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COURSE STRUCTURES & SYLLABI

M.Sc. in Computer Science

(2024– 2026)

Central University of Odisha

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Department of Computer Science

Central University of Odisha

Main Campus, Sunabeda

763004

PROGRAMME EDUCATIONAL OBJECTIVES

The students are expected to accomplish the following objectives after M.Sc. graduation:

PO1: Pursue a successful career in the field of computer science, contribute significantly to their profession in industry, research and academia or undertake entrepreneurial endeavours.

PO2: Continuously learn, engage and update themselves to carryout independent or collaborative research, and address constantly evolving technological and global challenges in their field of expertise.

PO3: Develop leadership skills and demonstrate professional, social and ethical responsibilities as an individual.

PROGRAMME OUTCOMES

M.Sc. programme is designed to ensure that each student acquires the desired competencies and on successful completion of the programme, the students are expected to:

PO1: Computational knowledge: Apply the knowledge of mathematics and computer fundamentals to solve real life problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex problems in their program of study using knowledge of mathematics and computer science.

PO3: Design/development of solutions: Design solutions for complex problems and design software components that meet the specified needs with appropriate consideration for the public health and safety, cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use application-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern IT tools to model complex solutions with an understanding of their limitations.

PO6: The professional and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional practice.

PO7: Environment and sustainability: Understand the impact of the professional solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the software professional practices.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex technical activities with the community and with society at large, write and present substantial technical reports/ documents, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the software and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES

PSO1: Ability to demonstrate a degree of mastery in the area of computer applications through the advanced knowledge of data acquisition, data analytics, big data, pattern recognition and knowledge discovery.

PSO2: Ability to independently carry out research/investigation and developmental work to solve practical problems.

PSO3: Develop sound knowledge and skill sets to develop and expand professional careers in fields related to human-computer interaction and management of industrial processes for the design and implementation of intelligent systems.

M.Sc. in Computer Science

COURSE STRUCTURE

(2024-2026)

FIRST SEMESTER (AUTUMN)

THEORY						
SL. NO.	**SUBJECT CODE**	**SUBJECT**	**L**	**T**	**P**	**CREDIT**
1	MCS-101	Theory of Computation	3	1	-	4
2	MCS-102	Discrete Mathematics	4	-	-	4
3	MCS-103	Database Management System	4	-	-	4
4	MCS-104	Advanced Operating Systems	3	-	-	3
5	MCS-105	MOOC-I	-	3	-	3
PRACTICAL						
6	MCS-106	Advanced Operating Systems Lab	-	-	4	2
7	MCS-107	Database Management System Lab	-	-	4	2
TOTAL						**22**

SECOND SEMESTER (SPRING)

THEORY						
SL. NO.	**SUBJECT CODE**	**SUBJECT**	**L**	**T**	**P**	**CREDIT**
1	MCS-201	Advanced Computer Networks	4		-	4
2	MCS-202	Advanced Data Structures and Algorithms	4		-	4
3	MCS-203	Object Oriented Programming	3		-	3
4	MCS-204	Artificial Intelligence	3			3
5	MCS-205	MOOC-II	-	3	-	3
PRACTICAL						
6	MCS-206	Java Lab	-	-	4	2
7	MCS-207	Seminar			4	2
TOTAL						**21**

THIRD SEMESTER (AUTUMN)

THEORY

SL. NO.	SUBJECT CODE	SUBJECT	L	T	P	CREDIT
1	MCS-301	Image Processing	3	-	-	3
2	MCS-302	Compiler Design	3	1	-	4
3	MCS-303	MOOC- III	-	3	-	3
4	MCS-304	MOOC-IV	-	3	-	3
5		Elective	3	-	-	3
PRACTICAL						
6	MCS-305	Image Processing Lab	-	-	4	2
7	MCS-306	Compiler Design Lab	-	-	4	2
TOTAL			-	-	-	**20**

FOURTH SEMESTER (SPRING)

THEORY						
SL. NO.	**SUBJECT CODE**	**SUBJECT**	**L**	**T**	**P**	**CREDIT**
1	MCS-401	Project Work	-	-	24	12
2	MCS-402	Comprehensive Viva	-		-	5
TOTAL			-	-	-	**17**

M.Sc.	1st Sem	2nd Sem	3rd Sem	4th Sem	Total Credits
Credits	22	21	20	17	80

ELECTIVES

ELECTIVE	
COURSE CODE	**COURSE**
MCS-307	Internet of Things

MCS-308	Mobile Computing
MCS-309	Data Mining
MCS-310	Computer Graphics
MCS-311	Blockchain Architecture
MCS-312	Formal Language and Automata Theory
MCS-313	Geographic Information System
MCS-314	Natural Language Processing
MCS-315	Organizational Behaviour
MCS-316	Graph Algorithm
MCS-317	Advanced Algorithm
MCS-318	Computer Vision
MCS-319	Cloud Computing

DETAILED SYLLABI

MCS101 THEORY OF COMPUTATION CREDITS-4

UNIT - I

Fundamentals& Finite Automata:

Alphabet, Strings, Language, Operations, Mathematical proving techniques, Finite state machine, Finite automaton model, Acceptance of strings and languages, Deterministic Finite Automaton (DFA) and Non deterministic Finite Automaton (NFA), Transition diagrams and Language recognizers, Equivalence of DFA and NFA, NFA to DFA conversion, NFA with € - transitions - Significance, acceptance of languages. Equivalence between NFA with and without € -transitions.

UNIT - II

Regular Expression and Languages:

Regular sets, Regular expressions, Constructing finite Automata for a given regular expression, Conversion of Finite Automata to Regular expressions, Regular grammars-right linear and left linear grammars, Equivalence between regular grammar, Regular expression and Finite State Automata, Pumping lemma of regular languages, closure properties of regular languages.

UNIT - III

Context Free Grammars and Push down Automata:

Context-Free Grammars, Leftmost and Rightmost derivations, Sentential Forms and Derivation Trees, Parsing and Membership, Parse Trees, Ambiguous Grammars, Simplification of Context-Free Grammars, Chomsky Normal Form, Greibach Normal Form, Pushdown Automata, Equivalence of PDA and Context-Free Grammars, Closure Properties of Context-Free Languages, Pumping Lemma for Context-Free Languages.

UNIT - IV

Turing Machines and other relevant Topics:
Turing Machines, Turing Machines as Language Accepters, Church-Turing hypothesis, Computable functions, recursively enumerable languages, Decidable, Undecidable and reducible problems, Efficiency of computation, Turing Machine and complexity, Language family and complexity classes, the complexity classes P and NP.

Books:

1. An Introduction to Formal Languages and Automata, 5th edition, Peter Linz, Jones & Bartlett Publishers, 2018.
2. Introduction to Automata Theory Languages and Computation, 3rd edition, J.E. Hopcroft, R Motwani and J.D. Ullman, Pearson Education, 2012.
3. Elements of the theory of computation, Lewis, 2nd edition, Harry R. and Christos H. Papadimitriou Prentice-Hall, Englewood, 1998.

COURSE OUTCOMES:

The students will be able to

CO1: Apply a number of proof techniques to theorems in language design.
CO2: Have a good knowledge of formal computational models and its relationship to formal Languages.
CO3: Present the theory of finite automata, as the first step towards learning advanced topics, such as compiler design.
CO4: Design and Implementation of FA, PDA and TM for various problems.
CO5: Be able to classify languages based on their type of grammars
CO6: Understand the basic concepts of complexity theory and limits of computation.

MCS102 DISCRETE MATHEMATICS CREDITS-4

UNIT I

Sets and Proposition

Basics: Finite and Infinite Sets, Combinations of Sets, Multisets, Venn Diagrams.

