Evaluation-II (Written)	Total
3	24	28	28	60

End Semester Examination Marks (EAS)

In Term A, all questions need to be answered and in Term B each student can choose any two full questions out of four questions.

Part A	Part B	Total
<ul style="list-style-type: none"> • 1 Question from each module. • Total of 10 Questions, each carrying 2 marks <p>(Total = 20 marks)</p>	<ul style="list-style-type: none"> • Each question carries 2 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-questions. <p>(Total = 10 marks)</p>	30

Course Outcomes (COs)

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

Course Outcomes	Skills & Knowledge Level (SKL)
CO1: Identify the different classes of enzymes and where they are used in everyday life.	SK1
CO2: Compare the effect of basic and alkaline substances on the growth of a particular enzyme (amylase) & how.	SK2
CO3: Interpret graphical representations that represent kinetics in a particular block of work.	SK2
CO4: Differentiate different strategies followed to reduce Industrial Level Pollution.	SK2
CO5: Compare different strategies followed to reduce Industrial Level Pollution and different measures followed to reduce Deep Pollution.	SK3
CO6: Illustrate the need for research, consistency, results and make informed decisions and explain the principle behind it.	SK3

Level: E1-Elementary E2-Understanding E3-Applying E4-analyse E5-Evaluating E6-Creating

EII-III Mapping Table (Migrating all Course References to Program References)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
G01	1	1	1									1
G02	1	1	1									1
G03	1	1	1									2
G04	1	1	1	1								2
G05	1	1	1	1								1
G06	1	1	1	1								2

1=High, 2=Medium, 3=Lowest, 4=Substantial (Neg), -1=Orphaned

Third Books

SL No.	Title of the Book	Name of the Authors	Name of the Publisher	Date and Time
1	Computer Architecture: A Quantitative Approach	Hennessy, J. and Patterson, D.	Morgan Kaufmann	Jan, 2013
2	The Dark Side of Climate Energy: Advances Comparing the Dark Climate Era	Karunam, Judd, et al.	Springer	Dec, 2017

Reference Books

SL No.	Title of the Book	Name of the Authors	Name of the Publisher	Date and Time
1	Computer Architecture	David H. Patterson, John L. Hennessy	Wiley	Jan, 2013
2	Advanced Computer Architecture	Agarwal, Suresh	Taylor & Francis	Dec, 2015
3	Computer Architecture	Charles Vines	McGraw-Hill	Jan, 2014

Video Links (OPTEL, SWAYAM, ...)

No.	Link ID
1	https://adobe.ly/2qfQa (201801010200)

SEMESTER SE

DATA MINING

(Common to ECE/CH/CS/AA)

Course Code	PERIODS	CIE Marks	SL
Teaching Hours/Week (L.T.D.Q)	10.03	EIE Marks	II
Credit	III	Term Marks	III & III-IV
Prerequisites (if any)	None		

COURSE OBJECTIVES:

1. To provide a thorough understanding of the key processes and concepts involved in data mining and their continuing vital application domains.
2. To enable students to understand the different data processing techniques, fundamentals and advanced concepts of classification, clustering, association rule mining, web mining and text mining, and apply their knowledge in real world contexts.

SYLLABUS

Module No	Syllabus Description	Contact Hours
1	Data Mining Frameworks :- Data Mining - concepts and applications, Taxonomy, Overview of Data Mining ⇒ Data mining, Architecture of typical data mining system, Data Mining Terminologies. Data warehouses :- Differences between Operational Databases Systems and Data Warehouses, Multidimensional data model- Factless schema, OLAP Operations, Data Warehouses Architectures	3
2	Data Preprocessing :- Data Preprocessing - Need of data pre-processing, Data Cleaning- Missing values, Noise and Data Integration and Transformation	4

	<p>Data Reduction : Data rule approximation, Feature subset selection, Dimensionality reduction, Numerosity reduction, Discretization and concept hierarchy generation.</p>	
4	<p>Classification And Clustering -</p> <p>Classification : Introduction, Bayesian classification principle, Naïve Bayes, Decision tree, Classification and regression trees (CART), Linear discriminant, Logit regression, Evaluation measures - accuracy, precision, recall, F1 score.</p> <p>Clustering : Introduction to clustering, K-means, Measures, Clustering Paradigm, Partitioning Algorithms - k-means, Hierarchical Clustering, DBSCAN.</p>	9
4	<p>Association Rule Analysis And Advanced Data Mining -</p> <p>Association Rule Mining : Coverage, Apriori Algorithm, TIDY Quickspace Algorithm.</p> <p>Text Mining : Web Content Mining, Web Document Mining, Text Rank, Web Page Mining, Programming, Data structures, Text Diversity, Pattern Analysis.</p> <p>Time Mining : Time Series analysis and Information Retrieval, Basic concepts in Text mining, Text Mining Applications, Text Mining Techniques</p>	10

Criteria for Evaluation (Teacher and Analyst): 10 marks

Students must be asked to identify problems involving large datasets and handle the right solution from the concepts already learned. A comparison of the results with a known approach is also need to be performed to assess the Knowledge Level.)

End Semester Examination Marks (SEM)

In Part A, all questions need to be answered and in Part B, each student can choose any one of 6/7 questions out of four questions.

Part A	Part B	Total
<ul style="list-style-type: none"> + 2 Questions from each module. + Total of 2 Questions, each carrying 5 marks (Total = 10 marks) 	<ul style="list-style-type: none"> + 2 questions will be given from each module, out of which 1 question should be answered. + Each question can have a maximum of 2 subquestions. + Each question carries 5 marks. (Total = 10 marks) 	10

Course Outcomes (COs)

The list of the course outcomes should be able to:

Course Outcomes		Mark's Excellence Level (SEL)
CO1	Understand the basic process of data mining and their underlying concepts in application domains.	S1
CO2	Apply appropriate programming techniques to implement data mining modules for practical data mining tasks.	S1
CO3	Understand the use of classification and clustering algorithms to resolve application domains.	S1
CO4	Compare and evaluate different data mining techniques.	S1
CO5	Understand the mining concept and their applications in emerging domains.	S1

Note: S1-Learner; S2-Understanding; S3-Apply; S4-Evaluate; S5-Evaluate; S6-Creative

CO-PO Mapping Table:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13
CO1	2	2											2
CO2	1	1	3	1	1								1
CO3	1	1	3	1	1								1
CO4	1	1	3	1	1								1
CO5	2	3											2

Text Books

Sl.No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1.	Data Mining: Concepts and Techniques	Witten, Frank and Eibe Frank	Elsevier	2nd, 2016
2.	Data Mining: Practical Machine Learning Tools and Techniques	Duda, Hart and Stork	Elsevier	2nd, 2001

Reference Books				
No.	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Introduction to Data Mining	Raghu Ra. Krishnakumar	Addison Wesley	1/e 2004
2	Data Mining: Concepts, Methods, Methods, and Algorithms	Mohamed Elomary	Wiley	1/e, 2009

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Module No.	Link ID
1	https://www.w3schools.com/html/html_links.asp
2	https://www.w3schools.com/html/html_links.asp?ref=html_iframe
3	https://www.w3schools.com/html/html_links.asp?ref=html_iframe&ref2=html_iframe
4	https://www.w3schools.com/html/html_links.asp?ref=html_iframe&ref2=html_iframe&ref3=html_iframe

SEMESTER SE

FOUNDATIONS OF SECURITY IN COMPUTING

Course Code	FECA5101	CIT Marks	40
Teaching Hours/Week (L-T-P-R-A)	3-0-0-0	EBC Marks	00
Credits	05	Exam Hours	1 hrs. 15 min
Prerequisites/Marks	None	Course Type	Theory

Course ID: CS120112.

1. To provide the fundamental security processes involving cryptography, authentication, and access control.
2. To enable the learners to identify and mitigate threats and vulnerabilities in software, networks, and operating systems.
3. To provide practical skills in securing computing systems and managing security policies and incident.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Number Arithmetic- Integer arithmetic - Integer division, Divisibility, Greatest Common Divisor (GCD), Euclid's algorithm for GCD, Extended Euclid's algorithm [Text 1/Text 2]. Prime Numbers and Factorization- Prime numbers - Prime numbers and composite numbers, Fermat and Mersenne primes, Fermat's theorem, Applications: Miller-Rabin, Miller's prime testing, Applications: Transposition - Transposition cipher, Polyalphabetic cipher [Text 2]	8
2	Stream & Cipher Models - Stream ciphers: Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad Transposition techniques, Block Cipher, stream cipher, Data Encryption Standard (DES), Strength of DES, Block Cipher Operations, Electronic Code Book, Cipher Block Chaining Mode, Cipher Feedback Mode, Output Feedback Mode, Counter Mode, Advanced Encryption Standard (AES) - Near-square Transposition Function, Key Expansion [Text 1]	8

3	Public Key Cryptography - Principles of Public Key Cryptosystems, RSA Algorithm- Description of the Algorithm, Components, Advantages of RSA, Diffie-Hellman Key Exchange Algorithm, Key Exchange Protocols, Non-mu-Malleable Arms, ElGamal Cryptography-Analysis of ElGamal, Elliptic Curve Cryptography-Decryption, Security of Elliptic Curve Cryptography (Sec. 2)	3
4	Operating system security - security in the operating system, Security in the storage of the operating system. Network security - security requirements of networks, Reliability, and Integrity, Database diskmarks. Cloud security : Cloud Computing Concepts, Moving to the Cloud, Cloud Security Tools and Techniques, Cloud Security Management (Sec. II)	3

Current Assessment Method:
(ECE: 40 marks, EEE: 30 marks)

Continuous Internal Evaluation Marks (CIE):

Achievement	Scored By	Evaluation	Analysis	Total
x	10	10	10	40

Criteria for Evaluation (Dishonest and Analysis): 20 marks

To evaluate based on the input from student and analyse the performance of the algorithm

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one of 2 questions out of 4 given questions.

Part A	Part B	Total
<ul style="list-style-type: none"> + 1 Question from each module + Total no. of 2 Questions, with varying 2 marks (sec 1) - 14 marks 	<ul style="list-style-type: none"> + 2 questions will be given from each module, out of which 1 question would be selected. + Each question can have a maximum of 4 subquestions. + Each question carries 2 marks (140 = 14 marks) 	

Course Outcomes (COs)

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

Course Outcomes		Student's Knowledge Level (SL)
CO1	Apply concepts of mobile systems, wireless, range, location, reliability, QoS, and pilot channels.	SL1
CO2	Apply mathematical concepts related to location estimation, including Farnsworth and Pollard methods, to solve triangulation problems.	SL2
CO3	Describe various systems using models, including substation and transmission networks, as well as block diagrams like DBX and AT&T.	SL3
CO4	List the principles of public key cryptography, including RSA and Diffie-Hellman, and discuss their security aspects.	SL4
CO5	Identify the security requirements in operating systems and networks, and analyze their security strengths, risks, and identify management techniques.	SL5

SL: SL-Essential SL-Understand SL-Applies SL-Extends SL-Career

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1								1
CO2	1	1	1	1								1
CO3	1	1	1	1								1
CO4	1	1	1	1								1
CO5	1	1	1	1								1

Note: 1-Aligned, 2-Minimum Coverage, 3-Different Depth, 4-No Correlation

Text Books

Sl.No	Title of the Book	Name of the Author/s	Publisher/Editor	Edition and Year
1	Geography and Economic Survey: Description and Delineation	William Blakely	Prentice Hall	4th, 2007
2	Geography and Economic Survey	William A. Franklin	Tata McGraw-Hill	1st, 2011

Reference Books				
SL No.	Title of the Book	Name of the Author/s	Name of the Publisher	Volume and Type
1	Dictionary Nuclear Theory	D.A. Sivia & D.M. Walker	Springer UTM	1E, 2007
2	The Cambridge Reference: Mathematics, Statistics	Mark Kervin-Doherty	Cambridge U.P.	3E, 2003
3	Handbook of Complex Analysis: Boundary Complex Analysis - Part I and Beyond	Wlodek J. Armitage, Greg R. Wilmanski	Birkhauser-Boston	1E, 2003

Vista Lata OPTTEL, SW-AYAM..!	
Module No.	Task ID
1	log4j-vulnerability-CVE-2023-35476-exploit-malicious.jar
1	log4j-vulnerability-CVE-2023-35476-exploit-malicious.jar
1	log4j-vulnerability-CVE-2023-35476-exploit-malicious.jar
2	log4j-vulnerability-CVE-2023-35476-exploit-malicious.jar
4	log4j-vulnerability-CVE-2023-35476-exploit-malicious.jar
4	log4j-vulnerability-CVE-2023-35476-exploit-malicious.jar

SEMESTER SE
AI ALGORITHM LAB

(Common to CSE & ECE)

Center Code:	POC4E88T	CTE Marks:	19
Total Marks With (L+T+P)	193.0	ECT Marks:	19
Credit:	3	Exam Hours:	2 hrs. 30 min.
Prerequisites (if any):	None	Course Type:	Theoretical

Course Objectives:

1. To implement and evaluate search and game algorithms
2. To write programs for various optimization and interesting problems
3. To enable the learners to build and evaluate machine learning and logic systems.

Topic No	Topics
1	Implement basic search strategies (Search problem)
2	Implement various reinforcement learning and game algorithms
3	Implement A* Algorithm
4	Implement Min-Max algorithm for game playing (Eight-Queens problem)
5	Kahn's resource allocation problem
6	Implement Forward Checking Algorithm
7	Implement Naive Bayes Model
8	The airline scheduling problem, where the objective is to schedule flights to maximize revenue utilization while minimizing delays. Key factors include flight availability, crew schedules, and airport slot access. Constraints involve capacity, departure/arrival schedules, and airport regulations.
9	In a scheduling problem, variables are the flights or routes to be scheduled. Constraints include avoiding scheduling conflicts, ensuring that no two flights occur at the same time for a given aircraft and meeting crew availability. Decisive values are the crew slots and instances for each class.
10	Write a program to build and train a decision tree classifier using a library (e.g., scikit-learn). Predict the model using metrics such as accuracy and confusion matrix. Discuss programming logic, training process, and performance evaluation.
11	Implement a Genetic and rule-based optimization as constraint propagation techniques. Decisive function conditions are checked and keys for algorithm suitable for a valid solution.

	Describe assumptions of how the solver handles & stores solution problem. *
12	Develop a simple cipher system using a tool or language of your choice (e.g. Python, Python with an import statement library). Implement the system for a given problem and use implementation. *
13	Develop a program to calculate a given para tree using alpha-beta pruning. Take the expression $(1 \cdot 2 \cdot 3 \cdot 4 \cdot 1 \cdot 3 \cdot 4 \cdot 2)^{1/2} \cdot 5 \cdot 1 \cdot 2 \cdot 6$ of ADDITIVE values for the nodes at the root/leaf of 4 gtrs. Assume the branching factor is 2. MCN makes for 20 moves, and nodes are generated from right to left.
14	Implementation of Encrypted representation of reference. *
15	Implement local search algorithm for CSP. *
16	Implement travelling salesman problem. *

Course Assessment Matrix (ECE-31 marks, ECE-32 marks)

Continuous Internal Evaluation Matrix (CIE)

Assessment	Preparation Pre-Lab Work assignments Title and Thirdly completion of Lab Reports - Based (Continuous assessment)	Journal Examination	Total
3	12	18	30

End Semester Examination Matrix (ESE)

Finalized Preparation workheets/ Algorithms	Content of assignment Execution of work/ Individual/Teamwork Presentation	Results with valid Information/ Quoted/Original Output	Time marks	Scored	Total
12	12	12	24	6	30

- Submission of Record: Student shall be allowed for the end semester examination only after submitting the duly certified record.
- Deliberately External Examination: The student commits Act of Academic Misconduct

Course Outcomes (COs)

All the test of the course students should be able to:

Course Outcomes		Showy Knowledge Level (SKL)
CO1	Apply Search Algorithms to Solve Complex Problems	K3
CO2	Develop and Optimize Convolutional Networks	K3
CO3	Implement and Evaluate Various Learning Models	K3
CO4	Build and Test Deep Conv.	K3
CO5	Utilize Advanced Optimization Techniques	K3

Level: K1: Knowledge; K2: Understanding; K3: Application; K4: Evaluation; K5: Creation

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

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13
CO1	1	1	1										1
CO2	1	1	1										1
CO3	1	1	1										1
CO4	1	1	1										1
CO5	1	1	1										1

1: Digit 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 and Year
1	Introduction to AI and ML	Dan C. Patilkar	Prentice Hall	1st, 2007
1	An Introduction to Machine Learning	Kristen M. Kohavi and Ron Kohavi	Morgan Kaufmann	1st, 2011
3	An Introduction to Machine Learning Examples	Douglas Eckhardt	Packt	1st, 2011
4	An Introduction to Machine Learning	Pedro Domingos	Packt	1st, 2012

Value Lenses (POTEL, VRVAYAM...)

Module No	Data ID
1	https://www.fabriqsoft.com
2	https://www.kaggle.com/datasets
3	https://www.tensorflow.org
4	https://www.tensorflow.org/tutorials
5	https://www.tensorflow.org/tutorials

Continuous Assessment (25 Marks)

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

- Pre-Lab Assignments: Assessment of pre-lab assignments to gauge the level understanding of the upcoming experiments.
- Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background relevant to the experiments.

2. Conduct of Experiments (11 Marks)

- Procedure and Execution: Abilities to carryout procedures, accurate execution of experiments, and following safety protocols.
- Data Proficiency: Proficiency in handling equipment, accuracy in observations, and manipulating skills during the experiments.
- Troubleshooting and problem solving in group experiments.

3. Lab Reports and Record Keeping (7 Marks)

- Quality of Reports: Clarity, organization and accuracy of lab reports. Proper documentation of experiments, data and relevant conclusions.
- Theory Application: Ability to illustrate the relevance of experiments to appropriate theory and connecting it well beyond the course.

4. Viva Voce (3 Marks)

- Oral Examination: Ability to explain the experiments, results and underlying principles during viva voce sessions.

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

Evaluation Pattern for End Semester Examination (50 Marks)

1. Pre-exam Preliminary Walk-Through (10 Marks)

- Assessment Understanding and Organization: Skills in organizing the process and understanding task requirements.
- Preliminary Walk- and Planning Throughs: in planning and executing materials required.

- Algorithm Development: Correctness and efficiency of the algorithm adopted in the organization.
- Creativity and ingenuity displayed in algorithmic design.

3. Conduct of Experiments: Execution of Work Preparation (12 Marks)

- Accuracy and Efficiency: Degree upto which accuracy and efficiency of the experiment or programme work.

4. Results with Valid Inferences: Validity of Outputs (10 Marks)

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

4. Write Up (10 Marks)

- Ability to explain the experiments, precision, results and answer to related questions
- Effectiveness in answering questions related to theoretical and practical aspects of the subject

5. Record (7 Marks)

- Completeness, validity and accuracy of the data record submitted.

SEMESTER SE
MACHINE LEARNING LAB

(Concurrent to CCA)

Course Code:	DOCSL700	CCE Marks:	III
Teaching Hours/Week (L T P R S)	0 0 3 0	EST Marks:	III
Credit:	3	Exam Marks:	3 hrs. 20 min.
Prerequisites (if any):	None	Course Type:	Lec

Course Objectives:

- To give the learner a practical experience of the various machine learning techniques and be able to demonstrate them using a language of choice.

Exp. No.	Topic/Task
1	<p>Implement linear regression with one variable on the California Housing dataset to predict housing prices based on a single feature (e.g., the average number of rooms per dwelling). Tasks:</p> <ul style="list-style-type: none"> + Load and preprocess the dataset. + Implement linear regression by using both gradient descent and the normal equation. + Evaluate the model performance using metrics such as Mean Squared Error (MSE) and R-squared. + Visualize the fitted line along with the data points.
2	<p>Implement polynomial regression on the Auto MPG dataset to predict miles per gallon (MPG) based on engine displacement. Compare polynomial regression models with linear regression.</p> <p>Tasks:</p> <ul style="list-style-type: none"> + Load and preprocess the dataset. + Implement polynomial regression of varying degrees. + Compare the polynomial regression models with linear regression using metrics such as MSE and R-squared. + Visualize the polynomial fit.
3	<p>Implement Ridge and Lasso regression on the Boston dataset. Compare the performance of these regularization methods with standard linear regression.</p> <p>Tasks:</p>

	<ul style="list-style-type: none"> • Load and preprocess the dataset • Implement Ridge and Lasso regression • Use Ridge regression using cross-validation • Compare performance metrics (MSE, R-squared) with standard linear regression <p>Evaluate the performance of a logistic regression model using MLE and MAP with the Diabetic Disease dataset. Compare the results and discuss the effects of regularization.</p> <p>Tasks:</p> <ul style="list-style-type: none"> • Load and preprocess the dataset • Implement logistic regression with MLE • Apply MAP estimator with different regularization parameters (L1 and L2 regularizations) • Compare the performance and parameter estimates with MLE and MAP
4	<p>Load LDA and HLLD to measure the presence of a multicollinearity variables on the 10 Wisconsin dataset. Explore the impact of different priors on the posterior.</p> <p>Tasks:</p> <ul style="list-style-type: none"> • Load and preprocess the dataset • Implement LDA for multicollinearity variables detection • Apply HLLD estimator with various prior (e.g., Dirichlet prior) • Compare results and evaluate the effect of different priors
5	<p>Implement a logistic regression model to predict the likelihood of a disease using the Pima Indians Diabetes dataset. Compare the performance with and without feature scaling.</p> <p>Tasks:</p> <ul style="list-style-type: none"> • Load and preprocess the Pima Indians Diabetes dataset • Implement logistic regression for binary classification • Evaluate model performance with and without feature scaling • Analyze metrics such as accuracy, precision, recall, and F1 score
6	<p>Implement a Naive Bayes classifier to segregate the documents into topics using the 20 Newsgroup dataset. Compare the performance of Multinomial Naive Bayes with Bernoulli Naive Bayes.</p> <p>Tasks:</p> <ul style="list-style-type: none"> • Load and preprocess the 20 Newsgroup dataset • Implement Multinomial Naive Bayes and Bernoulli Naive Bayes classifiers • Evaluate and compare the performance of both models using metrics such as accuracy and F1 score • Discuss the concepts and weaknesses of each Naive Bayes variant for text classification

	<p>Implement the K-Nearest Neighbors (KNN) algorithm for image classification using the Tuftsion MNIST dataset. Experiment with different values of K, and analyze their impact on model performance.</p> <p>Tasks:</p> <ul style="list-style-type: none"> + Load and preprocess the Tuftsion MNIST dataset. + Implement KNN for multiclass classification. + Experiment with different values of K and evaluate performance. + Discuss the impact of different K values on model accuracy and computational efficiency.
8	<p>Implement a Decision Tree classifier using the ID3 algorithm to separate customers based on their purchasing behavior using the Online Retail dataset. Analyze the tree structure and discuss the feature importance.</p> <p>Tasks:</p> <ul style="list-style-type: none"> + Load and preprocess the Online Retail dataset. + Implement Decision Tree using the ID3 algorithm. + Visualize the decision tree and analyze feature importance. + Discuss how tree structure helps in understanding customer behavior.
9	<p>Implement and compare Logistic Regression and Decision Tree on the ADA Income dataset for predicting income levels. Evaluate both models based on performance metrics and interpretability.</p> <p>Tasks:</p> <ul style="list-style-type: none"> + Load and preprocess the ADA Income dataset. + Implement both Logistic Regression and Decision Tree. + Compare the models based on metrics such as accuracy, precision, recall, and F1 score. + Discuss the interpretability of both models and their suitability for the dataset.
10	<p>Implement a Linear Support Vector Machine (SVM) to classify the Iris dataset. Visualize the decision boundary and distances from the margin to different classes.</p> <p>Tasks:</p> <ul style="list-style-type: none"> + Load and preprocess the Iris dataset. + Implement a Linear SVM for binary classification (e.g., class 0 vs. class 1 or 0 vs. class 2). + Visualize the decision boundary and margin. + Discuss the concept of the margin and how it influences classification.
11	<p>Implement and compare the performance of SVM classifiers with linear, polynomial, and RBF kernels on the Tuftsion MNIST dataset. Analyze the advantages and disadvantages of each kernel type.</p>

	<p>Data:</p> <ul style="list-style-type: none"> + Load and preprocess the Fashion MNIST dataset. + Implement a DNN with linear, polynomial, and RBF losses. + Compare the classification performance for each kernel. + Discuss the strengths and weaknesses of each kernel type.
	<p>Implementation: Implement and run a Multilayer Feed-Forward Network (MLP) on the Wine Quality dataset. Experiments with different numbers of hidden layers and neurons, and discuss how these choices affect the network's performance.</p> <p>Data:</p> <ul style="list-style-type: none"> + Load and preprocess the Wine Quality dataset. + Design and implement an MLP with varying architectures (different hidden layers and neurons). + Train and evaluate the networks. + Discuss the impact of performance choices on performance.
	<p>Implementation: Implement and compare the performance of a neural network using different activation functions (Sigmoid, ReLU, Tanh) on the Iris-ELT dataset. Analyze how each activation function affects the training process and classification accuracy.</p> <p>Data:</p> <ul style="list-style-type: none"> + Load and preprocess the Iris-ELT dataset. + Implement neural networks using Sigmoid, ReLU, and Tanh activation functions. + Train and evaluate each network. + Compare training progress, convergence, and classification accuracy.
	<p>Implementation: Implement and perform hyperparameter tuning for a neural network on the Fashion MNIST dataset. Experiments with different learning rates, batch sizes, and epochs, and discuss the impact on model performance.</p> <p>Data:</p> <ul style="list-style-type: none"> + Load and preprocess the Fashion MNIST dataset. + Experiments with different hyperparameters (learning rate, batch size, epochs). + Train and evaluate the networks. + Discuss how hyperparameter choices affect model performance.
	<p>Implementation: Implement and compare hierarchical (supervised) and partitioned (K-means clustering) algorithms on the Iris-Clusters dataset. Discuss the strengths and weaknesses of each method based on clustering results and evaluation metrics.</p> <p>Data:</p> <ul style="list-style-type: none"> + Load and preprocess the Iris Clusters dataset. + Apply both hierarchical (supervised) and K-means clustering. + Compare results using metrics such as inertia, silhouette score, and clustering

	<p>Challenges:</p> <ul style="list-style-type: none"> + Discuss the strengths and disadvantages of each clustering method. <p>Implement and apply K-means clustering to the Digits dataset. Experiment with different numbers of clusters and visualize the clustering results using methods such as inertia and silhouette score. Analyze the choice of K for the clustering performance.</p> <p>Data:</p> <ul style="list-style-type: none"> + Load and preprocess the Digits dataset. + Implement K-means clustering with various numbers of clusters. + Evaluate clustering performance using inertia and silhouette score. + Analyze the impact of the number of clusters on clustering quality.
17	<p>Implement k-nearest-neighbor and cross-validation on the Iris dataset. Compare the model performance metrics (e.g., accuracy, F1-score) obtained using these learning methods. Discuss the advantages and disadvantages of each method.</p> <p>Data:</p> <ul style="list-style-type: none"> + Load and preprocess the Iris dataset. + Implement k-nearest-neighbor using multiple samples and evaluate the model. + Implement k-nearest-neighbor and evaluate the model. + Compare the performance metrics and discuss the pros and cons of each learning method.
18	<p>Implement bagging and boosting ensemble methods on the Wine dataset. Compare the performance of both methods in terms of accuracy, precision, recall, and F1-score. Discuss how each method improves model performance and their impacts on strengths and weaknesses.</p> <p>Data:</p> <ul style="list-style-type: none"> + Load and preprocess the Wine dataset. + Implement bagging using a base classifier (e.g., decision tree) and evaluate performance. + Implement boosting using a boosting algorithm (e.g., AdaBoost) and evaluate performance. + Compare performance metrics and discuss the strengths and weaknesses of each method.
19	<p>Investigate the non-linear models using polynomial regression on the Boston Housing dataset. Plot the training and validation curves for various polynomial degrees and discuss the model's performance and variance.</p> <p>Data:</p> <ul style="list-style-type: none"> + Load and preprocess the Boston Housing dataset. + Implement polynomial regression with varying degrees.

- | | |
|--|--|
| | <ul style="list-style-type: none"> • Documenting and validating results to mark degree • Document time-schedule (allowable) and no impact on teach's performance |
|--|--|

Course Assessment Matrix

(CIE: 10 marks, EIE: 10 marks)

Continuous Internal Evaluation Matrix (CIE):

Assessments	Proportion Pre-Lab Work assignments		Journal Documentation	Total
	Written Test	Completion of Lab Report (Based on Continuous Assessment)		
A	B	C	D	E

End Semester Examination Matrix (ESE):

Question	Content of assignment	Scored with valid	Pre test	Scored	Total
Q1	Q2	Q3	Q4	Q5	Q6

* Submission of Answer Scripts must be allowed for the end semester examination by up to submitting the analysis of the research.

+ END SEMESTER EXAMINATION MARKS: 75% (CIE) + 25% (ESE) = 100% (Total Marks)

Course Outcomes (COs)

Each CO of the course needs to be able to:

Course Outcome	Bloom's Knowledge Level (KL)
CO1: Understand workings of Machine Learning algorithms and their limitations.	K2
CO2: Understand various metrics in data analysis/dimensionality computing.	K2
CO3: Apply various Machine Learning algorithms in practice and interpret their results.	K2
CO4: Perform experiments in Machine Learning using real world data.	K3

Page 21, Assessment 12- Universality, 21- Appl., 22- analyse, 23- Evaluate, 24- Create

KO-KO Mapping (Mapping of Course Outcomes with Program Outcomes)

	KO1	KO2	KO3	KO4	KO5	KO6	KO7	KO8	KO9	KO10	KO11	KO12
CO1	1	2	1	2								1
CO2	1	1	1	2								1
CO3	1	1	1	1								1
CO4	1	1	1	1								1

/ Right Click on 1. Moderate (Moderate), 2. Enhanced (Mod) - 3. Critical

Text Books				
SL.No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Introduction to Machine Learning	Bishop, Christopher M.	MIT Press	4/e, 2006
2	Machine Learning using Python	高尚峰, 李航	清华大学出版社	1/e, 2013
3	Machine Learning: Theory and Practice	Yishay Mansour, Y.L. Singer	Oxford University Press	1/e, 2004

Reference Books				
SL.No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Data Mining and Analysis: Practical Concepts and Algorithms	Abraham J. Zdziarski, Przemyslaw Włodarczyk	Cambridge University Press	1/e, 2013
2	Visual Cryptography Techniques	Christopher Kudla	Oxford University Press	1/e, 1998

Value Lenses (SOTEL, SWAVAM...)	
No.	Link ID
1	https://www.sotelsite.in/resource/1001001001001012
2	https://www.sotelsite.in/resource/1001001001001013
3	https://www.sotelsite.in/resource/1001001001001014

Continuous Assessment (25 Marks)

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

- Pre-Lab Assignments: Assessment of pre-lab assignments to evaluate individual understanding of the upcoming experiments.
- Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background relevant to the experiments.

2. Conduct of Experiments (7 Marks)

- Procedure and Execution: Adherence to stated procedures during execution of experiments and following safety protocols.
- Self-Reflection: Proficiency in handling equipment, accuracy in observations, and communication skills during the experiments.
- Teamwork: Collaboration and giving/seeking advice in group experiments.

3. Lab Reports and Record Keeping (8 Marks)

- Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data and relevant conclusions.
- Team Collaboration: Adherence to conditions for submitting the report as required and maintaining a well-organized file folder.

4. Final Exam (3 Marks)

- Oral Examination: Ability to explain the experiments, results and underlying principles during a one-hour session.

Final Marks Assignment: The final marks for preparation, conduct of experiments, lab and record keeping average of all the specified experiments in the syllabus.

Evaluation Patterns for End Semester Examination (20 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 the available equipment.
- Algorithm Design: Completeness and efficiency of the algorithm related to the experiments.
- Creativity and logic in algorithm or experimental design.

1. Content of Experiments: Execution of Work Programming (12 Marks)

- Design and Execution: Planning and execution execution of the experiments by programming tools.

2. Results with Valid Inferences (Quality of Output) (12 Marks)

- Accuracy of Results: Precision and consistency of the experimental results.

- Analysis and Interpretation: Validity of inferences drawn from the experiments in quality of program output.

3. Work Value (10 Marks)

- Ability to explain the experiments, precision results and answer related questions

- Ability to answer questions related to theoretical and practical aspects of the subject

4. Standard (4 Marks)

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

SEMESTER 6

**COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE)**

SEMESTER-SM
AGENT-BASED INTELLIGENT SYSTEMS

Course Code	LOCATION	CSE Major	SL.
Teaching Hours/Week (L.T.P.R)	81.00	BEE Major	40
Credits	4	Exam Hours	1 Hrs. 20 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. Enabled problem solving techniques and coordination in multi-agent systems To teach the representation formulation of agents and multi agent systems
2. To equip students in developing systems that make informed and adaptive decisions
3. To impart the knowledge of how agents collaborate, negotiate and exchange their inputs.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction: Definitions, Foundations, Agent, Intelligent Agents, Problem Solving, Reasoning, Inference, Common sense Knowledge, Perception, Planning.	12
2	Knowledge representation and reasoning: Logical agents, Fuzzy logic, Rule, Order Inference, Causality, Dynamic Decision Processes, Knowledge Representation: Objects, Actions, Events.	12
3	Planning Agents: Planning Problem, State Space Search, Partial Order Planning, Heuristic Search, Replanning, Constraint Planning, unification Planning, Multiagent Planning.	12
4	Agents And Uncertainty: Acting under uncertainty, Probability Measures, Bayes Rule and von Neumann Stability, Other approaches, Time and Uncertainty, Temporal Models, Utility Theory, Decision Networks, Cognitive Dissonance	12
5	Mixed Level Agents: Sociology in Learning, Reference Information, Statistical Learning Methods, Reinforcement Learning, Communication, Formal Grammar, Augmented Grammars, Games of AI	12

Course Assessment Method
ATB: 40 marks (ESE: 10 marks)

Continuous Internal Evaluation Marks (CIE):

Assessments	Assignment Management	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Total
7	12	8	10	47

End Semester Examination Marks (ESE):

In Year 1, all questions need to be answered and in Year 2, mark allocation per question may vary per question.

