ADVANCED ALGORITHM DESIGN AND ANALYSIS

OVERVIEW
Algorithm concepts, asymptotic efficiency of algorithms, asymptotic notations and their properties, recurrence equations and method of solving recurrences, Searching using hash tables, open addressing using linear probing, Medians and order statistics.

DYNAMIC PROGRAMMING
Deterministic & probabilistic, greedy algorithms, amortized analysis.

ADVANCED DATA STRUCTURES
B trees, B+ trees, data structures for disjoint sets.

ADVANCED GRAPH ALGORITHMS
Breadth First and Depth First Search, minimum spanning trees, shortest path algorithms: single source and all pair, max flow problem and its solutions.

LINEAR PROGRAMMING
Standard and Slack forms, Formulating problems as linear programs, simplex algorithm, representation of polynomials, DFT and FFT.

STRING MATCHING
Rabin Karp algorithm, String matching with finite automaton, Knuth-Morris-Pratt algorithm.

NP-COMPLETENESS CONCEPTS
Polynomial time verification, NP-completeness and reducibility, showing problems to be NP-complete like Clique problem, vertex cover problem etc.

APPROXIMATE ALGORITHMS
Approximate algorithms for vertex cover problem, traveling sales person problem, sum-subset problem.

ADVANCED COMPUTER NETWORKS

INTRODUCTION
Overview of computer networks, seven-layer architecture, TCP/IP suite of protocols.

MEDIUM ACCESS
MAC protocols for high-speed LANS, MANs, and wireless LANs. (For example, FDDI, DQDB, HIPPI, Gigabit Ethernet, Wireless Ethernet, etc.), CSMA/CD, CSMA/CA, Simple performance models; WAN access methods - PPP.

INTERNETWORKING AND ROUTING

RESOURCE MANAGEMENT

GROUP COMMUNICATION
Multicast Routing and Transport, IP Multicasting: Multicast routing protocols, address assignments, session discovery, Multicasting in mobile networks.

TRANSPORT LAYER PROTOCOL
TCP protocol dynamics, TCP extensions for high-speed networks, transaction-oriented applications. Other new options in TCP, Application protocols for email, ftp, web, DNS.

WIRELESS NETWORKS
Wireless LAN architecture, Mobile IP, Broadcast file system, Agent technology, Satellite technology.

SECURITY

SOFTWARE TESTING TECHNIQUES
INTRODUCTION
Terminology, Evolving nature of area, Errors, Faults and Failures, Correctness and reliability, Testing and debugging. Static and dynamic testing, Exhaustive testing: Theoretical foundations: impracticality of testing all data, impracticality of testing all paths, no absolute proof of correctness, Black Box Testing and White Box Testing.

SOFTWARE TESTING APPROACHES AND THEIR APPLICABILITY
Software technical reviews; Software testing: levels of testing - module, integration, system, regression; Testing techniques and their applicability-functional testing and analysis, structural testing and analysis, error-oriented testing and analysis, hybrid approaches, integration strategies, transaction flow analysis, stress analysis, failure analysis, concurrency analysis, performance analysis; Proof of correctness; simulation and prototyping; Requirement tracing.

TEST GENERATION
Test generations from requirements, Test generation paths, Data flow analysis, Finite State Machines models for flow analysis, Regular expressions based testing, Test Selection, Minimizations and Prioritization, Regression Testing, Web Testing.

**OBJECT ORIENTED TESTING**

**PROGRAM MUTATION TESTING**
Introduction, Mutation and mutants, Mutation operators, Equivalent mutants, Fault detection using mutants, Types of mutants, Mutation operators for C and Java.

**SPECIAL TOPICS IN SOFT COMPUTING**

**ISSUES IN EXPERT SYSTEMS**
Knowledge representation, planning and acting in real world, semantic networks, predicate calculus, structural/casual networks, inference control, theorem proving, deduction, truth maintenance, planning, case study of one or more examples from Natural Language Processing, question answering, vision, expert systems

**ARTIFICIAL NEURAL NETWORKS**
Concepts of Artificial Neural Networks and its basic mathematical model, simple perceptron, Feed-Forward Multilayer perceptron, Hopfield network, Self organizing network and recurrent network.

**FUZZY LOGIC SYSTEM AND GENETIC ALGORITHM**
Fuzzy logic, Fuzzification, Inferencing and defuzzification, Fuzzy Knowledge and rule bases, Fuzzy modeling and Control schemes, Genetic algorithm and detail algorithmic steps, Adjustment of free parameters, Search techniques like tabu search and ant-colony for solving optimization problems, Optimization techniques: PSO(Particle Swarm Optimization), ACO(Ant-colony Optimization), BVO(Binary Vector Optimization).

**APPLICATIONS**
GA application to power system optimization problem, Identification and control of linear and nonlinear dynamic systems, stability analysis of Fuzzy control systems.