Propositional Logic: Propositions and Logical Operations, Functionally complete set of connectives, Well Formed Formulas, Laws of equivalence, Normal forms, Predicate calculus, Inference Theory.

Notion of Proof: Direct and Indirect Proof, Inductive proofs.

UNIT II

Relations and Functions, Counting Techniques

Relations: Properties of Relations, Matrices of relations, Closure operations on relations, Equivalence Relations, Computer Representation of Relations, Partial Ordering Relations and Lattices, Properties of Lattices, Hasse Diagram of partially ordered set.

Functions: Introduction to functions and its types, Function for Computer Science, Discrete numeric Functions, Composition of Functions, Invertible Functions, Recursive Functions, Generating functions.

Counting- Basics of Counting Techniques, Pigeonhole Principle, Generalized Permutations and Combinations, Recurrences Relations.

UNIT III

Graph Theory- Basic Concept of Graph Theory and Terminology, representation of Graphs, Bipartite, Regular, Planar and connected graphs, reachability and connectedness.

Matrix representation of graphs, Storage representation and manipulation of graphs, Euler graphs, Hamiltonian path and circuits, graph traversals, shortest path in weighted graphs, Graph Isomorphism and Homomorphism.

Trees: Introduction, Undirected Trees, Binary search trees, Spanning trees, Minimum spanning trees, Kruskal's Algorithm, Prim's Algorithm.

UNIT IV

Algebraic Structures: Definition, Properties, Types: Semi Groups, Monoid, Groups, Abelian group, Subgroup, cyclic groups, Factor group, Permutation groups, Normal subgroup, Cosets and Lagrange's Theorem, Homomorphism and Isomorphism of Groups.

Boolean Algebra: Boolean Functions, Representing Boolean Functions, Principal of Duality, Design and Implementation of Digital Networks, Karnaugh maps.

Coding Theory: Codes and Group-codes, Error detection and correction using Group codes, Hamming Code.

Books*:*

1. K. E. Rosen, “Discrete mathematics and its applications”, McGraw Hill International, 7th Edition, 2011.
2. T.Veerarajan," Discrete Mathematics “. Tata McGraw Hill,2012.
3. B. Kolman, R. C. Busby, S. Ross, “Discrete Mathematical Structures”, Prentice Hall of India, 6th. Edition, 2010.
4. S. Lipschutz, Discrete Mathematics, Tata McGraw Hill, 2nd. Edition, 2005
5. Richard Johnsonbough, “Discrete Mathematics”, Pearson Education, 8th. Edition, 2018.

COURSE OUTCOMES:

The students will be able to

CO1: Describe fundamental mathematical concepts and terminology.

CO2: Understand circuit design using Boolean algebra concepts.

CO3: Apply counting principles of different types of discrete structures.

CO4: Analysis of recursive definitions.

CO5: Evaluates the techniques for constructing mathematical proofs using examples.

CO6: Design solutions based on Graph Theory, Coding Theory and Group Theory.

MCS103 DATABASE MANAGEMENT SYSTEM CREDITS-4

UNIT - I

Database & Database users, Characteristic of the database, database systems, Concepts & Architecture, schemas & instances, Data independence, Database languages & interfaces. Relational Data models, Concepts & Relational database constraints, Database design using ER, EER to Relational mapping and Relational algebra.

UNIT - II

Functional Dependencies and its implication, closure rules, Normalization, Decomposition, synthesis approach, 3NF and BCNF, lossless join and dependency preserving decomposition, multi valued dependency & 4NF, Join dependency & 5NF.

UNIT - III

Basics of query processing, Processing of joins, materialized vs. pipelined processing, DB transactions, ACID properties, interleaved executions, schedules, serialisability, concept of database recovery and backup.

UNIT-IV

Concurrency control techniques, Locking and management of locks, 2PL, locking techniques deadlocks, Optimistic Concurrency control, Comparison of Concurrency control methods, XML and relational databases and big data concept.

Books:

1. R. Elmasri and S. B. Navathe, Fundamentals of Database Systems, Pearson Education, Inc., 7th Edition, 2015.
2. Silberschatz, H. F. Korth and S. Sudarshan, Database System Concepts, Tata McGraw-Hill, 6th Edition, 2011.
3. Rob, Coronel, "Database Systems", 7th Edition, Cengage Learning, 2006.

COURSE OUTCOMES:

The students will be able to

CO1: Define basic database concepts, role of a database management system including the structure and operation of the relational data model.

CO2: Compare simple and moderately advanced database queries using SQL and Relational Calculus.

CO3: Apply logical database design principles, including E-R diagrams and database normalization.

CO4: Analyze the concept of a database transaction and related database facilities, including concurrency control, journaling, backup and recovery, and data object locking and protocols.

CO5: Evaluate the performance of query processing in distributed database systems.

CO6: Design basic database storage structures & access techniques.

MCS104 ADVANCED OPERATING SYSTEMS CREDITS-3

UNIT-I

Introduction: Evolution of operating systems, Types of operating systems, Different views of the operating systems, Operating system concepts and structures.

Processes: The process concept, system programmer's view of processes. The operating system's view of processes, Operating system services for process management, scheduling algorithms, Performance evaluation.

Inter-process Communication and Synchronization: The need for inter-process synchronization, Mutual exclusion, Semaphores, Classical problems in concurrent programming, Critical region, Monitors.

Deadlock: Deadlock criteria, prevention, avoidance, detection and recovery algorithms.

UNIT-II

Distributed Operating Systems: Introduction; Architecture types; Issues – Global Knowledge, Naming, Scalability, Compatibility, Process Synchronization, Resource Management, Security, Structuring, Client-Server Computing model; Communication primitives – message passing, remote procedure calls, design issues in RPC.

UNIT-III

Clock Mechanism in Distributed OS: Introduction; Limitations of distributed system – absence of global clock and shared memory; Lamport's Logical Clocks; Vector Clocks; Causal Ordering of messages; Global State and Chandy-Lamport Global State Recording Algorithm; Cuts in a Distributed Computation.

Distributed Mutual Exclusion: Introduction; Classification of algorithms; Requirements of the algorithms; Simple solution; Non-token based algorithms – Lamport's algorithm; Ricart-Agrawala algorithm; Maekawa algorithm; Token-based algorithms – Suzuki-Kasami algorithm; Raymond's tree algorithm.

UNIT-IV

Agreement Protocols: Byzantine Agreement problem; Consensus problem; algorithms at a glance. Distributed shared memory; Failure Recovery and Fault Tolerance.

Books:

1. Silberschatz& Galvin, Operating system concepts, 9th Edition, Wiley, 2018.
2. D. M. Dhamdhere , Operating Systems a Concept Based Approach, 3rd Edition, McGraw Hill Education, 2017.
3. Mukesh Singhal and Niranjan G Shivaratri, "Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems," Tata McGraw-Hill, 2001.
4. Pradeep K. Sinha, Distributed operating systems: concepts and design. PHI Learning Pvt. Ltd., 1998.

COURSE OUTCOMES:

The students will be able to

CO1: Define fundamentals of Operating System.

CO2: Compare processes scheduling algorithms.

CO3: Apply the concepts of memory management, paging and virtual memory.

CO4: Analyze and discuss the policies of synchronization.

CO5: Evaluate the uses of system call.

CO6: Develop interaction techniques among the various components of computing system.