Part A	Part B	Total
<ul style="list-style-type: none"> * 2 Questions from each module. * Total of 8 Questions, each carrying 2 marks (Total = 16 marks) 	<ul style="list-style-type: none"> * Each question carries 2 marks. * Two questions will be given from each module, one of which 1 question should be answered. * Each question can have a maximum of 2 sub/questions. <p style="text-align: center;">(Total = 16 marks)</p>	48

Course Outcome (COs):

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

	Course Outcome:	Bloom's Knowledge Level (BKL)
CO1	Define the objectives, formulation of open and multi open systems	EL1
CO2	Explain financial foundations of open based system	EL1
CO3	Apply Bayesian statistics for probabilistic reasoning	EL2
CO4	De-legal open for benefit things with the anti-logic	EL3

Score: EL1: Understanding; EL2: Applying; EL3: Analysing; EL4: Evaluating; EL5: Creating

EII-III Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
OOR	1	2	3									4
ODO	1	3	3									3
ODP	1	3	3									3
ODH	1	3	3									3

Note : 1. Digit (Digit), 2. Matrix (Matrix), 3. Substitution (Sub), - No Correlation.

Text Books

M. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Artificial Intelligence : A Modern Approach	John McCarthy and Peter Norvig	Prentice Hall	4th, 2017
2	An Introduction to Multi-Agent Systems	Holger Klockeberg	Elsevier	2nd, 2009.

Reference Books

M. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Artificial Intelligence	Winston, Hornbeam	Prentice Hall	2nd, 2001

Video Links (NETEL, SRM VASU...)

Module No.	Link ID
1	Artificial Intelligence, Representation and Reasoning: ITI Notes
2	Artificial Intelligence: AI Agents
3	Learn AI Agents

SEMESTER-SIX
ROBOTICS AND AUTOMATION

Crone/Credit:	300	CIE Marks:	40
Teaching Hours/Week (L.T.P.R)	100.0	ECE Marks:	60
Credits:	3	Exam Hours:	1 hrs. 30 min
Prerequisites/Assess:	None	Course Type:	Theory

Course Objectives:

- To enable the students to understand the characteristics of Sensors and the working of various sensors in various environments.
- To teach how robots use various sensors to perceive their environment, techniques for processing sensor data for analysis and methods for dividing an image into meaningful regions or objects to simplify analysis.
- To enable students understand the position and orientation of Robots, its kinematics and various end-effector mounting mechanism.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to sensors - Degrees of freedom, Linkages, Kinematics Analysis of a robotic manipulator-links joint, actuators, sensors, servos, Robot configurations (F/F, G/F, H/F, K/F). Robot velocities defined, Legend, wrist plates, end-effector plates, motion under plates. Dynamic characteristics of serial of robots, local trajectory equality & equal of segment length in robot effector - mechanical gripper, special tools, Magnetic gripper, Vacuum gripper, adhesive gripper, Arctic and Bubble gripper. Links in robotics - 2 more applications of robots.	8
2	Sensors, actuators and Control: Sensor classification: touch, heat, pressure, colour, passive, Inertial sensor, Position sensor, Velocity sensor, Acceleration sensor, force sensor, Robot sensor, sensor types, sensor types: Digital Camera - CCD camera - CMOS camera - Differential sensor, laser measurement, Actuators - DC Motors - H-Bridge - Pulse Width Modulation - Stepper Motors - Servos, Relays &	8

	prerequisite activities	
3.	Subtopic Vision: Setting, Preprocessing, Segmentation, Object Detection, Camera based binocular matching, Representation of Transformations - Application of a Pose Estimation ... Data Sources about an issue - Camera calibrations - Binocular Stereo - Relative to its Setting Frame, Basic understanding of Differential-Delta Visual-Motion-Blur, Degrees of mobility - Different sensor configurations, Inertial and non-inertial sensors - Dead-reckoned Model Mobile Robots	9
4.	Feature and descriptor - Representing visual process. Issues of feature extraction, Feature Localisation, Challenges in localisation - Continuous representation - Discrete spatial strategy - Global strategies & map representation. Feature-based registration (orb, SIFT method), Autoregression map building, Simultaneous localisation and mapping (SLAM) - Mathematical solutions and various types of SLAM - Data Planning: Depth aware, incremental pose aware, - Inverse frame aware - depth aware - Distance + algorithm, A*, D* algorithm, Potential Field based path planning, Dynamic window approach, Hyperplane Adjustment - Visibility for navigation and planning - Central localisation	9

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

Continuous Internal Evaluation Marks (CIE)

Achievements	Assignment/Project work	Internal Examination-I (Written)	Internal Examination-II (Written)	Total
9	12	31	31	46

Edu-Answers Questions Matrix (EAM)

In Term A, all questions need to be answered and in Term B, mark student responses by the full question number of your answers.

Term A	Term B	Total
<ul style="list-style-type: none"> + 2 Questions from each module. + Total of 6 Questions, each marking 2 marks <p>(Total = 12 marks)</p>	<ul style="list-style-type: none"> + Each question requires 2 marks. + Two questions will be given from each module, one which 1 question should be answered. + Each question can have a maximum of 2 additional marks. <p>(Total = 12 marks)</p>	48

Course Outcomes (COs)

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

	Course Outcomes	Elementary Knowledge Level (EKL)
CO1	Explain the concepts of manipulation and multidimensional.	E1
CO2	Choose the suitable measure, measures and context for their usage.	E2
CO3	Develop different models of analytic roles and dimensions, context, reuse, redesign.	E3
CO4	Apply the visualization and mapping methods in analysis.	E3
CO5	Plan the goals and appropriate alternatives by applying an efficient multidimensional algorithms.	E3

Term E1 - Elementary, E2 - Intermediate, E3 - expert, E4 - advanced, E5 - Excellent, E6 - Competent

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

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

Note : 1-Algebra Guru, 2- Discrete Mathematics, 3- Advanced Algebra, 4- Linear Computation

Text Books				
M. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Introduction to Information Model Systems	R. Sivaprasadarao, M. Nagabhushanam, D. Venkateswaran	MIT Press, USA	Dec, 2011
2	Enterprise Systems, Models, System Design and Applications with Fuzzy-based Systems	Thomas Seidel	Springer	Dec, 2006
3	Introduction to Mobile Systems Control	S. S. Tarkeshwar	Springer	Oct, 2014
4	Artificial Intelligence for Engineers	Frederick J. Gerosa	Book Publishing	July, 2012
5	Introduction to Relational Database Concepts Applications	Joseph R. Milewski	Wiley	Dec, 2011
6	Technology, Programming and Application	Mark R. Charnes	McGraw-Hill Education	Dec, 2017

Reference Books				
M. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Introduction to Database	John F. Dugay	Prentice Hall Pearson Int. Asia	Dec, 2006
2	Introduction to Database	E. E. Kalnay	TAIPEI McGraw-Hill Education	Dec, 2013
3	Relational, View and Object, Representations, Operations in DBMS	Steve Chaitin	Springer-Verlag Berlin Heidelberg	Dec, 2001

Video Links (SITTEL, SWAYAM...)	
Module No.	Link
1, 2, 3, 4	https://www.sititel.org/applications/module_10/ https://www.sititel.org/applications/module_10/ https://www.sititel.org/applications/module_10/

SEMESTER-SM

SOFTWARE TESTING

(Common to CSE/CIV/CH/CE/GR/ANALYST)

Course Code:	EC2203	CH Marks:	40
Teaching Hours/Wk:	3.00.0	EIE Marks:	10
Credits:	3	Exam Marks:	3 Day/Online
Prerequisites (if any):	None	Course Type:	Theory

Course Objectives:

1. To Develop proficiency in software testing methodologies and techniques.
2. To Familiarize in software testing tools and technologies.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	<p>Introduction to Software Testing & Automation -</p> <p>Introduction to Software Testing - Concepts, importance of testing, software quality, and measurement indices (e.g., success %, Threats etc),</p> <p>Software Testing Process - Levels of testing in testing, Testing Techniques - Verification, validation, black box, white box, test cases and coverage criteria, Types of Testing - Unit, Integration, System, Acceptance, Performance, stress, stability, regression, and Security Testing, Industry Trends - AI in software engineering, Introduction to Test Automation, Testing Methods - Black-Box, White-Box, and Gray-Box Testing, Automation in Testing - Introduction to automation tools (e.g., Selenium, Cypress, Chai, One Test), Automation of Unit Testing and Mutation Testing using JUnit.</p>	4
2	<p>Unit Testing, Mutation Testing & Coverage Analysis -</p> <p>Unit Testing-Static and Dynamic Unit Testing, control flow testing, decision testing, domain testing, Mutation Testing- Mutation operators, mutation measures static and dynamic measures among them (e.g., Hamming), End-to-end Testing - Automation of End-to-end, Functional Testing or end-to-end process, AI in Testing - Quantitative measures</p>	4

	<p>generations and epigenetics, legal or insurance, literary texts - application of AI-driven testing tools in insurance and probate testing. Case Study - Insurance testing using Risk Assessment test case insurance.</p>	
3	<p>Advanced White Box Testing & Security Testing: Graph Coverage Criteria - Node, edge, and path coverage, power path and control flow coverage. Test Flow Criteria - In paths, subsumption relationships. Graph Coverage for Code - Control flow graphs (CFG) for complex programs (e.g., loops, recurrences). Graph Coverage for Design Diagrams - Call graphs, class inheritance testing, and coupling class coverage. Security Testing - Fundamentals, tools (OWASP, Kali Linux), and their role in protecting modern applications. Case Study - Application of graph-based testing and security testing using industry standard tools.</p>	18
4	<p>Black Box Testing, Grey Box Testing, and Regression Testing: White Box Testing - Open spec partitioning, domain testing, Reduced testing (partitioned class partitioning, boundary value analysis, decision tables, random testing). Grey Box Testing - Teststructure, strategies, and methodologies (unit testing, regression testing, integrated unit testing). Performance Testing - Stress, latency testing, memory manageability, response testing across multiple drivers (e.g., NetworkLink, LoadRunner); Introduction to PCI - Systemic validation, performance and cost testing, systematic review tests, and their applications. Overall is Testing - Advanced use cases for predicate and response testing across access and measurements. Case Study - Implementation of Machine, proxy-based, and response testing using PDD and Q3Driver tools.</p>	18

COURSE ASSESSMENT Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Assessment	Assignment / Major project	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Total
4	24	20	22	66

End-Session Examination Matrix (EAM)

In Term 4, all questions need to be answered and in Term 5 each student can choose any two full questions out of four questions.

Part A:	Part B:	Total:
<ul style="list-style-type: none"> • 2 Questions based on: - recall; • Total of 3 Questions worth varying 1 marks <p>(Total = 3 marks)</p>	<ul style="list-style-type: none"> • Each question carries 2 marks • Two questions will be given from each module; one of which 1 question should be answered • Each question can have a maximum of 2 sub-tasks <p>Mark = 10 marks</p>	13

Course Outcomes (COs)

All the COs are assessed via the end-of-unit tasks as follows:

Course Outcomes	Student's Knowledge Level (KL)
CO1 Demonstrate the ability to apply a range of different pricing strategies including unit pricing using FIFO and summation rule's.	KL1
CO2 Evaluate using appropriate tools the minimum selling method for a given place of sale & identify values of loss that can't be recovered using other pricing methods.	KL2
CO3 Apply and apply graph analysis methods in terms of general linear and data from graphs to improve sales quality.	KL2
CO4 Demonstrate the importance of Mathematics application in terms of Demand and Personnel Training.	KL3
CO5 Evaluate the importance of security, compatibility, and performance among various devices.	KL3
CO6 Use assessment tools like SWOT to problem solveable resources and opinions for case presentation and also to usage AI tools for automated tool case presentation and automated communication with EAM.	KL3

Spec: E1-Example; E2-Understand; E3-apply; E4-analyse; E5-Evaluate; E6-Creat

EII_011 Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	EII_001	EII_002	EII_003	EII_004	EII_005	EII_006	EII_007	EII_008	EII_009	EII_010	EII_011	EII_012
CO1	3	3	4									3
CO2	3	3	3	3	3							3
CO3	3	3	4									3
CO4	3	3	3	3								3
CO5	3	3	3		3							3
CO6	3	3	4	3	3							3

Data: 1 Digit (Zero), 2 Alphabets (Without), 3 Alphanumeric digits, - No Correlation

Text Books

SL. No.	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Introduction to Software Testing	Paul Ammann, Jeff Offutt	Cambridge University Press	2/e, 2008
2	Software Testing and Quality Assurance: Theory and Practice	Kishmira Nall, Michael J. Repay	Wiley	1/e, 2004

Reference Books

SL. No.	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Software Testing	Tim Stueben	Prentice	2/e, 2001
2	Software Testing: A Craftsman's Approach	Paul C. Jorgensen	IEEE Press	4/e, 2007
3	Foundations of Software Testing	David R. Gries, Ken Bokov, and van Vliet	Cengage	4/e, 2011
4	The Art of Software Testing	Gerald M. Weinberg, Tom D'Silva, Gerry Weinberg	Wiley	2/e, 2011

Video Links (NETTEL_PP4VAM_1)

Message No.	Link ID
1	https://www.vrypalais.com/www/126126100001141
2	https://www.vrypalais.com/www/126126100001141
3	https://www.vrypalais.com/www/126126100001141
4	https://www.vrypalais.com/www/126126100001141

SEMESTER 56
INTRODUCTION TO BUSINESS ANALYTICS

Course Code:	PECATH	CIE Marks:	40
Teaching Hours/Week (L-T-P-R)	3-0-0-3	EEE Major:	60
Credit:	3	Exam Marks:	1. Dis- 10. Min
Prerequisites/Tags:	None	Course Type:	Theory

Course Objectives:

1. To enable the students to use business analytics to formulate and solve business problems and to support managerial decision making.
2. To make the students familiarize the process involved in developing, report and analysis business data.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Business Analytics : Overview, Steps, Models, Problem Solving with Analytics Descriptive Analytics : Data Visualisation, Measures without the communing data - Frequency distribution for categorical and numerical data. Histogram, Cumulative relative frequency, Measures of quality. Descriptive Statistical Measures: mean, median, mode, range, interquartile range, variance, standard deviation, correlation, covariance.	8
2	Probability Distributions : Basic concepts of probability, Random Variables and Probability distributions. Discrete Distributions: Binomial, Poisson, Continuous Probability Distributions: Uniform, Normal, Standard Inference - 1) Business testing procedure; Two Tailed Test of Hypotheses for An One, Two Sample Data for Differences in Means	8
3	Predictive : Modeling relationships and trends in data, Predicting future events based on data, Simple Regression and Correlation Analysis. Estimation using the regression line. Correlation Analysis, Multiple Regression, Tools for model building regression model, The F-test of a Multiple Regression model.	8

4	Transportation - Linear Programming Problem, Formulation, Graphical solutions, Simplex method, Revised Simplex method and Sensitivity Analysis, Transportation Problem, Formulation and solution, Assignment Problem, Formulation and solution.	8
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Course Assessment Method:
(CB = 40 marks, CA = 16 marks)

Continuous Internal Examination Marks (CIE):

Activities	Anticipated Management	Internal Examination-I (Written)	Internal Examination-II (Written)	Total
4	16	12	12	40

End Semester Examination Marks (ESM):

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

Part A	Part B	Total
<ul style="list-style-type: none"> + 2 Questions from each module + Total of 2 Questions, each carrying 3 marks <p align="center">(12+12=24 marks)</p>	<ul style="list-style-type: none"> Each question carries 2 marks. Two questions will be given from each module, one of which 1 question should be answered. Each question can have a maximum of 3 sub-questions. <p align="center">14+14=28 marks</p>	42

Course Outcomes (COs)

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

Course Outcomes		Student's Knowledge Level (SKL)
CO1	Apply statistical methods and data visualization techniques to explore unstructured and structured large datasets.	SK1
CO2	Apply probability, descriptive statistics to model business processes and scenarios.	SK2
CO3	Build and validate predictive models using regression analysis and other statistical techniques to forecast trends, identify patterns, and support business planning.	SK3
CO4	Formulate and solve optimization problems using linear programming and other quantitative methods.	SK1

Ref: IC-Business; IS-Data and IS-App; PA-Project; ES-Database; PV-Credit

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3		1						1	
CO2	4	1	2		1						2	
CO3	1	1	3		1						2	
CO4	1	1	3		1						2	

Note: 1-Alphabetic, 2-Distinctive, 3-Substantive, 4-Extensive, 5-Comprehensive

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Business Analytics	James R. Evans	Pearson Education Limited	5/e, 2017

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Complex Business Statistics	Amrit D. Jaiswal and J. Sambasiva Rao	Tata McGraw Hill	6/e, 2004
2	Operations Research: Applications and Algorithms	Ronald L. Winston	Duxbury Press	4/e, 2004

Video Links (PTEL, SWAYAM...)

Module No.	Link ID
1	Business Analytics For Management Decision https://lnkd.in/eCwzJg
2	Business Intelligence & Analytics https://lnkd.in/eCwzJg
3	Business Intelligence & Analytics https://lnkd.in/eCwzJg
4	Business Intelligence & Analytics https://lnkd.in/eCwzJg

SEMESTER-SM
AI FOR CYBER SECURITY

Course Code:	PECATH00	CIE Marks:	40
Teaching Hours/Week (L-T-O-R)	2-0-0-2	ECE Marks:	60
Credit:	3	Exam Hours:	1 hrs. 10 min
Prerequisites (if any):	POCAT001	Course Type:	Theory

Course Objectives:

1. To explore AI techniques for enhancing cybersecurity.
2. To develop/Choose security solutions for threat detection and response.
3. To identify and mitigate AI-specific security risks and vulnerabilities.
4. To design AI tools with existing security infrastructures.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	<p>Introduction to AI and Cybersecurity :-</p> <p>Introduction to AI - Definition and types of AI under AI in general educational context and evolution of AI. Basics of Machine Learning - Supervised learning, regression and classification. Unsupervised learning, clustering and Reinforcement learning. Implementations, basic and applications. Key Concepts and Terminology - Algorithms, models, and metrics. Overfitting and underfitting. Applications of AI in Cybersecurity - Case Studies. Examples of AI in malicious cybersecurity applications. Benefits and Limitations.</p>	3
2	<p>AI Techniques for Security :-</p> <p>Machine Learning - Techniques and Algorithms. Statistical methods for anomaly detection. Machine learning models. Isolation Forest, One-Class SVM etc. Deep Intelligence and Predictive-DNA. Detection and Denaturing. Outlayer and progression. Data mining, feature extraction and indexing. Predictive Analytics - Building and training predict</p>	3

	<p>modus der Denkt Ressourcen-Daten werden an diese verfügbaren systeme übertragen; Analyse-Techniken - Schwerpunkt prüfung und genau eingründen; Analyse von real systemen funktionieren nicht voraussichtlich</p>	
3	<p>Evaluating AI Security Weakness: Designing (versus) Defense Systems (D2D): D2D-type verhindern kann ist-hazard-Vorpräfung AI entgegen die zulässige Anwendung, Auswirkung Denkt Ressourcen-Nutzung - Designen strategisch und automatisches rechtliche-Urteile mit dem relevanten system; Designen von Design-Sicherheit, Testen; Integrative Technologie-Entwicklung AI entgegen mit beginnender technischer, Wissens- integrität und effizienzorientierter, Denkt Methoden</p>	15
4	<p>Addressing AI Systemic Risks and Future Trends: AI security, Risiko - AI-Kognitiv-Modelle: technologien und strategische Modelle prüfen und das priority machen: Mitigung AI Security Risiko; Designen von Real-Systemen - Integrierte für addressing AI-systems gegen unterschiedliche modus-Daten präsentiert und nach validieren strategische- Future Trends und Designing Technologie- Designing Technologie: Langlebigkeitsmaß in AI und cybersicherheit, Future directions und research areas, Design of new technologien er optimierung</p>	15

Critical Assessment Method (240- 40 min, ELL, 40 min)

Critical Assessment Internal Evaluation Matrix (CAIM)

Ausprägung	Ansprüche/ Mängelgrößen	Internal Evaluation-1 (Risiken)	Internal Evaluation-2 (Risiken)	Total
4	14	18	18	48

End Semester Examination Marks (EAM)

In Term A, all questions need to be answered and in Term B, marks below the scores may be full marks out of four questions.

Term A	Term B	Total
<ul style="list-style-type: none"> a. 4 Questions from each module. b. Total of 12 Questions, each carrying 2 marks (Total = 24 marks) 	<ul style="list-style-type: none"> a. Each question carries 2 marks. b. Two questions will be given from each module, but at least 1 question should be answered. c. Each question can have a maximum of 2 additional marks. 	(Total = 24 marks)

Course Outcomes (COs)

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

Course Outcomes	Student's Knowledge Level (KL)
CO1 Identify the use of AI concepts and machine learning techniques that can be used in system security	K1
CO2 Apply AI for threat detection and vulnerability assessments	K2
CO3 Implement and use various machine learning algorithms	K2
CO4 Apply AI driven security tools and solutions for data security	K3

Note: K1 - Knowledge; K2 - Understanding; K3 - Apply; K4 - Analyse; K5 - Evaluate; K6 - Create

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

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
CO1	1	1										1
CO2	1	1	3									1
CO3	2	2										2
CO4	2	2	2		1							2

Note: 1 - Align, 2 - Underline, 3 - Underline & Align, - Un Correlation

Time Series

No.	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Artificial Intelligence: A Guide for Thinking Humans	Wolfram Maass	Penguin Books	1st, 2019
2	Introduction to Machine Learning with Python	Audrey C. Miller, Sarah Guido	O'Reilly Media	1st, 2017
3	AI in Cybersecurity: Applications, Risks, and Challenges	Mohamad Al-Shabani, H. Faridah Lameer	CRC Press	1st, 2020
4	State-of-Artificial Intelligence and Robotics	Yves-Henry C. Müller	Springer	1st, 2020
5	Autonomy, Decision, and Knowledge: Towards a Practical Guide	David H. Wolpert	Wiley	1st, 2012
6	Smart Intelligence: A Practical Guide	Robert L. Martínez-Gómez	Springer	1st, 2020

Reference Books

No.	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Introduction to Machine Learning with Python	Audrey C. Miller, Sarah Guido	O'Reilly Media	1st, 2017
2	Machine Learning Yearning	Jeffrey Yih, Ian Goodfellow, Yoshua Bengio, Courville	MLP Press	1st, 2020
3	Adversarial Machine Learning	Itay Shabtai, Ofer Meshiv, Christian J.朔ppach	MIT Press	1st, 2020
4	Artificial Intelligence: The Next Generation	Eduard S. Dzindolet, Daniel P. Klahr	Wiley	1st, 2009
5	Relational Causality: The Probabilistic Approach to Causal Inference	Chris I. Boos, Tuhar Yıldız, M. O. Ünal	CRC Press	1st, 2018
6	Statistical Decision and Bayesian Spectra	I. V. Rughman	CRC Press	1st, 2017
7	Adversarial Cyber Defense: Concepts and Technologies	Chris Eagle	CRC Press	1st, 2018
8	Security Information and Event Management (SIEM) Implementation	David R. Miller	Springer	1st, 2013
9	AI Security: The Risks and Benefits of Artificial Intelligence	David R. Miller	CRC Press	1st, 2021
10	AI Safety and Survival	Sethu Vijayakumar	Springer	1st, 2020

Value Labels (NFTIL, AVAILA...)	
Sample No	Link ID
1	https://www.judicial.gov/reach/2021/12/2018/lawyers/
2	https://www.judicial.gov/reach/2021/12/2018/judges/
3	https://www.judicial.gov/reach/2021/12/2018/judges/
4	https://www.judicial.gov/reach/2021/12/2018/judges/

SEMESTER-SM
WIRELESS SENSOR NETWORKS

Course Code:	PECATH4	CIE Marks:	40
Teaching Hours/Weeks (L.T.P.R)	2.0.0.2	ECE Marks:	60
Credits:	3	Exam Weeks:	1,2,3,11,12
Instructor(s)/Name:	PECATH4	Course Type:	Theory

Course Objectives:

1. To introduce wireless Sensor Networks
2. To understand the different routing protocols used in wireless sensor networks and their design aspects.
3. To learn the message layer security and the security issues in wireless sensor networks.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Wireless Sensor Networks: Introduction to wireless sensor networks (WSN), Network architecture and protocol stack, MAC access control - contention based MAC protocols, MAC design for WSNs, MAC protocols for WSN (Random access, Collision free, and Hybrid protocols), IEEE 802.15.4, Zigbee, Sigfox	16
2	Routing and Transport Layer: Routing and tree disseminator - Fundamental and challenges, taxonomy of routing and tree disseminator protocols, Overview of routing and tree disseminator protocols - geographic routing (RIP, LEACH), tree protocols for information transmission, joint mobility and routing protocol, Trajectory protocol in WSNs, Optimizing systems for sensor networks - TinyOS, Contiki	18
3	Security in WSNs: Security requirements in WSNs, Security vulnerabilities in WSNs - Denial of service, physical layer attacks, link layer, network layer, message layer attacks, attacks on security and authentication, security mechanisms in WSNs - cryptography in WSNs, Key management protocols, Defense against Denial attacks, Defense against routing attacks - TESLA, SPOT, Jammer detection in WSNs	18

Course Assessment Matrix
(CIE - 40 marks, ECE - 60 marks)

Continuous Internal Evaluation Marks (CIE):

Assignment	Segmented Management	Central Lamination-1 (Written)	Central Lamination-2 (Written)	Total
6	14	26	10	50

End Semester Examination Marks (ESE):

In Part A, all questions need to be attempted and in Part B, each student can choose any two full questions out of four questions.

Part A	Part B	Total
<ul style="list-style-type: none"> • 10 Questions from each module. • Total of 5 Questions with carrying 2 marks (Total - 20 marks)	<ul style="list-style-type: none"> • Each question carries 2 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 12 sub-themes. (Half - 20 marks)	60

Course Outcomes (COs):

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

	Course Outcome	Student's Knowledge Level (SKL)
CO1	Explain the fundamentals of distributed systems and the DDC mechanisms used in TSS	SL
CO2	Explain the concepts like localisation and routing mechanisms used in distributed system services	SL
CO3	Describe the security issues in distributed system services	SL
CO4	Discuss the establishment of infrastructure of modern data networks	SL

Text: C1-Remember, P2-Understand, P3-Apply, P4-Analyse, P5-Evaluate, P6-Creat

EII_001 Mapping Table (Mapping of Course References to Program Courses)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13
C01	1	1	1										1
C02	1	1	1										1
C03	1	1	1										1
C04	1	1	1										1

Note : 1=High (Cr), 2=Medium (Common), 3=Advanced (Mgt), - =No Connection

Text Books

SL No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Warren, Klemen, Sammons, J.: Managing Projects: Fundamentals of Project Success. Prentice-Hall - Theory and Practice	Ian Sharp, John Sammons	John Wiley	1/e, 2002
2	Wetherbe, James C.: Fundamentals of Web Based Systems - Theory and Practice	Wetherbe, James C.	John Wiley & Sons Publications	1/e, 2001
3	Wetherbe, James C.: An Information Processing Approach	Wetherbe, James C.	Prentice Hall	1/e, 1997

Reference Books

SL No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Demetsky and Antonacopoulou Web-based Systems	Demetsky, Karl, Andrew Wiley	Wiley	1/e, 2004
2	Wetherbe, James C.: Technology, Methods and Applications	Karen Linton, David Moss, & Tom Tsui	John Wiley	1/e, 2007

Other Links (PTTEL_SWAYAM...)

Module No.	Link
1	https://gadgil.ac.in/stocks/18010506065100
2	https://ncl.tum.ac.in/~werner/teaching/
3	https://www.saylorproject.org/courses/18010506065100
4	https://www.problemset.com/information-technology-with-project/

SEMESTER-SM
DIGITAL IMAGE PROCESSING

(Semester-01 EXAMINATIONS)

Course Code	PERIODS	ESE Marks	%
Teaching Hours/Week (L.T.P-R)	18/03	ESE Marks	60
Credits	3	Exam Hours	120x 30 Min.
Prerequisites (if any)	N/A	Course Type	Theory

Course Objectives:

1. To provide fundamental concepts of digital image representation, processing, and analysis, including image acquisition, color theory, and various data structures, to effectively manipulate and analyze digital images.
2. To help the learners develop the ability to implement advanced image processing techniques, such as image segmentation, edge detection, and image compression, while assessing the performance and quality of these methods in practical applications.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	The image, its representation and properties - Image representations, Image dimensions, Sampling, Quantization, Digital image properties, Noise and topological properties of digital images, Histogram, Entropy, Visual perception of the image, Image quality, Issues in Images: Color Images - Physics of color, Color produced by humans, CIE space, Color consistency, Color structures for image analysis - Levels of image data representation, Traditional image data structures - matrices, Chain, Topological data structures - Relational structures, Hierarchical Data Structures, Pyramids, Quadtree, Other pyramidal structures	3
2	Image processing - Full brightness transformation, Non-linear image brightness correction, Geometric transformations, Geometric Transformations - Non linear transformation, Edge detection, Local processing, Image binarizing, Edge detection, Distance transform	3

	<p>the recent Advances (both in Image Processing, Convolutional Neural Network, Edge Detection, Feature Extraction, Edge Detection, Multi-modal Images, List detection by local processing approach, Detection of person/vehicle/point).</p> <p>Image Restoration - Operations that are very important, Denoising Filtering, Noise Threshing</p>	
3	<p>Image Segmentation - Threshold, Threshold Detection Methods, Optimal thresholding, Multi-modal thresholding, Edge-based segmentation, Edge-Image Thresholding, Edge Detection, Basic Techniques, Border Detection As Graph Searching, Border Detection As Dynamic Programming, Morph Transform, Global Detection Using Block Iteration, watershed,</p> <p>Region connected Area border Region-based segmentation - Region growing, Region Splitting - Splitting And Merging, Watershed segmentation</p> <p>Multilevel Segmentation, Connected Components Tracing, Edge Detection, Issues in Segmentation</p>	
4	<p>Image Transforms - Fourier Transform, Wavelet transform, Radon transform, Singular value decomposition, Principal component analysis, Linear Transform.</p> <p>Image Compression - Intra-block Frequency-Difference Transform; Transform-DCT; Image loss compression, Relative compression methods, Various quantizers, Unidirectional and Progressive Compression methods, Comparison Of Compression Methods, JPEG and JPEG2000 compression, JPEG2000 with image compression, JPEG-G3/G4 compression, JPEG2000-G3-G4 compression.</p>	20

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

Continuous Internal Evaluation Marks (CIE):

Achievement	Assessment Method	Internal Examination 1 (Written)	Internal Examination 2 (Written)	Total
I	II	II	II	40

End Semester Examination Marks (ESM)

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
<ul style="list-style-type: none"> • 2 Questions from each module. + Each question carries 2 marks. • Total no. of Questions, each varying module. <p>(Total = 10 Marks)</p>	<ul style="list-style-type: none"> • Two questions will be given from each module, one of which 1 question should be answered. • Each question can have a maximum of 2 sub-questions. <p>(Total = 10 marks)</p>	20

Course Outcomes (COs)

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

Course Outcomes	Elaborative Knowledge Level (EKL)
CO1 Understand the properties of monochrome and colour images and the basic concepts in image analysis	K2
CO2 Apply different pre-processing techniques in medical image enhancement	K2
CO3 Understand the concept of image representation and recognition techniques used in this	K2
CO4 Understand the various transforms used in image processing	K2
CO5 Understand the concept of image compression and apply various image compression techniques	K2

Dear ICV Students: E1-Understand, E2-apply, E3-analyse, E4-Evaluate, E5-Creat

EII_011 Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
O01	1	1	1									1
O02	1	1	1	1								1
O03	1	1	1	1								1
O04	1	1	1	1								1
O05	1	1	1	1								1

Note : 1=High Cor., 2=Moderate Correlation, 3=Additional Neg., -1=Correlation

Text Books

Sl. No	Title of the Book	Name of the Author(s)	Name of the Editor and Publisher	Year
1	Image Processing, Analysis and Vision	Allen Bruck, Yashin Bhattacharya, Roger Boyle	Omprakash	4/e, 2011

Reference Books

Sl. No	Title of the Book	Name of the Author(s)	Name of the Editor and Publisher	Year
1	Introduction of Signal and Image Processing	Anton N. Tikhonov	Russells	11/2012
2	Signal and Image Processing	George C. Temes, Charles D. Van	Dover	4/e, 2011
3	Digital Image Processing	R. Gonzalez, R. Woods, T. Lewis	Morley KTF	3/e, 2004

Value Links (VITEL, VPAVAN...)

No.	Link ID
1	http://www.vit.ac.in/vitel
2	http://www.vit.ac.in/vpan

SEMESTER-SM

EMBEDDED SYSTEMS AND ITS APPLICATIONS

Course Code:	PECAT07	CIE Marks:	40
Teaching Hours/Weeks (L:T:P:R)	2:0:0:2	ECE Marks:	60
Credits:	3	Exam Weeks:	1,2,3,11,12,Wk
Assessments (Format)	None	Course Type:	Theory

Course Objectives:

1. To learn the design concepts of embedded systems
2. To gain understanding about low power embedded systems
3. To understand the recent trends in embedded system design.
4. To learn how to use embedded systems in real-world applications.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Fundamentals of Embedded Systems - simple systems and microprocessors. The Embedded System Design Process: Requirements, Specifications, Architecture Design, Designing, Construction and Testimony. Comparative design of hardware and software components: sequential and concurrent descriptions.	8
2	System Behavior Co-Design and Program Modeling – Parameterized Specification Design and Development of Embedded Systems – Threaded Design and Development – Design Approaches, Various Development Languages	8
3	Integration and Testing of Embedded Hardware and Processor-Computer architectures and Tools for Embedded System Design and Environment – QML, Cross Compiler, Disassemblers, Debuggers, Simulators, Emulators and Debugging. Embedded product development cycle (EDD) – basic phases of EDD: R&D, C	8
4	RTOS based Design – Real time operating systems overview. Designing and using RTOS environment. Design Principles, Task scheduling methods. How to choose an RTOS. Events, Threads or Interrupts Computing: Interactions in Embedded Systems in IT, IoT and Smart Devices	10

Career Assessment Method
ATC: 40 marks ESE: 60 marks

Continuous Internal Testmarks Marks (CIT):

Assessment	Assignment/Shortpaper	Second Examination 1 (Written)	Second Examination 2 (Written)	Total
E	12	38	18	48

End Semester Examination Marks (ESE):

In Term A, all questions need to be attempted and in Term B, each student can choose any two of all questions out of four questions.

