ANNAMALAI UNIVERSITY

412. M.Sc. (COMPUTER SCIENCE)

Programme Structure and Scheme of Examination (under CBCS)
(Applicable to the candidates admitted in Affiliated Colleges
in the academic year 2022 -2023 ONLY)

Sem	Course Code	Study Components & Course Title	Hours	Credit	Maximum Marks		
					CIA	ESE	Total
SEMESTER-I							
I	22PCSCC11	Core Theory - I :Design and Analysis of Algorithm	5	4	25	75	100
	22PCSCC12	Core Theory -II: Advanced Java Programming	5	4	25	75	100
	22PCSCC13	Core Theory -III: Advanced Database Management System	5	4	25	75	100
	22PCSCP14	Core Practical- I:Algorithm LAB using JAVA	4	2	40	60	100
	22PCSCP15	Core Practical- II: Advanced RDBMS LAB	4	2	40	60	100
	22PCSCE16	Core Elective-I	4	4	25	75	100
	22PCSCO17	Open Elective-I	3	3	25	75	100
		Total	**30**	**23**			**700**
SEMESTER-II							
II	22PCSCC21	Core Theory -IV: Advanced Web Technology	5	4	25	75	100
	22PCSCC22	Core Theory -V:Data Mining and Business Intelligence	5	4	25	75	100
	22PCSCC23	Core Theory -VI: Distributed Operating System	5	4	25	75	100
	22PCSCP24	Core Practical- III: Advanced Web Technologies LAB	4	2	40	60	100
	22PCSCP25	Core Practical-IV: Data Mining Lab Using R	4	2	40	60	100
	22PCSCE26	Core Elective-II	5	4	25	75	100
	22PHUMR27	Compulsory Course: Human Rights	2	2	25	75	100
		Total	**30**	**22**			**700**
SEMESTER-III							
III	22PCSCC31	Core Theory- VII: Digital Image Processing	5	4	25	75	100
	22PCSCC32	Core Theory -VIII: Machine Learning	5	4	25	75	100
	22PCSCC33	Core Theory-IX: Research Methodology	5	4	25	75	100
	22PCSCP34	Core Practical- V:Image Processing Lab	4	2	40	60	100
	22PCSCP35	Core Practical- VI: Machine Learning LAB	4	2	40	60	100
	22PCSCE36	Core Elective-III:	4	4	25	75	100
	22PCSCO37	Open Elective-II:	3	3	25	75	100
		MOOC Courses					
		Total	**30**	**23**			**700**

SEMESTER-IV							
IV	22PCSCC41	Core Theory-X: Advanced Computer Networks	5	5	25	75	100
	22PCSCC42	Core Theory - XI: Block chain Technology	5	5	25	75	100
	22PCSCE43	Core Elective-IV:	4	4	25	75	100
	22PCSCD44	Core project -Project(Industrial / Research)	16	8	25	75	100
		Total	**30**	**22**			**400**
		Grand Total		**90**			**2500**

Sem	**LIST OF CORE ELECTIVEPAPERS (Choose 1 out3 in each Semester)**						
I	22PCSCE16-1	Compiler Design	4	4	25	75	100
	22PCSCE16-2	Human Computer Interaction	4	4	25	75	100
	22PCSCE16-3	Theory of Computation	4	4	25	75	100
II	22PCSCE26-1	Cryptography and Network Security	4	4	25	75	100
	22PCSCE26-2	Open Source Computing	4	4	25	75	100
	22PCSCE26-3	Soft Computing	4	4	25	75	100
III	22PCSCE36-1	Cloud Computing	4	4	25	75	100
	22PCSCE36-2	Optimization techniques	4	4	25	75	100
	22PCSCE36-3	Parallel computing	4	4	25	75	100
IV	22PCSCE43-1	Mobile Computing	4	4	25	75	100
	22PCSCE43-2	Embedded system	4	4	25	75	100
	22PCSCE43-3	Information Retrieval Techniques	4	4	25	75	100

Sem	**List of Open Electives (Choose 1out 3 in each Semester)**						
I	22PCSCO17-1	Fundamentals of Computer Application	3	3	25	75	100
	22PCSCO17-2	IoT and its Applications	3	3	25	75	100
	22PCSCO17-3	Multimedia and its applications	3	3	25	75	100
III	22PCSCO37-1	Business Intelligence	3	3	25	75	100
	22PCSCO37-2	Management Information system	3	3	25	75	100
	22PCSCO37-3	Web services	3	3	25	75	100

SEMESTER - I CORE - I	22PCSCC11: DESIGN AND ANALYSIS OF ALGORITHMS	CREDITS: 4 HOURS:5/W

COURSE OBJECTIVES

1) Learning basic concepts of Algorithm.
2) Method of sorting algorithms analyzed.
3) To Analyze Greedy Algorithm and Knapsack Problem.
4) To analyze Dynamic Programming.
5) To learn effective problem solving in Computing applications and analyze the algorithmic procedure to determine the computational complexity of algorithms.

UNIT I

Introduction: Algorithm Definition–Algorithm Specification–Performance Analysis-Asymptotic Notations. Elementary Data Structures: Stacks and Queues–Trees–Dictionaries – Priority Queues–Sets and Disjoint Set -Union–Graphs

UNIT II

Divide and Conquer: The General Method – Defective Chessboard –Binary Search – Finding the Maximum and Minimum – Merge Sort –Quick Sort – Selection-Stassen's Matrix Multiplication.

UNIT III

The Greedy Method: General Method-Container Loading-Knapsack Problem-Tree Vertex Splitting–Job Sequencing With Deadlines-Minimum Cost Spanning Trees- Optimal Storage On Tapes–Optimal Merge Patterns-Single Source Shortest Paths.

UNIT IV

Dynamic Programming: The General Method – Multistage Graphs –All-Pairs Shortest Paths–Single-Source Shortest Paths-Optimal Binary Search Trees-String Editing-0/1Knapsack- Reliability Design - The Traveling Salesperson Problem - Flow Shop Scheduling. Basic Traversal and Search Techniques: Techniques for Binary Trees –Techniques for Graphs–Connected Components and Spanning Trees–Bi connected Components and DFS.

UNIT V

Backtracking: The General Method – The 8-Queens Problem – Sum of Subsets–Graph Coloring–Hamiltonian Cycles–Knapsack Problem Branch and Bound: Least Cost searchhod-0/1Knapsack Problem.

COURSE OUTCOMES

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

1) Acquire knowledge on the concepts of Algorithm
2) Implementing various Algorithmic and sorting approach
3) Able to develop Greedy Algorithm.

4) Acquire knowledge in Dynamic Programming.
5) Develop Back tracking methods and its applications.

Text Books

1) Ellis Horowitz, Satraj Sahni and Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, Universities Press, Second Edition, Reprint 2009.

Supplementary Readings

1) Data Structures Using C-Langsam, Augenstien,Tenenbaum,PHI
2) Data structures and Algorithms,V.Aho,Hopcropft,Ullman,LPE
3) Introduction to design and Analysis of Algorithms-S.E.Goodman, ST.Hedetniem-TMH.
4) CarlosA.Coello, Gary B.Lamont, DavidA.VanVeldhuizen,"Evolutionary Algorithms for Solving Multi-Objective Problems", Springer 2nd Edition,2007.

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	2	2
CO2	3	3	2	2	2
CO3	2	3	3	2	2
CO4	1	3	3	2	1
CO5	2	3	3	3	2

SEMESTER - I CORE – II	22PCSCC12: ADVANCED JAVA PROGRAMMING	CREDITS: 4 HOURS: 5/W

COURSE OBJECTIVES

1) To get familiar with the concept of packages, interface.
2) Able to understand Inheritance and Exception handling in java.
3) To learn the concept of Graphical User Interface (GUI).
4) Analyse Network Programming, and database manipulation.
5) Student will be able to develop web application using Java Servlet and Java Server Pages technology.

UNIT I

Data Types, Variables and Arrays: Primitive Types-Literals-Variables-Type Conversion and Casting- Arrays. Operators: Arithmetic- Bitwise-Relational-Boolean-Logical – Assignment-Conditional. Control Statements: Selection statements- Iteration Statements- Jump Statements. Classes and Methods: Fundamentals- Declaring objects- Methods- Constructors-Overloading Methods-Recursion – Nested and Inner Classes-Command Line Arguments.

UNIT II

Inheritance: Basics-Super Class- Method Overriding- Abstract Classes. Packages and Interfaces: Packages- Access Protection – Importing Packages-Interfaces. Exception Handling: Fundamentals – Types – Try and Catch – Throw – throws- Finally – Built in Exceptions.

UNIT III

The Applet Class: Basics – Architecture – Applet Skeleton – Display Methods – Status Window- Passing Parameters. Event Handling: Event Model – Classes – KeyEvent Class- Event Listener Interfaces. AWT: Window Fundamentals – Working with frame windows- Graphics- Working with color- working with fonts. AWT controls – Labels- Buttons- Check Box- Choice Controls – Lists- Scroll Bars – TextField- Text Area.

UNIT IV

Servlet Fundamentals: Servlet overview and Architecture- Servlet Basics-Servlets and HTML- servlet Sessions- Servlets, JDBC, and Inter Servlet Communications. JSP Fundamentals: JSP Overview and Architecture – JSP Implicit Objects – JSP Standard Actions- Handling JSP Errors – Custom JSP Tag Libraries.

UNIT V

Using Relational Databases: Introduction – JDBC Drivers for RDBM Systems- Using java.sql API, Using javax.sql API – connection pooling. Network Programming: Introduction – Working with URLs – Working with Sockets – Remote Method Invocation.

COURSE OUTCOMES

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

1) Identify classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem.
2) Use the Java language for writing well-organized, complex computer programs with both command line and graphical user interfaces
3) Identify and describe common abstract user interface components to design GUI in Java using Applet & AWT along with response to events
4) Apply Servlets and JSP for creating Web based applications using JDBC
5) Design and Develop various application by integrating any of Servlets, JSPs, Swing and Applet using Database

Text Books

1) Herbert Schildt, "Java the Complete Reference", Oracle Press, TMH Company Ltd, New Delhi, 9th Edition, 2014.
2) James goodwill, " Developing Java Servlets: Web applications with servlets and JSP", 2nd Edition, SAMS Publishers, USA
3) Joe Wiggles worth and Paula McMillan, "Java Programming Advanced Topics", 3rd Edition, TMH, 2009.

Supplementary Readings

1) Alan Grid, "Java Programming", Via Etenea Limited, 2020.
2) John Dean, Raymond Dean, "Introduction to Programming with JAVA- A Problem Solving Approach", Tata McGraw Hill, 2012.
3) Ralph Bravaco, Shai Simonson, "Java Programming: From the Ground Up", Tata McGraw Hill, 2012.
4) Herbert Schildt, Dale Skrien, "Java Fundamentals – A Comprehensive Introduction", Tata McGraw Hill, 2013.

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	2	2
CO2	3	3	2	2	2
CO3	2	3	3	2	2
CO4	1	3	3	2	1
CO5	2	3	3	3	2

SEMESTER - I CORE – III	22PCSCC13: ADVANCED DATABASE MANAGEMENT SYSTEM	CREDITS: 4 HOURS: 5/W

COURSE OBJECTIVES

1) To understand the basic concepts and terminology related to DBMS and Relational Database Design.
2) To the design and implement Distributed Databases.
3) To apply normalization techniques to improve database design.
4) To understand advanced DBMS techniques to construct tables and write effective queries, forms, and reports.
5) Analyze a T/O based techniques for designing the database.

UNIT I

Formal review of relational database and FDs Implication – Closure - its correctness

UNIT II

3NF and BCNF -Decomposition and synthesis approaches - Review of SQL99 - Basics of query processing - external sorting -file scans

UNIT III

Processing of joins -materialized vs. pipelined processing -query transformation rules -DB transactions -ACID properties -interleaved executions – schedules -serialisability

UNIT IV

Correctness of interleaved execution -Locking and management of locks -2PL –deadlocks -multiple level granularity -CC on B+ trees -Optimistic CC

UNIT V

T/O based techniques -Multi version approaches -Comparison of CC methods - dynamic databases -Failure classification - recovery algorithm -XML and relational databases.

COURSE OUTCOMES

1) Exposure for students to write complex queries including full outer joins, self-join, sub queries, and set theoretic queries.
2) Know how of the file organization, Query Optimization, Transaction management, and database administration techniques.
3) Elaborate the concept of Concurrency control and Failure Recovery.
4) Illustrate concept of CC on B++ tree, Optimistic CC
5) Use Modern database such as XML and relational databases.

Text Books

1) R. Ramakrishnan, J. Gehrke, Database Management Systems, McGraw Hill, 2004
2) Silberschatz, H. Korth, S. Sudarshan, Database system concepts, 5/e, McGraw Hill, 2008.

Supplementary Readings

1) K. V. Iyer, Lecture notes available as PDF file for classroom use.