PRACTICALS

MCS106 ADVANCED OPERATING SYSTEMS LAB CREDITS-2

Processes: Basics of UNIX commands and Implementation of Shell Programming, Implementation of Process and thread (Life cycle of process), Implementation of CPU Scheduling. (i) FCFS, (ii) SJF, (iii) Shortest Remaining Time First and (iv) Priority based, (v) Round Robin (vi) Longest Job First and (vii) Longest Remaining Time First (LRTF), (viii) Highest Response Ratio Next (HRRN) and (ix) Multilevel Queue

Inter-process Communication and Synchronization: Producer-Consumer Problem using Semaphores and Reader Writer Problem

Deadlock: Simulate algorithm for deadlock prevention and detection, Simulate the algorithm for deadlock avoidance and study about deadlock recovery

Memory Management: Simulate memory allocation methods: (i) Best Fit, (ii) Worst Fit and (iii) Next Fit. Simulate page replacement algorithms: FIFO, LRU and Optimal

Disks: Implementation of Disk Scheduling using FCFS, SCAN, C-SCAN algorithm, LOOK, C-LOOK and SSTF algorithm

MCS107 DATABASE MANAGEMENT SYSTEM LAB CREDITS-2

Study features of a commercial RDBMS package such as Oracle and Structured Query Language (SQL).

Laboratory exercises should include defining schemes for the applications, creation of a database, writing SQL queries to retrieve and manipulate data from the database. Use of host language interface with embedded SQL.

SECOND SEMESTER

MCS201 ADVANCED COMPUTER NETWORKS CREDITS-4

UNIT - I

Introduction Concepts: Goals and Applications of Networks, Network structure and architecture, The OSI reference model, services, Network Topology Design - Delay Analysis, Back Bone Design, Local Access Network Design, Physical Layer Transmission Media, Switching methods, ISDN, Terminal Handling.

UNIT – II

Medium Access Sub Layer: Channel Allocations, LAN protocols, Overview of IEEE standards- FDDI. Data Link Layer - Elementary Data-Link Protocols, Sliding Window protocols, Error Handling. **Network Layer:** Point-to-Point Networks, routing, Congestion control, Internetworking-TCP / IP, IP packet, IP address, IPv4 & IPv6.

UNIT – III

TCP/IP Protocol Stack: TCP and UDP, Routing Protocols. **Transport and Session Layer:** Design issues, connection management, TCP - Window Management. remote procedure call. **Presentation Layer**: Design issues, Data compression techniques, cryptography. Application Layer: File Transfer, Access and Management, Electronic mail, Virtual Terminals, DHCP.

UNIT – IV

Software Defined Network -Comparison between SDN and traditional networks -SDN controller, Switch design, SDN Controller-Switch Protocols, Open Flow Protocol, Control Overhead & Handoff algorithms. Network Function Virtualization -NFV Architecture, Use cases, NFV Orchestration and NFV for 5G.

Books:

1. B. A. Forouzen, "Data Communication and Networking", 5th Edition, TMH, 2017
2. A.S. Tanenbaum, Computer Networks, 5th Edition, Pearson Education. 2013
3. W. Stallings, Data and Computer Communication, 8th Edition, Macmillan Press, 2017
4. Larry L. Peterson and Bruce S. Davie, Computer Networks: A System Approach, 5th Edition, Morgan Kaufmann Publishers, 2011
5. Goransson P, Black C, Culver T. Software Defined Networks: a Comprehensive Approach. Morgan Kaufmann; 2014.
6. Marschke D, Doyle J, Moyer P. Software Defined Networking (SDN): Anatomy of OpenFlow Volume 1. 2015.

COURSE OUTCOMES:

The students will be able to
CO1: Define fundamental concepts of computer networking.
CO2: Classify the basic taxonomy and terminology of computer networking.
CO3: Apply advanced networking concepts.
CO4: Analyze specific areas of networking such as the design and maintenance of individual networks.
CO5: Evaluate routes to create interconnect of nodes.
CO6: Design and implement the protocols used in computer networks.

MCS202 ADVANCED DATA STRUCTURES AND ALGORITHMS CREDITS-4

UNIT-I

Algorithms, Performance analysis- time complexity and space complexity, Asymptotic Notation-Big Oh, Omega and Theta notations, Complexity Analysis Examples. Data structures-Linear and non linear data structures, ADT concept, Linear List ADT, Array representation, Linked representation, Vector representation, singly linked lists -insertion, deletion, search operations, doubly linked lists-insertion, deletion operations, circular lists. Representation of single, two dimensional arrays, Sparse matrices and their representation.

UNIT-II

Priority Queues (Heaps) – Model, Simple implementations, Binary Heap: Structure Property, Heap Order Property, Basic Heap Operations: insert, delete, Percolate down, Other Heap Operations. Binomial Queues: Binomial Queue Structure, Binomial Queue Operations, Implementation of Binomial Queue, Priority Queues in the Standard Library.

UNIT-III

Searching–Linear and binary search methods, Hashing-Hash functions, Collision Resolution methods-Open Addressing, Chaining, HashSet, Hash table. Trees – AVL: Single Rotation, Double Rotation, B-Trees. Multi-way Search Trees – 2-3 Trees: Searching for an Element in a 2-3 Tree, Inserting a New Element in a 2-3 Tree, Deleting an Element from a 2-3 Tree. Red-Black Trees – Properties of red-black trees, Rotations, Insertion, Deletion.

UNIT-IV

Graphs Algorithms – Elementary Graph Algorithms: Topological sort, Single Source Shortest Path Algorithms: Dijkstra's, Bellman-Ford, All-Pairs Shortest Paths: Floyd-Warshall's Algorithm. Disjoint Sets – Equivalence relation, Basic Data Structure, Simple Union and Find algorithms, Smart Union and Path compression algorithm. String Matching – The naive string-matching algorithm, The Rabin-Karp algorithm, The Knuth-Morris-Pratt algorithm.

Books:

1. S. Sridhar, Design and Analysis of Algorithms, 1st Edition, Oxford, 2015.
2. T.H Coremen C. E. Leiserson, R. L. Rivest, Introduction to Algorithms, 3rd Edition, MIT Press, 2009.
3. E.HorwitzS.Sahani, S.Rajasekharn, Fundamentals of Computer Algorithms, 2nd Edition, University Press, 2008.
4. Michael T. Goodrich, Algorithm Design: Foundations, Analysis & Internet examples, 1st Edition, Wiley, 2001.
5. Advanced Data Structures, Reema Thareja, S. Rama Sree, Oxford University Press, 2018.

COURSE OUTCOMES:

The students will be able to

CO1: Explain different computational models, order notation and various complexity measures.

CO2: Compare the complexities of problem-solving techniques.

CO3: Apply the fundamental graph theory algorithms and to solve related problems.

CO4: Analyze efficient algorithms in common engineering design situations.

CO5: Evaluate the criteria and specifications of algorithmic design techniques.

CO6: Apply the concepts of advanced Trees and Graphs for solving problems effectively.

MCS203 OBJECT ORIENTED PROGRAMMING CREDITS-3

UNIT - I

OOPS Concept and Introduction to Java: OOP's concept, Programming Paradigm, Basics of Java, Data Types, Variables, Operators, Control Statements, Loops and Arrays.

Classes and Objects: Classes, Methods, Inner Classes, Packages, Strings, Inheritance & Polymorphism, Abstract class, Interfaces, Exception Handling, Java Collections.

UNIT - II

Java I/O: Input Stream, Output Stream, File Stream.

Multithreaded Programming: Multithreading concepts, Thread Life Cycle, Creating Multithreaded Application, Thread priorities, Thread synchronization.

Networking with Java: Networking basics, Sockets, port, java.net – networking classes and interfaces, Implementing TCP/IP based Server and Client, Datagrams – Datagram packet, Datagram server and client.

UNIT-III

Applets: Applet Architecture, Applet Life Cycle, adding images and sound to an applet, passing parameters to an applet, Creating Applet Application, Requesting repainting.

AWT & Event Handling: Layout Managers, Border layout, Flow layout, Grid layout, Card layout, AWT all components, Event delegation Model, Event source and handler, Event categories, Listeners, interfaces, Anonymous classes.