Part A	Part B	Total
<ul style="list-style-type: none"> • 1 Question from each module. • Total of 4 Questions, each carrying 3 marks (Total = 12 marks)	<ul style="list-style-type: none"> • Each question carries 2 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 2 subquestions. (Total = 16 marks)	48

Course Outcomes (CO's):

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

	Course Outcomes	Student's Knowledge Level (SKL)
CO1	Explain the basic idea about the controlable systems	K1
CO2	Describe the fundamental design of the controllable system	K2
CO3	Identify the role of different software modules in the development of an controllable system	K3
CO4	Apply controllable systems in real-world applications	K3

Note: K1: Knowledge; K2: Understanding; K3: Apply; K4: Analyse; K5: Evaluate; K6: Create

EII-III Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
O01	1	1										1
O02	1	1										1
O03	1	1										1
O04	1	1	1									1

Note: 1. Only 4 Cours 2. Maximum column, 2 columns (Avg), - No Correlation

Text Books				
Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Object Oriented Design Principles and Patterns	Ramalingam, Naveen, T. V. Raj	Springer	1st, 2007
2	Enterprise Systems Architecture, Programming and Design	Jay Kemerer	McGraw Hill	3rd, 2013
3	Implementation of Information Systems	Shivani KV	McGraw Hill	1st, 2009

Reference Books				
Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Computer as Computer: Principles of Distributed Computer System Design	Wulf, Wolf	Holger Laubhans	1st, 2011

Value Locus (OPTEL SWAYAM..)	
Module No.	Link ID
1	Embedded systems - RTOS http://www.cs.vt.edu/~mudkip/CS4249E/lecture-010-RTOS.pdf
4	Real-time operating systems - EC Koenig http://www.cs.vt.edu/~mudkip/lecture-010_EC_Koenig.pdf

SEMESTER-SM

CLOUD COMPUTING

(Common to C.G.C.A, C.G.I.M)

Course Code	PGCAT500	ECE Marks	40
Teaching Hours/Wk	133.0	ESE Marks	10
Credits	4.0	Exam Marks	2.00x 10.00
Prerequisites/Any	Sem:	Course Type	Theory

Course Objectives:

- To learn fundamentals of cloud and configure cloud environments, deploy virtual machines and work with communication tools, gaining practical skills.
- To learn to identify and address common security issues in cloud environments, implementing best practices in manageability and compliance of applications.

SYLLABUS

Weeks No.	Syllabus Description	Examination Marks
1	Weeks One - Limitations of Traditional Computing & evolution. Two Layer of Computing, Feature based Cloud Service Adoption, Evolution and Existing Components of Cloud, Benefits and Challenges (Text 1) Technical Concepts and Models - Roles and Responsibilities, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models (Text 1) Introduction to Cloud Providers (AWS, Azure, Google Cloud) Weekend - Cloud Instance Setup and Virtual Machine Deployment - Cloud services as a cloud provider and deploy virtual machine instances, and scenarios for provision and infrastructure.	2
2	Cloud Enabling Technologies - Networks and Computer Architectures, Cloud Data Center Technology, Modern Virtualization, Multicore Technology, Service Technology and Service API's. Understanding Communication - Information, Performance, Availability and Consistency, Understanding Clouds, Understanding Clouds: Images, Multi-Generation Types (Text 2)	18

	<p>Weekend - Hypothetical and Classroom Readiness - Read Hypothetical and apply; This is local machine. Install my chosen platform and deploy application.</p>	
3	<p>Weekend - Scenario Setting, Planning, Preparing, Testing in Cloud and its Strategic Capacity Planning in Cloud Computing, Storage and File Systems - Challenges: Cloud Storage File System, Deployment: mobile Storage Types, Popular Cloud Storage with performance Comparisons Matrix (Table 2)</p> <p>Weekend - Use Hypothetical to implement basic big data application such as word count.</p>	3
4	<p>Understanding Cloud Identity : Basic Identity Terminology, Basic Token Terminology, Token Agents, Common Tokens, Other Components - Token Implementation, Identity Policy, Discovery, Sessions, Data Management (Table 1)</p> <p>Weekend: Identify possible needs of my selected cloud application and suggest implementation solutions/policies for emergence.</p>	3

Course Assessment Method

(ETE- 40 marks, EEE- 40 marks)

Continuous Internal Evaluation Marks (CIE):

Assessment	Deadline	Excellence	Average	Total
4	12	10	10	40

Criteria for Evaluation (Examiner and Analyst): 20 marks

Major Assessment:

1. **Analyst Test:** - analyse performance of selected entity (Particular Application, Computing, security) available against that in the class.
2. **Evaluation Test:** - Demo presentation on the cloud programming language, compare security module based on selected performance evaluation criteria.

Endurance Examination Marks (EE)

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

Part A	Part B	Total
<ul style="list-style-type: none"> + 2 Questions from each module. + Total of 4 Questions not carrying 2 marks (Total -24 marks) 	<p>Questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 subquestions. All questions carry 2 marks (Total - 24 marks)</p>	

Course Outcomes (COs)

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

	Course Outcomes	Elaborate Knowledge Level (EKL)
CO1	Evaluate the importance of resilience computing models and comprise the factors driving cloud server migration and compare between resilience and performance in deployment models	K2
CO2	Demonstrate proficiency in cloud enabling technologies, including machine virtualization and containers	K3
CO3	Examine the resource management within the cloud, including resource policy, scaling strategies, and storage management and discuss tools like Hadoop for processing big data applications	K2
CO4	Identify process oriented issues in cloud environments and apply appropriate security measures in mitigating these risks	K3

Pass: E1-Exceeded; E2-Understand; M1-Apply; E3-Analyze; E4-Evaluate; N0-Credit

EDU 501 Mapping Table (Mapping of Course Objectives to Program Outcomes)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10a	P11
Q01	1	1	1	1	1						1
Q02	1	1	1	1	1						1
Q03	1	1	1	1	1						1
Q04	1	1	1	1							1

Note: 1. Align Score; 2. Unscored Question; 3. Guidance Only; - Un-Considered.

Text Books

SL. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Cloud Computing: Concepts, Technology, Security, and Management	Thomas Erl	Pearson	2/e, 2011
2	Cloud Computing	Santosh Bhamidipati	Cambridge University Press	1/e, 2017

Reference Books

SL. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Cloud Computing: Theory and Practice	Don E. Nettleton	Wiley-Ehance	2/e, 2011
2	Cloud Computing: A建于-On Approach	Amitabha Bagchi and Nitin H.百纳	Universities Press	1/e, 2009
3	Managing Cloud Computing	Stephen R. Boyce, Christian Vassilios Z. Dimoulas, Ed. et al.	Wiley-Ehance	2/e, 2011
4	Cloud Computing: A Business Approach	Jackson T. Voigt, Tracy J. Voigt, Robert E. Bryant	McGraw-Hill	2/e, 2010

Video Links (NPTEL, YouTube, ...)	
No.	Link ID
1	https://nptel.ac.in/courses/101/001/001/007

SEMESTER-SM
MOBILE APPLICATION DEVELOPMENT

(Common to CS/CA/CB/CI)

Course Code	PRECATION	CIE Marks	AI
Teaching: Class/Prac. (L-2 & P-2)	1.0.0.0	80 Marks	40
Credits	15	Exam Hours	2 hrs 30 Mins
Prerequisites/Co-req.	Sem:	Credit Type:	Theory

COURSE OBJECTIVES:

1. To equip students with a thorough understanding of mobile application development fundamentals, including platforms (OS and Android) and technologies (HTML, CSS, JavaScript, XML).
2. To assist students in Kullu and Dharwad Dean Faculty to use these effectively for cross-platform development and the Dart programming language to create responsive, user-friendly mobile applications.
3. To prepare students for real-world scenarios by involving app assembly, testing, CI/CD, and deployment processes, culminating in the development and deployment of a complete mobile application project.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Fundamentals of Mobile Application Development Introduction to Mobile Application Development, Overview of Mobile Platforms (OS and Android), Introduction to Frontend History, Features, and Benefits, Setting Up the Front-End Development Environment, Mobile App Architecture (HTML, CSS, JavaScript, and XML), Basics of Dart Programming Language, Introduction to UI and Widgets Control Assignment Project: Setting up the React environment and create a simple "Hello World"	8

	<p>Applications: The Go runtime, memory, profiling, and testing</p> <p>Milestone 1: Develop a class app with a single Windows functionality.</p> <p>Task Initiatives/Goals and User Experience:</p> <p>Principles of Native UI UX Design, Designing Responsive UIs with Flexbox, Using Flexbox Widgets, StackableFigma and StackableFigma Layout in Figma, Components, Columns, Rows, Stack, Variables and Reusing in Figma, Commenting (C) with Themes and Styles, Introduction to Material Design and Customized Widgets</p> <p>Assessment Project:</p> <p>Design and implement a new workflow using Figma widgets</p> <p>Milestone 1: Implement project from Milestone 1 with a multi-column UI, navigation, and animated features.</p>	
7	<p>Advanced Flutter Development:</p> <p>State Management in Flutter: Provider, Riverpod, and Bloc/C</p> <p>Networking in Flutter: GET API Requests, PATCH/Putting, DELETE/DELETE</p> <p>Data Persistence: SQLite, Shared Preferences, Hive</p> <p>Asynchronous Programming with Dart: Future, StreamController, and Stream</p> <p>Integrating Device Features: Camera, GPS, Sensors</p> <p>Working with Fire base: Authentication, Firestore, Cloud Functions</p> <p>Assessment Project:</p> <p>Develop an app with state management and data persistence.</p> <p>Milestone 1: Enhance the project with state management, data persistence and integration with a RESTful API or Firebase.</p>	
8	<p>Industry Practices and App Deployment:</p> <p>Advanced UI Components and Animations, App Delivery Best Practices, Testing and Debugging Native Applications, Continuous Integration/Continuous Deployment (CI/CD) with CircleCI, Publishing Apps to Google Play Store and Apple App Store, Industry Trends and Future of Mobile Development with Flutter</p> <p>Assessment Project:</p> <p>Add advanced UI components and animations to the project, implement CI/CD integrations and automation to the project, implement</p>	

	<p>simply measure in the Water egg lesson, Cuckoo Strength testing and scrapping of the developed app.</p> <p>Milestone 4: Complete the project, integrating all lessons and preparing it for submission.</p>	
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Course Assessment Method
(CIE- 40 marks, EEE- 60 marks)

Continuous Internal Evaluation Metric (CIE):

Assurance	Delivery	Enthusiast	Analyse	Total
4	12	10	12	46

Criteria for Evaluation(Deliver and Analyse): 10 marks

analyse

To various Difficulties, Organic, Anabolic

Mark and Targets

i. Cost-Benefit and Evaluating

- a. Total students are given a piece of code to analyse and release the better performance in readability.
- b. Total ability to identify sufficient or insufficient code and present optimised solution.

Example: Analysing a sample 12 modules and recommending it for better performance and readability.

ii. Design Pattern Identification

- a. Total students are asked to identify and apply appropriate design pattern for given scenarios.
- b. Name- Define identification and application of design pattern like Singleton, Factory, or MVC in their projects.

Example: Analysing an application management tools and choosing between Service and MVC patterns.

1. Key Designers

- a. Topic: Students are given a design project or task to analyse and design.
- b. Name: Ability to use design process tools and techniques to analyse and design.

Example: Analysing assessment tasks to identify and explain key conditions of success

Evidence:

Key Assessments: Check, Sketchup, Vizify

Design and Strategies

1. Critic Quality Assessment:

- a. Topic: Students critique each other's work and provide constructive feedback.
- b. Name: Ability to critically evaluate their quality based on feasibility, efficiency, and effectiveness of processes.

Example: Two users assess their designs critique assess and efficiency of each other's Project work.

2. UCD/UX Design Evaluation:

- a. Topic: Students evaluate the user interface and user experience of their given applications.
- b. Name: Ability to judge UX/UI designs based on usability, accessibility, and aesthetics.

Example: Considering usability, taking reviews and providing feedback on navigation flow, design consistency, and user engagement.

3. Design Presentations and Deliverables:

- a. Topic: Students present their projects and justify their design and implementation choices.
- b. Name: Ability to consider design objectives, defined communication channels and required visual guidelines.

Example: Stakeholders present their system using their theory of user management, evaluate energy, and performance optimisations.

Implications from the K-Index - Example Use Cases

Basic Mobile Application Development

- **Analyze:** Evaluate different mobile app architectures (UI/UX, M/F/D, S/M/C) and choose the best fit for a given project scenario.
- **Evaluate:** Critically review the design and configuration of the mobile development environment for potential improvements.

User Interface Design and User Experience

- **Analyze:** Analyze the representativeness and usability of designed UIs, identifying potential weaknesses.
- **Evaluate:** Critique the effectiveness of navigation and testing within the app.

Advanced User Development

- **Analyze:** Break down the iteration process of advanced features (user management, advertising) and evaluate their impact on app performance.
- **Evaluate:** Judge the influence of these processor intensive and experience programming implementations.

Mobile Business and App Deployment

- **Analyze:** Analyze the app's security measures and their effect (or lack thereof) on growing user data.
- **Evaluate:** Evaluate the completeness and readiness of the app for deployment based on industry standards and best practices.

Example Evaluation Schema

Analysis

Critique	Initial (0)	Good (1)	Satisfactory (2)	Mark Improvement (3)
Identification of Data Requirements	Identifies all requirements and provides optimal solutions	Identifies most requirements and provides good solutions	Identifies some requirements with basic solutions	Duplicates clearly conflicting requirements and provides solutions
Aggressiveness of Design Decisions	Conservatively applies design patterns with minor variance	Applies design patterns with moderate variance	Applies design patterns with significant variance	Innovatively applies or fails to apply design patterns

Evaluation

Critique	Excellent (4)	Good (3)	Satisfactory (2)	Mark Improvement (1)
Code Quality Assessment	Provides thorough, insightful feedback with reasonable suggestions	Provides good feedback with some reasonable suggestions	Provides basic feedback with limited reasonable suggestions	Provides minimal or unhelpful feedback
UML Design Evaluation	Provides detailed critique with sensible insights	Provides good critique with some sensible insights	Provides basic critique with limited sensible insights	Provides minimal or no critique

End Semester Examination Marks (GCE).

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

Part A	Part B	Total
<ul style="list-style-type: none"> + 1 Question from each module + Total of 12 Questions, each having a maximum of 12 additional marks 	<ul style="list-style-type: none"> 1 question will be given from each module, out of which 1 question should be answered. Both questions have to be answered. questions carry 1 marks (40 + 24 marks) 	64

Course Outcomes (COs)

Learning outcome of the course students should be able to:

Course Outcomes		Student's Knowledge Level (SKL)
CO1	Explain mobile application development using Native and different mobile platforms.	K2
CO2	Apply principles of mobile native COCO design, Development and interaction using Native Codes.	K2
CO3	Programmatically work with Java in Native application, networking and file processing.	K2
CO4	Apply security best practices in mobile app development, use, and design Native applications effectively.	K2
CO5	String COCO patterns for Native programs and deploy mobile app in Google Play store and Apple App Store.	K2

Note: K1-Knowledge; K2-Understanding; K3-Apply; K4-Analyse; K5-Evaluate; K6-Creatve

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1								1
CO2	1	1	1	1	1							1
CO3	1	1	1	1	1							1
CO4	1	1	1	1	1							1
CO5	1	1	1	1	1							1

Note: 1- Align; 2- Moderate Alignment; 3- Moderate (High); - UnCorrelation

Text Books

SL. No	Title of the Book	Name of the Author(s)	Name of the Edition and Publisher	Year
1	Mobile Application Development	Sunil Venkateswaran	India	2014, 2015
2	Android Basics	Dipak Patel	India	2015, 2016

Reference Books				
No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Primer of Content	Ann Wensel	Harrington	c. 2003
2	Primer and Data Up and Running	Sergio Otero, Royal Holloway	SAGE	c. 2002
3	Managing Your e-Marketing Strategically	William Aspray	Pearson	c. 2001
4	Ultimate Internet Marketing	Lakshmi Venkatesan Srinivasan	Prentice Hall	c. 2002

Title Link (HTTP://WWW.SPRINGER.COM/107126102)	
No.	Link ID
1	http://www.springer.com/107126102

SEMESTER 5M

INTRODUCTION TO DEEP LEARNING

Course Code:	PSCAT5M	CIE Marks:	40
Teaching Hours/Weeks (L:T:P:R)	2:0:0:1	ECE Marks:	40
Credits:	4	Exam Weeks:	14th-15th
Prerequisites (if any):	EEC2203	Course Type:	Theory

Course Objectives:

1. To teach the basic of neural networks along with advanced topics, including convolutional networks, long short-term memory cells, and recurrent neural networks.
2. To enable the students to complete programming solutions for real world problems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Neural Networks: Introduction to Human and Artificial Intelligence. History of AI. Terms of learning - Supervised and unsupervised learning. Perceptron Learning rule, Hebbian learning, Artificial Neural Networks. Backpropagation, Multilayer Perceptron model, Levenberg Marquardt Loss function, Optimization. Training Neural Networks - gradient descent, stochastic gradient descent, momentum, weight initialization, batch normalization, hyper parameter optimization, dropout option, model ensemble.	16
2	Differences of deep learning: very shallow neural networks, and learning deep models involving optimization techniques such as Gradient Descent (GD), SGD with momentum, stochastic GD, AdaGrad, RMSProp, and Adam. Regularization methods - L1 and L2, early stopping, feature augmentation, parameter sharing and tying, input noise injection, ensemble methods, dropout, and parameter initializations.	17
3	Convolutional Neural Networks: convolution layer, pooling layer, fully connected layer. Case No.: Case study of ImageNet challenge. LeNet, AlexNet, VGG, Google Net, ResNet, Inception Net, EfficientNet and Applications. Techniques: Data Augmentation, transfer learning.	17

	mapping, learning, error detection, self-supervised techniques, semi-supervised and weakly supervised learning, adversarial training, Transfer Learning, freezing the input layers, fine-tuning output layers	
4	Deep Disagreement Learning and Room Trends from friends (parallel, guest, family, colleague, etc), Facialized Associations, Attention, Generative Adversarial Networks, Auto-encoders and GANs, Multi-task Deep Learning, Multi-view Deep Learning	10

Negotiations Project Topic

- Applications of Deep Learning in Discrete VQA
- Applications of Deep Learning in NLP

Course Assessment Method
(ECE- 61 marks, EEE- 48 marks)

Continuous Internal Evaluation Marks (CIE):

Assessment	Project	Internal Ex-I	Internal Ex-II	Total
5	36	10.5	8.7	30

End Semester Examination Marks (ESE):

In Sem-A, all questions need to be answered and in Sem-B, each question can either be one full question or a set of two questions.

Test A	Test B	Total
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 6 Questions, each carrying 2 marks (Total = 12 marks) 	<ul style="list-style-type: none"> • 2 questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 2 subquestions. • Each question carries 6 marks (Total = 12 marks) 	48

Course Outcomes (CO)

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

	Course Outcome	Student's Performance Level (SPL)
CO1	Explain the fundamental principles of neural networks and discuss the practical challenges associated with them.	SPL 1
CO2	Explain the common regularization and optimization methods used in deep neural networks.	SPL 2
CO3	Use Deep Neural Networks with Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) for tasks such as object detection, image segmentation, and time-series analysis.	SPL 3
CO4	Discuss various deep learning algorithms we have used for different types of learning tasks across various domains.	SPL 3
CO5	Implement deep learning algorithms and solve real-world problems.	SPL 3

Score: 8.1; Semester: S2; Undergrad: 63 ; Appd: 64; Faculty: 63; Student: 63; Credit:

EEL510 Mapping Table

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13
CO1	-1	-1											-1
CO2	1	1											1
CO3	1	1	-3										1
CO4	1	1	-3										1
CO5	2	2	-3		2								1

Text Books

SL.No	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Deep Learning	Ian Goodfellow and Yoshua Bengio and Aaron Courville	MIT Press	1st 2016
1	Handwritten digit recognition : Part 2	Elman, Márton et al	Dynamical press	1st 2017
1	Reinforcement Learning: An Introduction	Sutton, R. S., Barto, A. G.	Springer	1st 2018
1	Deep Learning with Python	François Fleuret	Manning Publications	1st 2017

Bibliography Books				
S. No.	Title of the Books	Name of the Authors	Year of the Publication	Edition and Year
1	Neural Networks A Classroom Approach	Satish Kumar	Self-Study in Soft Education	Ed. 2001
2	An Introduction to Neural Networks	Yegnanarayanan, S.	PHILIPS	Ed. 2004

Video Links (SOTEL SWAYAM...)	
Module No.	Link ID
1	Fundamental principles of neural networks SOTEL - Computer Science and Engineering - NOC-Digit Learning-Pan Convolutional, fully connected networks
2	SOTEL - Computer Science and Engineering - NOC-Digit Learning-Pan Convolutional Neural Networks
3	SOTEL - Computer Science and Engineering - NOC-Digit Learning-Pan Autoencoders
4	SOTEL - Computer Science and Engineering - NOC-Digit Learning-Pan

PEL Generic Elements:

L-Lesson (File)	Project (P) Wkly	Lesson Number	
	Tutorial	Practical	Procedure
Lesson delivery	Review milestones	Completion/ Laboratory Work/ Videotape	Evaluation (Progress and Final Examination)
Drop Assessment	Project Analysis	Data Collection	Evaluation
Quality Control Sessions	Analytical thinking and P-Planning	Testing	Project Milestone Review, Feedback, Project information (IT required)
Guest Speaker (Industry Expert)	Case Study/ Field Survey Report	Emerging	Expert Interview, Visit Organization, Business process flow analysis on a 2 to 3 month cycle

Assessment and Evaluation for Project Activity

S. No	Evaluation for	Allocated Marks
1	Project Planning and Proposal.	1
2	Contributions in Project Presentation and Quality Assessment.	4
3	Involvement in the project work and Team Work.	1
4	Execution and Implementation.	3
5	Total Preparation.	1
6	Project Quality, Innovation and Creativity.	3
	Total	10

1. Project Planning and Proposal (1 Marks)

- Clarity and feasibility of the project plan
- Research and background understanding
- Originality, relevance and methodology

2. Contributions in Project Presentation and Quality Assessment (4 Marks)

- Individual contributions in the presentation
- Effectiveness in answering questions and handling doubts

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

- Active participation and individual contribution
- Teamwork and collaboration

4. Execution and Implementation (3 Marks)

- Effectiveness in the project execution and milestones
- Application of theoretical knowledge and problem solving
- Final output

5. Final Preparation (1 Marks)

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

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

- Overall quality and original excellence of the project
- Innovation and originality in the project
- Creativity in ideas and approaches

SEMESTER-SM

DATA STRUCTURES

Course Code	SUGGESTION	CSE Marks	SL.
Tracing BloomFilter (S. T. P. 3)	1000	200 Marks	80
Queues	4	Least Marks	1 Day 10 Hrs
PriorityQueue (Key)	+	Crash Test	Theory

Course OB(2019-20)

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

SYLLABUS

Module No	Syllabus Description	Comptt Hours
1	Basic Concepts of Data Structures Definitions; Data Structures; Performance Analysis - Time & Space Complexity; Asymptotic Notations; Polynomial representation using Arrays; Sparse matrix (Tuples representation); Stacks and Queues - Stacks; Multi-Stacks; Queues; Circular Queue.	3
2	Linked List and Memory Management Single- Linked List - Operations on Linked List; Matrix and Queue using Linked List; Polynomial representation using Linked List; Doubly Linked List.	3
3	Trees and Graphs Tree - Representation of Tree; Binary Tree - Types and Properties; Binary Tree Representation; Tree Operations; Tree Traversal; Binary Search Tree - Binary Search Tree Operations; Graphs - Definitions; Representation of Graphs; Depth First Search and Breadth First Search	3

4	Kunst en Geschiedenis Kunst Tukelspu - Eduard van Beieren kon. Quis dat. Mag. Son Kunstenaar Dethouwer - Lieve Zwart. Harry Koech, Steenberg - Lezing Antwerpen. Onder. Orlane-Rochelle. Uitvoerende Onderhouding	5
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Courtesy Assessment Standard
(CTE: 40 marks, EST: 40 marks)

Continuous Internal Evaluation Marks (CIE)

Attendance:	Assessment Management	Second Trimester-I (Written)	Internal Examination I (Written)	Total
7	17	10	18	42

End Semester Examination Marks (ESL)

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
<ul style="list-style-type: none"> • 1 Question from each module • Total of 2 Questions, each carrying 1 mark (Total = 2 marks)	<ul style="list-style-type: none"> • Each question carries 2 marks • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 2 sub-questions (Max = 20 marks) 	14

Course Outcomes (COs)

All the rest of the course outcomes should be similar:

	Course Outcomes	Student's Knowledge Level (KL)
CO8	Identify appropriate data structures for solving real world problems	K3
CO9	Describe and implement basic data structures such as arrays, linked lists, stacks, queues	K3
CO10	Describe and implement some basic data structures such as trees and graphs	K3
CO11	Select appropriate searching and sorting algorithms to be used in specific circumstances	K3

Note: L: Learning; KU: Understand; AL: Apply; IR: Integrate; EL: Evaluate; KS: Create

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1									1
CO2	1	1	1									1
CO3	1	1	1									1
CO4	1	1	1									1

Note: 1: Right Level; 2: Measures Classroom; 3: Advanced Depth; 4: Communication

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	Elliott Berman, Sartaj Sahni, and Sumant Arora/Aswin Balaji	Oxford/ICSI Books	3/e, 2007
2	Introduction to Algorithms	Thomas H. Cormen, Charles Leiserson, Ronald L. Rivest, Clifford Stein	MIT	3/e, 2009

Reference Books				
S.L. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Classical Data Structures	Kamala D.	Bennet & Scholten	2/e, 2011
2	Data Structures and Algorithms	Amit A. Vaidya, R. Aggarwal and I. D. Chandy	Pearson Publication	2/e, 2011
3	Introduction to Data Structures with Applications	Grewal, J. S. and D. S. Rawat	Tata McGraw Hill	2/e, 2017
4	Theory and Problems of Data Structure	Lipshutz, L.	Schaum's Outline	2/e, 2014

Video Links (PHASE-I & PHASE-II)	
Module No.	Link ID
1	http://www.iitm.ac.in/courses/130113004
2	http://www.iitm.ac.in/courses/130113005 (Spring-2011)

SEMESTER-SM
DATA COMMUNICATION
 (Common to CS-CM/CD-CA)

Course Code:	DECST01	CH Marks:	45
Teaching Hours/Week (L+T+P+Q)	3+0+0	TUT Marks	15
Credits	1	Lect. Hours	15 hrs. 10 min.
Prerequisites/Other	None	Course Type	Theory

Course Objectives:

1. To understand the details of data communication at the lower level and the associated laws.
2. To gain insight into the important aspects of data communication for computer networking systems and to apply the in practical applications.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	<p>Communication model - Simplex, Half duplex, Full duplex transmission.</p> <p>Tranmission coding signals - Base band, Anglular, Phase, Waveshaping. Time and Frequency domain, Bandwidth. Analog & digital data and signals.</p> <p>Transmission impairments - Attenuation, Delay distortion, Noise, Dispersion, Gain - Variation channel, Nyquist bandwidth, Unity channel, Dispersion, capacity formula.</p> <p>Source representation terms - Transient pair, Causal pair, Open pair.</p> <p>Encoded media - Radio media, Coaxial, microwave, Optical waveguides, Infrared, Wireless propagation, Ground wave propagation, Sky wave propagation, Line-of-sight (LoS) propagation.</p>	35
2	<p>Digital data to digital signal - Non Return-to-Zero (NRZ), Return-to-Zero (RZ), Manchester, Bipolar, Encoding data to digital signal - Sampling theorem, Pulse Code Modulation (PCM), Delta Modulation (DM), Digital data to analog signal - Amplitude, Half Sine wave (HSW), Triangular, Sawtooth.</p>	8

	Group (III), Three DMR Receiving (3DR). Adding noise to analog signal - amplitude Modulation (AM), Frequency Modulation (FM), Phase Modulation (PM).	
3	Multiplexing - Frequency Division Multiplexing (FDM), Wavelength Division Multiplexing (WDM), Time Division Multiplexing (TDM); Chrominance Subtraction TDM; Interleave TDM; Spread spectrum techniques - Direct Sequence Spread Spectrum (DSSS), Frequency Hopping Spread Spectrum (FHSS); Code Division Multiplexing, Code Division Multiple Access (CDMA)	3
4	Digital data communication techniques - Asynchronous transmission, Synchronous transmission, Streaming and buffering errors - Types of errors, Error check, Checksum, Cyclic Redundancy Check (CRC), Parity, Error Correction (EC), Hamming distance, Hamming code, Basic principles of encoding - Linear encoding, Polar encoding, Message encoding	3

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

Continuous Internal Evaluation Marks (CIE):

Achievements	Assessment throughout the year	Internal Evaluation-1 (Written)	Internal Evaluation-2 (Written)	Total
3	8	16	8	40

End Semester Examination Marks (ESE):

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

Part A	Part B	Total
<ul style="list-style-type: none"> • 10 Questions from each module. • Total 40 Questions, each carrying 2 marks. <p>(Total - 40 marks)</p>	<ul style="list-style-type: none"> • Each question carries 2 marks. • Two questions will be given from each module, one of which 1 question should be answered. • Each question carries a maximum of 20 additional marks. <p>(Total - 20 marks)</p>	60

Course Outcomes (CO)

Learning outcome of the course students should be able to:

Course Outcomes		Student's Knowledge Level (SKL)
CO1	Identify the characteristics of equal to society and legal communication to solve the communication related challenges.	K2
CO2	Understand communication model as communication for propagation media	K3
CO3	Classify appropriate legal writing techniques for a given scenario	K3
CO4	Discuss subliminal and spread spectrum technologies	K2
CO5	Use oral, written, electronic and existing techniques in mass communication	K3

Note: K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Creativity

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1									1
CO2	1	1	1	2								1
CO3	1	1	1	2								1
CO4	1	1	1	2								1
CO5	1	1	1	2								1

Note: 1-Digital Communication; 2-Information Theory; 3-Subliminal Message; 4-Spread Spectrum

Text Books

Sl. No	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Data Communication and Networking	Vernon S. S.	McGraw Hill	6th, 2018
2	Oral and Written Communication	William Bellinger	Prentice	10th, 2018

Reference Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	<u>Media Communications</u>	John D. Wiles	Prentice Hall	2/e, 2006
2	<u>Principles of Marketing and Communications</u>	Carroll, Wiles	Cengage	7/e, 2008

Video Links (NIVEL, YouTube, etc.)

Module No.	Link ID
1	https://www.youtube.com/watch?v=OOGUQ000000

SEMESTER-SM

FOUNDATIONS OF CRYPTOGRAPHY

Course Code	CEC650103	CIE Marks	40
Teaching Hours/Week	1333	ESE Marks	00
Credits	1	Exam Hours	1 hrs. 10 min.
Prerequisites (Any)	N/A	Exam Type	Theory

Course Objectives:

- Develop a fundamental understanding of mathematical concepts in cryptography.
- Gain comprehensive knowledge of cryptographic methods.
- Determine the principles and uses for cryptographic systems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Integer Arithmetic - Divisibility, Greatest Common Divisor, Euclid's and Extended Euclid's Algorithm for GCD, Modular Arithmetic - Operations, Inverses, Polynomial Arithmetic, Algebraic Structure - Group, Ring, Field, Data.	3
2	Data symmetry and Data Transposition - Permutation Matrix, Number of Distinct Perms for Data, Swap's Theorem, Symmetry Testing, Latin's Theorem, Rule's Test for Perms, Diaper, Legendre, Nth-order Arithmetic, Chinese Remainder Theorem.	3
3	Principles of security - Types of security, security services, Security Mechanisms, Cryptography - Symmetric, Asymmetric, Hashing, Message Authentication techniques, Transposition Techniques, Limitation of classical cryptography.	3
4	Stream key Cipher - Block Cipher principle & Algorithms: DES, AES, Differential and Linear Cryptanalysis, Asymmetric Key Cipher RSA, ECC, Best Practices - IDEA, AES.	3

Excerpt Assessment Standard
(C2E – 40 marks, E2E – 30 marks)

Continuous Internal Evaluation Marks (CIE):

Assessment	A&B(100%) Micro-project	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Total
E	15	35	35	40

End Semester Examination Marks (ESE):

In Term 4, all questions need to be answered and in Term 5, each student can choose any two full questions out of four questions.

Term A	Term B	Total
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 6 Questions, each 5 marks. 	<ul style="list-style-type: none"> • Each question carries 5 marks. • Two questions will be given from each module, one of which 1 question shall be answered. • Each question can have a maximum of 2 subquestions (Total = 30 marks). 	30

Career Guidance (CG)

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

	Career Guidance	Student's Knowledge Level (SKL)
C2D	Explain the major algorithmic operations involving divisibility and GCD algorithms, middle algorithmic operations and properties, polynomial arithmetic, and algebraic structures such as groups, rings, and fields.	S1
C2D	Describe the various theory concepts required for cryptographic applications and mathematical problem-solving.	S2
C2D	Explain the security principles, types of attacks, and practical measures, alongside a thorough understanding of cryptographic techniques and their applications in security area.	S2
C2D	Describe symmetric and asymmetric key cryptography, including block cipher principles, algorithms, public key cryptosystems, and hash functions.	S2

Data: E-Learning: ED-Universidad, ID-App: E2-Evaluation, ED-Subject: Pg-Cross

EE5203 Mapping Table (Mapping of Course Objectives to Program Outcomes)

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11
CO1	1	1									1
CO2	1	1									1
CO3	1	1									1
CO4	1	1									1

Note : 1=High Comp, 2=Moderate Satisfactory, 3=Insufficient Satisfy, 4=Completely

Text Books

SL No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Cryptography & Network Security	Ronald L. Rivest	McGraw Hill	1/e, 2007
2	Security in Computing	Charles P. Pfleeger, Shari L. Pfleeger, Matthew Bergman	Prentice Hall	1/e, 2004
3	Introduction to Cryptographic Principles and Applications	H. Stahl, U. Koell	Springer	1/e, 2002
4	Cryptography: Applications for Communications Security	George Vassilakis	Springer	1/e, 2009

Reference Books

SL No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Cryptography and Network Security	William Stallings	Pearson Education	7/e, 2011

Video Links (SPOTEL SWAYAM...)

