

SYLLABUS  
for  
M.Sc. Computer Science (One Year Program)  
(2026 Onwards)  
**Master of Science (CS)**  
Programme  
As Per  
**New Education Policy (NEP-2020)**



DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING  
SCHOOL OF ENGINEERING AND TECHNOLOGY  
HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY  
A CENTRAL UNIVERSITY  
SRINGAR GARHWAL – (246174)

## Program Structure

| Semester | Course Category                    | Course Title                                                               | Credits |   | Total Credit |
|----------|------------------------------------|----------------------------------------------------------------------------|---------|---|--------------|
|          |                                    |                                                                            | T       | P |              |
| 1        | Discipline Specific Core [DSC]     | Design and Analysis of Algorithm                                           | 3       | 2 | 5            |
|          |                                    | Combinatorics and Graph Theory                                             | 5       | - | 5            |
|          |                                    | Java Programming                                                           | 3       | 2 | 5            |
|          |                                    | Natural Language Processing                                                | 3       | 2 | 5            |
|          | Discipline Specific Elective [DSE] | Computer Vision/Fuzzy Logic & Neural Networks/Android Application Dev/MOOC | 3       | 1 | 4            |
|          | Or                                 |                                                                            |         |   |              |
|          | Multi-Disciplinary Elective [MDE]  | Genetic Algorithm and Application                                          | 3       | 1 | 4            |
|          |                                    | Total                                                                      |         |   | 24           |

| Semester | Course Category                    | Course Title                                    | Credits |    | Total Credit |
|----------|------------------------------------|-------------------------------------------------|---------|----|--------------|
|          |                                    |                                                 | T       | P  |              |
| 2        | Discipline Specific Core [DSC]     | Project Work                                    | -       | 10 | 10           |
|          |                                    | Data Warehousing and Data Mining                | 5       | -  | 5            |
|          |                                    | E-Commerce                                      | 5       | -  | 5            |
|          | Discipline Specific Elective [DSE] | Artificial Intelligence/ Image Processing /MOOC | 3       | 1  | 4            |
|          | Or                                 |                                                 |         |    |              |
|          | Multi-Disciplinary Elective [MDE]  | Bioinformatics                                  | 3       | 1  | 4            |
|          |                                    | Total                                           |         |    | 24           |

# SEMESTER 1

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| <b>Course: Design and Analysis of Algorithms (SET/CSE/O-MCS/DSC101)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Course Objectives:</b><br>This course introduces the fundamental concepts of algorithm design and analysis, data structures, and computational complexity. It enables students to design efficient algorithms, analyze their performance, and apply advanced algorithmic techniques to solve complex computational problems.                                                                                                                                                                                                                                                                                                             |
| <b>Course Outcomes</b> <ol style="list-style-type: none"><li>1. Explain the fundamentals of algorithms, asymptotic analysis, and computational complexity.</li><li>2. Apply appropriate data structures and sorting techniques to solve computational problems efficiently.</li><li>3. Design algorithms using dynamic programming, greedy, backtracking, and branch-and-bound techniques.</li><li>4. Analyze and implement graph algorithms for solving real-world problems.</li><li>5. Evaluate advanced algorithmic concepts, including randomized algorithms, string matching, NP-completeness, and approximation algorithms.</li></ol> |
| <b>UNIT 1:</b> Introduction: Algorithms, Analysis of Algorithms, Design of Algorithms, and Complexity of Algorithms, Asymptotic Notations, Growth of function, Recurrences. Sorting in polynomial Time: Insertion sort, Merge sort, Heap sort, and Quick sort Sorting in Linear Time: Counting sort, Radix Sort, Bucket Sort Medians and order statistics.                                                                                                                                                                                                                                                                                  |
| <b>UNIT 2:</b> Elementary Data Structure: Stacks, Queues, Linked list, Binary Search Tree, Hash Table. Advanced Data Structure: Red Black Trees, Splay Trees, Augmenting Data Structure Binomial Heap, B-Tree, Fibonacci Heap, and Data structure for Disjoint Sets. Union-find Algorithm, Dictionaries and priority Queues, mergeable heaps, concatenable queues.                                                                                                                                                                                                                                                                          |
| <b>UNIT 3:</b> Advanced Design and Analysis Techniques: Dynamic Programming, Greedy Algorithm, Backtracking, Branch-and-Bound, Amortized Analysis. Graph Algorithms: Elementary Graph Algorithms, Breadth First search, Depth First search, Minimum Spanning Tree, Kruskal's Algorithms, Prim's Algorithms, Single Source Shortest Path, All pair Shortest Path, Maximum flow and Traveling Salesman Problem. Randomized Algorithms, String Matching, NP-Hard and NP-Completeness Approximation Algorithms, Sorting Network, Matrix Operations, Polynomials and the FFT, Number Theoretic Algorithms.                                       |
| <b>References:</b> <ol style="list-style-type: none"><li>1. Horowitz Sahani, "Fundamentals of Computer Algorithms." Galgotia</li><li>2. Cormen Leiserson et al, "Introduction to Algorithms", PHI</li><li>3. Brassard Bratley, "Fundamental of Algorithms" PHI</li><li>4. M.T. Goodrich et al, "Algorithms Design" John Wiley</li><li>5. A.V. Aho et al. "The Design and analysis of Algorithms" Person Education</li><li>6. Algorithms and Data Structure: Baldwin Scragg, Wiley dreamtech</li></ol>                                                                                                                                       |