UNIT-IV

Swings: Model view Controller design pattern, Different layout, Menus, Dialog boxes, Text input etc.

Database Connectivity with JDBC: Java database connectivity, Types of JDBC drivers, writing first JDBC applications, Types of statement objects (Statement, Prepared Statement and Callable Statement), Types of Resultset, ResultSetmetadata, Inserting and updating records, JDBC and AWT, Connection pooling.

Books:

1. PatricNaughton, Herbert Schildt, Java 2 Complete Reference, 9th Edition, McGraw Hill Education, 2017
2. R. Nageswara Rao, Core Java: An Integrated Approach, 1st Edition, Dreamtech Press, 2016
3. Ivor Horton, Beginning Java, 7thEdition, Wiley, 2011
4. Core Java For Beginners, 3rd Edition, Vikash Publication, 2013
5. Jim Keogh, Complete Reference- J2EE, 1st Edition, McGraw Hill Education, 2017

COURSE OUTCOMES:

The students will be able to

CO1: Describe the differences between object-oriented programming and procedural programming.

CO2: Understand the fundamental concepts of object oriented programming.

CO3: Apply the advanced concept of object-oriented programming such as inheritance and polymorphism.

CO4: Analyze the additional features of JAVA that are not available in function oriented programming languages such as exceptional handling, Interface, etc.

CO5: Evaluate the functionalities like Multithreading and Networking with JAVA.

CO6: Develop small scale projects using AWT, swings and JDBC.

MCS204 ARTIFICIAL INTELLIGENCE CREDITS-3

UNIT-I

Introduction: The Foundations of Artificial Intelligence, The History of Artificial Intelligence and the State of the Art.

Agents and Environments: Introduction, Types of agents, Structure of Intelligent Agents and Rational Agents Environments.

UNIT-II

Solving Problems by Searching: Problem-solving Agents, Formulating Problems, Example Problems, and Searching for solutions, Search Strategies, Avoiding Repeated States.

Uninformed Search Strategies: (BFS, DFS, DLS, IDDFS, Bidirectional Search**).**

Informed Search Methods: Best-First Search, Heuristic Functions, A* search and Iterative Improvement Algorithms.

UNIT-III

Constraint Satisfaction Problems: Constraint Satisfaction Problems; Backtracking search for CSPs; Local search for CSPs.

Adversarial Search: Games, Optimal Decisions in Games, Alpha-Beta pruning.

Agents that Reason Logically: A Knowledge-based Agent, The Wumpus World Environment, Representation, Reasoning and Logic, Propositional Logic: A very simple logic, an agent for the Wumpus World.

First-Order Logic: Syntax and Semantics, Extensions and Variations, Using First Order Logic, Logical Agents for the Wumpus World.

UNIT-IV

Neural Network: -Learning in Neural and Belief Networks, How the Brain Works, Neural Network Perceptions. Multi-layered feed forward Networks, Back Propagation algorithm, Applications of Neural Networks.

Genetic Algorithms: Introduction, encoding, fitness function, reproduction operators, genetic modelling, genetic operators, crossover, single site crossover. two-point crossover, multi point crossover, uniform crossover.

Planning: A simple planning agent form problem solving to planning, planning in situation calculus. Basic representations for planning. A partial-order planning example, A partial order planning algorithm.

Books:

1. S.J. Russell & P. Norvig, Artificial Intelligence: A modern Approach, 4th edition, Pearson, 2022.
2. P.H Winston, Artificial Intelligence, 3rd edition, Addison Wesley, 2011.
3. E Rich &K Knight, Artificial Intelligence, McGraw Hill Education; 3rd Edition, 2017.
4. Nils J. Nilsson, Artificial Intelligence: A new Synthesis, 1stEdition, Elsevier, 1997.

COURSE OUTCOMES:

The students will be able to

CO1: Describe the key components of the artificial intelligence (AI) field

CO2: Explain search strategies and solve problems by applying a suitable search method

CO3: Apply artificial intelligence techniques, including search heuristics, knowledge representation, planning and reasoning

CO4: Analyse and apply probability theorem, Bayesian networks, knowledge representation.

CO5: Describe and list the key aspects of planning in artificial intelligence

CO6: Design and implement appropriate solutions for search problems and for planning problems

PRACTICALS

MSC206 JAVA LAB CREDITS-2

Introduction: An overview of JAVA program, data types, variable and arrays, operators, control statements.

Classes& Objects: The general form of a class, declaring objects, assigning object reference variables, methods, constructors.

Inheritance: Inheritance basics, member access and inheritance, using super to call super class constructors. Creating a multilevel hierarchy, method overriding, dynamic method dispatch, using abstract classes, using final with inheritance.

Packages: Defining a package, finding packages and CLASSPATH, access protection, importing packages.

Interfaces: Defining an interface, implementing interfaces, applying interfaces, variables in interfaces, use static methods in an interface.

Exception Handling: Exception-Handling Fundamentals, Exception Types.

I/O Basics: Streams, reading console input, writing console output, reading and writing files.

Multithreaded Programming: The java thread model, creating a thread, creating multiple threads.

Applet: Applet fundamentals, the applet class, applet architecture, applet initialization and termination.

AWT: Introducing the AWT, working with windows, graphics, and text.

JDBC: Introduction to JDBC, Drivers Types, JDBC Objects, SQL query objects.

THIRD SEMESTER

MCS301 IMAGE PROCESSING CREDITS-3

Unit I

Light, Brightness, Pixels, coordinate transformation,Perspective Projection, filtering and noise concept , sampling and quantization.

Unit II

Spatial Domain,Gray Level Transformation,Histogram Equalisation,Basics of Spatial Filtering,Frequency Domain,2D Fourier Transform,Basics of Frequency Domain Filtering,Color Models(RGB,CMY,HSV)

Unit III

Noise,Types of Noise.Filters associated with Noise, Basics of Image Segmentation, Edge Detection,Morphological Image Processing(Dilation,Erosion,Opening,Closing)

Unit IV

Compression, Types of compression, Image Compression Models, Lossy Compression, Image Compression Standards

Books

1.Fundamentals of Digital Image Processing By Anil K Jain.
2.Digital Image Processing By Gonzalez and Woods

Outcome:

CO1: Review the fundamental concepts of a digital image processing system
CO2: Analyze images in the frequency domain using various transforms
CO3: Evaluate the techniques for image enhancement and image restoration.
CO4: Categorize various compression techniques.
CO5: Interpret Image compression standards.
CO6: Interpret image segmentation and representation techniques.

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MCS302 COMPILER DESIGN CREDITS-4

UNIT - I

Introduction to Compilers: Structure of a compiler, Lexical Analysis, Role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, Lex, Finite Automata, Regular Expressions to Automata, Minimizing DFA.

UNIT - II

Syntax Analysis: Role of Parser, Grammars, Error Handling, Context-free grammars, Writing a grammar, Top Down Parsing, General Strategies Recursive Descent Parser Predictive Parser-LL(1), Parser-Shift Reduce Parser, LR Parser, LR (0), Item Construction of SLR Parsing Table, Introduction to LALR Parser, Error Handling and Recovery in Syntax Analyzer, YACC.

UNIT - III

Intermediate Code Generation: Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking.

UNIT - IV

Run-Time Environment and Code Generation: Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management, Issues in Code Generation, Design of a simple Code Generator.

Code Optimization: Principal Sources of Optimization, Peep-hole optimization, DAG- Optimization ofBasic Blocks, Global Data Flow Analysis, Efficient Data Flow Algorithm.

Books:

1. Alfred Aho, Jeffry O. Ullman, "Compilers: Principles Techniques and Tool", 2nd Edition, Pearson, 2013.
2. V. Raghavan, Principles of Compiler Design, 2nd Mc-Graw Hill, 2017.
3. C. N. Fischer and R. J. LeBlanc, "Crafting a compiler with C", 2ndEdition Benjamin Cummings, 2008.
4. J.P. Bennet, "Introduction to Compiler Techniques", 2ndEdition, McGraw-Hill, 2003.