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	2	3
CO2	2	3	2	2	2
CO3	3	2	2	2	2
CO4	2	3	3	2	2
CO5	3	2	2	3	2

SEMESTER - I CORE PRACTICAL- I	22PCSCP14: ALGORITHM LAB USING JAVA	CREDITS: 2 HOURS: 4/W

COURSE OBJECTIVES

1) Implement Sorting algorithm methods.
2) Analyze DFS and BFS Algorithm methods.
3) To evaluate Back Tracking and Greedy Algorithm.
4) Implement Dijkstra's Algorithm.
5) To Develop Dynamic Programming.

List of Experiments:

1) Implement Quick sort algorithm for sorting a list of integers in ascending order.
2) Implement Merge sort algorithm for sorting a list of integers in ascending order.
3) Implement the DFS algorithm for a graph.
4) Implement the BFS algorithm for a graph.
5) Implement backtracking algorithm for the N-queens Problem.
6) Implement the backtracking algorithm for the Hamiltonian Circuit's problem.
7) Implement Greedy Algorithm for Job Sequencing With Deadlines.
8) Implement Dijkstra's algorithm for the Single source shortest path problem.
9) Minimum cost Spanning Tree Using Prim's Algorithm.
10) Implement Dynamic Programming algorithm for the Optimal Binary Search Tree Problem.

COURSE OUTCOMES

1) To get Knowledge about Sorting Algorithm
2) To acquire techniques about DFS and BFS Algorithmic approach
3) To perform various Back track Programming techniques
4) To acquire knowledge in Dijikstra' s Algorithm
5) To become a better knowledge in algorithm

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	2	3
CO2	2	3	2	2	2
CO3	3	2	2	2	2
CO4	2	3	3	2	2
CO5	3	2	2	3	2

SEMESTER - I CORE PRACTICAL – II	22PCSCP15: ADVANCED RDBMS LAB	CREDITS: 2 HOURS:4/W

COURSE OBJECTIVES

1) To explore the features of a Database Management Systems.
2) To interface a database with front end tools.
3) To understand the internals of a database system.
4) To use of different Evaluation Plans.
5) To interface of Concurrency &Transcations& Big Date Analysis Using Hadoop.

List of Experiments:

1) Basic SQL
2) Intermediate SQL
3) Advanced SQL
4) ER Modeling
5) Database Design and Normalization
6) Accessing Databases from Programs using JDBC
7) Building Web Applications using PHP & MySQL
8) Indexing and Query Processing
9) Query Evaluation Plans
10) Concurrency and Transactions
11) Big Data Analytics using Hadoop

COURSE OUTCOMES

1) Ability to use databases for building web applications.
2) Gaining knowledge about the internals of a database system.
3) To use of ER Modeling, Database Design & Normalization
4) Implement the plan using Web Applications Using PHP & My SQL
5) Analysis various Query Evaluation plans, Big Data Analysis

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	2	3
CO2	3	3	2	3	2
CO3	2	3	3	2	2
CO4	2	2	3	2	3
CO5	3	3	2	3	2

SEMESTER – I CORE ELECTIVE – I	22PCSCE16-1: COMPILER DESIGN	CREDITS: 4 HOURS: 4/W

COURSE OBJECTIVES

1) Discover principles, algorithms and techniques that can be used to construct various phases of compiler.
2) Acquire knowledge about finite automata and regular expressions.
3) Learn context free grammars, compiler parsing techniques.
4) Explore knowledge about Syntax Directed definitions and translation scheme.
5) Understand intermediate machine representations and actual code generation.

Unit I

Lexical analysis -Language Processors, The Structure of a Compiler, Parameter passing mechanism – Symbol table - The role of the lexical analyzer - Input buffering - Specification of tokens - Recognition of tokens–Finite automata-Regular expression to automata.

Unit II

Syntax Analysis - The role of the parser - Context-free grammars – Writing a grammar-Top down Parsing-Bottom-up Parsing- LR parsers-LALR parsers.

Unit III

Semantic Analysis- Inherited and Synthesized attributes –Dependency graphs–Ordering the evaluation of attributes – S-attributed definitions – L-attributed definitions – Applications of Syntax Directed translation–Syntax Directed translations schemes- Storage organization–Stack allocation of space.

Unit–IV

Intermediate Code Generation- Variants of Syntax trees–Three Address code – Types and Declarations -Translation of Expressions –Type checking-Control flow-Back patching- Switch Statements-Procedure calls.

Unit–V

Code Generation and Code Optimization - Issues in the design of a code generator - The target language – Address in the Target Code – Basic Block and Flow graphs–Optimization of Basic Blocks-A simple code generator–Peephole Optimization.

COURSE OUTCOMES

1) To provide sound knowledge in Lexical Analysis.
2) To understand the importance of context-free Grammar.
3) To explore knowledge in Semantic Analysis.
4) To know the Variants of Syntax trees.

5) To identify Code generations and code optimization.

Text Books

1) Alfred V. Aho, Monica S.Lam, Ravi Sethi and Jeffrey D. Ullman,"Compilers Principles,Techniques and Tools", Second Edition,PearsonEducationAsia,2009.

Supplementary Readings

1) A.V. Aho, Ravi Sethi,J.D. Ullman, Compiler Principles, Techniques and Tools, Addison-Wesley, 2003.
2) Fischer Leblanc, Crafting Compiler,Benjamin Cummings,Menlo Park, 1988.
3) Kennath C.Louden, Compiler Construction Principle and Practice, Vikas publishing House, 2004.
4) Allen I. Holub, Compiler Design in C,Prentice Hall of India, 2001.
5) S.Godfrey Winster,S.Aruna Devi, R.Sujatha, "Compiler Design" , yes dee Publishers, Third Reprint 2019.

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	2
CO2	2	3	3	3	2
CO3	3	2	2	3	3
CO4	2	2	3	3	3
CO5	3	2	3	3	2

SEMESTER - I CORE ELECTIVE – III	22PCSCE16-2: HUMAN COMPUTER INTERACTION	CREDITS: 4 HOURS: 4/W

COURSE OBJECTIVES

1) To impart knowledge related to the various concepts, methods of Human Computer Interaction techniques.
2) Helps to Understand Interaction and Design basics.
3) Able to understand Design rules.
4) Approaches to user support Adaptive help systems – Designing user support systems.
5) Implementing new ideas and users support.

Unit I: The Interaction:

Introduction – Models of interaction – Frameworks and HCI Ergonomics – Interaction styles–Elements of the WIMP interface– Interactivity – The context of the interactions.**Paradigms:** Introduction–Paradigms for interaction.

Unit II: Interaction, Design basics:

Introduction – What is design? – User focus – Scenarios – Navigation design – Screen design and layout–Interaction and prototyping.

HCL in the software process: Introduction–The software life cycle–Usability engineering–interactive design and prototyping–Designrationate.

Unit III: Design rules:

Introduction– Principles to support usability – Standards – Guidelines – Golden rules and heuristics–HCI patterns.

Implementation Support: Introduction–Elements of windowing systems–Programming the application Using toolkits–User interface management systems.

Unit IV: Evaluation techniques:

What is evaluation–Goals of evaluation–Evaluation through expert analysis –Evaluation through user participation–Choosing an evaluation method.

Universal Design: Introduction – Universal design principles – Multi-modal interaction – Designing for diversity – summary. Introduction – Requirements of user support – Approaches to user support Adaptive help systems – Designing user support systems.

Unit V: User support:

Introduction Requirements of user support – Approaches to; user support – Adaptive help systems designing – designing user support systems.

COURSE OUTCOMES

1) Discuss the conceptual, practical, and ethical issues involved in evaluation.
2) Describe what interaction design is and how it relates to human computer interaction and other fields.
3) Discuss the advantages and disadvantages of using analytical evaluation.
4) Implementing ideas in application programs.
5) User support system can help to designing process

Text Books

1) Human Computer Interaction, Third Edition, "Alan Dix, Janet Finlay, Gregory D. Abowd and Russell Beale",Pearson Education,2004.

Supplementary Readings

1) Human Computer Interaction in the New Millennium, "John C.Carroll", Pearson Education- 2002.
2) Handbook of Human-Computer Interaction, M. G. Helander, Elsevier, 2014.

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	1	2	3	2	2
CO2	2	3	2	3	2
CO3	3	3	2	3	3
CO4	3	2	3	2	3
CO5	3	1	3	3	3

SEMESTER – I CORE ELECTIVE – III	22PCSCE16-3: THEORY OF COMPUTATION	CREDITS: 4 HOURS: 4/W

COURSE OBJECTIVES

1) To introduce students to the mathematical foundations of computation including automata theory.
2) Ability to understand the theory of formal languages and grammars.
3) To Understand the notions of algorithm, decidability, complexity and computability.
4) To enhance Students' ability to understand and conduct mathematical proofs for computational algorithms.
5) To Understand Un decidable problems about turning machine.

Unit I

Introduction to formal proof – Additional forms of proof– Inductive proofs –Finite. Automata (FA) – Deterministic Finite Automata (DFA) –Non-deterministic Finite Automata (NFA)–Finite Automata with Epsilon transitions.

Unit II

Regular Expression– FA and Regular Expressions – Proving languages not to be regular–Closure properties of regular languages –Equivalence and minimization of Automata.

Unit III

Context-Free Grammar (CFG) – Parse Trees – Ambiguity in grammars and languages–Definition of the Push down automata – Languages of a Push down Automata – Equivalence of Push down automata and CFG –Deterministic Push down Automata.

Unit IV

Normal forms for CFG–Pumping Lemma for CFL–Closure Properties of CFL–Turing Machines–Programming Techniques for TM. A language that is not Recursively Enumerable (RE).

Unit V

An undecidable problem RE–Undecidable problem about Turing Machine–Post's Correspondence Problem–The classes P and NP.

COURSE OUTCOMES

1) Analyse and design finite automata, pushdown automata.
2) To Analyse Turing machines, formal languages and grammars.
3) Demonstrate their understanding of key notions, such as algorithm, computability, decidability, and complexity through problem solving.
4) To Prove the basic results of the Theory of Computation.
5) To State and explain the relevance of the Church-Turing thesis.

Text Books

1) Peter Linz, "An Introduction to Formal Languages and Automata" , Third Edition , Narosa, 2005.
2) J.E.Hopcroft, R.Motwani and J.D. Ullman , " Introduction to Automata Theory , Languages and Computations " , second Edition , Pearson Education,2007.

Supplementary Readings

1) H.R.Lewis and C.H. Papadimitriou, "Elements of the theory of Computation", Second Edition, Pearson Education, 2003.
2) Thomas A. Sudkamp," An Introduction to the Theory of Computer Science, Languages and Machines", Third Edition, Pearson Education, 2007.
3) Raymond Greenlawan H . James Hoover , "Fundamentals of Theory of Computation, Principles and Practice", Morgan Kaufmann Publishers, 1998.
4) Micheal Sipser, "Introduction of the Theory and Computation", Thomson Brokecole, 1997.
5) J.Martin, "Introduction to Languages and the Theory of computation," Third Edition, Tata McGraw Hill, 2007.

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	1	2	3	2	2
CO2	2	3	2	3	2
CO3	3	3	2	3	3
CO4	3	2	3	2	3
CO5	3	1	3	3	3

SEMESTER – I OPEN ELECTIVE – 1	22PCSCO17-1: FUNDAMENTALS OF COMPUTER APPLICATION	CREDITS: 3 HOURS: 3/W

COURSE OBJECTIVES

1) To know about computer and basic applications of computer.
2) To get knowledge about operating system.
3) To aim at imparting a basic level appreciation Programme.
4) To Understand word processing.
5) To develop Word spread sheet and power point Presentation.

UNIT I: KNOWING COMPUTER

What is Computer - Basic Applications of Computer - Components of Computer System -Central Processing Unit (CPU) – VDU -Keyboard and Mouse - Other input/output Devices -Computer Memory - Concepts of Hardware and Software - Concept of Computing - Data and Information; Applications of IECT - Connecting keyboard – mouse - monitor and printer to CPU and checking power supply.

UNIT II: OPERATING COMPUTER USING GUI BASED OPERATING SYSTEM

What is an Operating System - Basics of Popular Operating Systems - The User Interface -Using Mouse - Using right Button of the Mouse and Moving Icons on the screen - Use of Common Icons - Status Bar - Using Menu and Menu – selection - Running an Application -Viewing of File - Folders and Directories - Creating and Renaming of files and folders -Opening and closing of different Windows - Using help - Creating Short cuts - Basics of OS Setup- Common utilities.

UNIT III: UNDERSTANDING WORD PROCESSING

Word Processing Basics-Opening and Closing of documents-Text creation and Manipulation-Formatting of text-Table handling-Spell check-language setting and thesaurus-Printing of word document.

UNIT IV: USING SPREADSHEET

Basics of Spreadsheet - Manipulation of cells - Formulas and Functions - Editing of SpreadSheet – printing of SpreadSheet.

UNIT V: MAKING SMALL PRESENTATION

Basics of presentation software – Creating Presentation – Preparation and Presentation of Slides-SlideShow-Taking printouts of presentation / handouts.

COURSE OUTCOMES

1) Students are able to know about computer and basic applications of computer.
2) Students are able to get knowledge about operating system.
3) Students are able to aim at imparting a basic level appreciation Programme.
4) Students can able to make spread sheets and its styles.
5) Students get knowledge about Power point presentation.