# SEMESTER 1

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| <b>Course: Combinatorics and Graph Theory (SET/CSE/O-MCS/DSC102)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Course Objectives</b> <ol style="list-style-type: none"><li>1. Understand the fundamentals of combinatorics and graph theory.</li><li>2. Learn counting techniques, recurrence relations, and generating functions.</li><li>3. Study graph properties, trees, and network models.</li><li>4. Analyze graph connectivity, planarity, and graph matrices.</li><li>5. Apply graph algorithms to solve computational problems</li></ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Course Outcomes</b> <p><b>CO1:</b> Explain the principles of combinatorics, permutations, combinations, and recurrence relations.</p> <p><b>CO2:</b> Analyze graph structures, trees, and spanning trees.</p> <p><b>CO3:</b> Apply graph traversal, connectivity, and network flow concepts.</p> <p><b>CO4:</b> Evaluate graph coloring, planarity, and graph representations.</p> <p><b>CO5:</b> Apply graph-theoretic algorithms to solve real-world and computational problems.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Course Content/Syllabus</b> <p><b>Unit I: Combinatorics</b><br/>Rules of Sum and Product, Permutations, Combinations, Permutation Groups and Applications, Probability, Ramsey Theory, Discrete Numeric Functions, Generating Functions, Combinatorial Problems, Difference Equations.</p> <p><b>Unit II: Recurrence Relations</b><br/>Introduction, Linear Recurrence Relations with Constant Coefficients, Homogeneous Solution, Particular Solution, Total Solution, Solution by the Method of Generating Functions.</p> <p><b>Unit III: Graphs and Trees</b><br/>Graphs, Subgraphs, Basic Properties, Walks, Paths and Circuits, Connected and Disconnected Graphs, Components, Euler and Hamiltonian Graphs, Graph Operations, Trees, Fundamental Circuits, Distance, Diameter, Radius, Pendant Vertices, Rooted Trees, Binary Trees, Counting Trees, Spanning Trees, Finding All Spanning Trees, Weighted Graphs.</p> <p><b>Unit IV: Graph Connectivity and Planarity</b><br/>Cut Sets and Cut Vertices, Fundamental Circuits and Cut Sets, Connectivity and Separability, Network Flows, Planar Graphs, Combinatorial and Geometric Duals, Kuratowski's Theorem, Detection of Planarity, Graph Thickness and Crossings, Vector Space of a Graph, Basis Vectors, Cut Set Vectors, Circuit Vectors, Orthogonal Vectors, Incidence Matrix, Adjacency Matrix.</p> <p><b>Unit V: Graph Coloring and Enumeration</b><br/>Graph Coloring, Covering and Partitioning, Chromatic Number, Chromatic Partitioning, Chromatic Polynomials, Matching, Covering, Four Color Problem, Directed Graphs, Types of Directed Graphs, Directed Paths and Connectedness, Euler Digraphs, Trees and Directed Edges, Fundamental Circuits in Digraphs, Matrices A, B and C of Digraphs, Adjacency Matrix of Digraphs, Graph Enumeration, Counting Labeled and Unlabeled Trees, Polya's Theorem, Graph Enumeration using Polya's Theorem, Graph-Theoretic Algorithms.</p> |
| <b>References</b> <ol style="list-style-type: none"><li>1. Narsingh Deo, <i>Graph Theory with Applications to Engineering and Computer Science</i>, PHI.</li><li>2. J. P. Tremblay and R. Manohar, <i>Discrete Mathematical Structures with Applications to Computer Science</i>, Tata McGraw-Hill.</li><li>3. K. D. Joshi, <i>Fundamentals of Discrete Mathematics</i>, New Age International.</li><li>4. John Truss, <i>Discrete Mathematics for Computer Scientists</i>.</li><li>5. C. L. Liu, <i>Discrete Mathematics</i>.</li></ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