COURSE OUTCOMES:

The students will be able to

CO1: Understanding of how the different phases of compiler work.

CO2: Study of lexical analysis, and various parsing techniques.

CO3: Understand the concept of intermediate code generation technique.

CO4: Analyze code optimization technique and fundamental of runtime environment.

CO5: Illustrate the concept of storage management.

CO6: Design and implement a simple compiler for a hypothetical machine using syntax directed translation.

MCS305 **IMAGE PROCESSING LAB** **CREDITS-2**

Following are the topics to be carried out by students using MATLAB to understand and implement the flavor of image processing.

- Image display, Image histogram, Histogram equalization
- Translation, Rotation and Scaling of an image
- Color model
- Spatial Domain
- Frequency Domain
- Filtering
- Morphological Image Processing
- Compression

MCS306 **COMPILER DESIGN LAB** **CREDITS-2**

Introduction to Compilers: Scan and Count the number of characters, words, and lines in a file**,** implement NFAs that recognize identifiers, constants, and operators of the mini language, lexical analyzer for the given language

Syntax Analysis: Designing Parser-LL(1), Parser-Shift Reduce Parser, LR Parser, LR (0), Item Construction of SLR Parsing Table, Introduction to LALR Parser

Intermediate Code Generation: Convert the BNF rules into YACC form, Code to generate abstract syntax tree, program to generate machine code from the abstract syntax tree generated by the parser.

ELECTIVE

MCS307 INTERNET OF THINGS CREDITS-3

UNIT - I

Introduction to Internet of Things: Definition & Characteristics of IoT, Physical Design of IoT, Things, Protocols, Logical Design of IoT, Functional Blocks, Communication Models, Communication APIs.
IoT Enabling Technologies: WSN, Cloud Computing, Big Data Analytics, Embedded Systems, IoT Levels (1 to 6) & Deployment Templates.

UNIT - II

Prototyping: Thinking About Prototyping: Sketching, Familiarity, Costs versus Ease of Prototyping, Prototypes and Production, Open Source versus Closed Source, Tapping into the Community. Prototyping Embedded Devices: Electronics, Embedded Computing Basics, Developing on the Arduino, Raspberry Pi, Beaglebone Black, Electric Imp, Mobile Phone and Tablets, Plug Computing: Always-on Internet of Things. Prototyping the Physical Design: Preparation, Sketch, Iterate, and Explore, Non-digital Methods, Laser Cutting, 3D Printing, CNC Milling, Repurposing/Recycling. Prototyping Online Components: Getting Started with an API, Writing a New API, Real-Time Reactions and other Protocols.

UNIT – III

Domain Specific IoTs: Home Automation, Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, Smart Cities: Parking, Lighting, Smart Roads. Structural Health Monitoring, Surveillance, Emergency Response. Environment: Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection, River Floods Detection. Energy: Smart Grids, Renewable Energy Systems. Retail: Inventory Management, Smart Payments, Smart Vending Machines. Logistics: Route Generation & Scheduling, Fleet Tracking, Shipment Monitoring, Remote Vehicle Diagnostics. Agriculture: Smart Irrigation, Green House Control. Industry: Machine Diagnosis & Prognosis, Indoor Air Quality Monitoring, Health & Lifestyle Health & Fitness Monitoring, Wearable Electronics.

UNIT - IV

IoT and M2M: Introduction, Difference between IoT and M2M. SDN and NFV for IoT, Software Defined Networking, Network Function Virtualization. DEVELOPING INTERNET OF THINGS: IoT Platforms Design Methodology, Purpose & Requirements Specification, Process Specification, Domain Model, Information Model, Service Specifications, Functional View, Operational View, Specification, Device & Component Integration, Application Development.

Books:

1. Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-On Approach, 1st edition, Universities Press, 2015.
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
3. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-onApproach)", 1st Edition, VPT, 2014.

4. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013.

Course Outcomes: After successful completion of this course, student will be able to

CO1: Understand general concepts of Internet of Things (IoT) (Understand)

CO2: Recognize various devices, sensors and applications (Knowledge)

CO3: Apply design concept to IoT solutions (Apply)

CO4: Analyze various M2M and IoT architectures (Analyze)

CO5: Evaluate design issues in IoT applications (Evaluate)

CO6: Create IoT solutions using sensors, actuators and Devices (Create)

MCS308 MOBILE COMPUTING CREDITS-3

UNIT-I

Introduction to Mobile Communications and Computing: Applications of Mobile Computing, Generations of Mobile Communication Technologies.

(Wireless) Medium Access Control: Motivation for a specialized MAC (Hidden and Exposed terminals, Near and Far terminals), SDMA, FDMA, TDMA, CDMA. Spreading Techniques.

UNIT-II

Cellular Systems: GSM, Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security and new data services, General Packet Radio Service (GPRS), EDGE, Universal Mobile Telecommunication System (UMTS). Next Generation Networks – Orthogonal Frequency Division Multiplexing (OFDM), LTE – Architecture & Interface – LTE radio planning, 5G Architecture, MIMO Satellite Communications Systems.

UNIT-III

Wireless LAN: IEEE 802.11 - Architecture – Services – MAC – Physical layer – IEEE 802.11a - 802.11b/g/n - 802.11AC/AD/AX standards – HIPERLAN – Bluetooth, ZigBee, RFID.

Mobile Network Layer: Mobile IP -Goals, assumptions, Entities and terminology, IP packet delivery, Agent Advertisement and Discovery, Registration, Tunnelling and Encapsulation.

Mobile Ad hoc Networks (MANETs): Properties of a MANET, Routing and various routing algorithms, Dynamic Source Routing (DSR), Vehicular Ad Hoc networks (VANET) – MANET Vs VANET.

UNIT-IV

Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/ fast recovery, Transmission /time-out freezing, Selective Retransmission, Transaction oriented TCP.

Protocols and Tools: Wireless Application Protocol-WAP Architecture, Mobile Device Operating Systems: iOS, Android, BlackBerry, Security.

Books:

1. Jochen Schiller, Mobile Communications, Pearson Education; 2nd edition, 2014
2. UpenaDalal, Wireless communication & networks, 1st edition, Oxford University Press, 2014
3. Kumkum Garg, Mobile Computing, Pearson Education India, 2010
4. GottapuSasibhushana Rao, Cellular Mobile Communication, 1st edition, Pearson Education India, 2012
5. Reza Behravanfar, Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML, 1st edition, Cambridge University Press, 2004

COURSE OUTCOMES:

The students will be able to

CO1: Identify the limitations of fixed networks.

CO2: Understand the network infrastructure requirements to support mobile devices and users.

CO3: Relate the different wireless technologies such as CDMA, GSM, GPRS, LTE, etc.

CO4: Compare the protocols and architectures employed in wireless local area networks and cellular

networks.

CO5: Evaluate the techniques to design and develop a simple mobile application for smaller devices.

CO6: Design solutions using mobile computing techniques.

MCS309 DATA MINING CREDITS-3

UNIT - I

Introduction to Data Mining: Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Major issues in Data Mining. Data

Preprocessing: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

UNIT - II

Data Warehouse and OLAP Technology for Data Mining: Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse implementation, Development of Data Cube Technology, From Data Warehousing to Data Mining Data Cube Computation and Data Generalization, Efficient Methods for Data Cube Computation.

Mining Association Rules: Mining Frequent Patterns, Associations and Correlations: Basic Concepts, Efficient and Scalable Frequent Item set Mining Methods, Mining various kinds of Association Rules, From Association Mining to Correlation Analysis, Constraint-Based aassociation Mining.