Module No.	Link SR
1	https://www.spoTEL.ac.in/module/EE5203/1
2	https://www.spoTEL.ac.in/module/EE5203/2
3	https://www.spoTEL.ac.in/module/EE5203/3

SEMESTER-SM

MACHINE LEARNING FOR ENGINEERS

(Common to CSE-COD-CIV-CEAD-MLA)

Course Code:	CE37410	CSE Marks:	42
Teaching Hours/Wk:	3x0.8	ECE Marks:	45
Credits:	3	Exam Marks:	20% 30% 50%
Prerequisites (if any):	None	Course Type:	Theory

Course Objectives:

1. To provide the basic concepts and algorithms in machine learning.
2. To discuss the classical and more popular supervised and unsupervised learning algorithms.

SYLLABUS :

Module No.	Syllabus Description	Contact Hours
1	Introduction to ML: Machine Learning vs Traditional Programming, Machine Learning paradigm : supervised, unsupervised, unsupervised, reinforcement learning Basics of parameter estimation: maximum likelihood estimation (MLE) and maximum a posteriori estimation (MAP), Bayesian framework Supervised Learning: Perceptron, LDA, Logistic Regression, Decision Tree, Random Forest and optimization Regression: Linear regression with one variable, Linear regression with multiple variables - solution using gradient descent algorithm and batch gradient descent.	32
2	Classification - k-Nearest Neighbors, SVM Generalization and Overfitting: idea of overfitting, LASSO and RIDGE	8

	<p>regression, Idea of Training, Testing, Validation</p> <p>Evaluation metrics - Classification - ROC-AUC, Recall, F1 score, Precision-Recall Curve, Area Under Curve (AUC)</p> <p>Regression - Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), R-Squared/Coefficient of Determination</p>	
3	<p>Naive Bayes (NB) - Naive, Naive Belief - Multiclass Naive Bayes, multinomial Naive Bayes (Smooth, Add 1, Trf), Bernoulli Naive Bayes</p> <p>Decision Trees - Information Gain, Gini Coeff, ID3 algorithm</p>	3
4	<p>Unsupervised Learning</p> <p>Clustering - Centroid methods, Hierarchical Clustering, Agglomerative Clustering, partitional clustering, K-means clustering</p> <p>Dimensionality reduction - Principal Component Analysis, Non-negative matrix factorization</p> <p>Ensemble methods - Bagging, Boosting</p> <p>Resampling methods - Bootstrapping, Cross Validation, Stratified k-folds, Hold-out method</p>	18

Course Assessment Method
(ECE-46 marks, EEE- 40 marks)

Continuous Internal Evaluations Marks (CIE):

Assessment	Assignment/Micro-project	Internal Examination-I (Written)	Internal Examination-II (Written)	Total
3	8	10	8	40

End Semester Examination Marks (EAS)

In Term A, all questions need to be answered and in Term B each student can choose any two full questions out of four questions.

Part A:	Part B:	Total
<ul style="list-style-type: none"> • 1 Question from each module. • Total of 12 Questions will be varying 3 marks <p style="text-align: center;">(12 x 3 marks)</p>	<ul style="list-style-type: none"> • Each question carries 2 marks. • Two questions will be given from each module, one of which 1 question should be answered. • Each question can have a maximum of 2 sub-questions. <p style="text-align: center;">(2 x 2 marks)</p>	36

Course Outcomes (COs)

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

Course Outcomes		Student's Knowledge Level (SLL)
CO1	Describe Multiple Learning strategies and their pedagogical outcomes methods	K2
CO2	Describe stages of learning outcome progression, classification	K3
CO3	Describe the concept of Multiple nested measures and Desirable terms	K3
CO4	Describe integrated learning strategy and its pedagogical outcomes techniques	K3
CO5	Use appropriate performance measures to evaluate students learning methods	K3

Note: K1-Knowledge; K2-Understanding; K3-Application; K4-Analysis; K5-Evaluation; K6-Creation

III.III Mapping Table (MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES)

	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30	P31	P32
O21	1	1	1	1								1
O22	1	1	1	1	1							1
O23	1	1	1	1	2							1
O24	1	1	1	1	1							1
O25	1	1	1	1	1							1

Note : 1. High, 2. Moderate, 3. Low, 4. Very Low

Text Books				
S. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Introduction to Machine Learning	Author: Umapati	TMH Books	2/e, 2018
2	Data Mining and Analysis: Practical Concepts and Algorithms	Author: I. H. Witten, E. Frank	Cambridge University Press	1/e, 2018

Reference Books				
S. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Machine Learning	Tom Mitchell	McGraw-Hill	1/e*
2	Applied Machine Learning	M. Ongel	Burrill	2/e, 2018
3	Visual C++ Guide for Pattern Recognition	Christopher Bishop	United University Press	1995
4	Machine Learning: A Bayesian Approach	Karen D. Miller	MIT Press	1/e, 2002
5	The Elements Of Statistical Learning	Trevor Hastie, Robert Tibshirani, Jerome Friedman	Springer	1/e, 2009

Video Links (NTTEL_PP4VAM_1)

Message No.	Link ID
1	https://www.nttel.vt.edu/~apple/1822711
2	https://www.nttel.vt.edu/~apple/1822711
3	https://www.nttel.vt.edu/~apple/1822711
4	https://www.nttel.vt.edu/~apple/1822711

SOLVENTES 90

OBJECT ORIENTED PROGRAMMING

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Chemical Class	Geographic	Clinical Marks	Age
Terpenoid Phenols (S- <i>T</i> -P-A)	S.E.A.	ESE Marks	30
Cordyceps	S.	Stem Marks	3 Gm. 30 min.
Tranquillizers (Xanax)	None	Cause Tics	These

Centro-Geometria

1. To introduce state-of-the-art principles such as the nature, regulation, structure and physiopathology, sexual maturing, and morphological changes in some groups related;
 2. To help the learner to develop skills related to managing biological structures, environments, and the effective utilization of risk types, energy, species, and control measures for program flow in 2013;
 3. To enable the learner to design and develop construction graphical user interface (GUI) based on applications using Green and sustainable resources components.

STYLARIS

Module No.	Syllabus Description	Contact Hours
4	Introduction to Java - Java programming Environment and Basics. Environment (Command Line & IDE), Java compiler, Java Virtual Machine, Primitive Data types and Wrapper Types, Casting and Interconverting Arrays, String, Variables, Operators, Arithmetic, Bitwise, Relational, Boolean Logical, Assignment, Conditional (Ternary) Operator, Inheritance, Control Statement Selection Structure, Iteration Structure and Loop Construct, Processing Command Line Arguments, Various Input/Output Streams, Classes, Objects, Methods, OOP Concepts - Class inheritance, encapsulation, abstraction, polymorphism, Overloading and Object oriented programming paradigm, Multithreading, Object Oriented	38

	Implementation in Java - Creating Objects, Object Subclasses, Overriding in Methods Constructors, Access Modifiers, Encapsulation	
2	Polymorphism - Method Overloading, Using Objects as Parameters, Returning Objects, Encapsulation, Static Methods, Final Variables, Final Class, Interfaces - Inner Class, Get Class, Types of Interfaces, The super keyword, private Methods, Calling Outer class Variables, Unique Overriding, Dynamic Method Dispatch, Casting with Interfaces.	8
3	Packages and Interfaces : Packages - Defining a Package, CLASSPATH, Access Protection, Importing Packages, Interfaces - Interface vs Abstract class, Adding an interface, Implementing Interfaces, Accessing implementation through another interface, overriding methods; Exception Handling - Checked Exceptions, Unchecked Exceptions, try Block and catch Block, Multiple catch Classes, Nested try Statement, Error, AssertionError, Not Built-in Exceptions, Custom Exceptions	8
4	Swing fundamentals - Overview of AWT, Using the AWT, Using Event Processors, Using Containers, Components and Components, Using Packages, Event Handling in Swing, Using Layout Managers, Exploring Swing Components, Labels, The Swing Toolkit, Menus, Event handling - Event Handling Mechanisms, Differences From Model, Event Classes, Sources of Events, Event Listener Interface, Using the Delegation Event Model, Developing Desktop Applications using JDBC - JDBC interface, Types of SQL, Common JDBC Components, Connection, PreparedStatement	9

Examination Marks
(CSE- 60 marks, EEE- 60 marks)

Continuous Internal Evaluation Marks (CIE):

Achievement	Assessment/ Management	Internal Assessment-I (Written)	Internal Assessment-II (Written)	Total
I	12	36	36	48

Eind Toetsen Structuur en Maat (ETSM)

In Term A, all questions need to be answered and in Term B each student can choose any two full questions out of four questions.

Part A	Part B	Total
<ul style="list-style-type: none"> - 1 Question from each module. - Total of 10 Questions, comprising 3 marks 	<ul style="list-style-type: none"> - Each question carries 3 marks. - Five questions will be given from each module, out of which 1 question should be answered. - Each question can have a maximum of 3 subquestions. 	
(Total = 30 marks)	(Total = 15 marks)	

Course Outcomes (COs)

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

	Course Outcomes	Student's Knowledge Load (KL)
CO1	Explain the process of developing Java programs, including how classes and components can be used to solve problems.	K2
CO2	Utilise object-oriented programming principles in the design and implementation of Java applications.	K2
CO3	Design and manage Java packages and methods, reflecting code readability and maintainability.	K2
CO4	Implement error handling using Java's exception mechanisms and strategy interface for reliable applications.	K3
CO5	Develop event-driven Java GUI applications with graphical consistency.	K2

Level: K: Remember; U: Understand; A: Apply; E: Analyse; L: Evaluate; C: Create

ESL/PGI Shopping Table

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
C01	1	2										3
C02	1	3	1									3
C03	1	3	1	3								3
C04	1	3	1	3								3
C05	1	2	2	2								2

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	Hersteller	Sun Microsystems	11/e, 2001
2	Introduction to Java Programming, Comprehensive Version	T. Daniel Liang	Pearson	10/e, 2014
3	Real Time Design Patterns	Brian Freeman, Elizabeth Robson, Scott Beaumont, Kathy Sierra	O'Reilly Media	1/e, 2004

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	2/e, 2011
2	UML™ for Developers	David Templer	Prentice Hall	1/e, 2009
3	Class Design : A Handbook of Agile Software Craftsmanship	Extreme Programming	Pearson India	1/e, 2013
4	Requesting with Java	T. Saligrama	Morgan Kaufmann	0/e, 2013
5	Java For Dummies	Barry J. Burd	Wiley	8/e, 2012
6	Effective Java	Joshua Bloch	Prentice	3/e, 2011

Télé-Links (NOTTEL, SWAYAM...)

Méthode	Liens
N/A	
1	https://openstax.org/r/ressources1280x1024 (Lien externe à l'URL, 1, 2, 3, 4)
2	https://openstax.org/r/ressources1920x1080 (Lien externe à l'URL, 1, 2, 3, 4, 5, 6, 7)
3	https://openstax.org/r/ressources1280x1024 (Lien externe à l'URL, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16)
4	https://openstax.org/r/ressources1280x1024 (Lien externe à l'URL, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15)

SEMESTER-SM

ROBOTICS LAB

Course Code:	PCCAL017	CIE Marks:	25
Teaching Hours/Weeks (L:T:P:R)	0:12:0	L.E.I Marks:	10
Credits:	2	Exam Hours:	2 hrs. 30 Mins.
Prerequisites (if any):	EECAL011	Course Type:	Lab

Course Objectives:-

1. To expose the students to the various sensor and actuator functioning, working of mobile robots and learning intelligent systems.

Topic No.	Topics
PART A	
1	Familiarization of Arduino IDE, Arduino microcontroller ICs including (L29, L293D, Servo Motor).
2	Introducing DC and DC motors along with Arduino.
3	Introducing DC motor with encoder (open and closed loop).
4	Introducing Servo Motors with Arduino – angle & Position.
5	Familiarization of Robotics Board & its IO handling.
6	Mobile Robot assembly.
7	Steering a robot using SLC.
PART B	
8	Writing a Simple Publisher and Subscriber, Simple Service and Client, Publishing and getting data, Creating messages from a msg file (YAML file).
9	Localization of a mobile robot using LIDAR (RPLIDAR).
10	Implementing a mobile robot using Python API.
11	Line Following Robot using Python.
12	Image Processing using RPI-PI Camera module.
13	Obstacle avoidance of a mobile robot while moving to a point.
14	Navigating a mobile robot using ultrasonic or LIDAR.

Course Assessment Method
(CCE: 40 marks, ECE: 40 marks)

Continuous Internal Evaluation Marks (CIE):

Assessment:	Pre-Task Work requirements Time and Tools; completion of Job Scripts - Revised (Continuous Assessment)	Internal Evaluation	Total
4	22	19	20

End Semester Examination Marks (ESE):

Procedure/ Programme/ Tool or Design/ Algorithm	Content of requirement/ Execution of work/ Tool/Design/ Programming	Score with valid Indicators/ Qualified Output	First mark	Second	Total
22	16	10	38	4	42

- Submission of Board 2 Student shall be allowed for the mid semester examination only after maintaining the daily specified record.
- Submission by External Examiner: The external examiner shall evidence the same.

Course Outcomes (COs):

At the end of this course student should be able to:

Course Outcomes	Bloom's Knowledge Level (OKL)
CO6: Identify different geographical areas, Indians and Englishmen %.	K3
CO7: Applyability of model in context with different cultures and countries.	K3
CO8: Implement implementation of model in context.	K3
CO9: Build model system or system by using different algorithms.	K3
CO10: Implement Indian language.	K3

Date: 21.12.2018 Version: 01. Under and ECE Deptt., PU, Author: SU, Duration: 45, Credit: 3

**CO. PII Mapping (Mapping of Course Outcomes with Program Outcomes);
 ✓ (High) > Moderate (Medium), ⚡ (Low) = No Correlation**

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
C02	2	2										2
C03	2	2										1
C04	1	1	2	2								1
C05	2	2	1	1	2							4
C06	2	1	2	2	2							3

Reference Books:

SL. No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Introduction to Autonomous Mobile Robots	George, Svenn	MIT Press	1/e, 2008
2	Robotics, Vision and Control: Fundamental Algorithms in Matlab	Stein, Danil	Springer	1/e, 2011
3	Introduction to Robotics	John J. Craig	Pearson	3/e, 2006
4	Introduction to Robotics	KR. Itoh	McGraw-Hill	1/e, 2006
5	Robotics and Control	KK. Vedhanayagam and JJ. Vaidyanathan	Taylor & Francis	1/e, 2002
6	Robotics: Sensing, Planning, Acting	Darren, Deisenroth, L., Tishby, Mordatch	Springer	1/e, 2012

Video Links (OPTEL, SWAYAM...)

No.	Link ID
	https://www.youtube.com/watch?v=JzXgjIwQfA8
1,2,3,4	https://www.youtube.com/watch?v=KmC_jeT9jpw
	https://www.youtube.com/watch?v=1D12q629
	https://www.youtube.com/watch?v=KmC_jeT9jpw

Continuous Assessment (25 Marks)

1. Progression and End-Lab Works (7 Marks)

- End-Lab Assignments - A sequence of open lab assignments or quizzes that are understanding of the upcoming assignment.
- Understanding of Theory: Influence based on students' progression and understanding of the theoretical background related to the requirements.

1. Content of Experiments (11 Marks)

- Structure and Function: Ability to create programs, create function of experiments, and defining safety protocols.
- Skill Proficiency: Demonstrating reading equipment, safety in laboratory, and troubleshooting skills during the experiments.
- Teamwork: Collaboration and participation in group experiments.

2. Lab Reports and Record Keeping (8 Marks)

- Quality of Reports: Clarity, completeness and accuracy of the reports. Proper documentation of experiments, data and relevant evaluations.
- Testimony Statement: Ability to explain the activities by referring to reports and record books, demonstrating a well-organized file record.

4. Viva Voce (2 Marks)

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

Final Marks Assessment: The final marks for progression, content of experiments, viva, and overall are the average of all the specified experiments in the evaluation.

Evaluation Patterns for End Semester Examination (40 Marks)

1. Practical Preliminary Work/Quality Algorithm (10 Marks)

- Structure Understanding and Description: Clarity in explaining the procedure and understanding task being involved.
- Preliminary Work and Planning: Thoroughness in planning and organizing the experiments.
- Algorithm Description: Correctness and efficiency of the algorithm related to the experiments.
- Creativity and logic in algorithm or experimental design.

1. Content of Experiments/Evaluation of Work/Programming (10 Marks)

- Logic and Functions: Representing and accurate outcome of the experiments or programming tasks.

3. Results with Valid Assessment (Quality of Output) (10 Marks)

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

4. Test View (18 Marks)

- Ability to explain the arguments, processes results and answer related questions
- Proficiency in answering questions related to theoretical and practical aspects of the subject

5. Round (5 Marks)

- Completeness, clarity, and accuracy of the last answer submitted

SEMESTER 7

**COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE)**

SEMESTER 5th

FORMAL METHODS IN SOFTWARE ENGINEERING

(Common to CSE, CH, CA, and AI)

Course Code	MEC5774	CIE Marks	48
Teaching Hours/Ticks (L: 72; T: 0)	24:00	ESE Marks	09
Credit	3	Total Hours	128s: 18 hrs.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To enable the learners to apply formal methods for modelling, validation, and verification of software systems.
2. To familiarize with a range of advanced tools that address challenges faced in usage, writing, and verification.
3. To provide an introduction to the theoretical aspects of these tools, as well as their applications.

SYLLABUS

Module No.	Syllabus Description	Credit of Hours
1	Introduction: Stages in software development, software defect measures of software problems, techniques for dealing with software defects Testing and validation, formal methods and tools.	8
2	Ensuring reliability in the design phase: Conceptual modelling, the real-life, conceptual modelling or UML, Applying UML models, Testing bugs in modelling, How AI is useful? How that for Generating Safety-critical system solutions.	8
3	Verification by Model Checking: Verifier for Concurrent C (VCC) - a Ctlm, Tigris, based tool for Verifying Concurrent C, Inter-procedural verification of programs, ghost variables	8
4	Program Verification:- Inter-procedural verification of programs in VCC, Aviation software program verifier, Using concrete, growing tool verifications of programs in VCC.	8

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

Continuous Internal Testbeds Marks (CIE)

Attendance *	Supervision Marks	Internal Evaluation-1 (Testbed)	Internal Evaluation-2 (Testbed)	Total
5	15	11	19	45

End Semester Examination Marks (ECE)

In Part A, all questions will be numerical and in Part B, each student can choose any one Self question out of four questions.

Part A	Part B	Total
2 Questions from each module. Total of 2 Questions, each varying 3 marks (Total = 6 marks)	Each question carries 2 marks. Two questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 subquestions. (Total = 8 marks)	14

Course Outcomes (CO)

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

	Course Outcomes	Elaborate's Knowledge Level (KLO)
CO1	Explore the need and use of formal methods and tools in software engineering.	KO
CO2	Demonstrate conceptual modelling of systems using UML.	KO
CO3	Elaborate the process of proving correctness of code using Static-Dynamic based method presentation analysis	KO
CO4	Demonstrate program verification using VCC.	KO

Note: 25-Assignment; 15-Understanding; 20-Apply; 5-Analysis; 10-Learning; 20-Creativity

EII-001 Mapping Table (Mapping of Course Elements to Program Outcomes)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13
C01	1	-	-	-	-	-	-	-	-	-	-	-	-
C02	1	1	3	3	1	+	-	-	+	-	-	-	-
C03	1	1	3	2	-	-	-	-	-	+	-	-	-
C04	1	1	3	2	1	-	-	-	-	-	-	-	-

(Step 1: Align C01, C02, C03, C04 with P01-P13; Step 2: Map C01-C04 to outcomes)

Text Books

M. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Verifying C Programs: A YCCC Tutorial, Working draft, version 1.2	T. Ollila, H. A. Hillenbrand, S. Tolosa, S. Stensrud, W. Koenig	MIT Press	2011

Reference Books

M. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Verifying C Programs: A YCCC Tutorial, Working draft, version 1.2	T. Ollila, H. A. Hillenbrand, S. Tolosa, S. Stensrud, W. Koenig	MIT Press	2011
1	The YCCC Library, Working draft, version 1.2			2010

Links

No.	Links
1	Tutorial for Library Developers (C Implementation Examples)

SEMESTER 5

WEB PROGRAMMING (Common to CS-CSE-CM-OD-CR-AD-AM)

Course Code:	PGCIT7403	CIE Marks:	40
Teaching Hours/Work (L.T.P.R)	1.000	ESE Marks:	10
Duration:	1	Exam Hours:	2 hrs. 10 min.
Prerequisites (if any):	None	Course Type:	Theory

Course Objectives:

1. To equip students with the knowledge and skills required to create, edit, and manage web pages using HTML, CSS, JavaScript, and related technologies.
2. To provide hands-on experience with modern web development tools and frameworks such as React, Node.js, jQuery, and databases, enabling students to design and build dynamic, responsive, and interactive web applications.

SYLLABUS

Module No.	Syllabus Description	Credit Hours
1	Creating Web Pages using HTML - Document, Head, HTML Elements, Writing, Linking, Images, Special Characters and Reserved HTML Tags, Title, Head, Inserted Linking, meta, Database, HTML Forms and Types, Input and Output Elements and corresponding Attributes, Page-Header Elements, Styles, Web Page with CSS - Introduction, Select Style, Embedded Style Sheet, Linking External Style Sheet, Positioning Elements, Absolute Positioning, relative Positioning, Dynamic Elements, Relative Positioning, Document, Box Model and Text Flow, Media Types and their Queries, Deep Dive about CSS, Extensible Markup Language - Introduction, XML, Data, Structuring Data, XML Processing, Document Type Definitions (DTD), XML Validation.	3
2	Scripting Languages - Client Side Scripting, Data Types, Conditionals, Loops, Arrays , Objects , Functions Definitions vs Function Expressions , Nested Functions , The Execution Scope Model (ES6) - Local and Global, Object Oriented Scripting Methods, Element Node Objects, Data Types	3

	<p>Asynchronous JavaScript and XML - A/JAX - Making Asynchronous Requests, Converting Content from A/JAX, Cross-Origin Resource Sharing</p> <p>JavaScript Errors - jQuery - jQuery Promises - Initiating, Query, Query-Selector, Common Element Manipulation in jQuery, Event Handling in jQuery</p>	
4	<p>JavaScript runtime environments : Node.js - The JavaScript of Node.js, Working with Node.js, Adding Express in Node.js, Server-side programming language - Node.js - What Is Server-side Development? Quick tour of Node, Project Context, Functions, Arrays, Classes and Objects in Node.js , Object-Oriented Design , Rendering HTML , React - React Foundation, The Philosophy of React, What is a component? Basic vs. composite, Composite and functional components - Types of components, Function Components, Differences between Function and Class Components</p>	
4	<p>API - REST, Angular 2, Working with databases - Database and Non-Database, SQL, Database API's, Accounting MySQL in Node, Web Application Design - REST API, RESTful API Design, Semantic API Learning , Behavior Design Patterns in the REST Context, Testing, Web services - Creation of Web Services - SOAP Services, REST Services, API Design: View Services, Viewpoints - Interacting systems</p>	

Course Assessment Method:
(ECE- 40 marks, EEE- 60 marks)

Continuous Internal Evaluation Marks (CIE):

Ambulance	Assessment/ Management	Internal Evaluation-I (Written)	Internal Evaluation-II (Written)	Total
5	15	15	15	45

End Semester Examination Marks (ESM):

In Sem-A, all questions need to be attempted and in Sem-B, each student can choose any two full questions out of four questions.

Part A	Part B	Total
12 Questions from each module. Total no. of Questions, marks carrying 3 marks (3x12 = 36 marks)	Each question carries 3 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 subquestions. (3x2 = 36 marks)	36

Course Outcomes (COs)

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

Course Outcomes		Student's Knowledge Level (SKL)
CO1	Develop functional web pages with HTML and style them using CSS techniques, including positioning, media queries, and the box model.	SK1
CO2	Write database design using normalization and utilize query by DOM manipulation, event handling, and AJAX requests to receive responses and interact with user interface.	SK2
CO3	Develop and deploy server-side applications using Node.js, Express, and MySQL, and integrate database using SQL to store and retrieve data for dynamic server-side processes.	SK2
CO4	Utilize React for building component-based single-page applications (SPA), understanding the fundamental principles of component architecture, and integrating AngularJS for web application development.	SK2

Score: E: Exceeded; M: Understood; L: Applied; R: Related; S: Estimated; A: Assessed

ECD-201 Mapping Table (Mapping of Course Outcomes to Program Competencies)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	1	1	-	1	-	-	-	-	-	-	-	1
CO3	1	1	1	-	1	-	-	-	-	-	-	-	1
CO4	1	1	1	-	1	-	-	-	-	-	-	-	1

Table 7: ECD-201 Course 2 (Assessed Outcome, 2 Semesters taught, 1st Semester).

Text Books

ECD No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	<i>Fundamentals of Web Development</i>	Sonya Ceramicci, Richard Geer	Pearson	1st 2017
2	<i>Building Web Interfaces with React.js - An Approachable Guide</i>	Chris McEvily	Wiley	1st 2017
3	<i>Java & World Wide Web - Java in Programs</i>	Paul J. Deitel, Harvey M. Deitel, Alice P. Deitel	Pearson	1st 2011

4	SEA Design and Development Understanding Single Page Web Applications	Pratik Sora	Memory Published	16/3/2011
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Reference Books				
S.R.No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	A Head First On REST Development : From Basics of HTTP to a Scalable and RESTful API	James Siera	O'Reilly press	1st, 2010
2	Advanced REST Development with Java	Adam Lindgreen	APress	1st, 2010
3	Up-Grade Your REST API Version With Developments	Tim Aprik, Michael Coughlin	APress	1st, 2012

Video Links (GATE, IIT-JAM, IIT-BHU)	
Module No.	Link
1	Link 1
1	Link 2

SEMESTER 5
BIOINFORMATICS

Course Code:	BCS3714F	CH Marks:	40
Teaching Hours/Week (L-T-P-W)	3-0-0	ESL Marks:	00
Credit:	1	Exam Hours:	2 hours
Prerequisites (if any):	None	Course Type:	Theory

Course Objectives:

1. To understand the fundamental concepts in Molecular Biology, Bioinformatics, Proteomics and Bioimaging.
2. To introduce bioinformatics tools such as genes and proteins, different biological databases, and tools and algorithms for biological data processing, analysis and interpretation, and the relevance of the systems approach in Molecular Biology.

SYLLABUS

Module	Syllabus Description	Count of Hours
1	Molecular Biology Frame (2 hours) Genes, DNA, RNA, Protein, Genetics, Reproductive strategies, Biochemicals as structure and usage Sequence Alignment (3 hours) Global and local sequence alignment-Dynamic programming algorithm, subsequence, similarity, Needleman-Wunsh, Kyburg, Smith-Waterman Algorithm	5
2	Biological Databases and Data Formats (3 hours) Sequence and protein Data formats, Genbank, EMBL, NCBI, and SGD, PROSITE, NCBI-Databank Searching, BLAST, FASTA Proteogenomics (3 hours) Proteogenomic Data mining and Comparative Genomics, UniProt, Neighborhood joining, Pancreas proteome, Address access, Bootstrapping	6
3	Computational Protein Mining (3 hours) Computational Protein Mining, Signal Mining, Enzyme Data, MAST, Trans, Protein domain search algorithms, Aggregation Protein Mining	3

	B FOR RECOMMENDATIONS Materials: Due dates, revised flow cytometry, Bring manipulants, Powerpoint, Summary essays, lab and lecture, For reading: Programs in health, Biological flow and power maps file for incorporation, pedigree for exome, GnomAD, FANTA, ELAST, Bioinformatics, and Bioinformatics (a). Individual Laboratories/Supervision Tasks Biological Database: Sequence alignment, BLAST, Study of programs FANTA, classify for multiple sequence alignment, Bioinformatics software, Genotype/Phenotype and Model curation, Related Programs in R.	
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Course Assessment Matrix
(CIE= 40 marks, EIE= 60 marks)

Continuous Internal Evaluation Marks (CIE):

Academic	Assessment Methodology	Internal Evaluation-1 (Written)	Internal Evaluation-2 (Written)	Total
8	30	30	18	48

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 10 Questions, each carrying 3 marks 300 - 30 marks	Each question carries 3 marks. Two questions will be given from each module, out of which 1 question has to be answered. Each question can have a maximum of 12 sub-questions. (300 - 30 marks)	90

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

Course Outcomes		Student's Knowledge Level (K.L.)
CO1	Understand the Basics of Bioinformatics	K1
CO2	Use various biological databases and apply sequence alignment techniques	K2
CO3	Use molecular phylogenetics to identify evolutionary relationships among various biological species	K3
CO4	Apply the concept of semi-supervised pattern matching in bioinformatics	K3
CO5	Use R language and packages to solve bioinformatics problems	K3

Direc: K.L. Dynamics; KL: Undergrad; K1 - Apply, K2 - Analyze, K3 - Evaluate, K4 - Create

CO-PO Mapping Table: Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	-	-	-	-	-	-	-	-	1
CO2	2	2	2	-	-	-	-	-	-	-	-	2
CO3	1	2	3	1	-	-	-	-	-	-	-	2
CO4	1	2	3	1	-	-	-	-	-	-	-	2
CO5	4	4	3	1	1	-	-	-	-	-	-	2

Dem: 1 - High-Deg, 2 - Medium-Degress, 3 - Subnormal (Avg), - 10 - Considered

Text Books

SL. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	An Introduction to Bioinformatics Algorithms	S. E. Levenson & A. Pachter	MIT Press, 2004	1st, 2004
1	bioinformatics for Bioprocess: from Quantitative Molecular Evolution, Bioinformatics, to Bioprocess	Supriyo Chakrabarti	Academic Press	1st, 2014
1	C Programming for Bioinformatics	Rakesh Srivastava	CCIC Press	1st, 2008

Reference Books				
S. No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Introduction to Biostatistics	T.E. Bedford and D.J. Pocock, S. Jones and F. Schutte	Springer International	4th, 2016
2	Analysis of Biological Networks		Wiley Publishers	1st, 2007
3	Mathematical Techniques Methods - Examples & Mathematics	T. Sze and T. Wan, Liang	Morgan & Claypool Publishers	1st, 2009
4	Mathematics for the Sciences	D. A. Brannan et al.	Cambridge University Press	1st, 2016

Title Links (NPTEL SWAYAM ..)

Module No	Link ID
1	https://academy.iitk.ac.in/course/121960010001
2	https://academy.iitk.ac.in/course/121960010002

SEMESTER 5th
INFORMATION SECURITY
 (Common to C1/CIVCA/CS)

Course Code	PE05TH	CSE Marks	40
Teaching Hours/Week (L+T+P)	3+0+0	TUE Weeks	00
Credit	1	Term Weeks	1 Day M/W/F
Prerequisite (if any)	PE04TH	Course Type	theory

Course Objectives:

1. To learn the concepts of confidentiality, integrity and apply access control mechanisms to the user information.
2. To understand Threat and Vulnerability and design security framework.
3. To learn how to measure the coverage and security status of threat as it is communicated over the network with real setting.

SYLLABUS

Module No.	Syllabus Description	Contact Hour
1	Introduction to Information Security - CIA model, OSI Security Architecture, Security Goals, Security Services and Mechanisms, Threats, Insider Threats, Denial of Service, Timing attack, Malware, Access Control Mechanisms - Access Control, Access-control matrix, Access control in OS (Windows, mac, Linux), Access control, Data based access control.	8
2	Network Vulnerabilities - Buffer overflow, Denial of Service, Denial of Service (DoS) and vulnerabilities, TCP, Inbound and Outbound firewalls, Routing Algorithms – Distance, Worms and Trojans, Topological worms, Trojans, Botnet attack, Denial-of-service attacks, Current threats	8
3	Protection of security of information storage - Processing, and Transmission Information Security Management - The ISO Standard relating to Information Security - Other Information Security Management Frameworks - Security Policies - Security Controls - The Risk Management Process – Cryptology and legal frameworks, Authentication – User Authentication, Token based, Biometric Authentication, Session Key authentication, Multifactor authentication.	8

4	Security in Networks - Threats to networks, Transport Security, Cryptographic Architecture, Encryption, Content Integrity, Strong Authentication, Access Control, Network Security, Cryptography, Tools for security, Firewall – Design and Types of Firewall, Firewall Protocols, SSL, Port Forwarding – TCP, UDP, ICMP.	9
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Course Assessment Marks:
(CIE: 40 marks, ESE: 10 marks)

Continuous Internal Evaluation Marks (CIE):

Assessment	Assignment/ Milestone	Second Examination-I (Written)	Second Examination-II (Written)	Total
5	12	16	16	48

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 4 Questions, each carrying 3 marks (80 - 24 marks)	Two questions cannot be asked. Two questions will be given from each module, out of which 1 question needs to be answered. Each question can have a maximum of 2 sub-bullets (80 - 16 marks)	

Course Objectives (CO):

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

Course Objectives		Bloom's Knowledge Level (OKL)
CO1	Explain the goals, purposes and mechanisms related to information security.	LO2
CO2	Identify the different types of threats and threats and the design strategies to mitigate the threats.	LO1
CO3	Discuss the different security policies within an organization, covering data protection and compliance with industry standards and legal requirements.	LO3
CO4	Discuss the skills to evaluate network security, plan for it in future, and respond to potential security incidents.	LO2

LO1- Identify; LO2-Understand; LO3-Apply; LO4-Analyse; LO5-Evaluate; LO6-Create

ECDL Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11
C01	3	1	3								3
C02	3	3	3								3
C03	3	3	3								3
C04	1	3	3								3

Note : / High Ord. / Moderate Ordin., / Satisfied / Neg. - Un-Satisfied

Text Books

No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Network Security and Cryptography	R. Venkatesan	Omega	Oct, 2013
2	Cryptography and Network Security Principles and Practice	William Stallings	Pearson	Jan, 2012

Reference Books

No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Cryptography and Network Security	R. A. Ferguson, D. Schneier, S. Kohno	McGraw-Hill	Dec, 2012
2	Network Security - Principles Applications and Standards	William Stallings	Pearson	Jan, 2011
3	Information Systems Security	James Stachura	Riley	Jan, 2011

Free Links (NOTE: WWW links...)