Text Books

1) Introduction to Computer Applications , TNAU , TamilNadu https://www.agrimoon.com/introduction-to-computer-applications-pdf-book/

Web References

1) https://homepage.cs.uri.edu/faculty/wolfe/book/Readings/Reading0
2) https://peda.net/kenya/ass/subjects2/computer-studies/form-1/itc2

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2	3	2	3	1
CO2	2	3	3	1	2
CO3	2	2	3	2	2
CO4	2	2	3	2	2
CO5	2	2	1	3	1

SEMESTER - I OPEN ELECTIVE – II	22PCSCO17-2: IoT AND ITS APPLICATIONS	CREDITS: 3 HOURS: 3/W

COURSE OBJECTIVES

1) To get familiar with the evolution of IOT with its design principles.
2) To outline the functionalities and protocols of internet communication.
3) To analyze the hardware and software components needed to construct IOT applications.
4) To identify the appropriate protocol for API construction and writing embedded code.
5) To realize various business models and ethics in Internet of Things.

UNIT I

The Internet of Things: An Overview –The Internet of Things – The Technology of the Internet of Things-Enchanted objects. **Design Principles for Connected Devices**: Calm and Ambient Technology–metaphor–Privacy–Web thinking for connected Devices.

UNIT–II

Internet Principles: Internet Communications overview – IP – TCP – TCP/IP UDP. IP Addresses: DNS–Static and Dynamic IP Address Assignment–MAC Addresses – TCP and UDP Ports – Application Layer Protocols. **Thinking about Prototyping:** Sketching – Familiarity – Prototypes and Production – Open Source versus Closed Source.

UNIT–III

Prototyping Embedded Devices: Electronics- Embedded Computing Basics–Arduino-Raspberry Pi- Beagle Bone Black-Electric Imp. **Prototyping the Physical Design:** Non digital Methods - Laser Cutting - 3D printing – CNC Milling-Repurposing/Recycling.

UNIT–IV

Prototyping Online Components: Getting started with an API - Writing New API-Real-Time Reactions - Other Protocols. **Techniques for Writing Embedded Code:** Memory Management – Performance and Battery Life–Libraries- Debugging.

UNIT–V

Business Models: History of Business Models – Model – Internet of Starting up –Lean Startups. **Moving to Manufacture:** Designing Kits - Designing Printed circuit boards – Certification – Costs - Scaling UpSoftware. **Ethics:** Privacy –Control–Environment–Solutions.

COURSE OUTCOMES

1) Able to understand building blocks of Internet of Things and characteristics.
2) Explain the Evolution of Internet of Things. Describe the principles for developing an IOT application.
3) Develop an IOT API using various protocols and techniques. Design kits and follow ethics to secure the IOT applications.
4) Compare and contrast Arduino, Raspberry Pi and Beagle Bone Black and analyze various protocols to build the business models.
5) Implement basic IoT applications on embedded platform.

Text Books

1) AdrianMcEwen and Hakim Cassimally , **"**Designing the Internet of Things**"**,Wiley,2014.
2) Anil Kumar Mishra, Ashis Kumar Mishra, Yogomaya Mohapatra, "Introduction to Internet of Things (Basic Concept, Challenges, Security Issues, Applications & Architecture)", Nitya Publications, 2020.
3) Donald Norris, "The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and Beagle Bone Black", McGrawHill,2015.

Supplementary Readings

1) Sudhir Kumar, "Fundamentals of Internet of Things", CRC Press, 2021.
2) Ovidiu Vermesan and Peter Friess, "Internet of Things– From Research and Innovation to Market Deployement", River Publishers, 2014.
3) PeterWaher, "Learning Internet of Things", Packt Publishing,2015.

OUTCOME MAPPING

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	2	3
CO2	3	2	3	3	2
CO3	3	3	3	2	2
CO4	3	3	3	1	2
CO5	3	3	3	1	2

SEMESTER - I OPEN ELECTIVE – III	22PCSCO17-3: MULTIMEDIA AND ITS APPLICATIONS	CREDITS: 3 HOURS: 3/W

COURSE OBJECTIVES

1) To understand the standards available for different audio, video and text applications.
2) To learn various multimedia authoring systems in multimedia production Team.
3) To learn an create a image.
4) To understand principles of animation in Multimedia.
5) To know the stages of various Multimedia Projects.

Unit I

Multimedia Definition - Use Of Multimedia - Delivering Multimedia - Text: About Fonts and Faces - Using Text in Multimedia - Computers and Text - Font Editing and Design Tools –Hypermedia and Hypertext.

Unit II

Images: Plan Approach - Organize Tools - Configure Computer Workspace - Making Still Images - Color - Image File Formats. Sound: The Power of Sound - Digital Audio - Midi Audio -Midi vs. Digital Audio - Multimedia System Sounds - Audio File Formats -Vaughan's Law of Multimedia Minimums-Adding Sound to Multimedia Project.

Unit III

Animation: The Power of Motion- Principles of Animation- Animation by Computer-Making Animations that Work. Video: Using Video - Working with Video and Displays – Digital Video Containers- Obtaining Video Clips-Shooting and Editing Video.

Unit IV

Making Multimedia: The Stage of Multimedia Project-The Intangible Needs-The Hardware Needs - The Software Needs – An Authoring Systems Needs- Multimedia Production Team.

Unit V

Planning and Costing: The Process of Making Multimedia - Scheduling - Estimating – RFPs and Bid Proposals. Designing and Producing –Content and Talent: Acquiring Content-Ownership of Content Created for Project-Acquiring Talent.

COURSE OUTCOMES

1) Work on multimedia.
2) Handle various multimedia software
3) Develop multimedia projects.
4) Deploy multimedia projects.
5) To Develop planning techniques for cost Estimation

Text Books

1) TayVaughan, "Multimedia: MakingItWork", 8thEdition, Osborne/McGraw-Hill, (2001).

Supplementary Readings

1) Ralf Steinmetz &KlaraNahrstedt"Multimedia Computing, Communication & Applications ", Pearson Education, (2012).

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	2	2
CO2	3	2	3	1	3
CO3	3	3	3	2	2
CO4	3	3	2	2	2
CO5	3	2	3	3	2

SEMESTER - II CORE – IV	22PCSCC21: ADVANCED WEB TECHNOLOGY	CREDITS: 4 HOURS: 5/W

COURSE OBJECTIVES

1) Explore the backbone of webpage creation by developing .NET skill.
2) Enrich knowledge about HTML control and web control classes.
3) Provide depth knowledge about ADO.NET
4) Understand the need of usability, evaluation methods for web services.
5) Developing Component based Programming.

UNIT I

OVERVIEW OF ASP.NET - The .NET framework – Learning the .NET languages Data types – Declaring variables- Scope and Accessibility- Variable operations Object Based manipulation-Conditional Structures-Loop Structures-Functions and Subroutines. Types, Objects and Namespaces: The Basics about Classes- Value types and Reference types- Advanced class programming- Understanding namespaces and assemblies. Setting Up ASP.NET and IIS.

UNIT II

Developing ASP.NET Applications - ASP.NET Applications: ASP.NET applications–Code behind-The Global.asax application file-Understanding ASP.NET Classes- ASP.NET Configuration. Web Form fundamentals: A simple page applet-Improving the currency converter-HTML control classes-The page class-Accessing HTML server controls. Web controls: Web Control Classes – Auto Post Back and Web Control events-Accessing web controls. Using Visual Studio.NET: Starting a Visual Studio.NET Project- Web form Designer-Writing code-Visual studio.NET debugging. Validation and Rich Controls: Validation-A simple Validation example-Understanding regular expressions- A validated customer form. State management -Tracing, Logging, and Error Handling.

UNIT III

Working with Data- Overview of ADO.NET - ADO.NET and data management-Characteristics of ADO.NET-ADO.NET object model. ADO.NET data access: SQLbasics–Select, Update, Insert, Delete statements- Accessing data- Creating a connection- Using a command with a Data Reader - Accessing Disconnected data - Selecting multiple tables – Updating Disconnected data. Data binding: Single value Data Binding- Repeated value data binding- Data binding with data bases. Data list – Data grid – Repeater – Files, Streams and Email – Using XML.

UNIT IV

Web Services- Web services Architecture: Internet programming then and now-WSDL–SOAP-Communicating with a web service – Web service discovery and UDDI. Creating Web services: Web service basics- The Stock Quote web service – Documenting the web service-Testing the web service- Web service Data types- ASP.NET intrinsic objects. Using web services: Consuming a web service- Using the proxy class-An example with Terra Service.

UNIT V

Advanced ASP.NET- Component Based Programming: Creating a simple component–Properties and state-Database components- Using COM components. Custom controls: User Controls Deriving Custom controls. Caching and Performance Tuning: Designing and scalability–Profiling-Catching-Output catching-Data catching. Implementing security: Determining security requirements-The ASP.NET security model-Forms authentication-Windows authentication.

COURSE OUTCOMES

1) Acquire knowledge on the concepts of .Net
2) Implementing various HTML controls and Visual studio projects
3) Able to develop applications using ADO .Net
4) Acquire knowledge in web services
5) Develop websites which contains adaptive web pages

TextBooks

1) Mathew MacDonald, "ASP.NET Complete Reference", TMH 2005.

Supplementary Readings

1) Crouch Matt J, "ASP.NET and VB.NET Web Programming", Addison Wesley 2002.
2) J. Liberty, D. Hurwitz, "Programming ASP.NET" ,Third Edition, O'REILLY, 2006.

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2	3	2	2	2
CO2	2	2	2	3	3
CO3	3	3	2	3	3
CO4	3	2	3	3	3
CO5	3	1	3	3	2

SEMESTER - II CORE – V	22PCSCC22: DATA MINING AND BUSINESS INTELLIGENCE	CREDITS: 4 HOURS: 5/W

COURSE OBJECTIVES

1) Demonstrate an understanding of the importance of data mining.
2) Understand principles of business intelligence.
3) Organize and prepare the data needed for data mining using pre-processing techniques.
4) Perform exploratory analysis of the data to be used for mining.
5) Implement the appropriate data mining methods like classification, clustering or Frequent Pattern mining on large data sets.

UNIT I

Introduction to data mining (DM): Motivation for Data Mining - Data Mining-Definition and Functionalities – Classification of DM Systems - DM task primitives - Integration of a Data Mining system with a Database or a Data Warehouse - Issues in DM – KDD Process- What is Business Intelligence (BI) - BI architecture and its types- What is data warehousing- Need for data warehousing - Basic elements of data warehousing – OLAP and OLTP Definitions – Difference between OLAP and OLTP.

UNIT II

Data Pre-processing: Why to pre-process data? - Data cleaning: Missing Values, Noisy Data - Data Integration and transformation - Data Reduction: Data cube aggregation, Dimensionality reduction - Data Compression - Numerosity Reduction - Data Mining Primitives - Languages and System Architectures: Task relevant data - Kind of Knowledge to be mined - Discretization and Concept Hierarchy.

UNIT III

Concept Description and Association Rule Mining: What is concept description? - Data Generalization and summarization-based characterization - Attribute relevance - class comparisons Association Rule Mining: Market basket analysis - basic concepts - Finding frequent item sets: Apriori algorithm - generating rules – Improved Apriori algorithm – Incremental ARM – Associative Classification – Rule Mining.

UNIT IV

Classification and Prediction: What is classification and prediction? – Issues regarding Classification and prediction: Classification methods: Decision tree, Bayesian Classification, Rule based, CART, Neural Network Prediction methods, Linear and nonlinear regression, Logistic Regression. Introduction of tools such as DB Miner /WEKA/DTREG DM Tools.

UNIT V

Data Mining for Business Intelligence Applications: Data mining for business Applications like Balanced Score card, Fraud Detection, Clickstream Mining, Market Segmentation, retail industry, telecommunications industry, banking & finance and CRM etc., Data Analytics Life Cycle: Introduction to Big data Business Analytics - State of the practice in analytics role of data scientists Key roles for successful analytic project - Main phases of life cycle - Developing core deliverables for stakeholders.

COURSE OUTCOMES

1) Analyse the concept of Data mining, Data Warehouse, Business Intelligence and OLAP.
2) Demonstrate data pre-processing techniques and application of association rule mining algorithms.
3) Apply various classification algorithms and evaluation of classifiers for the given problem.
4) Analyse data mining for various business intelligence applications for the given problem.
5) Apply classification and regression techniques for the given problem.

Text Books

1) J. Han, Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann, 3rd Edition, 2011.
2) P. N. Tan, M. Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson Education, 2018.
3) Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley India Publications, 2011.
4) G. Shmueli, N.R. Patel, P.C. Bruce, Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner, 2nd Edition, Wiley India.

Supplementary Readings

1) DursunDelen, "Predictive Analytics", Pearson Education, 2020.
2) Michael Berry and Gordon Linoff Data Mining Techniques, 2nd Edition Wiley Publications.
3) Michael Berry and Gordon Linoff Mastering Data Mining- Art & science of CRM, Wiley Student Edition.
4) VikramPudi & Radha Krishna, Data Mining, Oxford Higher Education.