UNIT -III

Classification and Prediction: Issues Regarding Classification and Prediction, Classification

by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, Prediction, Accuracy and Error measures, Evaluating the accuracy of a Classifier or a Predictor, Ensemble Methods.

UNIT-IV

Cluster Analysis: Introduction, Types of Data in Cluster Analysis, A Categorization of Major

Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint-Based Cluster Analysis, and Outlier Analysis.

Books:

1. J. Han and M. Kamber. Data Mining: Concepts and Techniques, 3rd Ed. Morgan Kaufman.
2. M. H. Dunham. Data Mining: Introductory and Advanced Topics. 1st edition, Pearson Education. 2001.
3. P.Tan, M.Steinbach and V.Kumar,Introduction to Data Mining–Pearson Education, 1st edition, 2005.

COURSE OUTCOMES:

The students will be able to

CO1: Fundamentals of data mining Functionalities, Classification, major issues in Data Mining.
CO2: Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment.

CO3: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization .
CO4: Mining Frequent Patterns, Associations and Correlations
CO5: Different Classification Methods and evaluating the accuracy of a Classifier or a Predictor
CO6: Major Clustering Methods, Clustering High-Dimensional Data and Outlier Analysis

MSCS310 COMPUTER GRAPHICS CREDITS-3

UNIT-I

Introduction to Computer Graphics: Image Processing and their applications, Raster-Scan System, Random-Scan Systems. Graphics Primitives: Points and Lines, Line-Drawing Algorithms: DDA and Bresenham's Line Algorithm. Circle-Generating Algorithms: Midpoint Circle Algorithm, Bresenham's Circle Algorithm. Ellipse-Generating Algorithm: Midpoint Ellipse Algorithm. Region Filling Algorithms: Seed Fill: Boundary-Fill Algorithm, Flood-fill Algorithm, Scan-Line Polygon Fill Algorithm.

UNIT-II

Two-Dimensional Geometric Transformations: Translation, Rotation, Scaling, Matrix Representations and Homogeneous Coordinates, Composite Transformations, Inverse transformations, General Pivot-Point Rotation, General Fixed-Point Scaling, General Composite Transformations. Other Transformations: Reflection, Shear.

Two-Dimensional Viewing and Clipping: The Viewing Pipeline, Viewing Coordinate Reference Frame, Window-to viewport Coordinate transformation, Clipping Operations: Point Clipping, Line Clipping: Cohen-Sutherland Line Clipping, Liang-Barsky Line Clipping. Polygon Clipping: Sutherland-Hodgeman Polygon Clipping.

UNIT-III

Three-Dimensional Concepts and Object Representation: Three-Dimensional Transformations: Translation, Rotation, Scaling and their Matrix Representations. Three-Dimensional Display Methods: Parallel Projection, Perspective Projection and their types. Polygon surfaces, quadric surfaces.

Curves and Surfaces: Parametric representation of curves: Bezier curves, B-spline curves. Parametric representation of surfaces; Interpolation method.

Basic Illumination models, polygon rendering methods. Basic Models, Displaying Light Intensities, halftone patterns and Dithering Techniques. Classification, back-face detection, depth-buffer, scan-line, depth sorting, BSP-tree methods, area subdivision and octree methods. Rendering: Polygon Rendering Methods, Gouraud shading and Phong Shading.

UNIT-IV

Intuitive colour concepts: RGB, YIQ, CMY, HSV and HLS colour model, Colour selection. Design of Animation Sequence, general computer animation functions, Raster Animation, computer animation languages, key frame systems, motion specifications.

Books:

1. D. Hearn, M.P. Baker, Computer Graphics C Version, 4th Edition, Pearson Education, 2013
2. Hearn, Baker, Computer Graphics with OpenGL, 4thEdition, Pearson Education, 2013.
3. Rajesh K. Maurya, Computer Graphics with Virtual Reality Systems, Wiley; Second edition, 2014.
4. J.D.Foley, V.Dam, S.K.Feiner, J.F.Huges - Computer Graphics Principles Practice, 2nd Edition, Pearson Education, 2002.
5. D. Rogers, Mathematical Elements of Computer Graphics, 2nd Edition, McGraw Hill Education, 2017.

COURSE OUTCOMES:

The students will be able to

CO1: Explain the core concepts of computer graphics.

CO2: Understand a typical graphics pipeline.

CO3: Apply various algorithms to scan convert the basic geometrical primitives, transformations, area filling, clipping.

CO4: Analyze the importance of viewing and projections in both 2D and 3D.

CO5: Evaluate the various factors of color and shading.

CO6: Design animations using related technologies.

MSCS311 BLOCK CHAIN TECHNOLOGY CREDITS-3

UNIT-I

Introduction of Cryptography and Blockchain: What is Blockchain, Blockchain Technology Mechanisms & Networks, Blockchain Origins, Objective of Blockchain, Blockchain Challenges, Transactions And Blocks, P2P Systems, Keys As Identity, Digital Signatures, Hashing, and public key cryptosystems, private vs. public Blockchain.

UNIT-II

BitCoin and Cryptocurrency: What is Bitcoin, The Bitcoin Network, The Bitcoin Mining Process, Mining Developments, Bitcoin Wallets, Decentralization and Hard Forks, Ethereum Virtual Machine (EVM), Merkle Tree, Double-Spend Problem, Blockchain and Digital Currency, Transactional Blocks, Impact of Blockchain Technology on Cryptocurrency.

UNIT-III

Introduction to Ethereum: What is Ethereum, Introduction to Ethereum, Consensus Mechanisms, How Smart Contracts Work, Metamask Setup, Ethereum Accounts, Receiving Ether's What's a Transaction?, Smart Contracts.

Introduction to Hyperledger: What is Hyperledger? Distributed Ledger Technology & its Challenges, Hyperledger & Distributed Ledger Technology, Hyperledger Fabric, Hyperledger Composer.

UNIT-IV

Solidity Programming: Solidity - Language of Smart Contracts, Installing Solidity & Ethereum Wallet, Basics of Solidity, Layout of a Solidity Source File & Structure of Smart Contracts, General Value Types (Int, Real, String, Bytes, Arrays, Mapping, Enum, address)

Blockchain Applications: Internet of Things, Medical Record Management System, Domain Name Service and Future of Blockchain, Alt Coins.

Books:

1. Imran Bashir, Mastering Blockchain, 2nd edition, Packt Publishing, 2018.
2. Melanie Swan, Blockchain – Blueprint for a new Economy, 2nd edition, OReilly, 2018.
3. A. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies, O'Reilly
4. Kevin Werbach, The Blockchain and the new architecture of Trust, 2nd edition, MIT Press, 2018.
5. Joseph J. Bambara and Paul R. Allen, Blockchain – A practical guide to developing business, law, and technology solutions, 2nd edition, McGraw Hill, 2018.

COURSE OUTCOMES:

The students will be able to

CO1: Familiarized with Blockchain Terminology.

CO2: Understand the concept of Blockchain, Bitcoin.

CO3: Understand de-centralization.

CO4: Gain knowledge about the domain of blockchain in real time.

CO5: Basic knowledge of Bitcoin, Ethereum and Hyperledger fabric.

CO6: Design and Implementation of case study based Distributed Applications.

MSCS312 FORMAL LANGUAGE AND AUTOMATA THEORY CREDITS-3

UNIT-I

Automata and Language Theory: Overview of Theoretical Computer Science (including computationally intractable problems) , Introduction to System software including various phases / Modules in the design of a typical compiler , Chomsky Classification, Finite Automata, Deterministic Finite Automata (DFA), Non-Deterministic Finite Automata (NFA),statement of Kleen's Theorem, Regular Expressions, Equivalence of DFAs, NFAs.