# SEMESTER 1

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| <b>Course: Java Programming (SET/CSE/O-MCS/DSC103)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Course Objectives</b> <ol style="list-style-type: none"><li>1. Understand the fundamentals of Java programming.</li><li>2. Learn object-oriented programming concepts using Java.</li><li>3. Develop applications using exception handling and multithreading.</li><li>4. Understand Java I/O, networking, and GUI programming.</li><li>5. Build Java applications using AWT and event handling.</li></ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Course Outcomes</b> <p><b>CO1:</b> Explain Java programming concepts, syntax, and object-oriented features.</p> <p><b>CO2:</b> Develop Java programs using classes, inheritance, packages, and interfaces.</p> <p><b>CO3:</b> Apply exception handling and multithreading techniques in Java applications.</p> <p><b>CO4:</b> Implement file handling and networking applications using Java APIs.</p> <p><b>CO5:</b> Design GUI-based applications using Applets, AWT, and event handling mechanisms.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Course Content/Syllabus</b> <p><b>Unit I: Overview of Java</b><br/>The Genesis of Java, Overview of Java, Java Virtual Machine (JVM), Java Development Kit (JDK), Java vs C++, Data Types, Literals, Variables, Arrays, Operators, Control Statements, Classes, Methods, Nested and Inner Classes, Java.lang Package, String Handling, Constructors, Garbage Collection, Finalize() Method.</p> <p><b>Unit II: Inheritance, Packages and Interfaces</b><br/>Types of Inheritance, Access Specifiers, Class Inheritance, using super, Method Overriding, Abstract Classes, Constructors in Multilevel Inheritance, using final with Inheritance, Dynamic Method Dispatch, Defining Packages, CLASSPATH, Access Protection, Importing Packages, Defining and Implementing Interfaces, Extending Interfaces, Nested Interfaces.</p> <p><b>Unit III: Exception Handling and Multithreading</b><br/>Exception Handling: try, catch, Multiple Catch Blocks, Nested try, throw, throws, finally, Built-in Exceptions, Uncaught Exceptions, User-Defined Exception Classes.<br/>Multithreading: Java Thread Model, Main Thread, Creating Threads, Thread Life Cycle, Thread Priorities, Synchronization, Inter-thread Communication, Suspending, Resuming and Stopping Threads.</p> <p><b>Unit IV: Input/Output and Networking</b><br/>Input/Output: Byte Streams, Character Streams, Predefined Streams, Console Input and Output, PrintWriter Class, Reading and Writing Files.<br/>Networking: Networking Classes and Interfaces, Sockets, TCP/IP Client and Server Sockets, InetAddress, URLConnection, Datagram.</p> <p><b>Unit V: Applets, AWT and Event Handling</b><br/>Applet: Applet Life Cycle, Creating Applets, Using Images and Sound, Passing Parameters.<br/>AWT: Overview of java.awt Package, Components and Containers, Control Components, Layout Managers.<br/>Event Handling: Delegation Event Model, Event Classes, Event Sources, Event Listener Interfaces, Mouse and Keyboard Events, Adapter Classes.</p> |
| <b>References</b> <ol style="list-style-type: none"><li>1. Patrick Naughton and Herbert Schildt, <i>Java: The Complete Reference</i>, Osborne McGraw-Hill, 1997.</li><li>2. James R. Levenick, <i>Simply Java: An Introduction to Java Programming</i>, Firewall Media.</li><li>3. E. Balagurusamy, <i>Programming with Java</i>.</li><li>4. Rashmi Kanta Das, <i>Core Java for Beginners</i>, Vikas Publishing House.</li></ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

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| <b>Course: Natural Language Processing (SET/CSE/O-MCS/DSC104)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Course Objectives:</b><br>This course introduces the fundamental concepts of Natural Language Processing (NLP), including language modeling, syntax, semantics, pragmatics, and machine translation. It enables students to develop computational techniques for analyzing, understanding, and generating natural language.                                                                                                                                                                                                                                                                                                              |
| <b>Course Outcomes</b><br><ol style="list-style-type: none"><li>1. Explain the fundamentals of natural language processing, regular expressions, automata, and language models.</li><li>2. Apply part-of-speech tagging, parsing, and grammar-based techniques for syntactic analysis.</li><li>3. Analyze semantic representations and lexical processing for language understanding.</li><li>4. Evaluate semantic analysis, word sense disambiguation, and information retrieval techniques.</li><li>5. Apply NLP techniques to discourse analysis, conversational agents, natural language generation, and machine translation.</li></ol> |
| <b>Unit 1:</b> Regular expressions and automata, Morphology and Finite State transducers, N – grams.<br><br><b>Unit 2:</b> Word classes and part of speech tagging, Context free grammars for English, Parsing with context free grammars.<br><br><b>Unit 3:</b> Features and Unifications, Lexicalized and Probabilistic parsing. Semantics: Representing meaning,<br><br><b>Unit 4:</b> Semantic analysis, Lexical semantics, Word Sense Disambiguation and Information retrieval.<br><br><b>Unit 5:</b> Pragmatics: Discourse, Dialog and Conversational Agents, Natural Language Generation, Machine Translation.                       |
| <b>References:</b><br><ol style="list-style-type: none"><li>1. Daniel, Jurafsky and Martin, Speech and Language Processing, Pearson, 2003.</li></ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