OUTCOME MAPPING

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	3	3
CO2	3	3	3	2	2
CO3	3	3	3	2	1
CO4	2	3	3	3	1
CO5	2	3	3	3	2

SEMESTER - II CORE – VI	22PCSCC23: DISTRIBUTED OPERATING SYSTEM	CREDITS: 4 HOURS: 5/W

COURSE OBJECTIVES

1) To study Distributed operating system concepts.
2) To understand hardware, software and Communication in Distributed OS.
3) To learn the distributed resource management components.
4) Practices to learn concepts of OS and Program the principles of Operating Systems.
5) To Learn Linux Operating System.

UNIT I

Introduction–Operating System Definition–Functions of Operating System – Types of Advanced Operating System – Design Approaches – Synchronization Mechanisms – concepts of a Process – Critical Section Problem–Process Deadlock–Models of Deadlock–Conditions for Deadlock– System with single unit requests, Consumable Resources, Reusable Resources.

UNIT II

Distributed Operating Systems: Introduction-Issues–Communication Primitives – Inherent Limitations –Lamport's Logical Clock, Vector Clock, Global State, Cuts–Termination Detection–Distributed Mutual Exclusion–Non Token Based Algorithms–Lamport's Algorithm - Token Based Algorithms –Distributed Deadlock Detection– Distributed Deadlock Detection Algorithms – Agreement Protocols

UNIT III

Distributed Resource Management – Distributed File Systems – Architecture–Mechanisms–Design Issues – Distributed shared Memory– Architecture–Algorithm–Protocols–Design Issues–Distributed Scheduling–Issues–Components–Algorithms.

UNIT IV

Failure Recovery and Fault Tolerance– Concepts – Failure Classifications – Approaches to Recovery – Recovery in Concurrent Systems–Synchronous and Asynchronous Check pointing and Recovery– Check pointing in Distributed Database Systems–Fault Tolerance Issues – Two-Phase and Non blocking Commit Protocols –Voting Protocols– Dynamic Voting Protocols.

UNIT V

Multi processor and Database Operating Systems –Structures – Design Issues – Threads – Process Synchronization – Processor Scheduling –Memory management–Reliability/Fault Tolerance –

Database Operating Systems–concepts–Features of Android OS, Ubuntu, Google Chrome OS and Linux operating systems.

COURSE OUTCOMES

1) Acquire knowledge on the concepts advanced operating system and approaches.
2) Implementing Lamport's Algorithm - Token Based Algorithms –Distributed Deadlock Detection Algorithm.
3) Gaining knowledge Distributed Resource Management–Distributed File Systems.
4) Acquire knowledge in Failure Recovery and Fault Tolerance.
5) To know the Features of Android OS, Ubuntu, Google ChromeOS and Linux operating systems.

Text Books

1) Mukesh Singhal N.G.Shivaratri, "Advanced Concepts in Operating Systems", McGraw Hill 2000.
2) Distributed Operating System–Andrew S. Tanenbaum, PHI.

Supplementary Readings

1) Abraham Silberschatz, Peter B.Galvin, G.Gagne "Operating Concepts", 6th Edition Addison Wesley publications 2003.
2) Andrew S.Tanenbaum, "Modern Operating Systems", 2nd Edition Addison Wesley 2001.

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	2	1
CO2	2	3	1	3	2
CO3	3	2	2	3	3
CO4	3	3	3	3	3
CO5	3	2	3	3	3

SEMESTER - II CORE PRACTICAL – III	22PCSCP24: ADVANCED WEB TECHNOLOGIES LAB	CREDITS: 2 HOURS: 4/W

COURSE OBJECTIVES

1) Create simple Web service Programs.
2) Develop windows application based web services.
3) Accessing Database in Web services.
4) To create an application that simulates sending a SOAP message.
5) Develop a Web intranet/internet based Web Service Client.

List of Experiments:

1) Create a simple Web Service that converts the temperature from Fahrenheit to Celsius and vice versa.
2) Use the above Web Service on a webpage and execute to fetch the results
3) Create a Web Services provider and make it available on the Internet or intranet.
4) Create a web based Consumer of an existing web service.
5) Create a Windows application based consumer of an existing web service.
6) Write an application that simulates sending a SOAP message as a request and receiving another as a response.
7) Develop a Web Service that provides images as responses.
8) Develop a web service that access table contents of a database.
9) Develop a console based Web Service Client.
10) Develop a Web intranet/internet based Web Service Client.

COURSE OUTCOMES

1) Acquire Excellent knowledge and execute simple web service programs.
2) Implementing various techniques in web services.
3) Able to develop applications based web services from existing programs.
4) Using SOAP techniques.
5) Develop Client server based web Services.

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	2	2
CO2	2	1	2	3	2
CO3	3	2	1	3	3
CO4	3	2	3	1	3
CO5	3	2	3	3	2

SEMESTER - II CORE PRACTICAL – IV	22PCSCP25: DATA MINING LAB USING R	CREDITS: 2 HOURS: 4/W

COURSE OBJECTIVES

1) To introduce the concept of data Mining as an important tool for enterprise data management and as a cutting-edge technology for building competitive advantage.
2) To enable students to effectively identify sources of data and process it for data mining.
3) To learn how to gather and analyze large sets of data to gain useful business understanding through the R language.
4) To impart skills that can enable students to approach business problems.
5) To analytically identifying opportunities to derive business value from data.

List of Experiments:

1) Introductory commands in R.
2) Programs using Descriptive Statistics.
3) Program to demonstrate pre-processing on dataset Mtcars.
4) Program to demonstrate Association rules on Groceries dataset using Apriori Algorithm.
5) Program to demonstrate Classification Rules process on dataset Titanic using id3 Algorithm.
6) Program to demonstrate Classification rule process on dataset Titanic using CART Algorithm.
7) Program to demonstrate Classification rule process on Breast Cancer dataset using Naïve Bayesian Algorithm.
8) Program to demonstrate Clustering rule process on dataset Iris using simple K-Means.
9) Program to demonstrate Clustering rule process on dataset Iris using Hierarchical Clustering.
10) Program to demonstrate Outlier Detection using dataset Iris.

COURSE OUTCOMES

1) Use different features of R Programming language.
2) Preprocess the data for mining for any dataset.
3) Determine association rules.
4) Model the classifiers for classifying various dataset.
5) Examine clusters from the available data.

OUTCOME MAPPING

	PO1	PO2	PO3	PO4	PO5
CO1	1	2	2	3	3
CO2	2	2	3	3	2
CO3	1	3	3	1	2
CO4	1	3	3	2	2
CO5	2	3	3	2	2

SEMESTER – II CORE ELECTIVE – II	22PCSCE26-1: CRYPTOGRAPHY AND NETWORK SECURITY	CREDITS: 4 HOURS: 4/W

COURSE OBJECTIVES

1) To understand basics of Cryptography and Network Security.
2) To be able to secure a message over in secure channel by various means.
3) To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
4) To understand various protocols for network security to protect against the threats in the networks.
5) To Understand Intruders and detection Techniques.

Unit I

Introduction - Security trends – Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies – Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of moderncryptography:perfectsecurity–informationtheory–productcryptosystem–cryptanalysis.

Unit II

Symmetric Encryption and Message Confidentiality – Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Stream Ciphers and RC4, Chipher Block Modes of Operation, Location of Encryption Devices, Key Distribution. Public-key Cryptography and Message Authentication: Approaches to Message Authentication, Secure Hash Functions and HMAC, Public-Key Cryptography Principles, Public-Key Cryptography Algorithms, Digital Signatures, Key Management.

Unit III

Authentication Applications - Kerberos, x.509 Authentication Service, Public-Key Infrastructure. Electronic Mail Security: Pretty Good Privacy (PGP), S/MIME.

Unit IV

IP Security- IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations. Web Security: Web Security Considerations, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET). Network Management Security: Basic Concepts of SNMP, SNMPv1 Community Facility, SNMPv3.

Unit V

Intruders - Intruders, Intrusion Detection, Password Management. Malicious Software: Virus and Related Threats, Virus Counter measures, Distributed Denial of Service Attacks. Firewalls: Firewall Design Principles, Trusted Systems, Common Criteria for Information Technology Security Evaluation.

COURSE OUTCOMES

1) Provide security of the data over the network.
2) Do research in the emerging areas of cryptography and network security.
3) Implement various networking protocols.
4) Protect any network from the threats in the world.
5) To protect from intruders and Virus Threats

Text Books

1) Behrouz A. Ferouzan, "Cryptography & Network Security", Tata McGraw Hill, (2007) , Reprint (2015).
2) Stallings William, "Cryptography and Network Security-Principles and Practice (2017).
3) WilliamStallings, "Network Security Essentials Applications and Standards", Third Edition, Pearson Education, (2008).

Supplementary Readings

1) Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms And Protocols", Wiley Publications, (2003).
2) Charles Pfleeger, "Security in Computing", 4th Edition, Prentice Hall Of India, (2006).
3) Ulysess Black," Internet Security Protocols",Pearson Education Asia,(2000).
4) Charlie Kaufman And Radia Perlman, Mike Speciner, "Network Security,Second Edition, Private Communication In Public World", PHI(2002).
5) Bruce Schneier And Neils Ferguson, "Practical Cryptography",First Edition,Wiley Dreamtech India Pvt Ltd,(2003).
6) Douglas R Simson, "Cryptography–Theory and Practice", First Edition, CRC Press, (1995).

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	3	3
CO2	3	3	3	2	2
CO3	3	3	2	3	2
CO4	3	3	2	3	2
CO5	3	3	3	2	2

SEMESTER – II CORE ELECTIVE – II	22PCSCE26-2: OPEN SOURCE COMPUTING	CREDITS: 4 HOURS: 5/W

COURSE OBJECTIVES

1) To understand the features of PHP.
2) To develop the different applications using PHP.
3) To demonstrate the applications using PHP with Mysql.
4) To understand the concepts of Perl.
5) To develop the applications using Perl.

Unit I: BASIC PHP

Web Server-Apache-PHP-Data Types-User defined Variables-Constants-Operators-Control Structures-User defined Functions-Directory Functions-File system Functions-Arrays-String Functions-Date and Time Functions-Mathematical Functions-Miscellaneous Functions.

UNIT II: ADVANCED PHP WITH MYSQL

Exceptions handling-Error Handling Functions-Predefined Variables- Cookies - Sessions-COM-DOM-CURL-SOAP-Classes and Objects-Mail Function-URL Functions. PHP with MySQL:PHP MySQL Functions-Database driven application.

UNIT III: ADVANCED PHP WITH AJAX, SEO AND CMS PHP WITH AJAX

Introducing Ajax-Ajax Basics-PHP and Ajax-Database Driven Ajax. PHP with SEO: Basic SEO-Provocative SE Friendly URLs-Duplicate Content- CMS: Word press Creating an SE-Friendly Blog.

UNIT IV: BASIC PERL

Introduction-Scalar Data-Lists and Arrays-Subroutines-Input and Output-Hashes-Regular Expressions-Control Structures-Perl Modules-File Tests

UNIT V: ADVANCED PERL

Directory Operations-Strings and Sorting-Smart Matching-Process Management-Advanced Perl Techniques

COURSE OUTCOMES

1) Students are able to understand the features of PHP.
2) Students are able to develop the different applications using PHP.
3) Students are able to demonstrate the applications using PHP with Mysql.
4) Students are able to understand the concepts of Perl.
5) Students are able to develop the applications using Perl.

Text Books

1) Mehdi Achour, Fried helm, Betz Antony Dovgal, Nuno Lopes, Hannes Magnusson, Georg Richter, Damien Seguy, Jakub Vrana and several others, " PHP Manual (Download the manual from PHP official website www.php.net)", 1997-2011 the PHP Documentation Group.

2) LeeBabin, “Beginning Ajax with PHP From Novice to Professional ” , Apress , 2007 (Chapters 1, 2, 3 and 4) Jaimie Sirovich and Cristian Darie, “Professional Search Engine Optimization with PHP A Developer’s Guide to SEO”,Wiley Publishing ,Inc., Indian apolis, Indiana, 2007 (Chapters2,3,5and16).
3) Randal L. Schwartz, Tom Phoenix, brian d foy, “Learning Perl, Fifth Edition Making Easy Things Easy and Hard Things Possible ” , O'Reilly Media , June 2008.

Supplementary Readings

1) Steven D.Nowicki, Alec Cove, Heow Eide goodman,”Professional PHP”, WroxPress, 2004.

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	2	3
CO2	2	2	2	3	2
CO3	2	2	3	2	3
CO4	2	3	2	3	3
CO5	3	2	2	3	2

SEMESTER – II CORE ELECTIVE – II	22PCSCE26-3: SOFT COMPUTING	CREDITS: 4 HOURS: 5/W

COURSE OUTCOMES

1) Familiarize with soft computing concepts.
2) Introduce and use the idea of fuzzy logic and use of heuristics based on human experience.
3) Familiarize the Neuro-Fuzzy modeling using Classification and Clustering techniques.
4) Learn the concepts of Genetic algorithm and its applications.
5) Acquire the knowledge of Rough Sets.
6) Introduce students to Bi-directional Associative Memory.

UNIT I Introduction to Soft Computing

Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.

UNIT II Artificial Neural Networks

Back propagation Neural Networks - Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network-Bi-directional Associative Memory -Adaptive Resonance Theory Neural Networks-Support Vector Machines - Spike Neuron Models.