No.	Link ID
1	https://www.tutorialspoint.com/cryptography/index.htm
2	https://www.geeksforgeeks.org/cryptography/

SEMESTER 5
PROGRAMMING IN R

Course Code:	FTE42794	CIT Marks:	40
Teaching Hours/Week (L.T.P. R)	2.00.0	L.E Marks:	20
Credit:	1	Exam Hours:	2 hrs. 10 min.
Prerequisites:	Their:	Examination Type:	Theory

Course Objectives:

- To equip students with the knowledge and skills required to utilize R for data analysis and visualization.
- To enable students to apply R programming techniques in statistical modelling and data science projects.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to R : Environment - Overview, Command Line Interface, and Basic processing; R Packages, Basic Data Types - Vectors, Lists, Data Frames, Matrices, and Arrays, Control Structures - If Else, Switch, For loops, While loops, Functions - Writing and using functions, Scope of variables, Function arguments, Returning values	8
2	Data Import, Cleaning, and Programming : Data Import and Export - Reading and writing data from file (CSV, Excel), and other software. Data Cleaning - Connecting to databases and importing data using package dplyr; Managing Data - NA, NULL, missing Data Cleaning and Programming - Cleaning and removing duplicates, Identifying outliers, Data transformation and normalization, combining data sets. Storing Data Objects, summarizing functions.	8
3	Statistical Analysis and Data Visualization : Introduction to Data analysis, Summary statistics, Statistical Tests - Continuous Data and Discrete Data	8

	<p>Common Multivariate regression: Probability distributions = Normal distribution.</p> <p>3. Origins = Overview; Computing Check; Original problem; New Origins Section; Links; Origins - Links; Authors; Download Links; Origins; Logins</p>	
4	<p>Markov Chain: with hidden variable, supervised vs Unsupervised learning, single step and chainlike transition. Building linear models - model fitting, predict values using models. Analysing the fit, Evaluating the model. Regression - Type, Unusual observations and diagnostic measures. Comparison of models.</p> <p>Case studies and applications - Euclidean applications of S in various fields like Finance, Healthcare, and Social Sciences</p>	3

Course Assessment Method (ETE: 44 marks, ESE: 46 marks)

Continuous Interval Examination Marks (CIE):

Attendance	Assignment Mid-Project	Interval Examination-1 (Written)	Interval Examination- 2 (Written)	Total
9	18	15	16	48

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, mark carrying 1 for question will be given from each module, out of 8 marks (In 32 marks)	Each question has a 2 marks. Two questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 marks (i.e., 40 = 32 marks)	48

Course Outcomes (COs)

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

Course Outcomes	Student's Knowledge Level (KL)
CO1 Explain the R programming environment for data analysis and visualization.	KL1
CO2 Utilize R tools to import, clean, and manipulate data efficiently.	KL1
CO3 Perform statistical analysis and interpret the results using R visualization.	KL1
CO4 Use basic machine learning models and perform prediction models using R.	KL2

Note: KL-Remember; KU-Understand; KI-Apply; KW-Analyze; KS-Evaluate; KL-Creat

CO-TO Mapping Table: Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	1	1											1
CO2	1	2	2	2	2								2
CO3	1	2	2	2	2								2
CO4	1	2	2	2	2								2

Note: 1-Algo; 2-Data; 3-Statistical Methods; 4-Statistical Inference; 5-Correlation

Text Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	R for Data Science	Hadley Wickham	O'Reilly	2nd, 2022
2	The art of R Programming	Thomas McFarland	O'Reilly	1st, 2011

Reference Books				
Sl. No	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	R. R. Bryson. Advanced analysis and graphics.	Donald R. Luenberger	John Wiley & Sons, Analytical Methods	1/e, 2004
2	R. R Data Science	Hilary Wrayman, Gareth Hardcastle	O'Reilly Media	1/e, 2016
3	Machine Learning with R.	Robert I. Evans	Packt Publishing	1/e, 2012

Video Links (NOTEEL, YouTube...)	
Module No	Link ID
1	https://noteel.org/plus/11139411334300
2	https://noteel.org/plus/11139411334300

SEMESTER 5
BIOMEDICAL ELECTRONICS

Center Code:	PECE57MT	CIE Marks:	40
Teaching Hours/Week (L-T-P-R)	10.6.3	ESE Marks:	20
Credit:	3	Lecture Hours:	24 hrs. 12 days.
Prerequisite (if any):	None	Examination Type:	Theory

Course Objectives:

1. To gain fundamental knowledge of biological acquisition and analysis
2. To develop an understanding of signal processing principles for biomedical applications
3. To become familiar with the measurement of various physiological parameters

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Basic Theory of Measurement: Concepts of Measurement: power, acoustics, memory measurements. Fourier & Window Measurements. Measurement Errors. Characteristics of Error: Scaling with Measurement Errors. Error Correlation Analysis.	8
2	Electrodes/Transducers and Transducers: Signal Acquisition, Transducers: Tendon and Spinal Recording for Infrared Sensing, Vertical Surface Measures, Microelectrodes, Glass Capillary, Glass Pressure Sensors, Standing Waves in Cables, Piezoelectric, Capacitive, and Inductive Transducers.	12
3	Biostress Amplifiers: Multiple Input Circuits, Signal Processing Circuits, Rectified Oscillators, Intensity Amplifiers, Chopper Modulated Amplifiers, Signal Conditioning: Working of inclusion amplifiers, bandpass, negative and optical sensors, active DC amplifiers and AC power amplifiers. (Circuit diagram and working principle)	12

1	Measurements of Force/moment: Measurements of blood flow: radiographic techniques, Indirect dye method, Acetyl cholinesterase, magnetic blood flow sensor, ultrasound bloodflow sensor. Measurement of blood pressure, haemostasis measurement, study of bone again, angiography and other measurement equipment, measurement of auditory, olfactory, imaging, skin, endogenous.	8
4	Recording Systems: Basic recording systems, Biometrical recording- DOD, VDO, ECG, EKG, Pulse Monitoring systems, system concepts, Biomedical telemetry- basic, ultramodern- basic concepts and general principles Medical Imaging Systems: X-ray, radionuclide and digital radiography, Ultrasound, computer tomography, Nuclear medical imaging systems, MRI, Ultrasonic imaging systems, thermal imaging systems (only) basic and principles	8

Course Assessment Method
(CIE- 40 marks, EST- 30 marks)

Continuous Internal Evaluation Marks (CIE)-

Attendance	Attendance Micro-projects	Internal Evaluation-1 (Written)	Internal Evaluation-2 (Written)	Total
5	10	10	10	40

End Semester Examination Marks (EST)

In Part A, all questions need to be answered and in Part B, each student can choose any 20/24 full points out of total questions

Part A	Part B	Total
Q1-Q10: Each question carries 2 marks. Total of 10 Questions, such carrying Two questions will be given from each module, out of which 2 questions should be answered. Each question can have a maximum of 2 sub-questions. (10x2=20 marks)	(40+30 marks)	40

At the end of this session student should be able to:

	Course Outcomes	Master's Knowledge Level (KL)
C08	Explain the terms of measuring, recording and interpreting the information.	K1
C09	Describe the various measuring processes in human body.	K2
C10	Distinguish the various recording systems, efficiency and storage of information.	K2
C11	Identify the various modes mapping techniques and their biomedical applications.	K2

Term: E-1, Semester: E2- Under and E3- Apply, E4- Analysis, E5- Electron, E6- Crash

CO-PO Mapping Table: Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	1								2
CO2	1	1	1	1								1
CO3	1	2	2	1								1
CO4	1	2	2	1								1

Note : 1-Digit (1ms), 2-Maximum (Maximum), 3-Likely (likely), -No Correlation

Term Basis:

SL No	Title of the Basis	Name of the Academic	Name of the Institution	Entered on
1	Standard Of Standard Data Structures	Dr. R. S. Khandwala	Gujarat Institute of Technology GIDC	12/12/2014
2	Information systems and automated management	Shrikant Patel	PES Institute of Tech	13/12/2014

Reference Books:

Sl. No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
2	Introduction to Statistical Quality Control	T. J. Cucarola and T. M. Brown	Jensen	4th, 2002
3	Identification of Numerical Techniques	S.S. Khurmi	McGraw-Hill	13, 2004
4	Principle of Applied Numerical Interpolation	L.A. Ostwald and L.T. Baker	Wiley	12, 2001
5	Principle of Numerical Mathematics and its Application	C. Deoheri and S.B. Deoheri	Government press	18, 2004

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Molten Salt	Link ID
Li ₂ SiO ₃	https://www.reaxys.com/reaxys/search?query=Li₂SiO₃&searchType=exact
Li ₂ SiO ₃	https://reaxys.reaxys.com/reaxys/search?query=Li₂SiO₃&searchType=exact

SEMESTER 5th
REAL TIME SYSTEMS
 (Common to CSE/CVAN)

Course Code	RCET5748	Credit Marks	40
Teaching Hours/Week (L-T-S-S)	3-0-3-0	E&L Marks	40
Examination	0	Exam Marks	20m, 20m
Prerequisites (if any)	POC57400, POC57401	Course Type	Theory

Course Objectives:

1. To enable the learners to familiarize with the concepts of Real Time systems.
2. To teach different task scheduling algorithms in uniprocessor and multiprocessor environments.
3. To learn the features of real-time communication, and their standards used now-a-days.

SYLLABUS

Module e No.	Syllabus Description	Credit Hours
1	Introduction to Real-Time systems: Basic concepts, applications of Real-Time systems, basic model of Real-Time systems, characteristics of Real-Time systems, types of Real-Time systems: hard, firm, soft, timing constraints, scheduling theory, constraints.	8
2	Real-Time task scheduling: Dead-line, slack-driven scheduling, deadline scheduling, cyclic, minimum, hybrid scheduling, event driven scheduling, EDF scheduling, EDD, DDD, round robin, preemptive RT tasks, Priority inversion, Priority Inheritance Protocol, Highest Lester Protocol, Shortest Job First Protocol, Scheduling Real-Time tasks in multiprocessor and distributed systems, Task allocation scheduling of tasks, tasks in distributed Real-Time systems.	12
3	Commercial Real-Time Operating Systems: Time servers, Features of real-time operating systems, UNIX and Windows as RTOS, PSLinux, RTLinux, QNX, RT Linux, Lynx, real RTOS, microkernel RT OS, Real-Time DB, databases, RT applications, NoSQL DB.	8
4	RT communications: QoS framework, mobile Real-Time Communication in a WLAN, IEEE 802.11, IEEE 802.19, Communication over Delay Insensitive Networks, Routing algorithms, RPL, rate control, RT database - Applications, characteristics of integral data, Concurrency control, Commercial RT	10

Assessment: Open Systems in Grid Data system

Course Assessment Method
(ECE- 40 marks, EEE- 40 marks)

Continuous Internal Evaluation Marks (CIE):

Assignment	Assignment Mid-semester	Internal Examination (Wiseup)	Internal Examination I (Wiseup)	Total
E	17	18	18	43

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 four questions.

Part A	Part B	Total
2 Questions from each module. Total of 3 Questions, each carrying 2 marks (Total = 6 marks)	Each question carries 2 marks. Two questions will be given from each module, out of which 1 question should be attempted. Each question can have a maximum of 2 subquestions (Total = 2 marks)	06

Course Outcomes (CO's)

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

	Course Outcomes	Student's Knowledge Level (SKL)
CO1	Relate the various Grid Data applications, servers, design requirements and architecture	SL
CO2	Develop efficient algorithms for searching and manipulating in unstructured and semi-structured environments	SL
CO3	Model, de-structure of a real world data operating system in creating a grid data application	SL
CO4	Identify and address the important issues in grid data communication	SL
CO5	Understand the concepts of open and closed standards	SL

Score: W1- Semester; E1- University; E2- Agency; E3- Institute; E4- Business; X1- Create

ECD 310 Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
O01	3	1										3
O02	3	4	3									3
O03	3	3	2									3
O04	1	3	3									3
O05	1	1	3									3

Note : 1=High Order, 2=Medium Order, 3=Substantial (Mgt), -1=Insufficient

Text Books

S.No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Real-Time Systems Theory and Practice	Steve Leffler	Prentice Hall Inc.	1/e, 2007
1	Real-Time Systems	Ivan S. E. Lioy	Prentice Hall Inc.	3/e, 2009

Reference Books

S.No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Real-Time Systems Design and Analysis, 2009	Philip A. Lapinska, Sergio J. Orosz	Wiley	1/e, 2011

Video Links (OPTEL, SWATAM...)

Module No	RAID
1.1.1.4	https://www.youtube.com/watch?v=9mCJxqU4gzw

SEMESTER 5
COMPUTER VISION

Course Code:	EEC57746	CIE Month:	-01
Teaching Hours/Week (L, T.D, A)	5,2,0,0	Exam Month:	-02
Duration:	45	Exam Month:	1 Sem & 2 Sem
Prerequisites (if any):	N/A	Course Type:	Theory

Course Objectives:-

1. To cover the basics of image formation, key computer vision concepts, methods, techniques, performance, and various problems in developing computer vision and object recognition systems.
2. To make the learners to understand the fundamentals of computer vision and machine learning module to develop applications in computer vision.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Fundamentals in Computer Vision :- Convex Optimization, Robotic camera model, Orientation Image Processing - Curves, Surfaces, Localized Image Features - Elements of (Unsupervised) Segmentation, Convolutional Camera Processing, Image processing - Essential Camera Functions, Epipolar Geometry, Binocular Stereovision, Local Methods for立体视觉 Reconstruction, Global Methods for Stereo Vision.	9
2	Features and Filters :- Linear Filters, Linear Filters and Derivatives, Non-Linear Filters, Edge Detection, Edge Detection with Prewitt, Sobel, Laplacian, Non-Maxima Suppression, Non-Maxima Suppression based Edge Detectors Image Quantization - Compressing the Image Quantum, Intensity Based Segmentation and Color Quantization, Filters in Discrete Space - Visual and Geometric and Fuzzy Filtering	9
3	Machine Learning for Computer Vision :-	9

	<p>Machine Learning - Introduction, Classify for Machine Learning. Supervised and Unsupervised Data, Basics of Classification and Clustering, Multi-Class Recognition</p> <p>Machine Learning for Computer Vision - Object Detection / Learning - Deep Learning</p> <p>Class Case</p> <p>Machine Learning Models for Vision - Deep Vision-Prediction Model, Transfer Learning, Fine-Tuning, Convolutional Networks, Convolutional Volumes, Boundary Convolutional Layers, Pooling Layers - Maxpool, Average Pooling, Mobile architecture - ResNet, Neural Architecture Search Design - NASNet</p> <p>Representation and Object Detection -</p> <p>Representation Using Clustering Methods - Human vision: Shifting and Sifted, Applications. User Scenario Detection, Background Subtraction, Image Segmentation by Clustering Patches- Simple Clustering Methods, Clustering and Segmentation by Examples</p> <p>Object detection - YOLO, Implementation-YOLO, R-CNN and TensorRT Implementation, VOC and COCO Segmentation Model (Yolov3) Metrics</p> <p>A new way to measure performance of various models as a metric</p> <p>Assignment</p>
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Course assignments marked
(CE: 40 units; EST: 80 hours)

Continuous External Evaluations Matrix (CEEM)

Attribute	Aspect/ Manifestation	Second Estimation-1 (N=60)	Second Estimation-2 (N=60)	Total
5	52	26	26	48

End Semester Examination Marks (EAM)

In Term A, all questions need to be answered and in Term B, marks allocated from previous term may be split between one or two questions.

Part A	Part B	Total
2 Questions from each module	Each question receives 2 marks	
Total of 12 questions, each carrying 2 marks	Two questions will be given from each module, out of which 1 question should be answered.	16
(80 - 24 marks)	Each question can have a maximum of 2 submissions	
	80 - 24 marks	

Course Outcomes (COs)

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

Course Outcomes		Student's Knowledge Level (SKL)
CO1	Understand the basic concepts and terminologies like Camera Calibration, Segmentation in computer vision	K1
CO2	Apply them for feature extraction and for finding gestures	K1
CO3	Build different machine learning models for segmenting vision	K2
CO4	Implement segmentation and object detection models	K3
CO5	Analyze different machine learning models for segmentation objects detection	K4

Note: K1: Knowledge; K2: Understanding; K3: Apply; K4: Analysis; 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	PO12	PO13
CO1	1	1	3										1
CO2	1	1	3										1
CO3	1	1	3										1
CO4	1	1	3	1									1
CO5	1	3	3	2	1								1

Note: 1: Align Series; 2: Answer Question; 3: Answer Only; 4: Correspondence

Text Books				
S.L.No.	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Computer Vision: A modern approach	Torralba, David and Ivan Weiss	Elsevier India	2011
2	Principles of Computer Vision	Urtasun, Oberweger and Ding Ding Kang	MIT	2014
3	Deep learning for Computer Vision	Yolanda Gil, Francesco Marzo, Ryan Golath	O'Reilly Media	2011

Reference Books				
S.L.No.	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Computer Vision: algorithms and applications	David S. Sclarf	Springer Science & Business Media	2011
2	Image Segmentation: Principles, Techniques, and Applications	Yan Liu, Junjie Li, Jianwei	John Wiley & Sons	2011
3	Deep Learning in Computer Vision: Fundamentals and Applications	Ali Ghodsi, Arash, Mohammad Rezaei, Soltan	CRC Press	2019

Video Links (NPTEL SWAYAM - I)	
Module No.	Link ID
1	Computer Vision and Image Processing - Fundamentals and Applications by Prof. M. K. Bhagat in ET GATE 2018 https://nptel.ac.in/noc21_001/gate/
2	Computer Vision in Real World Applications in ET Khargone https://nptel.ac.in/noc21_002/gate/
3	Deep Learning for Computer Vision by Prof. Venketh R Balaji in ET GATE 2018 https://nptel.ac.in/noc21_003/gate/
4	CVPR2019 Open Source Lectures - CVPR2019 CV 12 Weeks https://www.brightnowsystems.com/cvpr/

SOLSTICE ST

ADVANCED COMPUTER NETWORKS

Course Code	PEC57731	CIE Marks	40
Teaching Hours/Week (Lec/Tut/Prac)	3030	ESE Marks	00
Credit	6	Exam Marks	20+10+10
Prerequisites (if any)	Sem	Course Type	Theory

Comments? [Click here](#)

4. To give a comprehensive understanding of selected marketing concepts, including NPLS, VPSA, Data Centers Networks, and Software-Defined Networking (SDN).
 5. To impart the skills necessary to analyze, design, and evaluate complex marketing environments, utilizing the skills learned and previous work.

STUDENTS

Module No.	Syllabus Description	Contact Hours
I	Roles of Computer Networking Technologies - OTN and TCP/IP Models. Layer and Protocols, IP Addressing and Routing, Routing Protocols - IGP, OSPF, BGP. QoS in IP networks - Random Early Detection, Protocols for QoS support - DSCP, EXP, Weighted Round Robin (WRR), Convoy and Fair Queuing, Network Congestion Control - Perceptron, AGR, and MAT, Routing of SDH, Virtual Private Networks (VPNs) - Types and Architecture. Overview of Data Center Networks - Key Components and Deployment.	8
II	MAC switching - Overview, VLAN, IEEE 802.1Q Spanning Tree Protocol (STP) - IEEE 802.1D, Rapid Spanning Tree Protocol (RSTP) - IEEE 802.1w, Multiple Spanning Tree Protocol (MSTP) - IEEE 802.1s, IEEE 802.1QinQ.	8
III	Data Centers Network Architectures - Traditional vs. Modern Data Center Design (Hyper-Cloud, Cloud Networks), Data Center Network TRILL.	8
IV	SDN Architecture and Components - Central Element, Data Plane, and Application Plane, OpenFlow Protocol and its Rule in SDN; SDN Controllers - Open vSwitch, OpenDaylight, and ONOS; SDN Use Cases - Traffic Engineering, Network Function Virtualization, and Network Monitoring.	8

	<p>Implementing Network Functions Virtualization (NFV) - NFV Concepts, Virtualizing Network Functions and Services, NFV Infrastructure (NFVI) and Management (MANO); Service Function Chaining (SFC), NFV in Operator Networks</p> <p>Data Center Interconnect (DCI) - Technologies for Data Center Interconnection (FCoE, OTV, and RDMA), DCI Design and Deployment Considerations, Software-Defined Networking (SDN) - Introduction to Intent-Based Networking, Centralized Decisions vs. Decentralized - Architectures for Information-Centric Networking; Content Matching, Routing and Caching, Examples in Network Data Networking, Network Automation and Orchestration, Automation Tools : Ansible, Terraform, OpenShift, Kubernetes - Kubernetes</p>	
4		18

Course Assessment Model:
 (CE= 40 marks, ECE= 80 marks)

Continuous Internal Evaluation Marks (CIE):

Assessments	Assessment/ Microtopic	Internal Examination (Written)	Internal Examination E (Oral)	Total
4	34	34	34	84

End Semester Examination Marks (ESE):

In Part A, all questions will be in a general 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 12 Questions, each carrying 3 marks (Total = 36 marks)	Each question carries 3 marks. Two questions will be given from each module, out of which 1 question should be answered. Each question can be a assessment of 1 or 2 sub-topics. (Total = 36 marks)	84

Course Outcomes (COs)

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

	Course Outcomes	Student's Knowledge Level (SKL)
CO1	Apply and correctly analyse standard accounting processes for manufacturing including ABC, TFC, and SPC, and their applications in real-life scenarios.	K3
CO2	Demonstrate an understanding of data centre network infrastructure including the design considerations and protocols like IPv4, mobility, redundancy, and efficiency.	K3
CO3	Use Software-Defined Networking (SDN) and Network Function Virtualisation (NFV) to automate and optimise network operations.	K3
CO4	Explain emerging trends such as Internet-of-Things (IoT) and network automation, applying the knowledge in designing and implementing networking solutions.	K3

Note: K1: Knowledge; K2: Understanding; K3: Applying; K4: Analysing; K5: Evaluating; K6: Creating

CG-70 Mapping Table: Mapping of Course Outcomes to Program Outcomes

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11
CO1	1	1	1	1							1
CO2	1	1	3	1							1
CO3	1	1	3	1							1
CO4	3	1	3								1

Note: 1: Aligns Completely; 2: Partially; 3: Inconsistently; -: No Correlation

Text Books				
S.L.No.	Title of the Book	Name of the Author's	Name of the Publisher	Edition and Year
1	Complex Processing: A Top-Down Approach	James P. Kister, Josh W. Kern	Pearson	6th, 2012
2	Data Center Virtualization Performance & Optimization Techniques and Design for Highly-Diverse Data Centers with Cisco Nexus 1000V, MDS and Beyond	Shantanu	EDOCO Press	1st, 2013
3	HPC and Grid Architectures	San Gholam, Leon Degraeve, Andreyev	EDOCO Press	1st, 2013
4	High-speed Networks and Network Performance and Quality of Service	William Walling	Pearson	2nd, 2008
5	Software Defined Networks: A Comprehensive Approach	Prayitno, Chak Shuk, Sandy Calore	Morgan Kaufman	2nd, 2013
6	Information-Centric Networking (ICN): Content-Centric Networking (CCN) and Named Data Networking (NDN) Terminology	E. Ravaghi, C. Vural, A. Almeroth, A. Zhang, D. Oren, C. Castelluccia	IEECS Press	120

Reference Books				
S.L.No.	Title of the Book	Name of the Author's	Name of the Publisher	Edition and Year
1	Cloud Computing: Understanding Cloud-Based Data Center Technologies	Steve Lai	Morgan Kaufman	1st 2014

Video Links (SOTEL, SWATAN..)	
Module No.	Link ID
1	https://adobeexpress.com/www.126.198.100.244/

SEMESTER 5th
RESPONSIBLE ARTIFICIAL INTELLIGENCE

Course Code:	FECS5THI	CIE Marks:	44
Teaching Hours/Week (L, T.D, A)	3,0,0,0	TSH Marks	29
Duration:	4	Exam Hours:	1.25x 10 hrs.
Prerequisites (if any):	None	Course Type:	Theory

Course Objectives:

1. To impart the idea of fairness, accountability, transparency and privacy as fundamental aspects of responsible AI.
2. To teach the principles of interpretability techniques including simplification, visualisation, inverse interpretability methods, and post hoc interpretability for AI models.
3. To give the learners understanding of the ethical principles guiding AI development along with privacy concerns and concrete challenges associated with AI algorithms.

SYLLABUS

Module No.	Syllabus Descriptions	Contact Hours
I	Foundations of Responsible AI - introduction to Responsible AI, Overview of AI and its related impacts; Transparency and Bias - Intrinsic of Bias, Exploratory data analysis, Visualisation of a dataset, Interpreting, visualising and summarising relationships.	7
II	Interpretability and Explainability - Interpretability - Interpretability through simplification and visualisation; inverse interpretability methods, Post hoc interpretability, Explainability through causality, Model specific interpretation. Interpretability Tools - SHAP (Shapley Additive Explanations), LIME (Local Interpretable Model-agnostic Explanations)	10
III	Ethics, Privacy and Security - Ethics and Accountability - Assessing AI models, Human centered, Strategies for ethical governance. Privacy preservation - Attack models, Privacy-preserving Learning, Differential privacy, Fauding, The Laplace Mechanism, Limitations of	10

	Problem Solving: Society - Society in AI Systems. Strategies for solving AI systems and performing system-level social analysis.	
4	Future of Responsible AI and Our Studies:- Issue of Responsibility AI - Emerging trends and technologies in AI Ethics and responsibility Our Studies - Recommendation Systems, Mobile Agents, Computer Vision, Natural Language Processing.	8

Credit assessment Method:
(CIE: 48 marks, ESE: 32 marks)

Curriculum Internal Evaluation Marks (CIE):

Assessment	Learning Outcomes	Internal Examination I (Written)	Internal Examination II (Oral)	Total
I	12	36	36	48

End Semester Examination Marks (ESE):

In Sem-A, all questions need to be answered and in Sem-B, each student can answer any two full questions out of four questions.

Part A	Part B	Total
2 Questions from each module. Total of 12 Questions, each carrying 2 marks (Sub : 24 marks)	Each question carries 2 marks. Two questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub-questions (Sub : 32 marks)	48

Course Outcomes (CO)

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

Course Outcomes		Student's Knowledge Level (KL)
CO1	Identify and describe key aspects of responsible AI such as fairness, accountability, bias, and privacy.	KL1
CO2	Describe AI models for fairness and ethical design.	KL2
CO3	Understand responsible techniques such as simplification, visualization, robust incorporate methods, and peer review approaches.	KL2
CO4	Compare the ethical principles, goals, norms, and values challenges involved in development and deployment.	KL3
CO5	Understand responsible AI solutions for practical applications balancing ethical considerations with model performance.	KL3

Note: KL: Knowledge; KL1: Understand; KL2: Apply; KL3: Analyse; KL4: Evaluate; KL5: Create

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3									1
CO2	1	1	3									1
CO3	1	1	3									1
CO4	1	1	3									1
CO5	2	1	3									1

Note: 1: Very Good; 2: Moderate; 3: Fairly Good; - No Correlation

Text Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Responsible Artificial Intelligence: Designing and Unveiling a More Progressive Future	Vinayak Diggavi	Springer Nature	Jan. 2021
2	Responsible Machine Learning	Chirag Patel	Lulu	Jul. 2020

Reference Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Responsible AI Implementing Ethical and Fairness Algorithms	Very Agarwal, Gaurav & Srivastava	Springer Nature	Jul. 2021

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SEMESTER 5

FUZZY SYSTEMS

(Common to CSECA)

Course Code:	FIC5779	CIE Marks:	40
Teaching Hours/Week (L:T:P:R):	1:0:0	ESE Marks:	60
Credit:	3	Exam Hours:	2 hrs. 30 min.
Prerequisites [None]	None	Course Syllabus:	[None]

Course Objectives:

1. To understand the concepts of fuzzy sets and its use in building better solutions to problems.
2. To understand the basic concepts of fuzzy sets, fuzzy relations, fuzzy logic and building of fuzzy approximate-best solutions.

SYLLABUS

Module No.	Syllabus Description	Lecture Hours
1	Basic Fuzzy Set Theory :- Introduction - Universes, Impression and Vagueness. One to Fuzzy set Representations of Fuzzy sets. Membership Functions - Type, Basic operations - Union, intersection, complement, Linguistic hedges. Regularity of fuzzy set - Level sets - alpha-cut approximation. Operations on fuzzy sets - fuzzy programming, fuzzy iteration, fuzzy union, aggregation operators	8
2	Fuzzy Relations:- Operations on Fuzzy relations - union, intersection, composition, cartesian product. Fuzzy composition. Max min, Max - product. Composing Fuzzy Relations - fuzzy numbers, arithmetic operations on fuzzy numbers Fuzzy Reasoning :- Generalized Modus Ponens (GMP) and Generalized Modus Tollens (GMT).	8

	Particulars and Differentials Methods :- Power indices = Scale rule, Nominal rule; Development of monitoring Function = Income, Interest, Total value; Incentive mapping Declarative vs. Active :- The membership principle, Control method, Weighted aggregation method, Direct membership, Cross of sum, Cross of hyper- sum, Function of sum of scores.	8
4	Total Information :- aggregative reasoning, Total (Global) System - Multiple successive processes, Single response processes, Aggregation of fuzzy rules, Geographical Techniques of Information, Total Committee Method, TIS, Local Model.	3

Expert Assessment Method
(CIE- 40 marks, EST- 10 marks)
Continuous External Evaluation Marks (CE)

Assessor	Assessor/ Manager	External Examination-I (Written)	External Examination- II (Written)	Total
4	16	28	28	40

End Semester Examination Marks (ESI)

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

Part A	Part B	Total
<ul style="list-style-type: none"> • 2 Questions from each module • Second 2 Questions, worth total 1 mark; question should be answered <p>Max 1 marks</p> <p>(4x2 = 8 marks)</p>	<ul style="list-style-type: none"> • Each question carries 2 marks • One question will be given from each module • Each question can have a maximum of 2 sub-questions <p>(8x2 = 16 marks)</p>	24

Course Outcomes (COs)

under each of the course modules should be able to:

Course Outcome		Bloom's Knowledge Level (BL)
CO1	Simplifying Boolean Expressions and solving.	BL2
CO2	Demonstrate the concepts of crisp sets, fuzzy subsets, crisp logic with fuzzy sets, fuzzy relations and fuzzy logic.	BL3
CO3	String logic systems by defining appropriate membership functions, fuzzy relations and its classification, applications.	BL3
CO4	Derive solutions using graphical and rule-based methods	BL3
CO5	Maintain efficient logic information in real world problems	BL3

Note: E=Explanatory; D=Descriptive; I=Inquiry; K=Knowledge; P=Problem Solving; R=Reasoning

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1									1
CO2	1	1	1									1
CO3	1	1	1	1								1
CO4	1	1	1	1								1
CO5	1	1	1	1	1							1

Note : 1=Mandatory, 2=Additional (Maj) - 10 Credits

Text Books

SL No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Fuzzy Logic with Engineering Applications	Timothy J. Ross	John Wiley and Sons	3rd, 2012
2	Fuzzy Sets and Fuzzy Logic Theory and Applications	Gangapal K.клещ and Deo T. Venkateswara	Prentice	c. 2013

Reference Books				
S. No.	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Introduction to Fuzzy Logic, Fuzzy Logic, and Fuzzy Control Systems	Guangjiu Chen, Tong-Yi Wang	CRC Press	3rd, 2014
2	Discrete Mathematics and Its Applications with Combinatorics and Graph Theory	Kenneth H. Rosen	McGraw-Hill	7th, 2011
3	Discrete Mathematics with Applications in Computer Science	Essential J.F. Harel and R. LaRiviere	Tata McGraw Hill	1st, 2003
4	Discrete Mathematical Structures	Ronald Polman, Robert C. Faber, Sharpen Culmer, David	Pearson	1st, 2001

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SEMESTER 5

DIGITAL FORENSICS

(Common with CSE/CH/CA/CP/CSE/IT/AN/NA)

Course Code:	DEC50104	CSE Marks:	40
Teaching Hours/Ticks (L:T:P:R:R)	1:0:00	ECE Marks:	60
Credits:	1	Even Hours:	12 hrs. 10 Mins.
Prerequisites (if any):	None	Course Type:	Theory

Course Objectives:

- To impart the fundamental knowledge on incident management and reporting.
- To provide a good understanding on storage, operating systems, networks and mobile forensics.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	<p>Introduction to Digital Forensics - Principles in Digital Forensics, Basics in Digital Forensic Investigation, Forensic Imaging & Cloning, Coverage of Data of Cases, Digital Evidence Handling in Court, Basic Calculations/Operations and Recovery of Digital Evidence, Processing & analysis, Completion of Testing & Reporting, Registration of Stages in Digital Investigation.</p> <p>Type of Storage Media - Hard Disk Drive (HDD), Solid State Drive (SSD), USB Flash Drives, Optical Discs, Memory Cards, Cloud Storage, Data Servers, Clouds, Block, and Boxes, Logical Block Addressing (LBA), Examples of Types of Storage Medium.</p> <p>Overview of File Systems - Introduction to File Systems, File Systems in Digital Forensics, FAT (File Allocation Table), Stream and Cluster concept, NTFS (New Technology File System), Stream and Cluster concept, Master File Table (MFT), EFS (Encrypted File System), EXT2, EXT3, EXT4, Comparing in FAT32 and NTFS, LFS (Linux Logical File System), EXT4 and NTFS- Stream and Cluster concept, Metadata and attributes.</p> <p>Tools required: WinVista, FTK Imager, OI File viewer</p>	30
2	<p>Windows Forensics - Disk Analysis, Registry Analysis, Analysis of URLs</p>	8