# SEMESTER 1

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| <b>Course: Computer Vision (SET/CSE/O-MCS/DSE1.1)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Course Objectives:</b><br>This course introduces the fundamentals of image processing and computer vision, including image acquisition, enhancement, feature extraction, object representation, and 3D vision. It enables students to analyze visual data and develop computer vision solutions for real-world applications such as object detection, face recognition, and motion analysis.                                                                                                                                                                                                                          |
| <b>Course Outcomes</b> <ol style="list-style-type: none"><li>1. Explain the fundamentals of image processing, image formation, and preprocessing techniques.</li><li>2. Apply edge, line, and region-based methods for image analysis and feature extraction.</li><li>3. Analyze computer vision techniques for object representation, motion analysis, and 3D vision.</li><li>4. Evaluate computer vision algorithms for object detection, tracking, and scene understanding.</li><li>5. Develop computer vision solutions for applications such as face recognition, road sign detection, and gait analysis.</li></ol> |
| <b>Unit 1:</b> Fundamentals of Image Processing: Sources of imagery, Physics of imaging, Representing, acquiring and displaying images, Grayscale, color, noise, lens distortion, and filtering. Preprocessing, and image correction, Enhancing features and correcting imperfections, Addressing noise, lens distortion, and blurring.                                                                                                                                                                                                                                                                                  |
| <b>Unit 2:</b> Computer Vision Paradigms: Bottom-up, top-down, neural net, feedback, Pixels, lines, boundaries, regions, and object representations, Low-level, intermediate-level and high-level vision, Historical and illustrative examples. Finding Edges and Lines: Finding edges (low-level), Gradients, zero crossing detectors, line models, Roberts, Sobel, Canny, Finding and grouping lines (intermediate-level), Boundary tracing, line fitting, Hough transform.                                                                                                                                            |
| <b>Unit 3:</b> Region Processing and 3D Vision: Finding elementary regions (low-level), Merging, splitting and grouping regions (intermediate-level), Grouping and analyzing lines and regions (high-level), Stereo and Motion, Optical Flow, Motion Understanding Representing the environment and Matching, Clouds, generalized cylinders, semantic nets, Matching line and region groups to object representations (high-level).                                                                                                                                                                                      |
| <b>Unit 4:</b> Applications: Face detection, Face recognition, Foreground and background separation, object detection and tracking, combining views from multiple cameras, Identifying Road signs, Gait analysis.                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>References:</b> <ol style="list-style-type: none"><li>1. Digital Image Processing - R.C. Gonzalez and R.E. Woods, Third Edition, Pearson, 2014</li><li>2. Computer &amp; Machine Vision - E. R. Davies, Fourth Edition, Academic Press, 2012</li><li>3. Computer Vision - A Modern Approach - D.A. Forsyth and J. Ponce, PHI Pvt. Ltd, 2009</li><li>4. Image Processing, Analysis and Machine Vision - M. Sonka, V. Hlavac, and R. Boyle, Thomson Asia Pvt. Ltd., Singapore, 2001</li></ol>                                                                                                                           |

# SEMESTER 1

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| <b>Course: Fuzzy Logic &amp; Neural Networks (SET/CSE/O-MCS/DSE1.2)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Course Objectives:</b><br>This course introduces the principles of fuzzy logic and artificial neural networks for intelligent decision-making and learning. It enables students to understand fuzzy inference systems, neural network models, and hybrid intelligent techniques for solving complex real-world problems.                                                                                                                                                                                                                                                                        |
| <b>Course Outcomes</b> <ol style="list-style-type: none"><li>1. Explain the fundamentals of fuzzy logic, fuzzy sets, and fuzzy inference systems.</li><li>2. Apply fuzzy reasoning and fuzzy control techniques to decision-making problems.</li><li>3. Analyze neural network architectures, learning methods, and training algorithms.</li><li>4. Evaluate neural network models and hybrid neuro-fuzzy systems for intelligent applications.</li><li>5. Apply fuzzy logic and neural networks to solve problems in pattern recognition, prediction, data mining, and control systems.</li></ol> |
| <b>Unit 1:</b> Introduction to Fuzzy Logic: Introduction to artificial intelligence and soft computing, conventional logic vs fuzzy logic, uncertainty and imprecision, fundamentals of fuzzy sets, crisp sets and fuzzy sets, membership functions, linguistic variables, fuzzy relations, fuzzy operations, fuzzification and defuzzification methods, applications of fuzzy logic.                                                                                                                                                                                                              |
| <b>Unit 2:</b> Fuzzy Logic Systems and Applications: Fuzzy inference systems, rule-based systems, fuzzy propositions, fuzzy implications, fuzzy reasoning, Mamdani fuzzy model, Sugeno fuzzy model, fuzzy decision making, fuzzy control systems, applications of fuzzy logic in industrial automation, pattern recognition, image processing and expert systems.                                                                                                                                                                                                                                  |
| <b>Unit 3:</b> Fundamentals of Neural Networks: Introduction to artificial neural networks, biological neural systems, neuron model, architecture of neural networks, characteristics of neural networks, activation functions, single-layer and multilayer neural networks, feedforward and feedback networks, learning methods, supervised, unsupervised and reinforcement learning.                                                                                                                                                                                                             |
| <b>Unit 4:</b> Neural Network Models and Learning Algorithms: Perceptron model, multilayer perceptron, backpropagation learning algorithm, Hebbian learning, competitive learning, associative memory networks, Hopfield network, radial basis function network, self-organizing maps, error correction and performance evaluation of neural networks.                                                                                                                                                                                                                                             |
| <b>Unit 5:</b> Applications of Fuzzy Logic and Neural Networks: Hybrid neuro-fuzzy systems, adaptive neuro-fuzzy inference system (ANFIS), pattern recognition, speech recognition, image processing, medical diagnosis, data mining, forecasting and prediction systems, robotics and control systems, industrial and real-world applications of fuzzy logic and neural networks.                                                                                                                                                                                                                 |
| <b>References:</b> <ol style="list-style-type: none"><li>1. S. Rajasekaran and G.A. Vijayalakshmi Pai – <i>Neural Networks, Fuzzy Logic and Genetic Algorithms</i>, PHI Learning.</li><li>2. Timothy J. Ross – <i>Fuzzy Logic with Engineering Applications</i>, Wiley India.</li><li>3. Simon Haykin – <i>Neural Networks and Learning Machines</i>, Pearson Education.</li><li>4. B. Yegnanarayana – <i>Artificial Neural Networks</i>, PHI Learning.</li><li>5. J.S.R. Jang, C.T. Sun and E. Mizutani – <i>Neuro-Fuzzy and Soft Computing</i>, Pearson Education.</li></ol>                     |