UNIT III Fuzzy Systems

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations -Membership Functions -Defuzzification - Fuzzy Arithmetic and Fuzzy Measures -Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.

UNIT IV Genetic Algorithms

Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction -Inheritance Operators - Cross Over - Inversion and Deletion - Mutation Operator - Bit-wise Operators -Convergence of Genetic Algorithm.

UNIT V Hybrid Systems

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination - LR-Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by Fuzzy BP - Fuzzy Art Map: A Brief Introduction - Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller

COURSE OUTCOMES

1) Identify the difference between Conventional Artificial Intelligence to Computational Intelligence.
2) Understand fuzzy logic and reasoning to handle and solve engineering problems.
3) Apply the Classification and clustering techniques on various applications.
4) Understand the advanced neural networks and its applications.
5) Perform various operations of genetic algorithms, Rough Sets.
6) Comprehend various techniques to build model for various applications.

Text Books

1) Soft Computing – Advances and Applications – Jan 2015 by B.K. Tripathy and J. Anuradha – Cengage Learning.

Supplementary Readings

1) S. N. Sivanandam& S. N. Deepa, "Principles of Soft Computing", 2nd edition, Wiley India, 2008.
2) David E. Goldberg, "Genetic Algorithms-In Search, optimization and Machine learning", Pearson Education.
3) J. S. R. Jang, C.T. Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", Pearson Education, 2004.
4) G.J. Klir& B. Yuan, "Fuzzy Sets & Fuzzy Logic", PHI, 1995.
5) Melanie Mitchell, "An Introduction to Genetic Algorithm", PHI, 1998.
6) Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw- Hill International editions, 1995.

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	2	3
CO2	2	2	2	3	2
CO3	2	3	3	2	3
CO4	2	2	3	3	3
CO5	3	2	2	3	2

SEMESTER – II	2PHUMR27: HUMAN RIGHTS	CREDIT:2 HOURS:2/W

COURSE OBJECTIVES

1) To understands the conceptual background of Human Rights.
2) To study international and regional norms and institutional mechanisms of Human Rights.
3) To know the international concern for Human Rights.
4) To explores the emerging issues in international human rights.
5) To study the Classification of Human Rights.

UNIT-I: CONCEPTUAL BACKGROUND OF HUMAN RIGHTS

Meaning, Nature and Scope of Human Rights - Need for the Study of Human Rights - Philosophical and Historical foundations of Human Rights - Classification of Human Rights –Major Theories of Human rights.

UNIT-II: INTERNATIONAL HUMAN RIGHTS NORMS AND MECHANISMS

UN Charter - Universal Declaration of Human Rights - International Covenant on Civil and Political Rights - International Covenant on Economic, Social and Cultural Rights - Other Major instruments on Human rights (Conventions on Racial Discrimination. Women and Child Rights. Torture, Apartheid and Refugees) -UN High Commissioner for Human Rights and its Sub-Commissions - Geneva Conventions and Protocols - UN High Commission for Refugees -Humanitarian Interventions of UN

UNIT-III: REGIONAL HUMAN RIGHTS STANDARDS AND MECHANISMS

European Convention on the protection of Human Rights - European Commission on Human Rights -American Convention on Human Rights - American Commission and Court of Human Rights - African Charter on Human and People's Rights -African Commission and African Court for Human Rights- Universal Islamic Declaration of Human rights (198l)

UNIT-IV: ISSUES

Violence against Women and Children - Refugees & Internally Displaced People's rights - Racism - Rights of Prisoners, Rights of Prisoners of War - Rights of Disabled, Aged, and Homeless Persons - Cyber Crimes and Human Rights - Euthanasia Debate- Bio-Technology and Human Rights (Human Cloning. Feticide and Medical Termination of Pregnancy, Surrogate Parenthood, Sale of Human Organs. Drugs and Technologies)

UNIT V: EMERGING DIMENSIONS

Third Generation Human Rights: Right to Water, Food, Health, Clothing, Housing, and Sanitation- Right to Education – Right to Peace and Prosperity - Right to have Clean Environment.

COURSE OUTCOMES

At the end of the course, the student

1) will have knowledge about the conceptual background of Human Rights.
2) can apprise on International Human Rights norms and mechanisms.
3) can understand the emerging dimensions of Human Rights in international forum.
4) can explain about the Third Generation Human Rights
5) can discusses about Right to Clean Environment.

Text Books

1) M.P. Tandon. Anand. V.K. International Law and Human Rights. Haryana. Allahabad Law house, Allahabad, 2013.
2) N. Sanajauba. Human Rights in the New Millennium, New Delhi Manas Publications, 2011.
3) S.K. Kapoor. Human Rights under International Law and Indian Law. Allahabad: Central Law Agency. 2012,
4) Daniien Kings Lurge & Leena Avonius. Ed. Human Rights in Asia, London. Maemillan Publishers. 2016.

Supplementary Readings

1) Todd, Land Man, ed., Human Rights. London. Sage Publications. 2018.
2) G. Van Bueren, The International Law on the Rights of the child. Dordrecht: Martinus Nijhoff Publishers, 2011.
3) B.S. Waghmnre. ed. Human Rights. Problems and Prospects. Delhi. Lalinga Publications. 2011.

OUT COME MAPPING

CO/PO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	2	2	3	3	2
CO2	1	2	2	3	3
CO3	2	2	3	2	2
CO4	2	3	3	2	3
CO5	2	2	2	3	3

***1-Low *2-Medium *3-Strong**

SEMESTER - III CORE - VII	22PCSCC31: DIGITAL IMAGE PROCESSING	CREDITS: 4 HOURS: 5/W

COURSE OBJECTIVES

1) To provide complete knowledge on Digital Image Processing methods
2) Able to Understand image processing methods in Spatial domain and Frequency domain
3) To Understand Edge detection, Edge features and their applications.
4) To Provide concepts of Image Compression Models
5) Enable the students to understand the concepts and implement them empirically.

UNIT I

Fundamentals: Image Sensing and Acquisition, Image Sampling and Quantization, relationship between Pixels; Random noise; Gaussian Markov Random Field, σ-field, Linear and Non-linear Operations; Image processing models: Causal, Semi-causal, Non-causal models.

Color Models: Color Fundamentals, Color Models, Pseudo-color Image Processing, Full Color Image Processing, Color Transformation, Noise in Color Images.

UNIT II

Spatial Domain: Enhancement in spatial domain: Point processing; Mask processing; Smoothing Spatial Filters; Sharpening Spatial Filters; Combining Spatial Enhancement Methods.

Frequency Domain: Image transforms: FFT, DCT, Karhunen-Loeve transform, Hotlling's T^2 transform, Wavelet transforms and their properties. Image filtering in frequency domain.

UNIT III

Edge Detection: Types of edges; threshold; zero-crossing; Gradient operators: Roberts, Prewitt, and Sobel operators; residual analysis based technique; Canny edge detection. Edge features and their applications.

UNIT IV

Image Compression: Fundamentals, Image Compression Models, Elements of Information Theory. Error Free Compression: Huff-man coding; Arithmetic coding; Wavelet transform based coding; Lossy Compression: FFT; DCT; KLT; DPCM; MRFM based compression; Wavelet transform based; Image Compression standards.

UNIT V

Image Segmentation: Detection and Discontinuities: Edge Linking and Boundary Deduction; Threshold; Region-Based Segmentation. Segmentation by Morphological watersheds. The use of motion in segmentation, Image Segmentation based on Color.

Morphological Image Processing: Erosion and Dilation, Opening and Closing, Hit-Or-Miss Transformation, Basic Morphological Algorithms, Gray-Scale Morphology.

Course Outcomes

CO1	Analyze the concepts and fundamentals of Digital Image Processing
CO2	Demonstrate Spatial domain and Frequency domain and its applications
CO3	Analysis of residual based technique, Canny edge detection and their applications.
CO4	Apply Image Compression techniques
CO5	Use different features of Image Segmentation

Text Books

1. RafaelGonzalez, Richard E. Woods, " Digital Image Processing " , Fourth Edition, PHI/PearsonEducation,2013.
2. A.K.Jain, Fundamentals of Image Processing, Second Ed., PHI, New Delhi, 2015.

Supplementary Readings

1. B.Chanla, D. Dutta Majumder , " Digital Image Processing and Analysis " , PHI, 2003.
2. Nick Elford, "Digital Image Processing a practical introducing using Java", Pearson Education, 2004.
3. Todd R.Reed, "Digital Image Sequence Processing , Compression , and Analysis" ,CRC Press,2015.
4. L.Prasad, S. S. Iyengar, "Wavelet Analysis with Applications to Image Processing", CRCPress, 2015.

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**2**	**2**	**2**	**2**
CO2	**2**	**1**	**2**	**3**	**2**
CO3	**3**	**2**	**2**	**3**	**3**
CO4	**3**	**2**	**3**	**1**	**3**
CO5	**3**	**2**	**3**	**3**	**1**

SEMESTER - III CORE - VIII	22PCSCC32: MACHINE LEARNING	CREDITS: 4 HOURS: 5/W

COURSE OBJECTIVES

LO1	To introduce students to the basic concepts and techniques of Machine Learning.
LO2	To understand the regression methods, regularization methods.
LO3	To Analyze clusteringmethods and metrics.
LO4	To discover patterns in data and then make predictions based on often complex patterns to answer business questions, detect and analyze trends and help solve problems.
LO5	To introduce students to the state-of-the-art concepts and techniques of Machine Learning.

Unit I

Introduction: Basic definitions – Learning - Machine Learning vs AI - Machine Learning – features – samples – labels - Real-world applications and problems – hypothesis test -approaches of machine learning model - Data pre-processing.

Unit II

Representation of formal ML model: The statistical learning framework – training - testing – validation - cross validation - parametric and non-parametric methods - Difference between Parametric and Non-Parametric Methods and examples.

Unit III

Supervised learning Algorithms: Introduction – Approaches for classification – Linear Regression - Logistic regression - Decision Tree classification algorithm – Tree pruning - Rule based Classification –IF- THEN rules classification - Naïve Bayesian classification - Neural Network: Introduction to ANN – Feed Forward Neural Network – Back propagation –.

Support Vector Machines (SVM) - Lazy learners: k- Nearest Neighbor (k-NN) Algorithm – Case Based Reasoning (CBR) - Random Forest algorithm.

Unit IV

Unsupervised learning algorithms: Introduction– Defining Unsupervised learning – Cluster Analysis – Distance measures - Types of Clustering – Partition algorithms of clustering – Hierarchical clustering algorithms - Density based methods.

Unit V

Reinforcement Learning and ELM: Introduction: Markov Decision process - Monte Carlo Prediction - case studies – Applications. Introduction to Extreme Learning Machine (ELM) - Deep learning fundamentals: Convolutional Neural Networks (CNN) - Deep Belief Networks (DBN). Software Tools: Introduction to Weka, Matlab, Rapidminer, Tensorflow and Keras – case studies.

Course Outcomes

CO1	Apply the machine learning concepts in real life problems.
CO2	To Implement and analyze existing learning algorithms, including well-studied methods for classification, regression, clustering.
CO3	To Identify machine learning techniques suitable for a given problem.
CO4	To Design application using machine learning techniques.
CO5	To Solve the problems using various machine learning techniques

Text Books

1. Anuradha Srinivasaraghavan, Vincy Joseph (2019), Machine Learning, Wiley.
2. Balas Kausik Natarajan (1991), "Machine Learning: A Theoretical Approach", Morgan Kaufmann
3. Dinesh Kumar U Manaranjan Pradhan (2019), Machine learning using Python, Wiley.
4. Etham Alpaydin (2015), Introduction to Machine Learning, third edition, PHI Learning Pvt. Ltd.
5. Jiawei Han, Micheline Kamber, Jian Pei (2012), Data mining concepts and techniques, Morgan Kaufmann Publishers, Elsevier.

Supplementary Readings

1. Lovelyn Rose S, Dr. L Ashok Kumar, Dr. D Karthika Renuka (2019), Deep Learning
2. Using Python,Wiley,
3. Rajiv Chopra (2018), Deep Learning - A Practical Approach, Khanna Books 2018.
4. Shai Shalev-Shwartz and Shai Ben-David (2014), Understanding machine learning from
5. theory to algorithms,Cambridge university press.
6. UCI Machine Learning Repository: http://archive.ics.uci.edu/ml/index.php

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	2	2
CO2	3	3	3	2	2
CO3	3	3	3	2	2
CO4	2	3	3	1	2
CO5	2	3	3	2	2

SEMESTER - III CORE - IX	22PCSC33: RESEARCH METHODOLOGY	CREDITS: 4 HOURS: 5/W

COURSE OBJECTIVES

LO1	To demonstrate the knowledge of research processes (reading, evaluating, and developing);
LO2	To perform literature reviews using print and online databases;
LO3	To identify, explain, compare, and prepare the key elements of a research proposal/report;
LO4	To compare and contrast quantitative and qualitative research
LO5	To analyze Measurement concepts

UNIT I: Foundations of Research

Meaning – Objectives – Motivation - Utility. Concept of theory – empiricism - deductive and inductive theory.Characteristics of scientific method – Understanding the language of research –Concept – Construct – Definition – Variable - Research Process.