UNIT-II

Regular Expressions, Closure properties of Regular Language, Non-Regular Languages, Pumping Lemma, Use of Regular expressions in the Design of scanner (lexical analyzer)

UNIT-III

Context Free Languages: Context Free Grammar (CFG), Parse Trees, Push Down Automata (deterministic and nondeterministic) (PDA), Equivalence of CFGs and PDAs, Closure properties of CFLs, Pumping Lemma.

UNIT-IV

Turing Machines and Computability Theory: Definition of Turing Machine, Extensions of Turing machines, Non – deterministic Turing machines, Church – Turing Thesis, Decidability, Halting Problem.

Books:

1. M. Sipser, ―Introduction to the Theory of Computation, 3rd edition, Cengage Publication, 2014.
2. J. Hopcroft, R. Motwani, and J. Ullman, ―Introduction to Automata Theory, Language and Computation,3rd edition, Pearson Publication, 2008.
3. H.S. Behera, J. Nayak, H. Pattanayak, ‖Formal Languages and Automata Theory" 1st edition, Vikas Publication, 2008.

COURSE OUTCOME:

CO1: Express the overview of the theoretical foundation of computer science from the perspective of formal languages.
CO2: Demonstrate regular language and expression in the context of computation and Compiler. Define and design the deterministic and nondeterministic machines.
CO3: Demonstrate and design push down automata and context free language. .
CO4: Define the concept of Turing machine and able to design Turing machine for various languages.
CO5: Analyze the complexity classes, decidability, enumerable language, post Correspondence problem and associated concepts.

MSCS313 GEOGRAPHIC INFORMATION SYSTEM CREDITS-3

UNIT I

Fundamentals of GIS: Introduction to GIS - Basic spatial concepts - Coordinate Systems - GIS and Information Systems – Definitions – History of GIS - Components of GIS – Hardware, Software, Data, People, Methods – Proprietary and open source GIS Software – ArcGIS and Quantum GIS, Types of data – Spatial, Attribute data- types of attributes – scales/ levels of measurements.

UNIT II

Spatial Data Models: Database Structures – Relational, Object Oriented – ER diagram - spatial data models – Raster Data Structures – Raster Data Compression - Vector Data Structures - Raster vs Vector Models- TIN and GRID data models - OGC standards – Spatial Database-Spatial Data Infrastructure-Data Quality, Data interoperability.

UNIT III

Data Input and Topology: Scanner - Raster Data Input – Raster Data File Formats – Vector Data Input –Digitiser –Topology - Adjacency, connectivity, and containment – Topological Consistency rules – Attribute Data linking – ODBC – GPS - Concept GPS based mapping.

UNIT IV

Data Analysis and Web GIS: Vector Data Analysis tools - Data Analysis tools - Network Analysis - Digital Education models - 3D data collection and utilisation. Introduction to Web GIS, OGC Standards and services, Geospatial SOA, Introduction to Spatial Cloud Computing. **GIS Applications:** GIS Applicant - Natural Resource Management – Vehicle tracking and fleet management- Disaster Management System-Engineering - Navigation - Marketing and Business applications - Case studies.

Books:

1. Chang, Kang-Tsung. Introduction to geographic information systems.: McGraw-Hill, 9th Edition, 2019.
2. Ian, Heywood. An introduction to geographical information systems. 2nd edition, Pearson Education India, 2010.
3. Yang, Chaowei, and Qunying Huang." Spatial cloud computing: a practical approach". 2nd edition, CRC Press, 2013.

COURSE OUTCOMES:

CO1: Understand the foundations of geographic information systems (GIS).

CO2: Illustrate the concept and types of geospatial data models.

CO3: Acquire knowledge of data intake and topology.

CO4: Learn about geospatial data management functions and geospatial data output.

CO5: Process spatial and attribute data and prepare thematic maps.

CO6: Develop and find solutions to geographical challenges.

MSCS314 NATURAL LANGUAGE PROCESSING CREDITS-3

UNIT - I

Introduction: Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

UNIT - II

Word Level Analysis : Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

UNIT - III

Syntactic Analysis : Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.

UNIT - IV

Semantics and Pragmatics: Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

Books:

1. Daniel Jurafsky, James H. Martin, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition, 2 edition, Pearson, 2013.
2. Steven Bird , Ewan Klein, Natural Language Processing with Python: Analysing Text with the Natural Language Toolkit, 1st edition, SPD, 2011.
3. Manning, C. D. and H. Schutze, Foundations of Statistical Natural Language Processing, 1st edition, The MIT Press, 1999

COURSE OUTCOMES:

The students will be able to

CO1: Demonstrate a given text with basic Language features.

CO2: Explain a rule-based system to tackle morphology/syntax of a language.

CO3: Distinguish different Models & Tagging.

CO4: Design a tag set to be used for statistical processing for real-time applications.

CO5: Compare and contrast the use of different statistical approaches for different types of NLP applications.

CO6: Design an innovative application using NLP components.

MSCS315 ORGANIZATIONAL BEHAVIOUR CREDITS-3

Unit I:

Meaning, Fundamental concepts, Definition, Approaches to OB, Characteristics and limitationsof OB, Challenges and Opportunities of OB, Models of OB. Personality: Definition, Features, Big five model, MBTI, Johari Window, Managerial Implications of Personality. Perceptions and Attributions: Definition, Features, factors affecting perception, Process. Attribution, perceptual and attribution errors, Managerial Implications of Perception.

Unit II:

Learning: Definition, Features, Classical and operant conditioning, social learning theory, Behavioral modification. Attitude: Definition, Features, ABC model of Attitude, Managerial Implications of Attitude. Motivation: Concept, Definition, Features, Types of Motivation, Process, Managerial Implications of Motivation. Leadership: Concept, Definition, Leadership Styles, Transactional and Transformational Leadership, Leadership development.

Unit III

Groups and Teams: Definition, Features, Group development stages, Group vs. Teams, Managing and developing effective teams. Conflict Management: Definition, Features, Typesof Conflict, Conflict Resolution Strategies, Relationship between Conflict and Performance.

Unit IV

Organizational Culture: Elements and dimensions of organizational culture, Importance of organizational culture in shaping the behaviour of people. Organizational Change: Understanding the issues and managing change, Approaches to organizational change.

Books

1. Robbins, S. P., & Judge, T. Organizational behaviour, 15th edition, Boston: pearson, 2013.
2. Newstrom J. W., & Davis, K. Human behavior at work 15th edition, Tata McGraw Hill. 2011.
3. Pareek. U. Understanding Organizational Behaviour. 2nd edition, Oxford University Press, 2010.
4. Schermerhorn, J. R., Osborn, R.N., Hunt, M.U.J (2016). Organizational Behaviour, 12th edition, Wiley, 2016.

COURSE OUTCOMES

CO1: Demonstrate the applicability of the concept of organizational behaviour to understand the behaviour of people in the organization.

CO2: Demonstrate the applicability of analyzing the complexities associated with management of individual behaviour in the organization.

CO3: Analyze the complexities associated with management of the group behaviour in the organization.

CO4: Demonstrate how the organizational behaviour can integrate in understanding the motivation (why) behind behaviour of people in the organization.

CO5: Human aspects are critical in each functional aspects of management

CO6: Describe how people behave under different conditions and understand why people behave as they do.