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| <b>Course: Android Application Development (SET/CSE/O-MCS/DSE1.3)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Course Objectives:</b><br>This course introduces the fundamentals of Android application development, including application architecture, user interface design, data management, networking, and deployment. It enables students to design, develop, test, and deploy Android applications using Android Studio and the Android SDK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Course Outcomes</b><br><ol style="list-style-type: none"><li>1. Explain the architecture, components, and development environment of Android applications.</li><li>2. Design Android applications using activities, intents, services, and application resources.</li><li>3. Develop interactive user interfaces using layouts, animations, and Android UI components.</li><li>4. Apply Android APIs for data storage, networking, content sharing, and web services.</li><li>5. Test, debug, and deploy Android applications for real-world use.</li></ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Unit 1:</b> Introduction to Android: The Android Platform, Android SDK, Android Studio installation, Android Installation, building First Android application, Understanding Anatomy of Android Application, Android Manifest file.<br><br><b>Unit 2:</b> Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.<br><br><b>Unit 3:</b> Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.<br>Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.<br><br><b>Unit 4:</b> Using Common Android APIs: Using Android Data and Storage APIs, managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World. |
| <b>References:</b><br><ol style="list-style-type: none"><li>1. Meier Reto and Lake Ian, "Professional Android", Wrox</li><li>2. John Horton, Android Programming for Beginners, Packt Publishing</li></ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

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| <b>Course: Genetic Algorithm and Application (SET/CSE/O-MCS/MDE1.1)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Course Objectives:</b><br>This course introduces the principles and techniques of genetic algorithms and evolutionary computation for solving optimization problems. It enables students to understand genetic operators, hybrid optimization approaches, and real-world applications of genetic algorithms in machine learning, data mining, engineering, and intelligent systems.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Course Outcomes</b> <ol style="list-style-type: none"><li>1. Explain the fundamentals of genetic algorithms and evolutionary computation.</li><li>2. Apply genetic algorithm components, including encoding, selection, crossover, and mutation, to optimization problems.</li><li>3. Analyze optimization strategies and constraint-handling techniques using genetic algorithms.</li><li>4. Evaluate advanced genetic algorithm variants and hybrid evolutionary approaches.</li><li>5. Apply genetic algorithms to solve real-world problems in machine learning, data mining, scheduling, and engineering applications.</li></ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Unit 1:</b> Introduction to Genetic Algorithms: Introduction to optimization techniques, conventional optimization vs evolutionary optimization, basics of evolutionary computation, biological inspiration of genetic algorithms, Darwin's theory of evolution, chromosome, gene, population, fitness function, genotype and phenotype, history and development of genetic algorithms, advantages and limitations of genetic algorithms, applications of genetic algorithms.<br><b>Unit 2:</b> Genetic Algorithm Fundamentals: Structure and working of genetic algorithm, representation schemes, binary encoding, permutation encoding, value encoding, tree encoding, population initialization, fitness evaluation, parent selection techniques, roulette wheel selection, tournament selection, rank selection, elitism, reproduction strategies, termination criteria.<br><b>Unit 3:</b> Genetic Operators and Optimization: Crossover techniques, single point crossover, two point crossover, multipoint crossover, uniform crossover, mutation techniques, bit flip mutation, swap mutation, inversion mutation, adaptive mutation, parameter tuning, convergence of genetic algorithms, optimization problems using genetic algorithms, constraints handling techniques.<br><b>Unit 4:</b> Advanced Genetic Algorithms and Hybrid Approaches: Variants of genetic algorithms, adaptive genetic algorithms, parallel genetic algorithms, hybrid genetic algorithms, genetic programming, multi-objective optimization, comparison of genetic algorithms with simulated annealing, particle swarm optimization, neural networks, swarm intelligence approaches.<br><b>Unit 5:</b> Applications of Genetic Algorithms: Genetic algorithms in machine learning, feature selection, data mining, scheduling problems, travelling salesman problem, robotics and control systems, network optimization, image processing applications, medical diagnosis systems, financial prediction, real-world case studies and industrial applications. |
| <b>References:</b> <ol style="list-style-type: none"><li>1. David E. Goldberg – <i>Genetic Algorithms in Search, Optimization and Machine Learning</i>, Pearson Education.</li><li>2. Melanie Mitchell – <i>An Introduction to Genetic Algorithms</i>, MIT Press.</li><li>3. S. Rajasekaran and G.A. Vijayalakshmi Pai – <i>Neural Networks, Fuzzy Logic and Genetic Algorithms</i>, PHI Learning.</li><li>4. A.E. Eiben and J.E. Smith – <i>Introduction to Evolutionary Computing</i>, Springer.</li><li>5. Zbigniew Michalewicz – <i>Genetic Algorithms + Data Structures = Evolution Programs</i>, Springer.</li></ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## SEMESTER 2