UNIT II: Problem Identification & Formulation

Research Question–Investigation Question –Measurement Issues – Hypothesis –Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing –Logic & Importance.

UNIT III: Research Design

Concept and Importance in Research –Features of a good research design – Exploratory Research Design –concept, types and uses, Descriptive Research Designs –concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.

UNIT IV: Qualitative and Quantitative Research

Qualitative research –Quantitative research –Concept of measurement, causality, generalization, replication. Merging the two approaches.

UNIT V: Measurement

Concept of measurement–what is measured? Problems in measurement in research –Validity and Reliability. Levels of measurement –Nominal, Ordinal, Interval, Ratio.

Course Outcomes

CO1	Students are able to demonstrate knowledge of research processes (reading, evaluating, and developing);
CO2	Students are able to perform literature reviews using print and online databases;
CO3	Students are able to identify, explain, compare, and prepare the key elements of a research proposal/report;
CO4	Students are able to compare and contrast quantitative and qualitative research
CO5	Students are able to understand Concepts of Measurements.

Text Books

1) C. R. Kothari: Research Methodology: Methods & Technology, New Age Int.Publ.

Supplementary Readings

1) Gupta Gupta : Research Methodology: Texts and cases with SPSS Application (2011 edn.), International Book House, New Delhi.
2) A.K.P.C.Swain : A Text Book of Research Methodology, Kalyani Publishers.

WEB REFERENCES

https://libguides.wits.ac.za/c.php?g=693518&p=4914913
https://www.scribbr.com/dissertation/methodology/
https://www.intechopen.com/online-first/research-design-and-methodology

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	2	2
CO2	3	3	3	2	2
CO3	3	3	3	2	2
CO4	2	3	3	3	2
CO5	2	3	3	2	2

SEMESTER - III CORE - V	22PCSCP34: IMAGE PROCESSING LAB	CREDITS: 2 HOURS: 4/W

COURSE OBJECTIVES

LO1	To impart skills on the processing of digital images.
LO2	To learn the transformation of images from spatial domain to frequency domain.
LO3	To perform the edge deduction techniques.
LO4	To gain knowledge about compressing the images using suitable techniques.
LO5	To know the segmentation methods

List of Experiments:

1. Perform the linear and non linear operations on images.
2. Perform smoothing operations on an image in spatial domain.
3. Perform sharpening operations on an image in spatial domain.
4. Transform the image into DCT, FFT and wavelet.
5. Implement the canny edge deduction.
6. Evaluate the performance of gradiant operators.
7. Implement the huff-man coding technique.
8. Perform DCT compression method.
9. Implement the image segmentation based on color.
10. Implement the concepts of erosion and dilation.

Course Outcomes

CO1	Retrieve and display the image.
CO2	Transform the domain from spatial to frequency.
CO3	Apply suitable operators to detect the edge.
CO4	Perform the process of compression and segmentation using certain methods
CO5	Implementation the concept of erosion and dilation

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	3
CO2	3	3	2	2	1
CO3	3	2	3	2	2
CO4	3	3	2	2	1
CO5	3	3	3	3	3

SEMESTER - III CORE - VI	22PCSCP35: MACHINE LEARNING LAB	CREDITS: 2 HOURS:4/W

COURSE OBJECTIVES

LO1	To get an overview of the various machine learning techniques.
LO2	To demonstrate python and its applications
LO3	To familiarize various machine learning software libraries and data sets publicly available.
LO4	To develop machine learning based system for various real-world problems.
LO5	The knowledge of using machine learning to make predictions in a scientific computing environment

List of Experiments:

1. Write a python program to compute
   Central Tendency Measures: Mean, Median, Mode
2. Measure of Dispersion: Variance, Standard Deviation
3. Study of Python Libraries for ML application such as Pandas and Matplotlib
4. The probability that it is Friday and a student is absent is 3%. Since there are 5 school days in a week, the probability that it is Friday is 20%. What is the probability that a student is absent given that today is Friday? Apply Bayes' rule in python to get the result.
5. Extract the data from database using python.
6. Implementation of Logistic Regression and test with a dataset using sklearn.
7. Implement k-nearest neighbours' classification for an iris dataset using python.
8. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
9. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using real time data sets.
10. Implement SVM Classifier on a PIMA Indian diabetes dataset.
11. Performance analysis of Classification Algorithms on a specific dataset (Mini Project).

Course Outcomes

CO1	Understand the mathematical and statistical perspectives of machine learning algorithms through python programming.
CO2	Understand complexity of Machine Learning algorithms and their limitations;
CO3	Understand modern notions in data analysis-oriented computing;
CO4	Apply common Machine Learning algorithms in practice and implementing their own;
CO5	Perform experiments in Machine Learning using real-world data.

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	**2**	**2**	**3**	**2**	**2**
CO2	**2**	**3**	**3**	**2**	**2**
CO3	**2**	**3**	**3**	**3**	**2**
CO4	**2**	**3**	**3**	**2**	**3**
CO5	**2**	**3**	**3**	**3**	**2**

SEMESTER - III CORE - I PART - III	22PCSCE36-1: CLOUD COMPUTING	CREDITS: 4 HOURS: 4/W

COURSE OBJECTIVES	
LO1	The objective of this course is to provide students with the comprehensive and in-depth knowledge of Cloud Computing concepts
LO2	Introducing and researching state-of-the-art in Cloud Computing fundamental issues
LO3	To Understand Cloud Computing architecture and applications.
LO4	To expose the students to frontier areas of Cloud Computing and information systems.
LO5	To provide sufficient foundations to enable further study and research.

UNIT I COMPUTING BASICS

Cloud computing definition-Characteristics-Benefit-Challenges Distributed Systems-Virtualization-Service-oriented computing-Utility-oriented computing- Building Cloud Computing environments-computing platforms & technologies - Cloud Models – Cloud Service Examples - Cloud Based Services & Applications - Cloud concepts and Technologies.

UNIT II VIRTUALIZATION, CLOUD SERVICES AND PLATFORMS

Virtualization: Virtualization-Characteristics-taxonomy-types-Pros and Cons- Examples Architecture: Reference model- types of clouds-Compute Service-Storage Services-Cloud Database Services-Application Services - Content Delivery Services - Analytics Services –Deployment and Management Service Identity and Access Management Services-Open Source Private Cloud Software.

UNIT III CLOUD APPLICATION DESIGN AND DEVELOPMENT

Design consideration- Reference Architecture for Cloud Application - Cloud Application Design Methodologies - Data Storage Approaches-Development in Python: Design Approaches–Application: Image Processing – Document Storage-MapReduce-Social Media Analytics.

UNIT–IV PYTHON FOR CLOUD

Introduction-Installing Python-Data types & Data Structures-Control Flow Functions-Modules-Packages-FileHandling-Date/TimeOperations–Classes Python for Cloud: Amazon Web Services – Google Cloud Platform - Windows Azure –Map Reduced –Packages of Interest–Designing a RESTful Web API.

UNIT–V BIGDATA ANALYTICS, MULTIMEDIA CLOUD & CLOUD SECURITY

Big Data Analytics: Clustering Big data - Classification of Big Data – Recommendation systems. Multimedia Cloud: Case Study: Live Video Stream App - Streaming Protocols – Case Study: Video Transcoding App- Cloud Security: CSA Cloud Security Architecture-Authentication - Authorization - Identity and Access management - Data Security –Key Management-Auditing-Cloud for Industry, Health care & Education.

Course Outcomes	
CO1	To get depth knowledge Cloud concepts and technologies
CO2	To acquire various analytics service in cloud computing
CO3	Students are able to understand Cloud applications
CO4	To get knowledge in Python based cloud systems
CO5	To acquire knowledge in cloud architecture and security

Text Books

1. Buyya, Vecciola and Selvi, Mastering Cloud Computing: Foundations and Applications Programming, Tata McGraw Hill, 2013.
2. Arshdeep Bahga, Vijay Madisetti, “Cloud Computing: A Hands –On Approach” Universities press (India) Pvt. Limited, 2016.

Supplementary Readings

1. Ritting house and Ransome, Cloud Computing: Implementation, Management, and Security, CRC Press, 2016.
2. Michael Miller “Cloud Computing Web based application that change the way you work and collaborate online”. Pearsonedition, 2008.
3. KrisJamsa,Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and More , Jones & Bartlett Learning, 2012.

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**2**	**3**	**3**
CO2	**3**	**3**	**3**	**2**	**2**
CO3	**3**	**3**	**2**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**2**
CO5	**3**	**3**	**3**	**2**	**2**

SEMESTER - III CORE - I PART - III	22PCSCE36-2: OPTIMIZATION TECHNIQUES	CREDITS: 4 HOURS: 4/W

COURSE OBJECTIVES	
LO1	To understand the basic concepts of operations research and to impart the knowledge on various operations research techniques and their applications.
LO2	Optimization is an effective approach to achieve a "best" solution, where a single objective is maximized or minimized
LO3	Optimization methods are used in many areas of study to find solutions that maximize or minimize some study parameters,
LO4	To make the Students become familiar with the basic Principle of LPP and enrich knowledge to formulate and solve an LPP using various methods.
LO5	To impart Optimization Techniques.

Unit I

Linear Programming: Introduction– History of OR – Meaning of OR Principles of Modeling–Linear equation–Gaussian Elimination–Formulation of LP models –Graphical Solution – Algebraic Solutions – Simplex Method – Feasibility – Optimality –Artificial Variables–M–Technique– Duality – Dual simplex Algorithm –Transportation Problem–Assignment Problem–Least Time Transportation Problems.

Unit II

Queuing Models: Introduction–Deterministic Model–Queue Parameters – M/M/I Queue – Limited queue Capacity – Multiple Servers – Finite Sources – Waiting Times –Queue discipline–Non–Markovian Queues– Probabilistic models.

Unit III

Inventory Models: Determine Models – EOQ – Finite and Infinite Delivery Rates without Back-Ordering–Finite and Infinite delivery rates with back ordering –Quantity Discounts–EOQ with constraints–Probabilistic model–Single Period Model –Reorder Point Model–Variable Lead Times

Unit IV

PERT/CPM: Arrow(Network) Diagram Representation – Time estimates – Critical Path–Floats–Construction of Time chart and Resource Leveling – Probability and Cost Consideration in Project Scheduling–Project Control.

Unit V

Replacement Theory: Introduction– Various replacement situations – Replacement Policy–Variables Maintenance costs and fixed money value – Variable Maintenance Costs and Variable Money Value – Individual Replacement Policy – Group Replacement Policy–Reliability.

COURSE OUTCOMES

3) Formulate the LPP for a real life Problems and give the solution for the problem using suitable optimization techniques.
4) The problem formulation by using linear, dynamic programming, game theory and queuing models.
5) The stochastic models for discrete and continuous variables to control inventory and simulation of manufacturing models for the production decision making
6) Formulation of mathematical models for quantitative analysis of managerial problems in industry.
7) Apply LPP in Various fields such as Science, Engineering, Industry, Business, etc.

Text Books

1. Kanti Swarup P.K. Gupta and Man Mohan, "Operation Research", Sultan & Chand Publishers New Delhi, 1992.

Supplementary Readings

1. Jagdish S. Rustag, Optimization Techniques in Statistics, Academic Press, 2014.
2. Hamdy A Taha, Operations Research–An Introduction Macmillan Publishing Company, 1982.
3. Don.T.Philps, A.Ravindran, James.J.Solberg, "OperationsResearch–PrinciplesandPracticeJohnWiley&Sons, 1976.
4. S. Arumugam and A. T. Isaac, Topics in Operations Research Linear Programming , Edition 2015, New Gamma Publishing House.

OUTCOME MAPPING

COs/Pos	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	2	2
CO2	2	3	2	3	2
CO3	3	2	2	3	3
CO4	3	2	3	2	3
CO5	3	2	3	3	2

SEMESTER - III CORE - I PART - III	22PCSCE36-3: PARALLEL COMPUTING	CREDITS: 4 HOURS: 4/W

COURSE OBJECTIVES

8) To learn the Kinds of parallelism, Parallel computer architectures (processor arrays, centralized memory multiprocessors, distributed memory multiprocessors and multi computers)
9) To know and develop the Parallel algorithm design
10) To identify the MPI library of message-passing functions
11) To recognize the development of data-parallel programs
12) To develop manager-worker programs with functional parallelism

UNIT I: SCALABILITY AND CLUSTERING

Evolution of Computer Architecture–Dimensions of Scalability–Parallel Computer Models –Basic Concepts of Clustering–Scalable Design Principles–Parallel Programming Overview – Processes, Tasks and Threads – Parallelism Issues – Interaction / Communication Issues–Semantic Issues in Parallel Programs.

UNIT II:ENABLING TECHNOLOGIES

System Development Trends – Principles of Processor Design – Microprocessor Architecture Families–Hierarchical Memory Technology–Cache Coherence Protocols–Shared Memory Consistency – Distributed Cache Memory Architecture – Latency Tolerance Techniques– Multithreaded Latency Hiding.

UNIT III:SYSTEM INTERCONNECTS

Basics of Interconnection Networks – Network Topologies and Properties – Buses, Crossbar and Multistage Switches, Software Multithreading Synchronization Mechanisms.