	<p>Computer Forensics - Introduction to Computer Forensics, Data Recovery Techniques, Volatile and Non-Volatile Data, Electronic Evidence, Digital analysis,取证法, Forensics, File System Analysis Tools, Techniques for Recovering Deleted Files, File Carving, Memory Forensics - RAM Dump and analysis, Linux and MAC Forensics, and Network Forensics - Sniffing, Encryption, Wireless Data Storage.</p> <p>Tools suggested : WinHex, FTK, Image, autopsy, RegDigger, Volatility, Dump</p>	
4	<p>Mobile Forensics - Introduction to Mobile Forensics, Mobile Forensic Fundamentals, Understanding Mobile Device Storage, Android, iOS, Windows OS, Android, ADB (Android Debug Bridge), API, File Techniques for Acquiring Data from Mobile Devices, Recovery, Recovering analysis of Application Files - Asset Cache Files, Understanding and analyzing APK Files, Managing Malware, Malware Analysis, Cloud Data in Mobile Forensics, Analyzing Backups and Cloud Data, Advanced Data Recovery Techniques (Recovering Encryption, Prepared Deleting), Challenges in Mobile Forensics.</p> <p>Tools suggested : MobileCloud, MobiControl, AndroKit Forensic, Kali Linux, DroidBox, etc.</p>	8
4	<p>Network Forensics - Introduction to Network Forensics, Overview of Network Architecture and Protocols, Capturing and Analyzing Network Traffic using Wireshark, Traffic Log analysis, SSL and TLS Forensics, Email Traffic Analysis, Endpoint Security systems - Intrusion Detection Systems, Firewall, Router Forensics, NAS, Prop, VPN, Public Key Infrastructure Systems, Digital Signatures - Concepts of Public Key and Private Key, Confidentiality, Authentication and their keys, Creation and Authentication of Digital Signatures.</p> <p>Tools suggested : Wireshark, Apache Log Viewer</p>	8

Course Assessment Method
(CE: 40 marks, EST: 80 marks)
Continuous Internal Evaluation Marks (CIE):

Achievement	Assessment/Marking	Internal Examination-I (Written)	Internal Examination-II (Written)	Total
i	ii	20	20	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 2 Questions, each carrying 1 mark (EO = 24 marks)	Each question carries 3 marks. Two questions will be given from each module, out of which 1 question shall be answered. Each question has three components of 3 subquestions (EO = 36 marks)	60

Course Outcome (CO):

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

Course Outcomes		Klarm's Knowledge Level (K.L.)
CO1	Taking decision analysis based on, Heuristic, and multi-criteria	K1
CO2	Supplement with the normative methods	K2
CO3	Evaluate the analytical logic of the systems and identify the assumptions	K3
CO4	Develop robust management of the problems	K3

Level: K1: Knowledgeable; K2: Understanding; K3: Application; K4: Fluency; K5: Expert

CO-PO Mapping Table: Mapping of Course Outcome to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1									1
CO2	1	1	1		1							1
CO3	1	1	1		1							1
CO4	1	1	1		1							1

(1=Low, 2=Moderate, 3=High, 4=Very High, 5=Extremely High) – In Correlation

Reference Books				
No.	Title of the Book	Name of the Author(s)	Name of the Publisher	ISBN and Year
1	Digital Forensics and Incident Response	David Litchfield	Packt	978-1849692221
2	Guide to Computer Forensics and Investigations	Bill Moran, Jennifer Phillips, Christopher Moran	Syngress	978-1932266200
3	Practical Malware Analysis	John Tatte, Greg Hoglund, Roelof Botha, Scott Helmers	Packt	978-1849692205
4	Mobile Forensics - Advanced Investigation Techniques	Doug Aitken, Victoria Parker	Packt	978-1849692212
5	Network Forensics: Teaching Students Through Examples	Steve Dechant, Jonathan Van	Prentice	978-0132354513
6	File system forensic analysis	Steve Garton	Academic	978-0123820027
7	Windows Forensic: The Path Quick for Digital Computer Investigations	Chris Ford	Wiley	978-0470090607
8	Forensic Economics: Developments, Analysis and Market Trends for Digital Evidence	Audrey Regg	Syngress	978-1932266212

Links Used (NPTEL, SWAYAM, J)	
No.	Link ID
1	http://nptel.ac.in/courses/npTEL/CS/CS501/Week20/ (200 pages)
2	http://www.swayam.gov.in/curriculum/published_by_ministry_of_education.html
3	http://www.jntuh.ac.in/jsp/jsp?page_id=100100417&cat_id=1

SEMESTER 5

GAME THEORY AND MECHANISM DESIGN

Course Code:	FECE5709	CIE Marks:	40
Teaching Hours/Week (L, T.D, A)	3,0,0,0	EE Marks:	09
Duration:	4	Exam Month:	July, Dec, June
Prerequisite (if any):	None	Course Type:	Theory

Course Objectives:

1. To equip students with a general purpose tool to analyze strategic behavior in multi-agent interaction.
2. To discuss the mathematical details of analyzing and designing strategic interactions.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Game Theory - Computer equilibrium, Iterative, Design Games - Dominance, Null equilibria, Shanon example, dimension of sequential strategies, generation of pure Nash equilibria (PNE), mixed games, relation between dominant and PNE to mixed games, Mixed strategies, mixed strategy Nash equilibrium (MSNE), finding MSNE, MSNE characterization theorem, algorithm to find MSNE	8
2	Coalition equilibria (CE) - Computing CE, convex vs linear games, weak game, formation of strategic partial Nash equilibria, Importer-submitter model vs linear games (ISLG) - conversion to ISLGs, equivalence of strategies in ISLGs, partial Nash, Equilibrium in ISLG, Stackelberg equilibrium, 2x2 bidding	11
3	Bayesian games - strategy and utility in Bayesian games, equilibrium in Bayesian games	
4	Introduction to mechanism design - incentive principle, incentives and payoff of Arrow's impossibility, basic introduction to social choice map, Information and power of Gibbard-Satterthwaite theorem, sincere revelation, median voter theorem, Vickrey-Clarke-Groves, uniform rule, mechanism design with transfer, examples of quasi-linear preferences, linear economy and linear programs	8
5	Introduction to VCG mechanism, VCG to Combinatorial auctions	8

	Applications in business advertising, role of colour and patterns in positive success, give and cost of 100 reiterations, ABC; maximum, single viewer alternative, Myerson's law, optimal advertisement design, Single and multi-stage optimal advertisement designs, Examples of optimal advertisements	
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Course Assessment Method
(EE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Achievement	Assessment/Marking	Internal Examination (Written)	Internal Examination (Practical)	Total
4	24	36	18	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 2 Questions, each carrying 1 mark (B2=24 marks)	Each question carries 2 marks. Two questions will be given from each module, out of which 1 question needs to be answered. Each question can have a maximum of 12 subquestions (B2= 24 marks)	48

Course Outcomes (COs):

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

Course Outcomes	Bloom's Knowledge Level (BKL)
CO1: Differentiate between different types of gender identity, norms, conflicts related gender	K1
CO2: Identify stereotypical interactions	K2
CO3: Describe the basic concepts of non-cooperative and cooperative games	K2
CO4: Apply the concepts in different game scenarios	K3

Note: K1-Knowledge; K2-Understanding; K3-Apply; CO-Outcome; KI-Example; AI-Exercise

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
OII	4	4	3									3
OII	3	3	3									3
OII	3	3	3									3
OII	3	3	3									3

(Max : 12) (A=Avg, 3 = Moderate Selection, 5 = Advanced Selection, - No Guidance)

Text Books				
SL.No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	An Introduction to Game Theory	Wendy Dubois	Cambridge University Press	1st, 2014
1	Game Theory and Mechanism Design	T. Bhattacharya	World Scientific and ESI Press	1st, 2013

Reference Books				
SL.No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Game Theory 101: The Complete Textbook	William Pounder	last	1st,
1	Game Theory: An Introduction	Kenneth Binmore	McGraw-Hill University Press	1st, 2012

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://www.nptel.ac.in/courses/100100000121
1	https://www.swayam.gov.in/

SEMESTER 5

HIGH PERFORMANCE COMPUTING (Common to CSE/CH/CD/CA/AM/AS)

Course Code:	PEC5777	CIE Marks:	40
Teaching Hours/Week (L, T, P, R)	3,3,0,0	EEI Marks:	40
Credit:	3	Exam Hours:	2 hrs. 10 min.
Prerequisites (if any):	None	Course Type:	Theory

Course Objectives

1. To Gain an understanding of the modern processor architectures
2. To Give an introduction to parallel programming using OpenMP and MPI.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Memory hierarchy: Hierarchical memory architecture. General purpose architecture to programmable architecture - Performance metrics and benchmarks: Cache's Law - Pipelining - Super scalar - SIMD - Aligned, Unaligned - Cache - Cache mapping, Rehash, Multicore processor - Multithreaded processor - Thread processor - Design principles - Maximum performance solutions - Programming for cache architecture	9
2	Parallel computing - Summary of parallel computing paradigm - Shared-memory computers - Code coherence - DMA, coDMA, Shared-memory computers - Hierarchical memory systems - Locality - Data performance characteristics of memory, Cache, Systolic and Stream networks - Hash networks - Others	9
3	Shared memory parallel programming with OpenMP - Shared resources in OpenMP - Parallel iteration - Data racing - OpenMP wait/delaying for loops - Synchronization, Reduction, Loop scheduling, Tasking, Load-balancing, Case study: OpenMP parallel search algorithm	9

4	<p>Distributed memory parallel programming with MPI:</p> <p>Message passing + 4 client applications in MPI, a single computer, shared and peer-to-peer communication, Collective communication, Synchronization patterns in parallel communication, Thread techniques. Example: MPI parallelization of a Jacobian matrix - MPI implementation - Performance comparison.</p>	9
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Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment: Microprocessor	Journal Examination-1 (Written)	Journal Examination-2 (Written)	Total
5	10	10	10	40

End Semester Examination Marks (ESE):

In Part A, all questions need to be attempted and in Part B, each student can choose any two full questions out of four questions.

Part A	Part B	Total
Two questions will be asked from each module. Total of 4 Questions, each carrying 4 marks (4x4=16 marks)	<p>Each question carries 5 marks.</p> <p>Two questions will be given from each module, out of which 1 question should be answered.</p> <p>Each question can carry a maximum of 5 contributions.</p> <p>(5x2 = 10 marks)</p>	26

Course Outcome (CO's)

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

Course Outcomes		Bloom's Knowledge Level (KL)
CO1	Design parallel computing architecture supported by memory system	A2
CO2	Classify parallel computing paradigms and network topologies	A2
CO3	Implement distributed memory parallel programming with OpenMP	A2
CO4	Design and implement parallel algorithms using distributed memory parallel programming with MPI	A2

Pass: E2-Essential; E3-Understand; E4-Apply; E5-Analyze; E6-Evaluate; E7-Creat

EIS-001 Mapping Table (Migrating old Caesar Deliverables to Program Deliverables)

	P001	P002	P003	P004	P005	P006	P007	P008	P009	P010	P011	P012
C001	1	2										3
C002	1	2										4
C003	1	2	3	2								3
C004	1	2	3	2								3

Den 1: High (Cr), 2: Low/Medium (Cm), 3: Substantial (Sg), 4: Very Substantial (Vs)

Text Books

SL No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Introduction to High Performance Computing for Engineers and Scientists	George Hachtel Orlando Tuck	CRC Press	c. 2001
2	High Performance Computing: Modern Processor and Platform	Thomas Heroux, Klaus Stueben, Ulrich Naumann	Morgan Kaufmann	c. 2001

Reference Books

SL No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Parallel and Distributed Performance Computing	Rakesh Kumar Volume Editors	Kluwer Publishers	c. 2001
2	High-Performance Computing	Charles L. Brumley Eric D. Grosse	O'Reilly Media	c. 2001
3	Computer Architecture And Parallel Processing	Xiaofeng Wang Tao Chen Bingbing Li	John Wiley Sons	c. 2001
4	Computer Architecture: A Quantitative Approach	John L. Hennessy David A. Patterson	Morgan Kaufmann	c. 2001

Video Links (NPTEL, MIT, IITM, IITB)

Module No.	Link
1	https://npTEL.ac.in/course/100100002
2	https://npTEL.ac.in/course/100100004
3	https://npTEL.ac.in/course/100100003
4	https://npTEL.ac.in/course/100100007

SEMESTER 5
PROGRAMMING LANGUAGES
 (Common to CSE-CIV-CH-CE-AD-XI)

Course Code:	PECOT511	CE Marks:	40
Teaching Hours/Week (L-T-P-W)	2-0-0-0	CE Marks	10
Credit:	3	Lectures Hours	120+10 Sem.
Prerequisites (if any):	N/A	Course Type:	Theory

Course ID: OB120511

- To enable the student understand various constructs and their respective importance in different high-level languages so that he can choose a suitable programming language for solving a particular problem.
- To enable the student's ability to understand the salient features and paradigms in the language of programming languages.

SYLLABUS

Module No	Syllabus Details	Course Marks
I	Introduction – The Origin of Programming Languages, Classification of Programming Languages, Computational Paradigms, Language Constructs, Language Features, The Power of Programming Languages, Language Design Criteria : Historical Overview, Efficiency, Scalability, Inclusivity, Reusability, C++ – An Object-Oriented Extension of C, System : A General-Purpose Scripting Language, Syntax and Analysis Function, Lexical Structure of Programming Languages, Context-Free Grammars and BNF, Data Types and Abstract Syntax Tree, Ambiguity, Associativity, and Precedence, EBNF and Syntax Diagrams, Parsing Techniques and Tools, Lecture on Objects in C++, Case Study: Building a System Analyzer for Trig-Add.	8
II	Data Structures – Arrays, Binding and Scopes, Functions, Subfunctions, Blocks, and Scope, The Keyword Table, Name Resolution and Disambiguation, Allocation, Deletion, and the Environment, Variables and Constants, Arrays, Dynamic Structures, and Garbage, Case Study: Local Data Structure Lectures on Seminars Data Types – Data Types and Type Inference, Simple Types, Type Generation, Type Inference in Simple Languages, Type Equivalence,	8

	Type Checking, Type Inference, Polymorphic Type Checking, Explicit Polymorphism, Case Study: Type Checking in DayJobs	
3	Expressions and Statements - Expressions, Conditional Statement and Switch, Loops and Functions in VBA; The VOTD Community and Loop Data, Encryption Reading, Case Study: Computing the Values of State Expressions in DayJobs	8
4	Records and Ensembles- Record Definition and Access, Recursive Functions, Parameter-Passing Mechanisms, Recursive Environment, Activation, and Alteration, Dynamic Memory Management, Encryption Reading and Implementation, Case Study: Decoding Passwords Hidden in Encrypted Files	8
5	Almost Data Types and Modules - The Different Specifications of Almost Data Types, Almost Data Type Mechanisms and Modules, Separate Compilation w/ C, C++, VisualBasic, and Java Programs, Ads, Packages, Modules in ML, Modules in Erlang Languages, Problems with Almost Data Type Mechanisms, The Mathematics of Almost Data Types	8

Course assessment Method:
(CIE- 40 marks, ESE- 60 marks)

Continuous Internal Test/Online Marks (CIE):

Absenteeism	Assignment/ Mid-Module	Internal Examination I (Written)	Internal Examination II (Written)	Total
1	12	16	18	46

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
1 Questions from each module. Total of 10 Questions, each carrying 2 marks (Total = 20 marks)	Each question carries 3 marks. Two questions will be given from each module, out of which 1 question needs to be answered. Each question can have a maximum of 3 subquestions. (Total = 18 marks)	38

Course Outcomes (COs)

Each one of the course modules should have at least one:

Course Outcome	Student's Knowledge Level (SKL)
CO1 Understand the history of programming languages and include iteration, the concept of different language paradigms, and an overview of language design issues.	K1
CO2 Explain how the syntactic elements of a language can be precisely specified using context-free grammar rules or BNF (have been introduced).	K2
CO3 Explain the importance of the operations that occur during the execution and evaluation of programs.	K2
CO4 Apply the data types in various languages	K3
CO5 Apply promotion mechanism and parameter passing, and exception and resource handling.	K4

P1-P5-Simulation; K1-Understand; K2-Apply; K3-Analyze; K4-Evaluate; K5-Creative

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1									1
CO2	1	1	1									1
CO3	2	1	1									1
CO4	1	1	1									1
CO5	1	1	1									1

Note : 1-Algo/Geno, 2-Abstract Datastructure, 3-Datastructure Design, 4-DB-Communication

Text Books

SL No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Programming languages principles and practice	Kenneth H. Rosen	Prentice Hall	2/e, 2013
2	Concepts of programming languages	Silberschatz A., Galvin P., Gagne G.	Tata McGraw-Hill	1/e, 2009
3	Programming languages concepts and constructs	André S. Tanenbaum	Pearson	2/e, 2006

Books from Author:

Sr. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Date and Time
1	Empowering Languages: Pedagogies and Practices	Gillen Darden, Esther Yassini	Macmillan India	2-1-2017
2	Principles of Pragmatical Semantics	Gillen Darden	Sage	1-6-2000
3	Principles of Pragmatical Linguistics	Klaus Glüer	Sage	1-6-2004

Video Links (NPTEL SWAYAM...)

Sl.	Link ID
1	https://nptel.ac.in/courses/100/102/0000001

SEMESTER 5
INTERNET OF THINGS
(Common to CSE/ECN/CS)

Course Code	SE502704	CIE Marks	30
Teaching Hours/Week (L, T, P, S)	4,0,0,0	ESE Marks	10
Credit	III	Exam Hours	120x 16 Min.
Prerequisites (if any)	Theory	Exam Type	Theory

Course Objectives:

- To provide students with an understanding of IoT architecture, protocols, and important technologies that enable sensors, actuators, and machines to communicate.
- To enable students with the ability to design and implement IoT solutions using platforms like Raspberry Pi, cloud-based services, and analysis tools for developing real-world IoT applications.

SYLLABUS

Module No.	Syllabus Description	Content Score
1	Introduction - Why IoT Trends in IT Space; Internet of Things Era, Connected Devices/IoT/Mobile Integration, Device-to-Cloud (D2C) Integration, IoT Platform as a Service (PaaS), Cloud-to-Cloud (C2C) Integration, IoT Key Application Domains, Emerging IoT Trends, IoT Services - Applications for IoT, Mobile Technologies, Mobile Application Development Platform, IoT API's.	10
2	Interconnection and Integration - Discovery Protocols - Logical Architecture for IoT, Research Areas/Challenges of IoT, Interconnection Protocols, Sensors or Sensors Discovery for IoT, Protocol & protocol for IoT Device Discovery, Integration Technologies and Tools - Smart Enterprises and Businesses, Sensor and Actuator Networks, The IoT Device Integration Concepts, Standards, and Implementations, The Device Integration Research and Standardization, The Standard Language,	10
3	Mathematics for IoT Applications and Analytics - The IoT Building Blocks, Unsupervised, NGM, Regression Models, IoT Application Building Blocks, Data Analytics Platforms, IoT Data Visualization Techniques and approaches, The IoT Edge, Data Analytics, Cloud for IoT Applications and Analytics - Relational vs. Cloud Approach, The Key Requirements for Cloud-Enabled Businesses, IoT and Cloud beyond Internet of Businesses, Cloud,	10

	Protected, and signed property visual, The Benefits of Using Ftp, Cloud, SFTP and IDS.	
8	Introduction to Bashscript N, Creating your first project, Creating a Linux to Windows Ambient Light, Creating an Answer File Download Environment, Publishing Information Using MQTT & HTTP, Creating Rich Pages for Your Devices	12

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

Continuous Internal Evaluation Marks (CIE):

Assessments	Internal Re	Evidence	Analysis	Total
5	15	15	15	45

Criteria for Evaluation/Evaluation and Analysis: 10 marks

Students must be assessed in analysis (where data collection, analysis, and iteration lead to revised IoT applications). Evaluation of the methodologies and recommendations based on processes should be done in program appropriate technologies.

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B each student can choose any one (1) question out of four questions.

Part A	Part B	Total
2 Questions from each module Total of 4 Questions, worth carrying 1 marks (Total = 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 4 subquestions Each question carries 2 marks (Total = 16 marks)	16

Course Outcomes (CO)

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

Course Outcome		Student's Knowledge Level (KL)
CO1	Understand IoT basic architecture layers, and key technologies, including Device-to-Device, Device-to-Cloud, and Cloud-to-Cloud integration.	K1
CO2	Describe how differentiation between various IoT technologies, sensor diversity, and integration protocols, as well as their role in IoT ecosystems.	K2
CO3	Develop simple IoT projects using Raspberry Pi, integrating sensors, cameras, and protocols such as MQTT and HTTP to receive information streams.	K3
CO4	Explain cloud and edge computing models, comparing typical cloud hosted environments, and apply these concepts to build real-time and efficient IoT applications.	K4

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

CO-PO Mapping Table: Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2									2
CO2	1	3	3	1								1
CO3	1	2	2	2								2
CO4	2	2	2	1								1

Note : 2-High Cred., 1-Medium Cred., 0-Lowest Cred. - 10 Courses

Text Books				
S.No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	The Internet of Things	Telkin Ray, Anupam K. Sahoo	CRC Press	1st, 2017
2	Mastering Internet of Things	Paul Vautin	Packt	1st, 2018

Reference Books				
S.No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Internet of Things - Architecture and Design Principles	Sajal Kumar	McGraw Hill	2nd, 2018
2	Internet of Things - Principles and Protocols	Rajkumar Buyya, Lesly Venetis Daniopoulou, Sajal Kumar, Arunabha Ghosh	Kellogg Foundation	1st, 2018
3	Introduction to IoT		Cambridge University Press	1st, 2018

Color Links (XTEL, WWW, ETC.)

No.	Link ID
1	http://www.english-test.net (ID: 1381381381381)

SEMESTER 5

CYBER SECURITY

Course Code:	OBGSTU1	CIE Marks:	44
Teaching Hours/Week (L, T.D, A)	13.0.0	ESE Marks:	29
Duration:	1	Exam Month:	I Sem. II Sem.
Prerequisite (if any):	None	Course Type:	Theory

Courses Objectives:

1. To teach the basic attacks, threats and vulnerabilities of the cybersecurity.
2. To make the better aware of cyber security and cyber laws.
3. To give knowledge of the best practices to prevent malfunctions in systems and mobile devices.

SYLLABUS

Module e No.	Syllabus Description	Contact Hours
1	Introduction to Cyber Security :- Basic Cyber Security Concepts, Layer of Security, Vulnerability, Threats, Computer Crimes, Cpt. Trial, Malware of Windows, Anti-virus, Security attacks, Defences attacks, Malicious attacks, Cyber Threats and its Classification- Malware, Social Engineering, DDoS,DDoI, Botnet, Threat Assessment, Intrusion Detection (IDS), Data Encryption and Information Tools.	9
2	Cybercrimes and Cyber Laws :- Cybercrimes, Classification of Cybercrimes, The legal perspective- Indian perspective, Global perspective, Categories of Cybercrimes. Fundamentals of cyber law, Duties of legislature, Functions of cyber law, History and emergence of cyber law, Content and scope of cyber law, Major developments in various countries.	9
3	Malware and Protection against Malware :- Virus, Worms, Trojans, Spyware, Adware, Rootkits, Ransomware, Common Methods of Malware Propagation- Email attachment, Malicious Websites, Removable Media, File Sharing Networks, Malvertising, Rerources against Malware, Antivirus, Antimalware, Firewall, Regular Software Updates, Email Filtering, Web Filtering, Data Backup and Recovery, Strong Firewall and Multi Factor Authentication (MFA).	9

A	Mobile App Security: Security Implications of Mobile Apps. Mobile App Permissions Management and Best Practices, Role of Location-Based Social Networks, Data Security on Mobile Devices. Importance of Data Security on Mobile Devices to Protect Sensitive Information, Role of Encrypted Data Storage and Communication on Mobile Platforms. Benefits of Device Encryption, Keen Management App, and Encrypted Storage Solutions.	B
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Course Assessment Method:
 (ECE-41 marks, ECE-31 marks)

Continuous Internal Evaluation Marks (CIE):

Attribute	Assessment/ Management	Internal Examination-1 (KU)	Internal Examination-2 (KU)	Total
1	12	18	18	48

End Semester Examination Marks (ESE):

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

Part A	Part B	Total
2 Questions from each module. Total of 10 Questions, each carrying 3 marks (ECE-34 marks)	Each question carries 8 marks. Total questions will be given from each module, out of which 1 question shall be unanswered. Each question can have a maximum of 2 subquestions (ECE-32 marks)	66

Course Outcomes (COs):

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

Course Outcome:	Knowledge Level (KL)
CO1 Explain the attacks, security mechanisms and measures to avoid vulnerabilities	K1
CO2 Identify the cyber threats and threats to the cyberspace against the country	K2
CO3 Discuss the malwares and the protection mechanism against malwares	K2
CO4 Describe the access and solutions related with mobile applications	K2

Score: K1: Understanding, K2: Unstructured, K3: Apply, K4: Analysing, K5: Evaluate, K6: Create

EDD-001 Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011
C01	1	1									1
C02	1	1	1								1
C03	1	1	1								1
C04	1	1	1								1

Note : 1=High Comp, 2=Moderate Compreh., 3=Somewhat (Avg.), 4=Compreh.

References Books

No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Computer Systems: Structure and Behavior	William Stallings	Pearson	6/e, 2013
2	Object-Oriented Understanding Object Classes, Computer Fundamentals and Logical Generalizations	Wes Goffield, Kurt Saligman	Wiley	1/e, 2013
3	Computer and Other Systems: Principles, Application, Applications, and Perspectives	R.D.Gupta, D.J. Agarwal, Suresh Chandra	Cambridge University Press	1/e, 2013
4	Object Oriented Analysis	James Oshani, Robert Martin, Steven Osher	Prentice Hall	1/e, 2013

Video Links (YOUTUBE, MIT, & YouTube)

Module No.	Link ID
1	https://www.youtube.com/watch?v=111111111111
1	https://www.youtube.com/watch?v=1111111111111111
1	https://www.youtube.com/watch?v=1111111111111111
4	https://www.youtube.com/watch?v=1111111111111111

SEMESTER 5
CLOUD COMPUTING

Course Code:	OBG57111	CH Marks:	40
Teaching Hours/Week (L, T, P, A)	3,0,0,0	ESL Marks:	00
Credit:	1	Exam Marks:	100% (100)
Prerequisites (if any):	N/A	Course Type:	Theory

Course Objectives:

- To understand the core principles, structure, and technologies for cloud computing, including virtualization, data storage, and cloud services.
- To equip students with the skills to use cloud computing tools effectively, implement cloud-based applications, and address security challenges within cloud environments.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction - Cloud Computing, Types of Cloud, Working of Cloud Computing, Cloud Computing Services - Cloud Computing Technologies, Cloud Infrastructure, Cloud Modeling and Design	3
2	Virtualization - Fundamentals, 3rd-Gen Virtualization, Virtualization and Cloud Computing, Data Storage And Cloud Computing - Data Storage, Cloud Storage, Cloud Storage from LVM to RAID.	3
3	Cloud Computing Services - Cloud Computing Themes, Understanding Services and Applications by Types, Cloud Services, Cloud Computing and Security - Risks in Cloud Computing, Data Security in Cloud, Cloud Security Services	16
4	Cloud Computing Tools - Tools and Technologies for Cloud, OpenStack, Cloud Foundry, Cloud Aggregators - Moving Applications to the Cloud, Managed Cloud Services, Design Cloud Applications, Container Cloud Services	8

Course Assessment Method
(CE: 44 marks, ESE: 56 marks)

Coursework Internal Evaluation Marks (CE):

Assessment	Assignment/ Major project	Second Examination I (Written)	Second Examination II (Written)	Total
+	16	16	16	48

End Semester Examination Marks (ESE):

In Part A, all questions need to be attempted and in Part B, each student can choose any one set of questions out of four questions.

Part A	Part B	Total
2 Questions from each module. Total of 4 Questions, each carrying 3 marks (Total = 12 marks)	Each question carries 2 marks. Two questions will be given from each module, out of which 1 question shall be answered. Each question can have a maximum of 3 sub-questions (Total = 3 marks)	15

Course Outcomes (COs):

After studying the course students should be able to:

	Course Outcome	Student's Knowledge Level (SKL)
CO1	Understand the fundamentals - strengths of cloud computing, its types and how cloud computing environment operates	LO2
CO2	Understand and describe the foundations of virtualization, its advantages and cloud computing	LO2
CO3	Describe various cloud computing services, understand the different service models and identify potential risks	LO3
CO4	Demonstrate proficiency in using cloud computing tools such as OpenShift, Jenkins, and deploy applications using popular cloud platforms	LO3

Note: LO = Remember; KI = Understand; K3 = Apply; K4 = Evaluate; K5 = Create.

EI2.20 Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11
CO1	1	2	2								3
CO2	1	2	2	2							3
CO3	2	2	2	2							3
CO4	2	2	2	2							3

Dear /, Right Hon'ble, I, University Director, I, Academic Head, - Mr. Convener

Title Books

SL No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Cloud Computing: A Practical Approach for Learning and Implementation	Akbaruzzaman, Ziaur	Prentice Hall	1st, 2014

Reference Books

SL No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Cloud Computing: Concepts, Technology, Security and Applications	Thomas D.	Springer	1st, 2013
2	Cloud Computing	Santosh Srivastav	Cambridge University Press	1st, 2017
3	Cloud Computing: A Work-On Approach	Anil Kumar Singh and Vinay Malhotra	Universities Press	1st, 2014

Video Links OTEL, SWAYAM...)

Module No.	Link ID
1	https://www.swayam.ac.in/module_id/149900

SEMESTER ST
SOFTWARE ENGINEERING

Course Code:	0ECS0103	CIE Marks:	40
Teaching Hours/Week (L: T: P: E)	30:0:0	EIE Marks:	60
Credit:	3	Exam Hours:	2 Hrs 30 Min.
Prerequisites (If any):	Data	Course Type:	Theory

Course Objectives:

1. To provide fundamental knowledge in the Subject Development process involving Software Development, Client Oriented Design, Project Management concepts and methodology models.
2. To enable the students to apply various software engineering processes in Software development.

SYLLABUS

Module No.	Syllabus Description	Content Hours
1	<p>Introduction to Business Engineering and Process Models - Business engineering, Software characteristics and types, levels of business engineering process, Utilities, Tools and Quality focus, Business Process models - Waterfall, Prototyp, Spiral, Incremental, Agile model - Velocity and Priorities</p> <p>Requirements engineering - Functional, Non-functional, System and User requirements, Requirements elicitation techniques, Requirements validation, Feasibility analysis and its types, UML diagram classification and its products</p> <p>Case study: UML for College Library Management Software</p>	18
2	<p>Software design - Software architecture and its approaches, Software architecture patterns: Composite and Container; Layered, Aggregation, Client-Server, Publish-Subscribe, Functional and Object-based - Coupling and Cohesion (Case study), Analysis design factors</p> <p>Client Oriented Software Design - UML diagrams and wireframing- static and dynamic models, Class diagram, Use diagram, Use case diagram,</p>	20

	<p>Software Design</p> <p>Case Studies: Vista Wallpapers, AT&T Blueprint</p> <p>Software process - Model View Controller, Cleanroom Design Patterns types - Testcase, module, Allocated, Testcase method, Sequence method, Testscript method, Toolkit method. Generalized Design Patterns and its types - Adapter, Bridge, Decorator, Composite, Delegation, Factory, Flyweight, Behavioral Design Patterns</p>	
3	<p>Testing, Testing and Maintenance:</p> <p>Code reviews - Code review, Code walkthrough and Code integration, Code debugging and its methods.</p> <p>Testing - Unit testing, Integration testing, System testing and its types, Black box testing and White box testing, Regression testing</p> <p>Overview of DevOps and Code Management - Code management, DevOps processes, Continuous Integration, Delivery, and Deployment (CI-CI-CD), Case study - Netflix</p> <p>Software maintenance and its types - Adaptive, Corrective, Corrective and Predictive maintenance; Boehm's maintenance model (Initiation, and maintenance)</p>	38
4	<p>Software Project Management - Project management - LSC, Functional points and Story points, Communication among Stakeholders</p> <p>Task management, Task and its types, Task monitoring and management models</p> <p>Software Project Management - Planning, Scheduling, Organizational structures, Scheduling using Gantt chart, Software Configuration Management and its phases, Software Quality Management - ISO 9000, CMMI, Six Sigma for software engineering</p>	7

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

Continuous Internal Evaluation Matrix (CIE):

Attendance	Assessment Management	Internal Evaluation-1 (Written)	Internal Evaluation-2 (Practical)	Total
5	25	10	20	40

Total Successive Examination Matrix (SEM):

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

Part A	Part B	Total
2 Questions from each module. Total 10 Questions, each covering 2 marks. (Total = 20 marks)	Each question carries 6 marks. Total 6 Questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 3 subquestions. (Total = 30 marks)	50

Course Outcomes (COs)

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

Course Outcome	Stage 1 Knowledge Level (K1)
CO1 Plan the system requirements and recommend a suitable software process model.	K1
CO2 Model various software patterns based on system requirements.	K2
CO3 Apply testing and maintenance strategies in the developed software products to enhance quality.	K2
CO4 Design a software product based on cost, schedule and risk management.	K2

COs: K1-Knowledge; K2- Understanding; K3- Apply; K4-Analyse; K5-Evaluate; K6-CREATE

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

	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	Po10	Po11
CO1	1	1	3								1
CO2	1	1	3								1
CO3	1	1	3								1
CO4	1	1	3								1

Note / High (1), Medium (2), Moderate (3), Low (4), - No Correlation

Text Books:

SL.No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Software Engineering: A practitioner's approach	Roger S. Pressman	McGraw-Hill	4/e, 2004
2	Software Engineering	Ian Sommerville	Addison-Wesley	5/e, 2003
3	Design Patterns, Elements ofReusable Object-Oriented Software	Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides	Pearson Education Addison-Wesley	3/e, 2001

Reference Books:

SL.No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Entity-Relationship Modeling With Open Source and Oracle	Stanley Iacob	Wiley India	1/e, 2003
2	Software Engineering: A Process	Thomas S. Rumbaugh	Longman-Glen-Gray-Hill	1/e, 2003
3	Object-Oriented Modelling and Design with UML	Mihai Dascalu, James Rumbough	Pearson Education	2/e, 2001
4	Software Engineering Fundamentals: A Software Science Perspective	Yngve Rang	Asymmetrik Publications	1/e, 2004
5	Object-Oriented Design and Patterns	Cay Horstmann	Wiley India	1/e, 2001
6	Engineering Software Products: An Introduction to Modern Software Engineering	Ian Sommerville	Pearson Education	1/e, 2002

Title List: [WTEL, STATAM...]	
Module No.	Link ID
1	http://www.yousdo.com/watch?v=Q3944X864U
2	http://www.yousdo.com/watch?v=LdLcig0J7IQ
3	http://www.yousdo.com/watch?v=9612119CfIw
4	http://www.yousdo.com/watch?v=7B213598U
5	http://www.yousdo.com/watch?v=1H0jw61931U

SEMESTER 5th
COMPUTER NETWORKS

Course Code:	DIC50704	CIE Marks:	40
Teaching Hours/Week (L-T-R-W)	10.0.0	ECE Marks:	60
Credits:	1	Total Hours:	150x 10 Wks
Prerequisites (if any):	None	Course Type:	Theory

Credit Objectives:

1. To introduce the basic concepts of computer networking.
2. To explore routing protocols and their role in network communication.