MSCS316 GRAPH ALGORITHM CREDITS-3

UNIT - I

Introduction to Graphs: Definition and basic concepts, Efficient representations of Graphs, graphs as models, matrices and isomorphism, decomposition and special graphs, Paths, Cycles and Trails, Bipartite graphs, Eulerian circuit, Vertex degrees and counting, directed graphs

UNIT - II

Graph Searching: DFS and BFS; Application of Graph Searching: finding connected components, bi-connected components, testing for bipartite graphs, finding cycle in graph. **Trees:** Different MST algorithms, enumeration of all spanning trees of a graph; Paths and Distance in Graphs: Single source shortest path problem, All pairs shortest path problem, center and median of a graph, activity digraph and critical path;

UNIT -III

Hamiltonian Graphs: sufficient conditions for Hamiltonian graphs, traveling Salesman problem; Eulerian Graphs: characterization of Eulerian graphs, construction of Eulerian tour, The Chinese Postman problem; Planar Graphs: properties of planar graphs, a planarity testing algorithms

UNIT-IV

Graph Coloring: vertex coloring, chromatic polynomials, edge coloring, planar graph coloring; Matching: maximum matching in bipartite graphs, maximum matching in general graphs; Networks: The Max-flow min-cut theorem, max-flow algorithm; NP-Complete Graph problems; Approximation algorithms for some NP-Hard graph problems; Algorithms for some NP-Hard graph problems on special graph classes

Books:

1. D.B. West, Introduction to Graph Theory, 2nd Edition, PHI 2002.
2. G. Chatrand and O.R. Oellermann, Applied and algorithmic Graph Theory, 1st edition, McGraw – Hill, Inc. 1993.
3. M C Golumbic, Algorithmic Graph Theory and Perfect Graphs, Volume 57 in the series Annals of Discrete Mathematics. , 2nd edition , North Holland, 2004.
4. Cormen, Leiserson, Rivest, and Stein, Introductions to Algorithms, PHI, 2nd edition, 2002.

COURSE OUTCOMES:

The students will be able to

CO1: To understand and apply the fundamental concepts in graph theory

CO2: The course aims at presenting a rigorous introduction to graph algorithms

CO3: To apply graph theory based tools in solving practical problems

CO4: To find the approximation algorithms for graph NP-complete problems.

CO5: To formally describe an algorithm and estimate its complexity

CO6: To apply principles and concepts of graph theory in practical situations

MSCS317 ADVANCED ALGORITHM CREDITS-3

UNIT - I

Analysis Techniques: Growth functions, Recurrences and solution of recurrence equations;
String Matching: Naive String Matching, Rabin-Karp algorithm, matching with finite Automata, Knuth-Morris – Pratt algorithm.

UNIT - II

Number Theoretic Algorithms: Elementary notions, GCD, Modular arithmetic, Solving modular linear equations, The Chinese remainder theorem, Powers of an element RSA Cryptosystem, Primality testing, Integer factorization

UNIT -III

DFT and FFT efficient implementation of FFT, Graph Algorithms, Bellman-Ford Algorithm Shortest paths in a DAG, Johnson's Algorithm for sparse graphs, Flow networks and the Ford-Fulkerson Algorithm, Maximum bipartite matching.

Linear Programming: Formulating problems as linear programming, simplex algorithm, duality, Solving system of linear Equations.

UNIT-IV

Computational Geometry: Line segment properties, Clipping: Cyrus-Beck and Sutherland-Hodman Algorithms; Determining any pair of segment intersects, Convex hulls, Gift wrapping and Graham Scan; Removing hidden surfaces

NP-completeness: Examples, proof of NP-hardness,and NP-completeness.

Books:

1. Kleinberg and Tardos, Algorithm Design, 1st edition, Pearson Education, 2013.
2. Gilles Brassard and Paul Bratley, Fundamentals of Algorithms, 1st edition, Pearson Education, 1995.
3. Cormen, Leiserson, Rivest, and Stein, Introductions to Algorithms, PHI, 2nd edition, 2002.

COURSE OUTCOMES:

The students will be able to

CO1: to design and analyze programming problem statements.

CO2: to choose appropriate data structures and algorithms, understand the ADT/libraries, and use it to design algorithms for a specific problem.

CO3: to describe major algorithmic techniques (divide-and-conquer, greedy, dynamic programming, Brute Force, Transform and Conquer approaches) and mention problems for which each technique is appropriate.

CO4: to describes how to evaluate and compare different algorithms using worst-case, average-case and best-case analysis.

CO5: to come up with analysis of efficiency and proofs of correctness.

CO6: to comprehend and select algorithm design approaches in a problem specific manner.

MSCS318 COMPUTER VISION CREDITS-3

UNIT-1

The image, its representations and properties: Image representations a few concepts, Image digitization, Digital image properties, Colour images, Cameras: an overview. Mathematical and physical background – Linear integral transforms, Images as stochastic processes, Image formation physics.

UNIT-2

Data structures for image analysis: levels of image data representation, traditional image data structures, and Hierarchical data structures. Image understanding-fitting via random sample consensus, point distribution model

UNIT-3

Segmentation II: Mean Shift Segmentation , Active contour models – snakes, Geometric deformable model – level sets and geodesic active contours, Fuzzy connectivity, Towards 3D graph – based image segmentation, Graph cut segmentation

UNIT-4

3 D Vision Geometry: 3 D Vision tasks, basics of projective geometry, A Single perspective camera, Scene reconstruction from multiple views, two camera stereopsis, Use of 3D vision Shape from X, Full 3D objects, 3D model-based vision, 2D view based representations of a 3D scene.

BOOKS

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, ”Digital Image Processing and Computer Vision” Cengage Learning, 1st Edition, 2008
2. Gonzales Woods, Digital image processing, 3rd Edition, Pearson Education, 2007.
3. Anil K. Jain, Fundamental of Digital Image Processing, 1st edition, PHI Pub. 1988.

Course Outcomes

CO1: Describe different image representation, their mathematical representation and different their data structures used.

CO2: Classify different segmentation algorithm for given input

CO3: Create a 3D object from given set of images

CO4: Detect a moving object in video using the concept of motion analysis

CO5: Recognize the object using the concept of computer vision

MSCS319 CLOUD COMPUTING CREDITS-3

UNIT-I

Introduction to Cloud Computing: Cloud Computing in a Nutshell, System Models for Distributed and Cloud Computing, Roots of Cloud Computing, Grid and Cloud, Layers and Types of Clouds, Desired Features of a Cloud, Basic Principles of Cloud Computing, Challenges and Risks, Service Models.

UNIT-II

Virtualization concepts: Virtual Machines and Virtualization of Clusters and Data Centers, Levels of Virtualization, Virtualization Structures / tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization Data-Center Automation.

UNIT-III

Cloud computing architectures over Virtualized Data Centers: Data–Center design and Interconnection networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms, Inter-cloud Resource Management. Cloud Security and Trust Management, data Security in the Cloud: An Introduction to the Idea of Data Security, The Current State of Data Security in the cloud.

UNIT-IV

Common Standards in Cloud Computing: The Open Cloud Consortium, the Distributed Management Task Force, Standards for Application Developers, Standards for Messaging. Internet Messaging Access Protocol (IMAP), Standards for Security, Examples of End-User Access to Cloud Computing.

Books:

1. RajkumarBuyya, James Broberg and Andrzej Goscinski , Cloud Computing Principles and Paradigms, 1st Edition, Wiley Publication, 2011.
2. Judith Hurwitz, Robin Bloor, Marcia Kaufman and Fern Halper, Cloud Computing for Dummies, 2nd edition, Wiley Publication, 2009.
3. Divyakant Agrawal, K. G. SelcukCandan, Wen-Syan Li (Eds.), New frontiers in information and software as a service, 1st edition, Springer Proceedings, 2011.

COURSE OUTCOMES:

The students will be able to

CO1: Elaborating the basic concepts of cloud computing and defining the basic terms.

CO2: Understanding the various cloud implementations and migration techniques.

CO3: To define the various industrial applications of cloud virtualization.

CO4: In depth learning of security challenges and preventive measures in cloud computing.

CO5: To Illustrate Virtualization for Data-Center Automation.

CO6: Practical implementation of cloud computing and live case studies.