UNIT–IV:PARALLEL PROGRAMMING

Paradigms and Programmability–Parallel Programming Models–Shared Memory Programming.

UNIT-V:MESSAGE PASSING PROGRAMMING

Message Passing Paradigm – Message Passing Interface–Parallel Virtual Machine.

Course Outcomes	
CO1	Students are able to compute speedup, efficiency and scaled speedup of parallel computations, given appropriate data
CO2	Students are able to apply Amdahl's Law to predict the maximum speedup achievable from a parallel version of a sequential program , given its execution profile
CO3	Students are able to analyze the efficiency of a parallel algorithm

CO4	Students are able to explain the relative advantages and disadvantages of mesh, hypercube, and butterfly networks with respect to diameter, bisection width, and number of edges/node
CO5	Students are able to explain the advantages and disadvantages of constructing parallel computers

Text Books

1. Kai Hwang and Zhi.Wei Xu, "Scalable Parallel Computing",Tata Mc Graw-Hill ,NewDelhi,2003.

Supplementary Readings

1. David E. Culler & Jaswinder Pa lSingh , " Parallel Computing Architecture : A Hardware / Software Approach", Morgan Kaufman Publishers, 1999.
2. Michael J.Quinn, "Parallel Programming in C with MPI & Open MP", Tata McGraw-Hill, New Delhi, 2003.
3. Kai Hwang, "Advanced Computer Architecture" Tata McGraw-Hill, New Delhi, 2003.

Web References

www.computing.llnl.gov/tutorials/parallel_comp/www.geeksforgeeks.org/introduction-to-parallel computing/www.techopedia.com/definition/8777/parallel-computing

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	2	3
CO2	2	2	2	3	2
CO3	2	3	3	2	3
CO4	2	2	3	3	3
CO5	3	2	2	3	2

SEMESTER – III OPEN ELECTIVE – II	22PCSCO37-1: BUSINESS INTELLIGENCE	CREDITS: 3 HOURS: 3/W

COURSE OBJECTIVES	
LO1	Be exposed with the basic rudiments of business intelligence system.
LO2	Understand the modeling aspects behind Business Intelligence.
LO3	Understand of the business intelligence life cycle and the techniques used in it.
LO4	To Link data mining with business intelligence
LO5	To know the future of Business Intelligence

Unit I

Business Intelligence: Effective and timely decisions – Data, information and knowledge –Role of mathematical models – Business intelligence architectures: Cycle of a business intelligence analysis – Enabling factors in business intelligence projects – Development of a business intelligence system–Ethics and business intelligence.

Unit II

Knowledge Delivery: The business intelligence user types, Standard reports, Interactive Analysis and Adhoc Querying, Parameterized Reports and Self-Service Reporting, dimensional analysis, Alerts/Notifications, Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic Visualization, Integrated Analytics, Considerations: Optimizing the Presentation for the Right Message.

Unit III

Efficiency: Efficiency measures–The CCR model: Definition of target objectives-Peer groups –Identification of good operating practices; cross efficiency analysis–virtual inputs and outputs -Other models. Pattern matching–cluster analysis, outlier analysis.

Unit IV

Business Intelligence Applications: Marketing models – Logistic and Production models –Case studies.

Unit V

Future of Business Intelligence: Future of business intelligence – Emerging Technologies, Machine Learning, Predicting the Future, BI Search & Text Analytics – Advanced Visualization –Rich Report, Future beyond Technology.

Course Outcomes	
CO1	Explain the fundamentals of business intelligence.
CO2	Link data mining with business intelligence.
CO3	Apply various modeling techniques.
CO4	Explain the data analysis and knowledge delivery stages.
CO5	Apply business intelligence methods to various situations.

Text Books

1. Efraim Turban, Ramesh Sharda, Dursun Delen, "Decision Support and Business Intelligence Systems", 9th Edition, Pearson (2013).

Supplementary Readings

1. LarissaT.Moss, S.Atre, "Business Intelligence Roadmap: The Complete Project Life cycle of Decision Making", Addison Wesley, (2003).
2. CarloVercellis, "BusinessIntelligence: Data Mining and Optimization for Decision Making", Wiley Publications,(2009).
3. David Loshin Morgan, Kaufman, "Business Intelligence: The Savvy Manager's Guide",Second Edition,(2012).
4. Cindi Howson, "Successful Business Intelligence: Secrets to Making BIa Killer App", McGraw-Hill,(2007).
5. RalphKimball, Margy Ross,Warren Thornthwaite , Joy Mundy , Bob Becker , " The Data Warehouse Lifecycle Toolkit",Wiley Publication Inc.,(2007).

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**3**	**2**	**2**
CO2	**3**	**3**	**3**	**1**	**3**
CO3	**3**	**2**	**3**	**2**	**2**
CO4	**3**	**2**	**2**	**3**	**3**
CO5	**3**	**2**	**2**	**2**	**3**

SEMESTER - III OPEN ELECTIVE – II	22PCSCO37-2: MANAGEMENT INFORMATION SYSTEM	CREDITS: 3 HOURS: 3/W

course Objectives	
LO1	Understand the leadership role of Management Information Systems in achieving business competitive advantage through informed decision making.
LO2	Understand Modern Information System & its life cycle.
LO3	Analyze and synthesize Concept of DSS, IS, ES information system.
LO4	Develop the skills about Testing Security & Cost benefit analysis.
LO5	Learning Concept of Knowledge & Human dimension.

UNIT I

INTRODUCTION: Information system – establishing the framework – business model – information system architecture – evolution of information systems.

UNIT II

SYSTEM DEVELOPMENT: Modern information system – system development life cycle – structured methodologies – designing computer based method, procedures control, designing structured programs.

UNIT III

INFORMATION SYSTEM: Functional areas, Finance, marketing, production, personnel – levels, Concepts of DSS, EIS, ES – comparison, concepts and knowledge representation – managing international information system.

UNIT IV

IMPLEMENTATION AND CONTROL: Testing security – coding techniques – detection of error – validation – cost benefit analysis – assessing the value and risk of information systems.

UNIT V

SYSTEM AUDIT: Software engineering qualities – design, production, service, software specification, software metrics, software quality assurance – systems methodology – objectives – Time and Logic, Knowledge and Human dimension – software life cycle models – verification and validation.

Course Outcomes	
CO1	Evaluate the role of information systems in today's competitive business environment
CO2	Interpret information systems in the enterprise.
CO3	Explain relationships between concepts of information systems, organization, management and strategy.
CO4	Debate infrastructure of information technology &illustrate redesigning the organization with information systems.
CO5	Evaluate models for determining the business value of information systems &identify appropriate strategies to manage the system implementation process

Text Books

1. Kenneth C. Laudon and Jane Price Laudon, Management Information Systems Managing the digital firm, Pearson Education Asia.

Supplementary Readings

1. Gordon B.Davis, Management Information System: Conceptual Foundations, Structure and Development, McGraw Hill, 1974.
2. Joyce J. Elam, Case series for Management Information System Silmon and Schuster, Custom Publishing 1996.
3. Steven Alter, Information system – A Management Perspective – Addison – Wesley, 1999.
4. James AN O' Brein, Management Information Systems, Tata McGraw Hill, New Delhi, 1999. 5. Turban Mc Lean, Wetherbe, Information Technology Management making connection for strategic advantage – John Wiley, 1999.
5. Ralph M.Stair and George W.Reynolds - Principles of Information Systems – A Managerial Approach Learning, 2001.

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2	2	3	2	3
CO2	3	3	2	3	2
CO3	2	2	3	3	2
CO4	2	2	2	3	3
CO5	3	2	2	2	2

SEMESTER - III OPEN ELECTIVE – II	22PCSCO37-3: WEB SERVICES	CREDITS: 3 HOURS:3/W

Course Objectives	
LO1	To Understand Web Services and implementation model for SOA
LO2	To Understand the SOA, its Principles and Benefits.
LO3	Understanding cloud computing as a web service.
LO4	Discuss the concept of virtualization and data in cloud.
LO5	Learning basic concept of cloud computing & cloud service Modes.

Unit I :

Web Service and SOA fundamentals Introduction, Concept of Software as a Service (SaaS), Web services versus Web based applications, Characteristics of Web services, Service interface and implementation, The Service Oriented Architecture (SOA), Quality of service (QoS), Web service interoperability, Web services versus components, RESTful services, Impact and shortcomings of Web services.

Unit II:

Web Services Architecture. Web services Architecture and its characteristics, core building blocks of web services, standards and technologies available for implementing web services, web services communication, basic steps of implementing web services, developing web services enabled applications.

Unit III:

SOAP: Simple Object Access Protocol: Inter-application communication and wire protocols, SOAP as a messaging protocol, Structure of a SOAP message, SOAP communication model, Building SOAP Web Services, developing SOAP Web Services using Java, Error handling in SOAP, Advantages and disadvantages of SOAP.

Unit IV:

Describing and Discovering Web Services: WSDL in the world of Web Services, Web Services life cycle, anatomy of WSDL definition document, WSDL bindings, WSDL Tools, limitations of WSDL, Service discovery, role of service discovery in a SOA, service discovery mechanisms, UDDI – UDDI Registries, uses of UDDI Registry, Programming with UDDI, UDDI data structures, support for categorization in UDDI Registries, Publishing API, Publishing information to a UDDI Registry, searching information in a UDDI Registry, deleting information in a UDDI Registry, limitations of UDDI.

Unit V:

Emerging trends: Cloud Computing : What is Cloud Computing?, SOA meets the Cloud, Cloud Service Models, SaaS- Salesforce.com, PaaS-Google App Engine, IaaS-Amazon EC2, Cloud Deployment Models – Public, Community, Private, Hybrid. Virtualization, Virtual Machine (VM) Technology, Virtual Machine Monitor or Hypervisor - KVM, Xen, VMware hypervisors and their features, Multi-tenancy, Architecture model for Cloud Computing. Case Study: Use Cloud Services – Amazon EC2, Google App Engine, Salesforce.com

Course Outcomes	
CO1	Understand & Identify basic concept of Web Services & Web Service applications
CO2	Explain the Concept of Web services Architecture and its characteristics
CO3	Student Learn about current trends in SOAP Web Services.
CO4	Illustrate about UDDI Registries & Programming with UDDI.
CO5	Elaborate about Virtualization, Virtual Machine (VM) Technology, Virtual Machine Monitor or Hypervisor in current trends.

Text Books

1. Web Services & SOA Principles and Technology, Second Edition, Michael P. Papazoglou.
2. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India.
3. Developing Enterprise Web Services, S. Chatterjee, J. Webber, Pearson Education.
4. GautamShroff, “Enterprise Cloud Computing” ,Cambridge.

Supplementary Readings

1. Building Web Services with Java, 2nd Edition, S. Graham and others, Pearson Edn., 2008.
2. Java Web Services, D.A. Chappell & T. Jewell, O’Reilly,SPD.
3. J2EE Web Services, Richard Monson-Haefel, Pearson Education.
4. Java Web Services Programming,R.Mogha,V.V.Preetham,Wiley India Pvt.Ltd.
5. RonaldKrutz and Russell Dean Vines, “Cloud Security”, Wiley-India
5. XML, Web Services, and the Data Revolution, F.P.Coyle, Pearson Education.
6. Dr. Kumar Saurabh,”Cloud Computing”, Wiley Publication
7. BorkoFurht, “Handbook of Cloud Computing”, Springer

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	2	3
CO2	2	3	2	2	2
CO3	2	3	3	2	3
CO4	3	2	3	3	3
CO5	2	2	3	2	2

SEMESTER - IV CORE - X	22PCSCC41: ADVANCED COMPUTER NETWORKS	CREDITS: 5 HOURS: 5/W

COURSE OBJECTIVES

LO1	Focusing on advanced topics and is a must for anyone interested in doing research in computer networks.
LO2	To build a solid foundation in computer networks concepts and design
LO3	The course will expose students to the concepts of traditional as well as modern day computer networks –Wireless transmissions, Communication Satellites.
LO4	The student understand concept of like Data Link Layer in the Internet & Medium Access Layer.
LO5	Student's study this paper knows about Internet Transport Protocol (ITP), Network Security and Cryptography.

Unit I

Introduction – Network Hardware – Software – Reference Models – OSI and TCP/IP models – Example networks: Internet, ATM, Ethernet and Wireless LANs - Physical layer – Theoretical basis for data communication - guided transmission media.

Unit II

Wireless transmission - Communication Satellites – Telephones structure – local loop, trunks and multiplexing, switching. Data link layer: Design issues – error detection and correction.

Unit III

Elementary data link protocols - sliding window protocols – Data Link Layer in the Internet - Medium Access Layer – Channel Allocation Problem – Multiple Access Protocols.

Unit IV

Network layer - design issues - Routing algorithms - Congestion control algorithms – IP protocol – IP Address – Internet Control Protocol.

Unit V

Transport layer - design issues - Connection management - Addressing, Establishing & Releasing a connection – Simple Transport Protocol – Internet Transport Protocol (TCP) - Network Security: Cryptography.