SYLLABUS

Module No.	Syllabus Description	Credit Hours
1	Introduction to Computer Networks:- Structure, Network Components, Network Models, ISO/OSI, TCP/IP Physical Topology, Services of the Internet, Routing, Routing Layer, Transmission media (wires, Optical, wireless), Diagnose Techniques Virtual Circuits, Protocols	7
2	Data Link Layer:- Layer Structure and Functions : Isolation, Addressing Code (CRC) Checking, Framing, Unicast, Flow Control, Multicast Channels, Many Channels, Multiple Access Control- Random Access, Controlled Access Protocol (CSMA, IEEE802 Standard, Ethernet, IEEE 802.11)	11
3	Network Layer:- Logical Addressing- D-I and E-I Address, Source Routing- IP/ICMP and BGP, Router Function, Distance Vector Routing, Link State Routing Multicast Routing Protocols	9
4	Transport Layer:- Transport Layer Protocols- UDP, TCP, Connection Control- Seq. Log. 1/1 Check Log, Sequence Control, Sequence Control in TCP, Application Layer – Application Layer Protocols, Client-server applications, World Wide Wide and WWW, EDI, Electronic Mail, DNS, Peer-peer protocol - P2P Services	8

Career Development Method
(CE: 44 marks, ESE: 00 marks)

Concurrent Interval Evaluation Matrix (CIM):

Assessment	Assessor/ Manager	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Total
I	II	III	IV	V
End Semester Examination Marks (ESE):				
In Sem-I all questions will be answered and in Sem-II, each student can answer any two full questions out of four questions.				
Part A:		Part B:		Total
2 Questions from each module. Total of 12 Questions, each carrying 1 mark (Total = 12 marks)	Each question carries 2 marks. Two questions will be given from each module, out of which 1 question shall be answered. Each question can have a maximum of 12 sub-instructions. (Total = 24 marks)			36

Career Guidance (CG):

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

	Course Outcomes:	Bloom's Knowledge Level (KL):
CO1	Compare the COB and TGP-P modules, its functioning of different network layers and the general tasks used in various protocols.	EL
CO2	Understand various communication models (logistic, tree, meshed), peer-to-peer, client-server, workgroup, and medium access control mechanisms in both wired and wireless LANs.	EL
CO3	Demonstrate a working knowledge of IPv4 and IPv6 addressing schemes using protocols (header and payload), and apply them to network scenarios.	EL
CO4	Interpret TCP and UDP protocols, explain congestion control mechanisms, and understand client-server and peer-to-peer applications like HTTP, FTP, DNS, and P2P networks.	EL

Table E-1: Learning CO-Understanding EL-AppL CO-Analys. CO-Evaluate EL-Creat. CG-PO Mapping Table: Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1										1
CO2	1	1	1									1
CO3	1	1	1									1
CO4	1	1	1									1

Note: 1=High Cred; 2=Medium Cred; 3=Low Cred; +=In-Complete

Text Books				
S. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Computer Networks: A Top-Down Approach	Kurose & Ross	McGraw Hill	8th, 2011

Reference Books				
S. No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Computer Networks: A Top-Down Approach	L. L. Peterson and B. S. Davie	Morgan Kaufmann	5th, 2011
2	TCP/IP Architecture, Design, and Implementation in Linux	James F. Kurose and Keith W. Ross	Prentice Hall	5th, 2008
3	Computer Networks	Andrew S. Tanenbaum	Prentice Hall	6th, 2011
4	Computer Networking: A Top-Down Approach (Principles and Practice)	J. F. Kurose and K. W. Ross	Prentice Hall	5th, 2011

Value Links (SFTEL SWAYAM..)	
No.	Last Date
1	https://spoc.sftel.ac.in/swayam/106133136102112

SEMESTER 5th

MOBILE APPLICATION DEVELOPMENT

(Commons CCA/CACD/CHATAM/AD)

Course Code:	00227722	CIE Marks:	45
Teaching Hours/Week (L T P R)	3 0 0 0	EIE Marks:	45
Credits:	3	Exam Theory:	2.50x 18 = 45
Prerequisite/Allegy:	00227722 00227711	Exam Type:	Theory

Course Objectives:

1. To impart a Comprehensive Mobile Application Development Knowledge.
2. To give Proficiency in Front end Data, UI/UX Design Skills.
3. To generate Industry, Business and Deployment skills in app security, testing.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Fundamentals of Mobile Application Development: Introduction to Mobile Application Development, Overview of Mobile Platforms, iOS and Android, Introduction to Data, Memory, Threads, and Semantics, bring Up the Player Development Environment, Mobile App Architecture (MVC, MVVM, and RxJava), Basics of One Programming Language.	8
2	User Interface Design and User Experience: Principles of Mobile UX/UI Design, Designing Responsive UIs with Flexbox, Using Flexbox Manager, Slides and Swiper/Slides, Layout in React: Context, Columns, Row, Stack, Navigation and Routing in Twitter, Consuming API with Thunks and Actions	9
3	Advanced Mobile Development: Data Management in Firebase, Firestore, Realtime, and Cloud	8

	<p>Developing in Python: LISTE Examples, FLASK/PYTHON, DART/HTML/JS</p> <p>Unit Test using SOLID: Data/Procedures, Unit</p> <p>Advanced Programming with Data: Functions, generators, and Iterators</p>	
4	<p>Industry Practice and App Deployment:</p> <p>Advanced UI Components and Animations, App Security, Best Practices, Testing and Debugging Native Applications, Publishing Apps to Google Play Store and Apple App Store, Indiana Tools and Trends of Mobile Development with Flutter</p>	5

Credit assessment Method:
(CE= 40 marks, EBL= 60 marks)

Continuous Internal Evaluation Marks (CIE):

Assessment	Assessment Management	Internal Evaluation-1 (Written)	Internal Evaluation-2 (Written)	Total
5	15	18	18	45

End Semester Examination Marks (ESM):

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

Part A	Part B	Total
10 Questions from each module. Total of 10 Questions, each carrying 3 marks (Total = 30 marks)	<p>Each question carries 2 marks.</p> <p>Two questions will be given from each module, out of which 1 question should be answered.</p> <p>Each question can be answered by 12 individuals.</p> <p>(Total = 30 marks)</p>	60

Course Outcomes (COs)

Each one of the course modules should have at least one:

Course Outcome		Student's Knowledge Level (SKL)
CO01	Explain the basics of mobile applications development and different mobile platforms and the environment setup.	K1
CO02	Apply principles of efficient mobile UI/UX design, develop responsive web interface using Native language.	K2
CO03	Implement efficient code base in Native applications, connecting and data persistence in Native apps.	K3
CO04	Apply security best practices in mobile app development and design Native applications efficiently.	K3

Note: K1-Knowledge; K2- Understanding; K3- Application; K4- Analysis; K5- Evaluation; K6- Creation

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3								1
CO2	3	4	3	3	3							3
CO3	3	3	3	3	3							3
CO4	3	3	3	3	3							3

Note: 1=Highly Correlate, 2=Moderately Correlate, 3=Slightly Correlate, - No Correlation

Text Books

SL. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Primer Of Mobile	Sivaram Krishnamoorthy	Pearson	2nd, 2021
2	Mobile for Business	Alexander Stach	Pearson	1st, 2018

Reference Books				
S. No	Title of the Books	Name of the Authors	Name of the Publisher	Editor and Year
1	Principles of Action	Iku Watanabe	Munich	J.A. 2010
2	Practical Data- Up and Running	Deepa Chopra & Deepak Chopra	MG	J.A. 2012

Value Dates (NPTEL, IITAYAAR...)	
Seq.	Link ID
1	https://www.youscan.com/doc/1-1341126000

SEMESTER 8

COMPUTER SCIENCE AND ENGINEERING

(Artificial Intelligence)

SEMESTER 5S
SOFTWARE ARCHITECTURES

Course Code	SE5005	C.U. Status	A
Teaching Weeks Weeks (S,T,F,R)	4200	ESE Marks	A
Credit	3	Exam Marks	250.00/50
Prerequisites (List)	None	Course Type	Theory

Course Objectives:

1. To develop a comprehensive understanding of Software architecture principles and patterns.
2. To provide the ability to design and analyse software architectures.

SYLLABUS

Module No.	Syllabus Descriptions	Contact Hours
1	Introduction to Software Architecture: Definition and Importance; Life Cycle, State of the System in Different Requirements Engineering, Stakeholders, Classes, and Types of Requirements, Use Cases and Tactics.	3
2	Architectural Patterns and Styles: Component-Based, Object-oriented Patterns and Styles. Applying Patterns and Choosing a Style: Patterns for Enterprise Applications, Enterprise Applications and Layered Systems, Component-Based.	3
3	Composability, Contracts, and Service-Oriented Architectures: Composability: Basics of Composability and Boxes, UML and Component Design By Contracts: Contracts, Polymorphism, Interactions, and Discrepancy Between Contract Architectures: Services, Technologies, and Issues.	3
4	Architecture Brochures and Diagrams: Overview Architecture and Viewpoints. Evaluating Architectures. Architectural Description Languages: UML-Overview and Applications	3

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment Management	Statistical Examination-1 (Written)	Statistical Examination-2 (Written)	Total
8	16	32	36	48

End Semester Examination Marks (ESE):

In Part A, all questions need to be attempted and in Part B, each student can choose any two out of four questions out of four questions.

Part A	Part B	Total
<ul style="list-style-type: none"> • 10 Questions from each module. • Total of 8 Questions, each carrying 3 marks <p style="text-align: center;">(Total = 24 marks)</p>	<ul style="list-style-type: none"> • Each question carries 2 marks • Two questions will be given from each module, one of which 1 question should be attempted • Each question contains a maximum of 3 sub-questions. <p style="text-align: center;">(Total = 12 marks)</p>	48

Course Objectives (COs)

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

Course Objectives		Student's Knowledge Level (SKL)
CO1	Understand the fundamental concepts of software engineering, including the roles of stakeholders and the importance of requirements engineering.	S1
CO2	Apply structured process and cycles in design software systems, particularly in enterprise systems.	S2
CO3	Understand the principles of integrated-parallel software design, including the use of web-based technologies in creating reliable software systems.	S2
CO4	Apply systematic, discipline techniques to document and evaluate software architectures.	S2

Page: 15 • Author: Dr. Udayashankar, SIT-Jagga Jyoti, SC-2019, TS-Eduhub, TS-Campus

EERI Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	P04	P05	P06	P07	P08	P09	P10	P11	P12
C01	3	3	3						3
C02	3	3	3	3					3
C03	3	3	3	3					3
C04	3	3	3	3					3

(Step 1: Align) (Step 2: Measure Outcome, 3: Measure Depth, 4: Consistency)

Title Books:

E. No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Software Architecture: A Beginner's Guide to Understanding Third Generation	A. S. Dutt, R. J. Morris, E. P. Koenig, J. R. Sander	Tech Technology Academy	1st, 2011
2	Software Architecture 2: Advanced Design Patterns	Richard Constantine	Wiley	1st, 2004

Reference Books:

E. No	Title of the Books	Name of the Authors	Name of the Publisher	Edition and Year
1	Model First Software Architecture: A Beginner's Guide to Understanding Third Generation	David Denzin, Mark Schildt, Neal Taal	O'Reilly	1st, 2004

Title Links (PPT31, SWAVAN ...)

No.	Link ID
1	https://www.csseas.com/paperfile-3543.html?g=3&C1%5B1%5D=0%2F0

SEMESTER 5S

NATURAL LANGUAGE PROCESSING

(Common to C3,C4,CD)

Course Code:	PEC5001	CIE Marks:	40
Teaching Hours/Week:	12.00	EBC Marks:	60
Credit:	1	Exam Hours:	2 hrs. 30 min.
Prerequisites (if any):	None	Examiner Type:	Theory

Course Objectives:

1. To provide an optional understanding of natural language processing (NLP) techniques, focusing on the principles and techniques of parsing, engineering an efficient grammar and applying AI-driven models.
2. Essential skills necessary to design, implement, and evaluate parsing algorithms across various applications, while considering the related implications and challenges associated with AI-generated outputs.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	<p>Introduction to NLP:</p> <p>Introduction to Natural Language Processing - Various stages of Natural NLP - Challenges, Basic Text Processing techniques - Common NLP Tasks</p> <p>N-gram Language Models: - Markov Models for Text Classification, and Sentence Analysis - Evaluation Measures, Recall, and Precision Test and their relationships.</p>	7
2	<p>Traditional NLP Techniques:</p> <p>Analyzing Linguistic Structures - Context-Free Grammars, Constituency Parsing, Antiquity, CYK Parsing, Dependency Parsing - Transition-Based Dependency Parsing, Graph-Based Dependency Parsing, Evaluation.</p>	7
3	<p>Neural Networks for NLP:</p> <p>Word representation - Lexical Semantics, Vector Semantics, TF-IDF, Part-of-Speech Information (POS), Neural Word embeddings - Partitive N-grams, Common Verb Inflections, Unlabeled Vector Models - Trained and Shared Vectors for Text Classification</p>	10

	Advanced NLP and Applications Sequence Modelling - Recurrent Neural Networks, RNNs as Language Models, LSTM for NLP tasks, Variational and Deterministic RNN architectures. Sequence Neural Networks: LSTM & GRU, Convnet RNN, RNN Architectures, Encoder-Decoder Model with RNNs, machine translation DeepLearning NLP Applications - Machine Translation, Question Answering and Information Extraction, Introduction to Large Language Models.	11
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Course Assessment Marks
(TE= 45 marks, ESE= 45 marks)

Continuous Internal Evaluation Marks (CIE)

Assessment	Assignment (Supervised Classification)	Internal Evaluation-1 (Written)	Internal Evaluation-2 (Written)	Total
5	10	11	10	45

End Semester Examination Marks (ESE)

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

Part A	Part B	Total
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 6 Questions, each carrying 1 mark (Total = 12 marks) 	<ul style="list-style-type: none"> • 2nd question carries 2 marks. • Two questions will be given from each module, and whichever 1 question should be answered. • Each question can have a maximum of 2 additional attempts. 	45

Course Outcomes (COs)

All the rest of the course objectives should be able to:

Course Outcomes		Glossar's Knowledge Level (GKL)
CO6	Understand the grammatical categories of NLP and apply them to the text processing	G3
CO8	Understand representations and evaluate neural models for NLP tasks and implement advanced linguistic annotation and parsing techniques	G3
CO9	Apply advanced sequence modeling techniques using Recurrent Networks	G3
CO4	Apply NLP techniques in machine translation, question answering, and information retrieval.	G3
CO5	Apply NLP techniques in machine translation, question answering, and information retrieval.	G3

Term: E- English, T- Technical, A- Apply, P- Practice, D- Discuss, C- Class

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

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13
CO6	1	1									1		
CO2	1	1				1							
CO8	1	1											1
CO4	1	1	1			1							
CO5	1	1	1				1						

Note: 1-High, 2-Medium, 3-Lowest, 4-No Correlation

Text Books

Sl.No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Speech and language processing: An introduction to natural language processing, computational linguistics, and speech recognition	Dipanjan Das and Deeyan Li-Wen He	Tata McGraw-Hill	2006
2	Introduction to Natural Language Processing	Sasha Earley	MIT Press	2009
3	Natural Language Processing with Python	Lewis L. Neverov, and Thomas Hofmann	O'Reilly	2010

Reference Books				
S. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Using Learning for National Languages PROJECTS	Douglas Kaufman	Macmillan	2002
2	National Language Processing with P. T. Dash	Utpal Das and Kausik Mukherjee	O'Reilly	2002
3	Deep Learning	Ian Goodfellow, Yoshua Bengio, Aaron Courville	MIT Press	2016

Take Links (NPTEL, SWAYAM ...)	
No.	Link ID
1	https://swayam.nptel.ac.in/courses/100-100010001/

SEMESTER 5S
NETWORK SECURITY PROTOCOLS

Course Code:	ITCAT501	CIE Marks:	40
Teaching Hours/Week: (L.T.P. R.)	200.00	ESE Marks:	60
Credit:	3	Exam Hours:	3 hrs. 10 min.
Prerequisites (if any):	ITCAT501	Course Type:	Theory

Course Objectives:

1. To explore various network and system security protocols.
2. To teach the authentication protocols. Details and security protocols from different layers such as host level, network, message and application.
3. To enable the learners in effectiveness of security protocols for securing network applications.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Authentication protocols: Simple Authentication Requests, Authentication Functions: X.509, authentication tokens, Hash Functions, Digital signatures, Authentication Protocols - Manual authentication, One-time authentication, Kerberos Kerberos Version 4, Kerberos Version 5, S/KEY Authentication and 3rd Party Key Infrastructure (PKI) - Certificate Services. Bluetooth: MAC identity, Trust, Out of Range (POR) - Operation, Encryption, Cryptographic keys and key maps, Message formats, POR message generation, POR message reception, Bluetooth message types: L1/L2CAP - Tunneling, Logical Link Control processing, Enhanced security services.	8
2	Network Layer Security and Web Security: Internet Protocol (IPsec) - Overview, IP security architecture, Authentication Header (AH), Encapsulating Security Payload (ESP), Confidentiality Header, Association, Key-management, Internet Key Exchange (IKE) - Details. Web Security - Web security considerations, Secure Sockets Layer and Transport Layer Security (SSL/TLS) - SSL, Application, SSL protocols. 	12

4	<p>Appliance Layer Security and System Security Update Trends</p> <p>Protocol Issues (STPS) - Configuration status, Circuit, Joint Rule (2024), - Changes have greatest, User authentication greatest, Configuration protocol issues, Recovery, Recovery, Firewall, Participants, Dual signatures, Reputation processing.</p> <p>Protocol - Firewall characteristics, Type of protocols, Firewall configuration, Encrypted Traffic, Tunnel issues - Data access control, The security of Internet systems, Single home address</p>	25
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Circuit Assessment Module
(ECE - 40 marks, EEE - 30 marks)

Certification Test and Evaluation Marks (CTE):

Attribute	Assignment Marks per question	Second Examination I (Written)	Second Examination II (Written)	Total
1	12	10	10	40

End Semester Examination Marks (ESE)

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

Part A	Part B	Total
<ul style="list-style-type: none"> • 1 Question from each module. • Total of 2 Questions, each carrying 2 marks (2x2=4 marks)	<ul style="list-style-type: none"> • Both questions carry 2 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Both questions can take a maximum of 2 marks each. (4x2 = 8 marks)	12

Course Outcomes (COs)

All the rest of the course contents should be able to:

Course Outcomes		Glossar's Knowledge Level (KL)
CO8	Explain symmetric, asymmetric, X.509 certificates, secure shell and Public Key Infrastructure (PKI).	S1
CO9	Identify the security weaknesses in E-mail security services.	S2
CO10	Describe the non-functional requirements for data availability, reliability, consistency and security.	S2
CO11	Describe application layer security protocols.	S2
CO12	Explain the concepts of system security and threats.	S1

Note: S1: Statement; S2: Understanding; S3: Apply; S4: Analyse; S5: Evaluate; S6: Create

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO8	1	1	2									2
CO9	1	1	3									3
CO10	1	1	3									3
CO11	1	1	3									3
CO12	1	1	3									3

Note: 1: Very Low; 2: Moderate; 3: High; - No Correlation

Text Books				
Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Cryptography and Network Security – Principles and Practice	William Stallings	Pearson Education	4/e, 2002
2	Network Security: Private Communication in a Public World	D. Kasten, J. L. Vieira and M. Spira	Addison Wesley Professional	2/e, 2002

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Cryptography and Network Security	William S. Stalling, Venkatesh Manohar	McGraw Hill Education (India) Private Limited	7th, 2011
2	Computer Network: Internetworking Applications and Protocols	William Stallings	McGraw Hill	6th, 2011
3	Network security : the complete volume	Shay Almansi	McGraw Hill Global	2nd, 2008

Video Links (NPTEL, TRIVIA, etc.)	
Module No.	Link ID
1, 2, 3, 4	https://npotx.com/100/100100111 https://npotx.com/100/100200111 https://npotx.com/100/100311100

SEMESTER 5S

BIG DATA ANALYTICS

Course Code:	FIC4114	CIE Marks:	40
Teaching Hours/Week: (L, T,P, R)	3,0,0,0	ECE Marks:	30
Credit:	3	Exam Hours:	2 hrs. 10 min.
Prerequisites (if any):	Date:	Course Type:	Theory

Course Objectives:

1. To understand the basic concepts of big data analysis. This course covers mathematical for Data analysis, prediction & association analysis of data, Big data and its applications.
2. To apply the methods in the analysis of Structured, Unstructured Data.
3. To correlate the studies in Data Analytics with R programming. To enable the learners to perform data analysis on a real world scenario using appropriate tools.

SYLLABUS

Module No.	Syllabus Descriptions	Contact Hours
1	Mathematics for Data Analytics - Descriptive statistics - Measures of central tendency and dispersion, Association of two variables - Scatter variables - Ordinal and Continuous variable, Probability - axioms + properties - Randomness, Uniform measure - Joint measure, Joint measure, Hypothesis Testing - Basic definitions p-value	8
2	Introduction to Data Analytics and Big Data Analytics - - Explain Process Model, Analytical Model Requirements, Data Analytics Life Cycle overview, Data of data mining, example, pre-processing and dimensionality reduction - Big Data Overview - Data of big data in analysis, Example Applications - Credit Risk Modeling, Business Process Analysis	8
3	Principles of Data Mining Algorithms - Supervised Learning - Classification, Naïve Bayes, ID3/ID3, C4.5, Logistic Regression, Decision Tree Learning - Clustering - Hierarchical algorithms - Agglomerative algorithm, Divisive algorithm - K-Means, Association Rule Mining - Apriori algorithm	8

4	R programming for Data Analysis – Data Analysis Using R - Introduction to R - R Objects Use Functions, Data Import and Export, Analysis and Data Types, Descriptive Statistics, Regression, Data Analysis - Visualisation, Index, Analysis, Data, Data Visualizing, 1 Single Variable, Examining Multiple Variables, Data Exploration, Visual Representation, Statistical Methods for Evaluation	10
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Exercises Assessment Method:
 (CEI: 40 marks, EIT: 60 marks)

Continuous Internal Evaluation Marks (CEI):

Achievement	Assessment Measurements	Second Examination-1 (Written)	Second Examination-2 (Written)	Total
I	II	16	16	40

End Semester Examination Marks (ESE):

In Term A, all questions will be answered and in Term B, mark allocation will increase by 10% and questions will be unanswered.

Term A	Term B	Total
<ul style="list-style-type: none"> • 10 Questions from each module. • Total will be 20 Questions, each carrying 2 marks (Total = 20 marks)	<ul style="list-style-type: none"> • Each question carries 2 marks. • Two questions will be graded from each module, i.e. minimum 1 question should be unanswered. • Each question can have a maximum of 12 sub-questions. (Total = 20 marks)	40

Course Outcomes (COs)

All the test of the course students should be able to:

Course Outcomes		Glossary Knowledge Level (GKL)
CO6	Discuss fundamental concepts of data analysis	E1
CO9	Explain basic concepts of data analysis and big data	E2
CO9	Describe various problems and data-driven analysis algorithms	E3
CO10	Describe key concepts and approaches of Big Data Analytics	E3
CO10	Design programming and implementation of data analysis and visualization	E3

Note: E1-Remember, E2-Understand, E3-Apply, E4-Analyze, E5-Evaluate, E6-Creat

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO6	2	1									1	
CO9	2	2									1	
CO10	1	1			2						1	
CO10	1	1									1	
CO10	1	1				1					1	

Note: 1-High, 2-Medium, 3-Low, 4-Additional (App), - NC-None

Text Books				
Sl. No.	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Analytics in a Big Data World: The Essential Guide to Data Science and its Business Intelligence and Analytics Trends	Eric Siegfried	John Wiley & Sons	1st, 2012
2	DATA Structures, Algorithms and Big Data Analytics: Streamlining Processing, Visualizing and Presenting Data	Sandip Banerjee	John Wiley & Sons	1st, 2011
3	Data Mining Concepts and Techniques	Jiawei Han, Micheline Kamber	Elsevier	3rd, 2006
4	Introduction to Statistics and Data Analysis	Cynthia H. Weisberg, Nitin G. Patel	Springer	1st, 2004

Reference Books				
S. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Data Mining: Introductory and Advanced Topics	Wesley B. Dubois	Pearson	1st 2003
2	Intelligent Data Analysis	Howard Wainer, David J. Thorne	Springer	1st, 2004

Video Links (NOTEL, SRIVASAM ...)	
Module No.	Link ID
1	http://www.notel.org/notel/resource/video/1.0/001001112.html
2	http://www.vasantham.psu.edu/10.1.1.103/Unacademy-10-0334
3	http://www.notel.org/notel/resource/video/1.0/00004110.html
4	http://www.vasantham.psu.edu/10.1.1.103/

SEMESTER 55

SPEECH AND AUDIO PROCESSING

(Offered to C3/C4/C5/C6 CR/AD/OC/CD)

Course Code:	FDC37064	CIE Marks:	40
Teaching Hours/Term:	2.0/0.8	IIE Marks:	00
Credit:	3	Total Hours:	120s. 10 Min
Prerequisites (if any):	FDC37058	Course Type:	Theory

Course Objectives:

1. To familiarise with speech processing and audio processing concepts.
2. To equip the students to apply speech processing techniques in dealing situations in day-to-day activities.

SYLLABUS :

Module No.	Syllabus Descriptions	Contact Hours
1	Speech Production - Acoustic theory of speech production, Linear Filter model - Dual-Tiered Speech-gene. Time and source based speech-synthesis. Speech model for speech perception - Short-Time Spectral Analysis, Windowing (STFT), Time domain perception (short time energy, short time zero crossing Rate, ACF), Frequency domain perception - Filter bank analysis, STFT analysis.	8
2	Mid-Frequency spectral synthesis (MFSS) - Composition, Full Lissajous ACF-LPC approaches, Cepstral analysis - Both are forward estimation using signal analysis, LPC analysis - LPC model, linear prediction model - Levinson Durbin Algorithm.	8
3	Speech Enhancement - Signal enhancement and Filtering, Reverberation Damping, Resonance reduction, Speech coding - Entropy-coded dual channel vocoder - Time domain speech decompressor, Self-based coding, step-rate - speech coding, place vector, Syntactic Recognition - Syntax classification and speaker identification, big-English, Language identification - English and English models, Machine learning methods in Speaker Recognition.	8

4	Signal Processing models of voice perception - Basic anatomy of hearing System, Basilar membrane, cochlea - Sound perception - Auditory Filter Banks, Critical Band, Intensity, Spectral Bandwidth of hearing, Auditory - Simultaneous Masking, Temporal Masking, Models of speech perception	8
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Course Assessment Method
(C01- 40 marks, C02- 40 marks)

Continuous Internal Evaluation Marks (CIE):

Attribute	Assignments	Internal Examination-I (Written)	Internal Examination-II (Written)	Total
	16	12	12	40

End Semester Examination Marks (ESE):

In Sem A, all questions need to be attempted and in Sem B, each student can choose any two out of four questions

Part A	Part B	Total
<ul style="list-style-type: none"> • 10 Questions from each module. • Total of 8 Questions, each carrying 2 marks <p>(Total = 16 marks)</p>	<ul style="list-style-type: none"> • Each question carries 2 marks. • Two questions will be given from each module, one of which 1 question should be answered. • Each question can have a maximum of 2 sub-questions. <p>(Total = 16 marks)</p>	48

Course Outcomes (COs)

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

Course Outcome		Globally Accredited Level (GL)
CO1:	To recall various stages in the speech generation process	A1
CO2:	To compute various speech processing algorithms	A2
CO3:	To develop speech-processing applications in various domains	A3
CO4:	To analyse the speech processing model for audio perception	A4

Page: E1-Journalism, E2-Undeclared, E3-Apple, E4-Analys, E5-English, E6-Cross

EII-III Mapping Table (Mapping of Course References to Program Outcomes)

	P04	P05	P06	P07	P08	P09	P10	P11	P12
C01	3	1	1	2	4	4			3
C02	3	1	1						2
C03	1	1	1						2
C04	3	1	2	2		2			2

Note : 1) Only 1 Group 2) Masters Course, 3) Reference Books, 4) Corebooks

Text Books

No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Speech Communication: Basics & Advances	Douglas O'Shaughnessy	Prentice Hall	3rd, 2008
2	Source-Filter Speech Signal Processing: Principles and Examples	Thomas J. Quinn	Prentice Hall	1st, 2001
3	Fundamentals of Speech Recognition	Luisier Robert, Bing-Shiang Yang, N. Krishnamurthy	Prentice	1st, 2008

Reference Books

No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Theory and Application of Digital Processing of Speech Signals	Julian and Linda	Prentice Hall	1st, 2008
2	Speech and Audio Signal Processing: Processing and Perception of Speech and Music	Julian Ullman and Jim Goad	John Wiley & Sons	2nd, 2011

Video Links (NPTEL, KhanAcademy...)

No.	Link ID
1.	http://www.nptel.ac.in/courses/101_102/101_102/101_102.html

SEMESTER 5
STOCHASTIC DECISION MAKING

Course Code:	PGCAT507	CIE Marks:	40
Teaching Hours/Week (L-T-S-R)	3-0-0-0	Exam Marks:	40
Credit:	3	Exam Hours:	1 hr + 10 Min.
Examination Format:	Probability and Statistics	Course Type:	Theory

Course Objectives:

1. To enable the learners to model and manage uncertainty and randomness in various real-world scenarios, such as finance, engineering, and operations research.
2. To equip the learners to make more informed decisions that optimize expected outcomes, balancing risk and reward.
3. To enable the learners to make better predictions of future states or outcomes based on potential models, which is crucial for planning and managing resources effectively.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	<p>Introduction to Stochastic processes: Overview of stochastic processes and their relevance.</p> <p>Discrete-Time Stochastic Processes: Markov chains, States, transition matrices, steady-state analysis, Examples and practical applications.</p> <p>Continuous-Time Stochastic Processes: Poisson process, continuous-time Markov chains, Birth processes and applications.</p>	4
2	<p>Stochastic Decision Processes (SDP)- Introduction to SDPs. Components of SDPs: States, actions, rewards, and policies. Bellman equation and value functions.</p> <p>Stochastic Methods for MDPs- Dynamic programming methods: Value iteration, policy iteration.</p>	3

	Advanced Topics in OR/ORc: Application of linear OR/ORc to large OR/ORc problems and non-convex methods	
3	Stochastic Optimization: Introduction to stochastic Optimization; Terminology, origins of stochastic optimization; policies, Bell's principle and illustrative examples	3
	Markovian Decision Processes: Algorithms (value, policy iteration, policy evaluation); Comparison with deterministic optimization methods	
4	Applications and Case Studies: Reinforcement learning; Finance; AI; strategic analysis of practical challenges and case studies	
	Applications in AI and Robotics: Business decision making in AI; Natural language processing; autonomous systems; Case studies in robotics; Data mining; major's exam	3
	Applications in Finance and Operations Research	
	Financial modeling: Risk management, portfolio optimization; Operations research applications: Inventory management; queueing systems	

Credit Assessment Model
(120-40 marks, EEE- 40 marks)

Continuous Internal Evaluation Marks (CIE):

Assessment	Autumn Midterm	Second Examination I (Written)	Second Examination II (Written)	Total
5	25	35	35	40

End Semester Examination Matrix (ESM)

In Part A, all questions need to be answered and in Part B, mark under one section may have full marks out of four questions.

Part A	Part B	Total
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 6 Questions, each carrying 1 marks (30-34 marks)	<ul style="list-style-type: none"> • Each question carries 3 marks • Two questions will be given from each module, you will answer 1 question should be unanswered. • Each question you have a maximum of 3 subquestions Half = 3 marks	40

Course Outcomes (COs)

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

Course Outcomes	Bloom's Knowledge Level (KL)
CO1: Demonstrate and apply fundamental concepts of numerical processes, including limit theory, the intermediate value theorem, in problem applications	K1
CO2: Evaluate and solve linearizing processes using Taylor Series Process (TSP), and apply different solution techniques, including approximation methods, to address real-life scenarios	K2
CO3: Translate and solve nonlinear optimization problems, and apply them techniques to address real-world scenarios effectively	K2
CO4: Demonstrate and analyze the application of advanced derivative techniques, including methods to solve complex real-world problems across various fields	K3

Part: E1-Explain E2-Understand E3-Apply E4-Analyze E5-Evaluate E6-Creat

EII-III Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
C04	1	1	1									1
C05	1	1	2									1
C06	2	2	2									1
C07	2	2	3									1

1=Very High, 2=High, 3=Moderate, 4=Low, 5=Very Low

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Stochastic Processes: Theory for Applications	Sinan U. Salihoglu	Cambridge University Press	1st, 2014
2	Stochastic Limiting and Intensification	Richard J. Saccoccia and Andrew G. Sircar	MIT Press	1st, 2004

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Stochastic Processes	Sheldon M. Ross	Wiley	2nd, 2002
2	Introduction to Stochastic Processes	Paul E. Kintner	Dove Publications	1st, 2010
3	Stochastic Optimization: Algorithms and Applications	Edgar F. Vom Hofe Berg, J. W. T. M. Van der Berg, and J. I. C. C. Jansen	Springer	1st, 2001
4	Dynamic Programming and Optimal Control	Dimitri P. Bertsekas	Athena Scientific	4th, 2014
5	Markov Decision Process: Theory and Applications in Reinforcement Learning	Paul A. Gelfand	Wiley	1st, 2011

Video Links (NOTES, NOT AVAILABLE)	
Module No.	Link ID
1	https://openlearning.uon.ac.ke/mod/video/view.php?id=12345
1	https://openlearning.uon.ac.ke/mod/video/view.php?id=123456
1	https://openlearning.uon.ac.ke/mod/video/view.php?id=12345678
1	https://openlearning.uon.ac.ke/mod/video/view.php?id=123456789

SEMESTER 5S
INTRODUCTION TO REINFORCEMENT LEARNING

Course Code:	ITCAT508	CIE Marks:	40
Teaching Hours/Week: (L, T, P, R):	3,0,0,0	ECE Marks:	30
Credit:	3	Exam Hours:	2 hrs. 10 min.
Prerequisites (if any):	EECE2100	Course Type:	Theory

Course Objectives:

1. To provide a comprehensive overview on the concepts and methods of reinforcement learning.
2. To understand the fundamental issues of reinforcement learning.
3. To develop skills in implementing reinforcement learning algorithms and apply the techniques to solve real-world problems.
4. To explore advanced topics and recent developments in reinforcement learning.