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| <b>Course: Data Warehousing and Data Mining (SET/CSE/O-MCS/DSC201)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Course Objectives</b> <p>This course introduces the concepts of data warehousing and data mining, including data preprocessing, association analysis, classification, clustering, and web mining. It enables students to analyze large datasets and apply data mining techniques to discover meaningful patterns and support decision-making.</p>                                                                                                                                                                                                                                      |
| <b>Course Outcomes</b> <ol style="list-style-type: none"><li>1.Explain the fundamentals of data warehousing, OLAP, and data mining techniques.</li><li>2.Apply data preprocessing and association rule mining techniques to extract useful patterns from data.</li><li>3.Analyze classification and clustering algorithms for predictive and descriptive data analysis.</li><li>4.Evaluate web mining techniques and data mining methods for complex data sources.</li><li>5.Apply data mining techniques to solve real-world problems and support intelligent decision-making.</li></ol> |
| <b>UNIT 1:</b> Introduction to data mining, need for data warehousing and data mining, application potential, keywords and techniques. Data Warehousing and On line analytical Processing (OLAP): Aggregation operations, models for data warehousing, star schema, fact and dimension tables, conceptualization of data warehouse and multidimensional databases, Relationship between warehouse and mining.                                                                                                                                                                             |
| <b>UNIT 2:</b> Data mining primitives: Data preprocessing, data integration, data transformation. Definition and specification of a generic data mining task. Description of Data mining query language with examples. Association analysis: Different methods for mining association rules in transaction based data bases. Illustration of confidence and support. Multidimensional and multilevel association rules. Classification of association rules. Association rule algorithms – A priori and frequent pattern growth.                                                          |
| <b>UNIT 3:</b> Classification and Prediction: Different classification algorithms. Use of genie index, decision tree induction, Bayesian classification, neural network technique of back propagation, fuzzy set theory and genetic algorithms. Clustering: Partition based clustering, hierarchical clustering, model based clustering for continuous and discrete data. Scalability of clustering algorithms. Parallel approaches for clustering.                                                                                                                                       |
| <b>UNIT 4:</b> Web mining: Web usage mining, web content mining, web log attributes. Data mining issues in object oriented data bases, spatial data bases and multimedia data bases and text data bases.                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>References:</b> <ol style="list-style-type: none"><li>1. J. Han, M. Kamber, “Data Mining Concepts and Techniques”, Harcourt India Pvt Ltd, 2001.</li><li>2. M. Dunham, “ Data Mining : introductory and Advanced Topics”, Pearson Pub, 2003.</li><li>3. A.K. Pujari, “Data Mining Techniques”, Universities Press.</li></ol>                                                                                                                                                                                                                                                           |