Course Outcomes

CO1	Analysis a basic concept of Network Hardware, software and different types of transmission techniques.
CO2	Design, Implement & Evaluate Wireless transmission & Communication Satellite.
CO3	Communicate Effectively the Medium Access Layer & Data Communication etc.
CO4	Recognize the principal of Routing Algorithm & Congestion Control Algorithm
CO5	Elaborate advanced network concept of Network Security & Cryptography

Text Books

1. A. S.Tanenbaum, 2003, Computer Networks, Fourth Edition, Pearson Education, (Prentice hall of India Ltd), New Delhi.

Supplementary Readings

1. B. Forouzan, 1998, Introduction to Data Communications in Networking, Tata McGraw-Hill, New Delhi.

2. F. Halsall, 1995, Data Communications, Computer Networks and Open Systems, Addison Wessley, Boston.

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	**2**	**2**	**2**	**2**	**3**
CO2	**2**	**2**	**2**	**3**	**2**
CO3	**2**	**2**	**3**	**2**	**3**
CO4	**2**	**3**	**2**	**3**	**3**
CO5	**3**	**2**	**2**	**3**	**2**

SEMESTER - IV CORE - XI	22PCSCC42: BLOCKCHAIN TECHNOLOGY	CREDITS: 5 HOURS: 5/W

COURSE OBJECTIVES

LO1	To understand the history Blockchain
LO2	To Understand types and applications of Blockchain
LO3	To acquire knowledge about cryptography and consensus algorithms.
LO4	Deploy projects using Web and design.
LO5	To Understand blockchain based Security issues.

UNIT I

Introduction: Need for Distributed Record Keeping, Modeling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Nakamoto's concept with Blockchain based cryptocurrency, Technologies Borrowed in Blockchain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash etc.

UNIT II

Basic Distributed Computing & Crypto primitives: Atomic Broadcast, Consensus, Byzantine Models of fault tolerance, Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems

UNIT III

Bitcoin basics: Bitcoinblockchain, Challenges and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use. Blockchain Network, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

UNIT IV

Ethereum basics: Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts, Writing smart contracts using Solidity & JavaScript

UNIT V

Privacy, Security issues in Blockchain: Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains: Sybil attacks, selfish mining, 51% attacks advent of algorand; Sharding based consensus algorithms to prevent these attacks. **Case Studies:** Block chain in Financial Service, Supply Chain Management and Government Services

Course Outcomes

CO1	Contentedly discuss and describe the history, types and applications of Block chain
CO2	Gains familiarity with cryptography and Consensus algorithms.
CO3	Create and deploy projects using Web3j and design block chain based applications.
CO4	Implement an ICO on Ethereum
CO5	Design block chain based application with Swarm and IPFS

Text Books

1. Narayanan, Bonneau, Felten, Miller and Goldfeder, "Bitcoin and Cryptocurrency Technologies – A Comprehensive Introduction", Princeton University Press, 2016.
2. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.
3. Imran Bashir, "Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained", Packt Publishing, 2018.

Supplementary Readings

1. Merunas Grincalaitis, "Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum-supported Tools, Services, and Protocols", Packt Publishing.
2. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts, 2016.
3. Prof. SandipChakraborty, Dr. Praveen Jayachandran, "Block chain Architecture Design And Use Cases" [MOOC], NPTEL: https://nptel.ac.in/courses/106/105/106105184/

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**2**	**2**	**2**	**3**
CO2	**2**	**2**	**3**	**2**	**2**
CO3	**3**	**2**	**2**	**2**	**2**
CO4	**3**	**3**	**2**	**2**	**2**
CO5	**3**	**2**	**3**	**2**	**3**

SEMESTER - IV CORE ELECTIVE - IV PART - III	22PCSCE43-1: MOBILE COMPUTING	CREDITS: 4 HOURS: 4/W

COURSE OBJECTIVES	
LO1	To Introduce the concept of wireless devices with signal, Antenna, Radio Frequencies, Signal Propagation.
LO2	To Introduce wireless communication and networking principles
LO3	To know the connectivity of cellular networks, Wireless LAN, GSM, CDMA.
LO4	To introduce the WAP Architecture, MANET and Routing
LO5	To analyze next generation Mobile Communication System

Unit I

Introduction – Applications – History of wireless communication – A Simplified reference model - Wireless transmission – Frequencies for radio transmission –Regulations–Signals–Antennas-Signal propagation: Path loss of radiosignals-Additionalsignalpropagationeffects-multi-pathpropagation–Multiplexing-Modulation.

Unit II

Spread spectrum–Direct sequence spread spectrum–Frequency hopping spread spectrum– Cellular systems. Medium access control: Hidden and exposed terminals – Near and far terminals – SDMA, FDMA, TDMA, Fixed TDM, Classical Aloha, slotted Aloha, Carrier sense multiple access–Reservation TDMA–Multiple access with collision avoidance– Polling – CDMA – Spread Aloha multiple access.

Unit III

GSM- Mobile services – System architecture–Radio interface–Protocols–Localization and calling – Handover –Security – New Data services. UMTS andIMT-2000-SatelliteSystems: Applications–Basics–Routing–Localization–Handover.

Unit IV

Wireless LAN: Infra-red vs. radio transmission– Infrastructure and ad-hocnetwork–IEEE802.11–Systemarchitecture–Protocolarchitecture–
Physicslayer– Medium access control layer – MAC management –Bluetooth. Mobile network layer: Mobile IP: Goals, assumptions and requirements–entities and terminology – packet delivery – Agent discovery – Registration – Tunneling and encapsulation Recent technologies.

Unit V

WAP: Architecture– wireless datagram Protocol, Wireless transport layer security, Wireless transaction protocol , Wireless session protocol , Wireless application environment, Mobile Ad-hoc networks – MANET Characteristics –Classification of MANETs , Routing of MANETs, Proactive Routing Protocol -DSDV, Reactive Routing Protocols –DSR,AODV.

Course Outcomes	
CO1	To understand basic concepts of Mobile Communication.
CO2	To analyze next generation Mobile Communication System.
CO3	To understand network and transport layers of Mobile Communication.
CO4	Classify different types of mobile telecommunication systems
CO5	Analyze various protocols of all layers for mobile and ad hoc wireless communication networks.

Text Books

1. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education, 2009.
2. Kum Kum Garg, "Mobile Computing Theory and Practice", Pearson Education, 2014.

Supplementary Readings

1. Kamal, "Mobile Computing", Oxford University Press, 2019.
2. Rifaat A. Dayen, "Mobile Data & Wireless LAN Technologies", Prentice Hall, 1997.
3. SteveMannandScootSchibli,"TheWirelessApplicationProtocol",JohnWiley &Inc.,2000.

OUTCOME MAPPING

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**2**	**2**	**2**	**2**
CO2	**3**	**2**	**2**	**2**	**3**
CO3	**3**	**2**	**2**	**3**	**2**
CO4	**3**	**3**	**2**	**2**	**2**
CO5	**3**	**2**	**2**	**1**	**1**

SEMESTER - IV CORE ELECTIVE - IV PART - III	22PCSCE43-2: EMBEDDED SYSTEMS	CREDITS: 4 HOURS: 4/W

COURSE OBJECTIVES	
LO1	Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
LO2	Describe the hardware software co-design and firmware design approaches
LO3	Know the RTOS internals , multitasking, task scheduling, task communication and synchronisation
LO4	Learn the development life cycle of embedded system
LO5	Design real time embedded systems using the concepts of RTOS.

Unit I

Introduction to Embedded system-Embedded system vs General computing systems – History – Classification – Major Application Areas – Purpose of Embedded systems- Smart running shoes: The innovative bonding of lifestyle with embedded technology. Characteristics and Quality Attributes of Embedded systems.

Unit II

Elements of an Embedded system- core of the embedded system: General purpose and domain specific processors, ASICs, PLDs, COTS - Memory – Sensors and Actuators – Communication Interface: Onboard and External Communication Interfaces-Embedded Firmware - Reset circuit, Brown-out protection circuit, Oscillator unit, Real-time clock and Watch dogtimer-PC Band Passive Components.

Unit III

Embedded Systems-Washing machine: Application-specific-Automotive: Domain specific. Hardware Software Co-Design - Computational Models – Embedded Firmware Design Approaches-Embedded Firmware Development Languages-Integration and testing of Embedded Hardware and firmware.

Unit IV

RTOS based Embedded System Design: Operating System Basics-Types of operating Systems-Tasks, process and Threads-Multiprocessing and Multitasking-Task Scheduling- Task Communication - Task Synchronisation - Device Drivers - choosing an RTOS.

Unit V

Components in embedded system development environment, Files generated during compilation, simulators, emulators and debugging – Objectives of Embedded product Development Life Cycle-Different Phases of EDLC-EDLC Approaches-Trends in Embedded Industry-Case Study: Digital Clock.

Course Outcomes	
CO1	To know differences between the general computing system and the embedded system,
CO2	Ability to recognize the classification of embedded systems.
CO3	Become aware of interrupts, hyper threading and software optimization.
CO4	Design real time embedded systems using the concepts of RTOS.
CO5	Students can able to enhance the future study in Embedded System.

Text Books

1. K. V. Shibu, "Introduction to embedded systems", TMH educationPvt.Ltd.2009.

Supplementary Readings

1. Raj Kamal , “Embedded Systems: Architecture, Programming and Design”, TMH Second Edition, 2009
2. Frank V ahid, Tony G ivargis, “Embedded System Design ” , John Wiley . Third Edition, 2006
3. Cliff Young, Faraboschi Paolo, and Joseph A. Fisher, "Embedded Computing: A VLIW Approach to Architecture, Compilers and Tools", Morgan Kaufmann Publishers, An imprint of Elsevier, 2005.
4. David E.Simon,“ An Embedded Software Primer ” Pearson Education , 1999

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**2**	**2**	**2**	**2**
CO2	**2**	**3**	**2**	**3**	**2**
CO3	**3**	**2**	**2**	**3**	**3**
CO4	**3**	**2**	**3**	**2**	**3**
CO5	**3**	**2**	**3**	**3**	**2**

SEMESTER - IV CORE ELECTIVE - IV PART - III	22PCSCE43-3: INFORMATION RETRIVAL TECHNIQUES	CREDITS: 4 HOURS: 4/W

COURSE OBJECTIVES	
LO1	To understand the basics of Information Retrieval.
LO2	To understand machine learning techniques for text classification and clustering.
LO3	To understand various search engine system operations.
LO4	To learn different techniques of recommender system
LO5	To learn Web retrieval and web crawling

UNIT I

INTRODUCTION: Information Retrieval – Early Developments – The IR Problem – The User's Task – Information versus Data Retrieval - The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes - The Web – The e-Publishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces.

UNIT II

MODELING AND RETRIEVAL EVALUATION: Basic IR Models - Boolean Model - TF-IDF (Term Frequency/Inverse Document Frequency) Weighting - Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.

UNIT III

TEXT CLASSIFICATION AND CLUSTERING: A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – k-NN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation metrics – Accuracy and Error – Organizing the classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing.

UNIT IV

WEB RETRIEVAL AND WEB CRAWLING: The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations -- Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.

UNIT V

RECOMMENDER SYSTEM: Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models – Neighborhood models.

Course Outcomes	
CO1	Use an open-source search engine framework and explore its capabilities
CO2	Apply appropriate method of classification or clustering.
CO3	Design and implement innovative features in a search engine.
CO4	Design and implement a recommender system
CO5	Design an efficient search engine and analyze the Web content structure.

Text Books

1. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, “Modern Information Retrieval: The Concepts and Technology behind Search”, Second Edition, ACM Press Books, 2011
2. Ricci, F, Rokach, L. Shapira, B.Kantor, “Recommender Systems Handbook”, First Edition, 2011.

Supplementary Readings

1. C. Manning, P. Raghavan, and H. Schütze, “Introduction to Information Retrieval,” Cambridge University Press, 2008.
2. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, “Information Retrieval: Implementing and Evaluating Search Engines”, The MIT Press, 2010.
3. GopalChaudhary, DharmenderSaini, Vedika Gupta “Computational Intelligence for Information Retrieval”, United States: CRC Press, 2021.

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2	3	2	3	1
CO2	2	3	3	1	2
CO3	2	2	3	2	2
CO4	2	2	3	2	2
CO5	2	2	1	3	1

SEMESTER - IV CORE PROJECT PART -	22PCSCD44: PROJECT (INDUSTRIAL / RESEARCH)	CREDITS: 8 HOURS: 16/W

COURSE OBJECTIVES

LO1	To provide insights in to rea l world challenges and problem those required IT Related solutions.
LO2	To empower the students to bring out the IT related solutions for the requirements.
LO3	To expose the students to have a broad idea of literature related to the Project domain.
LO4	To enable students to use all concepts of IT in creating a solution for a problem.
LO5	To improve the team building, communication and management skills of the students

Course Outcomes

CO1	Discover the most thrust areas in the field of Information Technology.
CO2	Develop a complete project for a particular problem domain.
CO3	Identify analyses, design and implement any IT related projects.
CO4	Compare and contrast existing solutions for developing a project.
CO5	Demonstrate an ability to work in teams and manage with good communication skill.

OUTCOME MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**2**	**3**	**3**
CO2	**3**	**3**	**3**	**2**	**3**
CO3	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**3**
CO5	**3**	**3**	**2**	**3**	**3**