SYLLABUS

Module No.	Syllabus Description	CONTACT HOURS
1	Introduction to Reinforcement Learning: Overview, Motivation, and Applications of Reinforcement Learning, Differences from Supervised and Unsupervised Learning, Basic Concepts: Agents, Environment, Rewards, and Policies.	3
2	Markov Decision Process (MDPs) and Dynamic Programming (DP): Definitions and Properties, Value Functions, Bellman Equations, Policy Evaluation, Improvement, Policy Iteration, Value Iteration, Approximate DP, Efficiency of DP Algorithms.	3
3	Monte Carlo Methods and Temporal Difference (TD) Learning: Monte Carlo Prediction, Monte Carlo Control, Off-Policy Prediction and Control, TD Prediction, Q-Learning, SARSA, Eligibility Trace.	4
4	Function Approximation and Advanced Topics: Linear Function Approximation, Neural Networks for Function Approximation, Deep Q-Networks (DQN), Policy Gradient Methods, Actor-Critic Methods, Applications of Reinforcement Learning in Games, Robotics, and Other Domains.	3

Course Assessment Method
(CIL: 40 marks, EIL: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment Management	Second Evaluation-1 (Written)	Second Evaluation-2 (Written)	Total
5	12	12	20	49

End Semester Examination Marks (ESE):

In Sem-A all questions need to be attempted and in Sem-B each student can attempt only two of all questions out of four questions.

Part A	Part B	Total
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 5 Questions, each carrying 2 marks <p>(5x2 = 10 marks)</p>	<ul style="list-style-type: none"> • 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 2 sub-parts. <p>(2x2 = 16 marks)</p>	26

Course Outcomes (CO's):

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

Course Outcomes		Higher Education Level (HLL)
CO1	Explain the fundamental concepts of reinforcement learning.	H1
CO2	apply reinforcement tools & analyze reinforcement learning problems.	H2
CO3	Design basic reinforcement learning algorithms and compare their performance.	H3
CO4	apply advanced techniques and recent developments in the field of reinforcement learning.	H3

Score: H1- Responses H2- Understanding H3- Application H4- Evaluation H5- Creativity

EII-III Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
C01	1	2										2
C02	1	1	1									1
C03	1	1	2									1
C04	1	1	1									2
C05	2	1	2									2

Note: 1. Align; 2. Moderate Alignment; 3. Substantial Align; 4. Very Good Alignment.

Text Books:

S. No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Artificial Intelligence: An Introduction	Ronald S. Norvig, Andrew G. Russell	Prentice Hall	3rd, 2016
2	Deep Reinforcement Learning: Methods	Martin Liptchinski	Pragmatic Publishing	2nd, 2020
3	Artificial Intelligence: From Novice to Expert	Marie-France Michalewicz	Springer	1st, 2011

Reference Books:

S. No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Artificial Intelligence: A Modern Approach	Sheth, Russell, Peter	Prentice	3rd, 2016
2	Algorithms for Reinforcement Learning	Cenk Biyikoglu	Morgan & Claypool	1st, 2019
3	Deep Learning	Ian Goodfellow, Yoshua Bengio, Aaron Courville	MIT Press	1st, 2016

Video Links (NPTEL, SWAYAM -)	
Module No.	Link ID
1	Introduction to Reinforcement Learning https://npTEL.ac.in/course/20130142
2	Motion Dynamics Processes and Dynamic Programming https://npTEL.ac.in/course/20130129
3	Markov Decision Process and Temporal Difference Learning https://npTEL.ac.in/course/20130127
4	Forward Approximation and Action-Value Function https://npTEL.ac.in/course/20130126

SEMESTER 5

NEXT GENERATION INTERACTION DESIGN

(Common to CSOR/CHCA/CDAM/ADCM/CCD)

Course Code	SECTIME	CIE Marks	40
Teaching Hours/Term (L-T-P-R)	1.00	EST Marks	30
Crads	11	Exam Hours	2 hrs. 20 min.
Prerequisites (if any)	N/A		

Course Objectives:

1. To provide a comprehensive understanding of the principles of interaction design and their application in augmented reality (AR) and virtual reality (VR) environments.
2. To equip learners with practical skills in developing, prototyping, and evaluating AR/VR applications, focusing on user-centered design and advanced interaction techniques.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Interaction Design and AR/VR :- Fundamentals of Interaction Design - Examples of interaction design, User-centered interaction (UCI), Inputs, User interface (UI), Design principles, Introduction to AR and VR - Overview of AR and VR technologies (Key differences and Applications), Dimensions of AR/VR (Features, Benefits, constraints, examples), Software tools and platforms for AR/VR development.	4
2	User-Centered Design and Prototyping:- Understanding User Needs and Context - User research methods, Personas and user journey mapping, Continuous Inquiry for AR/VR, Designing for AR/VR environments, Spatial design principles, Immersion and presence in AR/VR; User interface (UI) design for AR/VR, Prototyping and Testing - Rapid prototyping techniques, Usability testing methods, Iterative design and feedback loops.	8
3	Advanced Interaction Techniques:- Sensors - Designing for gesture-based interaction, Implementing gesture controls in AR/VR applications, Vision - Voice recognition technology in integrating voice commands in AR/VR, Haptic Feedback and haptic integration - Understanding haptic feedback and tactile interactions, Eye-Hand - Designing and integrating Eye Gaze in VR, Spatial Audio	11

	Management, Client support and training strategies, Technical Language Interactions and interpretation, Interface, Type of IT systems used	
4	Implementation, Evaluation, and Future Trends - Developing AS/VS, Issues - Project planning and management, Database design and development, Case studies of successful AS/VS projects, Evaluating AS/VS Requirements - Evaluation methods and metrics, Analyzing new features, Sustaining and upgrading AS/VS applications, Future Trends and Ethical Considerations - Emerging technologies in AS/VS, Ethical implications of AS/VS, Design decisions in innovative design for AS/VS.	8

Credit Assessment Method
(ELE - 40 marks, EBL - 40 marks)

Continuous Internal Evaluation Marks (CIE):

Assessment	Interaction	Review	Analysis	Total
1	12	18	28	58

Criteria for Evaluating/Assessing and Analysis: 10 marks

- The students must be assessed to measure the quality of their answers - QCI based or various techniques such as interviewing.
- The students may be assessed based on their ability to collect, collate, gather and evaluate information (KCA).

End Semester Examination Marks (ESM):

In Part A all questions need to be answered and in Part B each student can choose any one full question and either part question.

Part A	Part B	Total
<ul style="list-style-type: none"> 2 Questions from each module. Total of 4 Questions, with carrying 3 marks (Total - 12 marks) 	<ul style="list-style-type: none"> 1 question will be given from each module, and each 1 question should be answered. Each question can have a maximum of 3 sub-questions. Each question carries 3 marks. 	12

Course Outcomes (CO)

Each cell of the course outlines should be able to:

	Course Outcome	Elbow's Knowledge Level (SKL)
CO1	Apply fundamental information design principles and human-centered interaction (HCI) concepts to assess, refine and evaluate user experience in AR/VR applications.	SK3
CO2	Develop user-centered design methodology to facilitate the development and prototyping of interactive environments.	SK3
CO3	Conduct user research and apply user-centered design methodologies to refine AR/VR experiences that are appropriate to audiences and contexts.	SK4
CO4	Implement user-centered interaction techniques such as gaze control, voice commands, haptic feedback, and eye gaze in AR/VR applications to enhance user engagement and immersion.	SK3
CO5	Evaluate AR/VR projects, utilizing appropriate evaluation methods and metrics, and propose improvements based on user feedback and emerging needs in the field.	SK3

Note: SK-Elementary, SK-Understand, SK-Apply, SK-Analyze, SK-Evaluate, SK-Creat

CO-PD Mapping Table: Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1								1
CO2	1	1	1	1	1							1
CO3	1	1	1	1	1							1
CO4	1	1	1	1	1							1
CO5	1	1	1	1								1

Note: 1=High-Grey, 2=Moderate-Grey, 3=Substantial (High), -10=Complete

Reference Books				
S. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Augmented Reality - History, Design and Development	Christopher G. Stach	McGraw-Hill	14, 2022
2	Virtual Reality and Augmented Reality: Models and Methods	Ralf-Detlev Wolfgang Esel, Paul Gräfe, and Stephan Jung	Springer	14, 2018
3	Augmented Reality: Technologies and Trends	David Luebke and Texas Hellfire	Prusa	14, 2019
4	Human-Computer Interaction	Alan Dix, Alan Dix, Gregory D. Abowd, Russell Beale	Prusa	14, 2004
5	Extending User Experience to Design Concepts and Methods	Rajesh Basudaghi	Springer	14, 2019
6	Measuring User Engagement: Collecting, Analyzing, and Improving Customer Interest	Tom Atiles, Tom Tolka	Morgan Kaufmann	14, 2011
7	The Future Transformations from Augmented Reality to Extended Intelligence: A 3D Design Encyclopedia	Rajesh Basudaghi	Taylor & Francis	14, 2019
8	Augmented Reality and Virtual Reality: The Future of AR and VR for Business	W. Charles von Drasek and Timothy Jung	Springer	14, 2019

Video Links (NPTEL, SWAYAM...)	
No.	Link ID
1	Interactive Design/Logo
2	Virtual Reality
3	Augmented Reality

SEMESTER SE

INTRODUCTION TO ALGORITHM

(Common to CSE/CA/CH/CD/CR/AD/AD)

Course Code	SE201011	CSE Major	AI
Teaching Hours/Week (L, T, S, P)	3-0-0-0	BEE Marks	60
Credit	2	Exam Marks	20% 20% 60%
Prerequisite Class(es)	None	Course Type	Theory

Course Objectives:

1. To give proficiency in analyzing algorithm efficiency and solve a variety of computational problems including sorting, graph algorithms.
2. To promote an understanding in algorithmic problem-solving techniques, including Divide and Conquer, Greedy Strategy, Dynamic Programming, Backtracking, and Branch & Bound algorithms.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Algorithm Analysis Time and Space Complexity - Asymptotic notation, Elementary operations and Comparisons of Time Complexity, Best, worst and Average Case, Congruence - Complexity, Calculation of asymptotic expansions, Recurrence Relations, Solution of Recurrence Equations - Iteration Method and Elimination, Tree Methods	8
2	Tree - Binary Tree - Root and height of tree, root, complete-binary tree representations using array, tree traversals (Inorder, pre, postorder), applications, binary search tree - insertion, deletion, tree deletion and search operations, applications, Graphs - representation of graphs, DFS and BFS (examples are required), Topological sorting	8
3	Divide and Conquer - General iteration, Partition, Recursion and Iteration, Core cases and direct comparison and divide conquer, Binary Search, Quicksort, Merge Sort - Recurrences, Greedy Strategy - General Recursion, Fractional Knapsack Problem, Minimum Coin Splicing Tree - PRIM's Algorithm, Kruskal's Algorithm, Single Source Shortest Path Algorithm - Dijkstra's algorithm	8
4	Dynamic Programming - The General Idea, The Optimal Substructure Property,	3

Mark Chain Monte-Carlo Analysis, All Point States, MC Algorithm -
 Trajek-Planck Algorithm, The Central Limit Theorem of Probability - The N-
 Queen Problem, Branch and Bound Algorithm for Travelling Salesman
 Problem.

Current Assessment Method
 (CIE- 40 marks, ESE- 40 marks)

Continuous Internal Evaluation Marks (CIE):

Assessment	Assignment Management	Internal Evaluation-I (Written)	Internal Evaluation-II (Written)	Total
6	24	24	24	48

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
<ul style="list-style-type: none"> + 2 Questions from each module + Total of 4 Questions, each carrying 3 marks 60 - 24 marks	<ul style="list-style-type: none"> + Each question carries 7 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 subquestions 140 - 28 marks	96

Course Outcomes (COs):

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

Course Outcomes	Learning Objectives Level (LOL)
CO1: Identify algorithm efficiency using asymptotic notation, compare algorithms, and solve recurrence equations	LO1
CO2: Use theory of computation tools, and apply graph representations, DFA, DFA, and topological sorting	LO2
CO3: Use divide and conquer to solve problems like finding maximum minimum, binary search, quick sort, and merge sort	LO3
CO4: Apply greedy strategies to solve the Huffman's longest problem, minimize the spanning tree using Dijkstra's and Kruskal's algorithms, and shortest path with Dijkstra's algorithm	LO3
CO5: Understand the concepts of Dynamic Programming, Backtracking and Branch & Bound	LO2

Data 1: Essential; LO1: Understanding; LO2: Applying; LO3: Analysing; LO4: Creating

ED-201 Mapping Table (Mapping of Course Objectives to Program Outcomes)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
C001	1	3	2									1
C002	2	2	1	1								2
C003	4	3	1	1								2
C004	2	2										2
C005	3	3	2									3

Date : 08/01/2018 (Mysore Semester, J. Academic Deptt., - 7th Semester)

Text Books

Sl. No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Introduction to Algorithms	T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein	Prentice Hall India	3rd, 2011
1	Algorithms for Computer Algorithms	Eric Gamma, Richard Helm, Ralph Johnson, John Vlissides	Chennai Rose	2nd, 2003

Reference Books

Sl. No	Title of the Book	Name of the Authors	Name of the Publisher	Edition and Year
1	Algorithm Design	Jon Kleinberg, Éva Tardos	Prentice	1st, 2006
2	Algorithms	Rüdiger Reischuk, Karin Wagner	Prentice	4th, 2011
3	The Algorithm Design Manual	Steven S. Skiena	Spirge	1st, 2000

Video Links (NPTEL, IITAVAN...)

No.	Link ID
1	https://www.youtube.com/watch?v=188133128128

SEMESTER 5
WEB PROGRAMMING

Course Code:	DECEP501	CIT Month:	46
Teaching Hours/Week (L: T:R: L:)	3:0:0:0	BEE Months:	00
Credit:	2	Lectures Hours:	18hrs. 30 Min.
Prerequisite (if any):	DECEP500	Course Type:	Theory

Course Objectives:

1. To equip students with the knowledge and skills required to create static and dynamic pages using HTML, CSS, JavaScript, and related technologies.
2. To provide hands-on experience with modern web development tools and frameworks such as Node.js, React.js, Angular, and Bootstrap, teaching students to design and build dynamic, responsive, and efficient web applications.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	<p>Creating Web Page using HTML - Introduction, Few HTML concepts, Headings, Listing, Images, Special Characters and Restricted Texts, Lists, Tables, Forms, Internal Linking, meta Elements, HTML Form input Types, Organizational Elements and unstructured Articles, Paragraph Elements, Styling Web Pages using CSS - Introduction, inline Style, Embedded Style Sheets, Linking External Style Sheets, Preexisting Elements, Absolute Positioning, relative, Positioning Elements, Relative Positioning, span, Backgrounds, Element Dimensions, Box Model and Text Flow, Media Types, Media Queries, Deep Dive into CSS, Cascading Style Sheet Language - Introduction, CSS Syntax, Structuring Data, CSS Namespace, Document Type Definitions (HTML, XML, JSON).</p>	3
2	<p>Scripting language - Client-Side Scripting, Data Types, Conditionals, Loop, Arrays, Classes, Function Declaration vs Function Expressions, Nested Functions, The Document Object Model (DOM) - Nodes and NodeList, Document Objects, Selection Methods, Dynamic Node Objects, Data Types, Asynchronous JavaScript and XML (AJAX) - Making Asynchronous Requests, Caching Content via AJAX, Once-Only Resource Loading</p>	3

	<p>JavaScript Library - jQuery - (jQuery Foundations), JavaScript, jQuery, jQuery Scripts, Common-Dom Manipulations in jQuery, Event Handling in jQuery</p> <p>Javascript common enhancement : Node.js - The foundation of Node.js Working with Node.js, adding Express in Node.js, Server-side programming language : PHP - What is Server-Side Development? Quick use of PHP, Session Control, Formulas, Arrays, Classes and Objects in PHP , Object-Oriented Design, Realizing HTML - Root - Root/Path Translation, The University of Texas "What is a component" Built-in components, User-defined components - Types of components, Function Components, Differences between Function and Class Components</p>	
4	<p>API – Basics, Angular JS, Working with databases - Database and Web Development, SQL, Container API, Armstrong MySQL vs SQL; Web Application Design - End-User Web Application Design, Principles of Learning, Address Design Patterns in the Web Context, Testing, Test coverage - Overview of Web Services - SOAP Services, REST Services, An Example Web Service WebService - Working options</p>	9

Course assessment Method:
(CIE- 40 marks, ESE- 60 marks)

Continuous Internal Test/Assessments Marks (CIE):

Attribute	Assignment Manager	Internal Evaluation-I (Written)	Internal Evaluation-II (Written)	Total
I	10	40	30	40

End Semester Examination Marks (ESE):

In Sem I, all questions need to be answered and in Sem II, each student can choose any two full questions out of four questions.

Part A	Part B	Total
<ul style="list-style-type: none"> ▪ 2 Questions from each module ▪ Total of 8 Questions, each carrying 2 marks <p>(Total = 16 marks)</p>	<ul style="list-style-type: none"> ▪ Each question carries 6 marks. ▪ Two questions will be given from each module, the other one question should be answered. ▪ Each question can have a maximum of 3 sub-questions. <p>(Total = 18 marks)</p>	44

Course Outcomes (CO)

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

Course Outcomes		Alumni's Knowledge Level (KL)
CO1	Design databases from paper trials to databases using EER diagrams, identifying primary key, foreign keys, and the tree model.	KL1
CO2	User interface design using Windows and either Query by Example manipulation, menu handling, and GUIX response to user inputs and interactions via interface.	KL2
CO3	Build and deploy server-side applications using Visual Basic, Lazarus and Delphi, and integrate databases using SQL or stored and remote view for dynamic content generation.	KL3
CO4	Office Read for building component-based single-page applications (SPA), understanding the fundamental principles of component architecture, and integrating AngularJS for such application development.	KL2

Data: KL1: Beginner; KL2: Intermediate; KL3: Expert; KL4: Business; KL5: Creator

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1		1							1
CO2	1	1	1		1							1
CO3	1	1	1		1							1
CO4	1	1	1		1							1

Note: 1=Very Little; 2=Minimum; 3=Sufficient; 4=Good; 5=Excellent

Text Books

SL No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Fundamentals of Web Development	David Powers; Lennart Söder	Prentice	11.2017*
2	Building User Interfaces with ReactJS - An Approachable Guide	Chris Mannino	Kiley	14.2017
3	Learn & Build Web App Using React.js	Jeff J. Drael, Harvey H. Drael, Abby Drael	Prentice	11.2017
4	ES6 Design and JavaScript: Understanding Single Page Web Applications	Jameson Quinn	Manning Publications	11.2017

Reference Books				
S. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	A Head First Web Development: From Novice to Professional	Eric S. Mattson	HeadFirst	1st, 2002
2	Advanced Web Development with Java	Matthew Tamm	O'Reilly	1st, 2008
3	Angular Framework for Instant Web Development	Tin Andric, Subjective Logic, Vaibhav Choudhary	Agate	1st, 2018

Video Links (NPTEL, SWAYAM...)

Module No.	Link ID
1	https://nptel.ac.in/courses/100-100-100012/
2	https://nptel.ac.in/courses/100-100-100015/

SEMESTER 5S
SOFTWARE TESTING

Course Code	SE50100	CIE Marks	40
Teaching Hours/Work (L.T.P)	8.00.0	Expt. Hours	40
Credit	4	Start Month	1 Dec 2018
Prerequisite (if any)	None	Course Type	Theory

Course Objectives:

- 1. To Define quality in software testing methodology and techniques.
- 2. To Foster experience in software testing tools and technologies.

SYLLABUS

Module No.	Syllabus Description	Credit Hours
1	<p>Introduction to Software Testing & Assessment:</p> <p>Introduction to Software Testing - Concepts, Importance of testing, software quality, and real-world Software Eng., Chapter 4), Software Testing Processes - Levels of testing in testing, Testing Techniques - Verification, validation, static, code, bug, test issue, and coverage analysis, Types of Testing - Unit, Integration, System, Acceptance, Performance (time, memory, performance), and Security Testing, Testability Trends - AI in test case generation, Introduction to Gherkin in testing, Testing Metrics - Black-Box, White-Box, and Gray-Box Testing, Automation in Testing - Introduction to automation tools (e.g., Selenium, Cypress, JUnit), Case Study - Application of Unit Testing and Integration Testing using Java.</p>	8
2	<p>Unit Testing, Mutation Testing & All-Driven Techniques:</p> <p>Unit Testing, Static and Dynamic Unit Testing, review, flow testing, tree testing, branch testing, boundary testing, Mutation Testing-Mutation operators: mutants, mutation score, and modern mutation testing tools (e.g., Mutigraph), Unit Frameworks - Automation of unit testing, Introducing the testing in real-world projects, AI in Testing - Guided for use case generation and optimization, Inputs in automation, Testability Tools - Application of AI-driven testing tools in mutation and predicate testing, Case Study - Mutation testing using RSpec, AI-based test case generation.</p>	8

	<p>addressed White Box Testing & Gray Box Testing:-</p> <p>Graph Coverage Criteria - Node, edge, and path coverage, prime path and meeting coverage; Data Flow Criteria - no gain, do gain, advancing invariance, Graph Coverage for Code - Control Flow graphs (CFG), the complex structures (e.g., loops, exceptions); Graph Coverage for Design Elements - Call graph, class inheritance trees, and coupling-flow flow paths; Scenario Testing - Requirements, code (JFC/JCF, BDD, BDDC), and checklist in generating producing applications. Case Study - Application of graph based testing and scenario testing using selected tools.</p> <p>Black Box Testing, Gray Box Testing, and Regression Testing:-</p> <p>Black Box Testing - Input space partitioning, random testing, boundary testing (equivalents, class partitioning, boundary value analysis, decision tables, random testing). Gray Box Testing - Instruction coverage and modifications (mutation testing, expression testing, integrated way testing); Performance Testing - Network latency using latency compatibility, capacity using stress multiple servers (e.g., Stressanalyzer, LoadImpact); Ingestion or P2P - Ingestion iteration, guaranteed rate testing, specific ingestion rates, and their applications; Growth Testing - Advanced use cases for production and acceptance testing server version and environments; Case Study - Implementation of Black, Gray, profile, and regression testing using P2C and A-Metric tool.</p>	12
4	<p>Course Assessment Model: (EE: 40 marks, ET: 30 marks)</p>	

Examination Internal Evaluation Matrix (IEM):

Assessment	Assignment/ Mid-semester	Internal Evaluation-I (Written)	Internal Evaluation-II (Written)	Total
7	10	10	10	40

End Semester Examination Matrix (ESM):

In Exam-I, all questions need to be answered and in Exam-II, each student can choose any one full question out of two questions.

Exam-I	Exam-II	Total
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 3 Questions, each carrying 2 marks <p>(Total = 12 marks)</p>	<ul style="list-style-type: none"> • Each question carries 2 marks. • Two questions will be given from each module, one of which 1 question should be answered. • Each question can have a maximum of 2 sub-questions. <p>(Total = 16 marks)</p>	1

Course Outcomes (COs)

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

	Course Outcomes	Student's Knowledge Level (KL)
CO1	Demonstrate the ability to apply a range of software testing techniques, including unit testing using TUnit and systematic tests.	S1
CO2	Describe using appropriate tools the various testing methods for a given class of code to identify hidden defects that can't be discovered using other testing methods.	S2
CO3	Apply and apply appropriate coverage measures to various TUnit test cases for people to improve code quality.	S2
CO4	Demonstrate the importance of Black-Box approaches in terms of Domain and Functional Testing.	S3
CO5	Discuss the importance of accuracy, completeness, and performance testing www.tunit.com	S3
CO6	The addressed tests for TUnit to perform systematic measure and optimize the test generation will like coverage, AI tests for assessment for the problems and systematic measure with TUnit.	S2

Data: E= Essential; I= Understanding; SI= Applied; S= Analysis; UG= Evaluate; RI= Create

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1									1
CO2	1	1	1	1	1							1
CO3	1	1	1									1
CO4	1	1	1	1								1
CO5	1	1	1									1
CO6	1	1	1	1	1							1

Note : 1=High; 2=Medium; 3=Lowest; 4=Additional (N/A); -=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 Software Testing	Paul Ammann, Jeff Offutt	Cambridge University Press	1st, 2009
2	Software Testing and Quality Assessment: Theory and Practice	Kishore Kini, Pradyumn Taparia	TMH	1st, 2008

Reference Books				
No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Business Today	Leslie D. Frazee	Prentice Hall	3rd, 2001
2	Business Today: A Critical Approach	Paul C. Hagen	Cengage	4th, 2011
3	Foundations of Business Today	Darlene Gashaw, Ken Black Indiana University	Cengage	4th, 2011
4	The Art of Business Today	Stanford J. Myers, Tim Budgett, Cindy Sandiford	Wiley	3rd, 2011

Table 1-1 (Source: MUTHU, PRAYAGAM...)

Module No.	Links IP
1	http://www.vedicglobalinstitute.com/100101100101101
2	http://www.vedicglobalinstitute.com/100101100101101101
3	http://www.vedicglobalinstitute.com/100101100101101101101
4	http://www.vedicglobalinstitute.com/100101100101101101101101

SEMESTER 5S
INTERNET OF THINGS

Course Code	QECAT5M	CSE Marks	10
Teaching Hours/Week G.T.P. E:	18.03	ESE Marks	10
Crifles:	3	Exam Hours	1.40.30 Mins.
Prerequisites (if any)	EEA	Course Type	Theory

Course Objectives:

1. To give an understanding in the Internet of Things, including its components, tools and analysis through its fundamentals and real-world applications.
2. To enable the students to develop IoT systems including the architecture and programming of Raspberry Pi modules.

SYLLABUS :

Module No	Syllabus Description	Contact Hours
1	Introduction to IoT - Standard Designation, Legacy Designated IoT protocols and Digital protocols, Domain Specific IoT - Sensor network, Sensor Aggregation, Health and Wellness.	8
2	IoT and M2M/2M, Differences between IoT and M2M, Application Domains, Networking, Network Protocol, visualization, Web for IoT, System Management, Simple Network Management Protocol (SNMP), IEEE802.15.6, V2V, LPWAN - LPWA/IoT applications, LPWA/IoT technologies, Cellular (2G/3G) and Non 2G/3G standards, Comparison of various protocols like Zigbee, LoRa, LORA/IOT, Meshwave, IEEE 802.15.4, LPWA/IoT.	8
3	Developing IoT - IoT design methodology, Our study on IoT system for weather monitoring, Mathematics for using python, IoT-systems, Logical data processing, Python packages of libraries for IoT - (MQTT, AMQP, MQTTSSD, IoTML, MQTTLS).	8
4	Programming Raspberry Pi with Python Controlling LCD with Raspberry Pi, Interfacing with I2C and analog with Raspberry Pi, Other IoT devices- Arduino, Raspberry Pi, Block Chain based Data Analytics for IoT	8

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

Continuous Internal Evaluation Marks (CIE)

Assessment	Subjective Dimensions	Scored Examination-I (Written)	Scored Examination-II (Written)	Total
S	H	S	S	S

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one of 5 questions and answer them.

Part A	Part B	Total
5 Questions from each module Total of 5 Questions, each carrying 3 marks (30 - 34 marks)	Two questions will be given from each module, out of which 1 question should be answered. Each question will have a maximum of 3 subquestions (10 - 11 marks)	41

Course Outcomes (COs)

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

	Course Outcomes	Student's Knowledge Level (K1)
CO1	Understand domain-specific applications and apply the principles of AI including physical and logical domains; logic reasoning	K1
CO2	Use the principles of AI and NLP, their differences and by solving the NLP, NER, and neural interpretation problems	K1
CO3	Design and apply IoT using methodology, various Python for logical system design, and implementation. Python packages through graphical user interface	K1
CO4	Requirements using Raspberry Pi with Python to control LCDs and interface interface with other IoT devices	K1

Pass ESE-Evaluation 10- Undergrad 10- Apply ESE-Evaluation 10- Evaluate 10-Credit

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

	DG1	DG2	DG3	DG4	DG5	DG6	DG7	DG8	DG9	DG10	DG11
CO1	1	1	1						1	1	
CO2	1	1	1						1	1	
CO3	1	1	1	2					1	1	
CO4	1	1	1	1					1	1	

Note: 1=High Corp., 2=Moderate, 3=Low, 4=Correlation

Text Books				
No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Invent of Things - a Design Co Approach	Ambient Living, Von Moltke	Gowariker Prints	1/e, 2011

Reference Books				
No. Sr.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Invent of Things - Addiction and Design Principles	Dijkhoff	Wiley AUS	1/e, 2011
2	The Invent of Things - Key applications and Principles MIT Laboratories: Manufacturing Technologies, Protocols and use cases for the Internet of things	Oliver Gervais, David Bresnen, Omer Blumenthal, David Ross Smith, Sukanya, Ganesan, Robert Koenig	Wiley	1/e, 2011
3			Elsevier	1/e, 2017

Video Links (NPTEL, IWAVAN...)	
No.	Link ID
1	https://nptel.ac.in/courses/100102108/100102108101100
2	https://nptel.ac.in/courses/100102108/100102108101100100

SEMESTER 5
COMPUTER GRAPHICS

Course Code	OEC51011	CIE Marks	40
Teaching Hours Week (L-T-R-S)	1-1-0-0	ESE Marks	10
Credit	3	Exam Hours	02x 30 Mins
Prerequisites (if any)	Data	Course Type	Theory

Course Objectives:

1. To generate various output devices using computer graphics including the three-dimensional environment representation in a memory, transformation of 3D/2D objects and their mathematical techniques and operations used in field applications.

SYLLABUS

Module No.	Syllabus Descriptions	Contact Hours
1	Basics of Computer graphics - Basics of Computer Graphics and its applications, Video Display devices - LED, OLED, LCD, TFT and LED and Plasma displays, Backplane and Frame scan displays and systems.	10
2	Line and Circle Drawing Algorithms - Line drawing algorithms, Bresenham's algorithm, Long Bresenham algorithm, Circle drawing algorithms - Midpoints Circle generation algorithm, Bresenham's Circle drawing algorithm	10
3	Coordinate transformations- 2D and 3D basic transformations - Translation, Rotation, Scaling, Reflection and Shearing, User representations and homogeneous coordinates	10
4	Filled Area Techniques - Scan line polygon filling, Boundary Filling and flood filling	8
5	Transformations and Clipping Algorithms - Window to N window transformations, Cohen Sutherland and Hilbert methods for clipping algorithms, Sutherland Hodgeman and Wu's Algorithms Polygon Clipping algorithms	8
6	Three dimensional graphics - Three dimensional viewing process, Projections, Parallel and Perspective projections, Matrix window clipping algorithms, Back face detection, Depth buffer algorithms, Line line algorithm, A buffer operation	8

Einzel Assessment Method
(ET: 40 min; ESE: 10 marks)

Continuous Integration in Software Testing 2019

Abonnement	Abonnement-Mitglied	Direkt- Lizenziat (Wieder)	Direkt- Lizenziat (Neues)	Total
7	17	11	9	46

East New York Transportation Museum

In Part A, all questions must be answered and in Part B, each student can choose any two full marks out of four questions.

Part A	Part B	Total
<ul style="list-style-type: none"> • 1 Question from each module. • Total of 8 Questions, each carrying 3 marks <p>(Total - 24 marks)</p>	<ul style="list-style-type: none"> • Each question carries 8 marks. • Two questions will be given from each module, one question 1 question should be answered. • Each question can have a maximum of 10 sub-questions. <p>(Total - 36 marks)</p>	60

Country Summary (C9)

With all of the above options available, no one

	Classical Duties	Student's Knowledge Level (K3)
C04	Determined the principles of computer programs and displays.	K3
C05	Demonstrated how learning, research, drawing and writing skills may be applied to problem solving.	K3
C06	Demonstrated 2D and 3D basic transformations and matrix representations.	K3
C07	Demonstrated different clipping algorithms and 2D rendering pipelines.	K3

Rev. E. James G. Pollio and Dr. and Mrs. John McElroy, Directors

CO-500 Management Techniques: Application of Control Techniques in Business Environment

Rev. 1/14/2013 10:00:11 AM, 5 Major/Notch, 100% Capacity

Text Books				
No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Computer Graphics - Algorithms and Techniques	D. R. Hirschberg, Donald P. Toga, Donald E. Knuth, M. Rudolf Oechslin and Vernon Corcoran	SIAM	1st, 2008
2	Computer Graphics with OpenGL	David Eberly, M. Rudolf Oechslin and Vernon Corcoran	SIAM	4th, 2011

Reference Books				
No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Introduction to the Field of Displays	Sun-Min Lee, M.-Huei Cheng, Sung-Chun, Shin Tsun-Yi	Wiley	1st, 2010
1	Computer Graphics and Mathematics	HT. Ertl	Pearson	1st, 2012
1	Computer Graphics	Ziqiang Tang and Ray Dwivedi	McGraw-Hill	3rd, 2009
4	Graphics of Information Computer Graphics	William M. Newman and Robert F. Sproull	McGraw-Hill	1st, 2001
5	Practical Examples for Computer Graphics	David F. Rogers	McGraw-Hill	1st, 2017
6	Computer Graphics	Donald D. Eberly, M. Vernon Eckert	Pearson	3rd, 2002

Video Links [NPTEL, IITAVAN...]	
No.	Link ID
1	Computer Graphics by Prof. Suresh Bhavani-Shankar at IIT-Dharwad http://www.iitdharwad.ac.in/~sbs/ug/cg/