## SEMESTER 2

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| <b>Course: E-Commerce (SET/CSE/O-MCS/DSC202)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Course Objectives:</b><br>This course introduces the fundamentals of electronic commerce, including e-commerce technologies, network infrastructure, web security, electronic payment systems, and legal aspects. It enables students to understand secure online business transactions and the technologies that support modern e-commerce applications.                                                                                                                                                                                                                                   |
| <b>Course Outcomes</b> <ol style="list-style-type: none"><li>1. Explain the fundamentals, architecture, and business applications of electronic commerce.</li><li>2. Analyze the network infrastructure and mobile technologies that support e-commerce systems.</li><li>3. Apply web security mechanisms and firewall technologies to secure online transactions.</li><li>4. Evaluate encryption techniques and digital security methods for electronic communication.</li><li>5. Analyze electronic payment systems, e-commerce regulations, and legal issues in digital business.</li></ol> |
| <b>UNIT 1:</b> Introduction: Electronic Commerce - Technology and Prospects, Definition of E-Commerce, Economic potential of electronic commerce, Incentives for engaging in electronic commerce, forces behind E-Commerce, Advantages and Disadvantages, Architectural framework, Impact of E-Commerce on business.                                                                                                                                                                                                                                                                           |
| <b>UNIT 2:</b> Network Infrastructure of E-Commerce: Internet and Intranet based E Commerce Issues, problems and prospects, Network Infrastructure, Network Access Equipments, Broadband telecommunication (ATM, ISDN, FRAME RELAY). Mobile Commerce: Introduction, Wireless Application Protocol, WAP Technology, Mobile Information device, Mobile Computing Applications.                                                                                                                                                                                                                   |
| <b>UNIT 3:</b> Web Security: Security Issues on web, Importance of Firewall, components of Firewall, Transaction security, Emerging client server, Security Threats, Network Security, Factors to consider in Firewall design, Limitation of Firewalls.                                                                                                                                                                                                                                                                                                                                        |
| <b>UNIT 4:</b> Encryption: Encryption techniques, Symmetric Encryption-Keys and data encryption standard, Triple encryption. Asymmetric encryption-Secret key encryption, public and private pair key encryption, Digital Signature, Virtual Private Network.                                                                                                                                                                                                                                                                                                                                  |
| <b>UNIT 5:</b> Electronic Payments: Overview, The SET protocol, payment Gateway, certificate, digital Tokens, Smart card, credit card, magnetic strip card, E Checks, Credit/Debit card based EPS, online Banking EDI Application in business, E-Commerce Law, Forms of Agreement, Govt. policies and Agenda.                                                                                                                                                                                                                                                                                  |
| <b>References:</b> <ol style="list-style-type: none"><li>1. Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce" Addison Wesley.</li><li>2. Bajaj and Nag. "E-Commerce the cutting edge of Business". TMH.</li><li>3. P. Loshin, John Vacca, "Electronic Commerce" Firewall Media, N.Delhi.</li><li>4. E Business and Commerce: Brahm Cazner, Wiley dreamtech.</li></ol>                                                                                                                                                                                                          |

## SEMESTER 2

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| <b>Course: Artificial Intelligence (SET/CSE/O-MCS/DSE2.1)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Course Objectives:</b><br>This course introduces the fundamental concepts of Artificial Intelligence, including knowledge representation, search techniques, reasoning, planning, and intelligent system design. It enables students to understand AI methodologies and apply them to solve real-world problems involving decision-making, perception, and learning.                                                                                                                                                                                                    |
| <b>Course Outcomes</b> <ol style="list-style-type: none"><li>1. Explain the fundamentals, concepts, and applications of Artificial Intelligence.</li><li>2. Apply search strategies and heuristic techniques to solve AI problems.</li><li>3. Analyze knowledge representation and reasoning using predicate logic and rule-based systems.</li><li>4. Evaluate planning and decision-making techniques for intelligent agents and problem-solving.</li><li>5. Apply AI techniques in knowledge-based systems, image processing, and natural language processing.</li></ol> |
| <b>Unit 1</b> Introduction: Definition and meaning of artificial intelligence, A.I. techniques, pattern recognition, Level of, speech recognition representation in A.I. properties of internal representation.                                                                                                                                                                                                                                                                                                                                                            |
| <b>Unit 2:</b> Production System: Different types of tracing, strategies, graph search strategies, Heuristic graph, search procedure, AND/OR graph, relationship between decompositional and compatible systems, searching Gate Tree, min max search game playing, actual game playing.                                                                                                                                                                                                                                                                                    |
| <b>Unit 3:</b> Introduction to Predicate Calculus: Predicates and Arguments, connectives, Simplifications of strategies, extracting answers from Resolution Refutation. Control strategies.                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Unit 4:</b> Rule Based Deduction Systems: Forward and backward deduction system, resolving with AND/OR graph, computation, deduction and program synthesis, central knowledge for rules based deduct systems. Managing Plans of Action: Plan interpreter, planning decisions, execution monitoring and re-planning domain of application robot motion planning and game playing.                                                                                                                                                                                        |
| <b>Unit 5:</b> Structural Object Representation: Semantic networks semantic market matching deductive operations on structured objects.                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Unit 6:</b> Architectural for A.I. Systems: Knowledge, acquisitions representation IMAGES PROCESSING, Natural language processing.                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>References:</b> <ol style="list-style-type: none"><li>1. Introduction to artificial Intelligence Eugene Charnik Drew MC mott</li><li>2. Artificial Intelligence Elaine Rice.</li><li>3. Principal of Artificial Intelligence, Nelson, Springer-Verlag.</li><li>4. Artificial Intelligence Application Programming: Tim Jones, Wiley dreamtech.</li></ol>                                                                                                                                                                                                                |

## SEMESTER 2

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| <b>Course: Image Processing (SET/CSE/O-MCS/DSE2.2)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Course Objectives:</b><br>This course introduces the fundamentals of digital image processing, including image enhancement, restoration, compression, segmentation, and object recognition. It enables students to analyze digital images and apply image processing techniques for solving real-world computer vision and multimedia applications.                                                                                                                                                                                                       |
| <b>Course Outcomes</b> <ol style="list-style-type: none"><li>1. Explain the fundamentals of digital image processing and image acquisition.</li><li>2. Apply image enhancement and filtering techniques in spatial and frequency domains.</li><li>3. Analyze image restoration and compression methods for efficient image representation.</li><li>4. Apply morphological operations and image segmentation techniques for image analysis.</li><li>5. Evaluate object representation and recognition techniques for image processing applications.</li></ol> |
| <b>Unit 1:</b> Processing, Examples of Digital Image Processing application, Fundamental steps in Digital Image processing, Components of Image Processing system Fundamentals: Elements of Visual Perception, Light and Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some basic Relationships between Pixels, Linear and Nonlinear Operations.                                                                                                                                                                 |
| <b>Unit 2:</b> Image Enhancement in the spatial domain: Background, Some basic gray level transformation, Introduction of Histogram processing, Enhancement using Arithmetic/Logic operations, Basics of spatial filtering, Smoothing spatial filters, Sharpening spatial filters, Image Enhancement in the Frequency Domain: Introduction.                                                                                                                                                                                                                  |
| <b>Unit 3:</b> Image Restoration: Model of the Image Degradation/Restoration process, Noise Models, Restoration in the presence of noise only spatial filtering, Inverse filtering, Minimum Mean Square Error (Wiener) filtering, Geometric mean filter, Geometric Transformations, Image Compression: Fundamentals, Lossy Compression, Lossless Compression, Image Compression models, Error-free Compression: Variable length coding, LZW coding, Bit plane coding, Run length coding, Introduction to JPEG.                                               |
| <b>Unit 4:</b> Morphology: Dilation, Erosion, Opening and Closing, Hit-and Miss transform, Morphological Algorithms: Boundry Extraction, Region filling, Extraction of connected components, Convex Hull, Image Segmentation: Definition, characteristics of segmentation Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region based segmentation. Introduction to Representation and Description, Introduction to Object Recognition.                                                                                    |
| <b>References</b> <ol style="list-style-type: none"><li>1. Digital Image Processing: Rafael C. Gonzalez and Richard E.Woods. Addison Wesley.</li><li>2. Fundamentals of Digital Image Processing. Anil K. Jain, PHI.</li><li>3. Digital Image Processing and Analysis: B. Chanda and D. Dutta Majumber, PHI.</li><li>4. Image Processing in C: Dwayne Phillips, BPB.</li></ol>                                                                                                                                                                               |

## SEMESTER 2

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| <b>Course: Bioinformatics- (SET/CSE/O-MCS/MDE1.1)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Course Objectives</b> <p>This course aims to provide students with a fundamental understanding of biological systems and bioinformatics concepts. It introduces sequence analysis, genomics, proteomics, and computational approaches for analyzing biological data. The course also develops knowledge of molecular modeling, drug design, and bioinformatics tools used in modern biological and pharmaceutical research.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Course Outcomes</b> <ol style="list-style-type: none"><li>1. Explain the structure and function of biological systems and molecular processes.</li><li>2. Apply sequence alignment techniques and biological database search tools.</li><li>3. Analyze genomic and proteomic data using bioinformatics methods.</li><li>4. Demonstrate the principles of molecular modeling and computer-aided drug design.</li></ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <p><b>UNIT 1:</b> Fundamentals of Biological Systems: Introduction to cells: Structure of prokaryotic and eukaryotic cells. Cell organelles and their functions. Molecules of life: Introduction to carbohydrates, proteins, lipids and nucleic acids – Different structural forms and functional organizations. DNA replication, transcription and translation. Gene regulation.</p> <p><b>UNIT 2:</b> Sequence Analysis: Introduction to Sequence alignment, Substitution matrices, Scoring matrices –PAM and BLOSUM. Local and Global alignment concepts, dot plot, dynamic programming methodology, Multiple sequence alignment- Progressive alignment. Database searches for homologous sequences – FASTA and BLAST versions.</p> <p><b>UNIT 3:</b> Genomics and Proteomics: Functional Genomics: Gene expression analysis by cDNA micro arrays, SAGE, Strategies for generating ESTs and full length inserts; EST clustering and assembly; EST databases- DBEST, UNIGENE Proteomics: Protein and RNA structure prediction, polypeptic composition, secondary and tertiary structure, algorithms for modeling protein folding, structure prediction, proteomics, protein classification, experimental techniques, ligand screening, post-translational modification prediction.</p> <p><b>UNIT 4:</b> Computer Aided Drug Design: Introduction to the concepts of molecular modeling. Molecular structure and internal energy. Macromolecular modeling. Design of ligands for known macromolecular target sites. Drug – receptor interactions. Classical SAR/QSAR studies and their implications to the 3-D modeler. Molecular Docking. Structure-based drug design for all classes of targets.</p> |
| <b>References:</b> <ol style="list-style-type: none"><li>1. Andreqas D. Baxevanis, B. F. Francis Ouellette. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins John Wiley and Sons, New York (1998).</li><li>2. C. Rastogi, Namita Mendiratta, Parag Rastogi. Bioinformatics-concepts, skills, Applications.</li><li>3. Bioinformatics Sequence and Genome Analysis. 2001. David W. Mount. Cold Spring Harbor Laboratory Press.</li><li>4. Andrew, R. Leach Molecular modeling: Principles and applications Prentice Hall Publications.</li></ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |