

Guru Nanak Dev Engineering College, Ludhiana
Department of Computer Science & Engineering

Syllabus of 2nd Mid-Semester Examination

B.Tech.: 4th Sem.

Discrete Mathematics PCCS-103
<p>Combinatorial Mathematics: Recurrence relations – Solving homogeneous and non-homogeneous recurrence relations, Sequences, Generating function.</p> <p>Algebraic Structures and Morphism: Algebraic structures with one binary operation, Properties of an operation, Congruence relation, Semi groups, Monoids, Groups, Substructures, Cyclic groups, Cosets, Normal subgroups, Dihedral groups, Permutation Groups. Homomorphism and isomorphism of groups, Applications of groups. Algebraic structures with two binary operation, Rings – Introduction, Abelian ring, Ring with unity, Multiplicative inverse, Subrings, Homomorphism of rings. Integral Domain, Ideals.</p> <p>Boolean algebra: Boolean algebra, Boolean sub-algebra, Boolean rings, Application of Boolean algebra (Logic implications, Logic gates, Karnaugh-map).</p> <p>Graphs and Trees: Graphs – Definition, degree, Connectivity, path, cycle, Directed and undirected, Sub Graph, Bi-connected component and Articulation points. Eulerian chains and cycles, Hamiltonian chains and cycles, Shortest paths algorithms – Dijkstra's algorithm, Warshall's algorithm. Rooted trees, Spanning tree algorithms – Kruskal's algorithm, Prim's algorithm. Graph coloring, Map Coloring, Chromatic number, Planar graphs, Euler's formula, Isomorphism and homomorphism of graphs, Applications of graph theory.</p>
Computer Architecture and Microprocessor PCCS-104
<p>Central Processing Unit and Input-Output Organization: General register organization, Stack organization, Addressing modes, RISC and CISC architecture, I/O interface, Asynchronous data transfer, Modes of transfer, Priority interrupt, DMA, I/O processor.</p> <p>Memory Organization: Memory hierarchy, Main memory, Auxiliary memory, Associative memory, Cache memory, Virtual memory, Memory management hardware.</p> <p>Microprocessor Architecture: Introduction to microprocessors, 8085 microprocessor architecture – Bus structure, Register organization.</p> <p>Programming with 8085: Addressing modes, Instruction classification, Instruction formats, Data transfer operations, Arithmetic operations, Logical operations, Branch operations, Stack and subroutine operations, looping, counting and indexing operations.</p> <p>Interfacing: Memory and I/O mapped I/O, Programmable interfaces – 8255 programmable peripheral interface, 8259 interrupt controller, and 8237 DMA controller.</p> <p>Microprocessor Applications: Interfacing of keyboards and seven segment LED display, Study of traffic light system, stepper motor controller.</p>
Operating Systems PCCS-105
<p>Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, and Semaphore</p> <p>Deadlocks: Introduction to deadlocks, Conditions for deadlock, Resource allocation graphs,</p>

Deadlock prevention and avoidance, Deadlock detection and recovery.

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging, Segmentation.

File Management: Concept of File, Access methods, File types, File operation, Directory structure, Allocation methods (contiguous, linked, and indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Secondary Storage: Disk structure, Disk scheduling – FCFS, SSTF, SCAN, C-SCAN, LOOK, CLOOK, Disk Management, Disk Formatting, Boot blocks, Bad blocks.

Data Structures PCCS-106

Trees: Basic terminology, Sequential and linked representations of trees, Different types of Trees- Binary Tree, Binary search tree, Threaded binary tree, AVL tree and B-tree. Operations on each of the trees. Application of Binary Trees.

Graphs: Basic terminology, Representation of graphs – Adjacency matrix, Adjacency list. Operations on graph, Traversal of a graph – Breadth first search, Depth first search. Shortest path algorithms – Dijkstra’s and Floyd. Minimum spanning tree – Prim and Kruskal. Applications of graphs.

Heaps: Representing a heap in memory, Operations on heaps, Application of heap in implementing priority queue and Heap sort algorithm.

Hashing and Hash Tables: Introduction to hash table, Hash functions, Concept of collision and its resolution using open addressing and separate chaining, Double hashing, Rehashing.

Searching and Sorting: Linear and binary search techniques, Sorting methods – Bubble sort, Selection sort, Insertion sort, Quick sort, Merge sort, Shell sort and radix sort. Complexities of searching and sorting algorithms.

Software Engineering PCCS-107

Project Management and Risk Analysis: Project planning, Cost estimation techniques– Size metrics, Empirical estimation, Heuristic estimation and analytical estimation, Project monitoring and control– Work breakdown structure, Activity chart, Gantt charts, PERT charts, Critical path method, Manpower management, Risk management- Identification, Analysis, Planning and Monitoring.

Software Design: Modular design– Coupling, Cohesion and abstraction, Function oriented design– Data flow diagrams, Structure chart, Object oriented design–Objects and object classes, Relationships between classes, User interface design.

Coding & Testing: Coding standards and code reviews, Testing – Need of testing, Unit testing, Integration testing, System testing, White-Box testing, Black-box testing, Alpha, Beta and acceptance testing, Smoke testing, Sanity testing, Regression testing, Cyclometric Complexity, Verification and validation.

Maintenance and Re-engineering: Software maintenance, Software re-engineering, Reverse engineering, Forward engineering, PSP and Six sigma.

Environmental Sciences MCCS-101

Biodiversity and its conservation: Introduction- Definition- genetics, species and ecosystem diversity, Bio-geographical classification of India, Value of biodiversity- competitive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, national and local level, India as a mega diversity nation, Hot spots of biodiversity, Threats to biodiversity- habitat loss, poaching of wildlife, man wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity- in-situ and ex- situ conservation of biodiversity.

Environmental Pollution: Definition, causes, effects and control measures of – Air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards, Solid waste management- Causes, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, case studies.

Social issues and the Environment: From unsustainable to sustainable development, Water conservation, rain water harvesting, water shed management, Resettlement and rehabilitation of people- its problems and concerns, case studies, Environmental Ethics- issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies, Environmental protection act, Air (prevention and control of pollution) act, Water (prevention and control of pollution) act, Wildlife protection act, Forest conservation act.

Human population and the Environment: Population growth and variation among nations, Population explosion- family welfare program, Environment and human health, Human rights, value education, HIV/AIDS, Women and child welfare.

B.Tech.: 6th Sem.

Theory of Computation CS-14601

Regular Grammar Regular grammars, Regular expressions, Algebraic method using Arden's theorem, Equivalence of Finite Automata and Regular expressions, Properties of regular languages, Pumping lemma.

Context Free Language Derivation, Ambiguity, Simplification of context free grammar, normal forms– Chomsky Normal Form, Greibach Normal Form, Pumping lemma.

Push Down Automata Description and definition, Acceptance by Push Down Automata, Equivalence of Push Down Automata and context free grammars and languages.

Turing Machine Definition and Model, Representation of Turing Machine, Design of Turing Machine, Variants of Turing Machine, Decidability and recursively enumerable languages, Halting problem, Post correspondence problem.

Context Sensitive Language Context sensitive language, The model of linear bounded automata, Relation between linear bounded automata and context sensitive language.

Advanced Database Systems CS-14602

Distributed DBMS Concepts and Design: Introduction, Functions and architecture of a DDBMS, Distributed relational database design, Transparencies in a DDBMS, Date's Twelverules for a DDBMS, Distributed design concepts – Transaction management, Concurrency control, Deadlock management, Database recovery, Query optimization.

Object-Oriented DBMS: Introduction, Advanced database applications, Weakness of RDBMS, Storing objects in a relational database, Next-generation database systems, OODBMS perspectives, Persistence, Issues in OODBMS, Advantages and disadvantages of OODBMS, Object-oriented database design, Comparison of ORDBMS and OODBMS.

Data Warehousing Concepts, OLAP and Data mining: Evolution of data warehousing, Dataware housing concepts, ETL, Data Warehouse design benefits and problems of data warehousing, Comparison of OLTP systems and data warehousing, On-Line Analytical Processing, Introduction to data mining.

Software Engineering CS-14603

Project Management and Risk Analysis: Project planning, Cost estimation techniques– Size metrics, Empirical estimation, Heuristic estimation and analytical estimation, Project monitoring and control– Work breakdown structure, Activity chart, Gantt charts, PERT charts, Critical path method, Manpower management, Risk management- Identification, Analysis, Planning and monitoring.

Software Design: Modular design– Coupling, Cohesion and abstraction, Function oriented design– Data flow diagrams, Structure chart, Object oriented design–Objects and object classes, Relationships between classes, User interface design, Component based design, IEEE recommended practice for software design description.

Coding & Testing: Coding standards and code reviews, Testing – Need of testing, Unit testing, Integration testing, System testing, Alpha, Beta and acceptance testing, Smoke testing, Sanity testing, Verification and validation.

Maintenance and Re-engineering: Software maintenance, Software re-engineering, Reverse engineering, Forward engineering, PSP and Six sigma.

Artificial Intelligence DECS-14606 (Elective -II)

Planning: Basic representation of plans, Partial order planning, Planning in the blocks world, Hierarchical planning, Conditional planning, Representation of resource constraints, Measures, temporal constraints.

Uncertainty: Basic probability, Bayes rule, Belief networks, Default reasoning, Fuzzy sets and fuzzy logic; Decision making– Utility theory, Utility functions, Decision theoretic expert systems.

Inductive learning: Decision trees, Rule based learning, Current-best-hypothesis search, Least-commitment search, Neural networks, Reinforcement learning, Genetic algorithms.

.NET Technologies DECS-14608 (Elective -II)

Object Oriented Programming with VB.NET: Structure of a VB program, Namespaces , Data structure and language highlights , Classes and inheritance , Structured error handling, Exploring the base class library, The .NET type system, Threads, Creating classes in VB.NET, Overloading, Constructors, Inheritance, Controlling scope and visibility, Dispose and finalization, Debugging.

Introduction to ADO.NET: Brief introduction of ADO.NET solution architecture, Data access models, Dissecting ADO.NET, Working with ADO.NET in connected and disconnected mode, Data centric application architecture, Data binding XML integration in ADO.NET, Transactions in ADO.NET, DB concurrency exception – Disconnected mode.

ASP.NET and Web Services: Introduction to web applications, services and ASP.NET, ASP.NET web forms, ASP.NET controls, User controls and custom controls, Error handling and tracing, Data binding, ASP.NET built in objects.

Software Project Management OECS-14601 (Open Elective)

Project Scheduling and Risk Management: Project sequencing and scheduling activities, Scheduling resources, Critical path analysis, Network planning, Risk management – Nature and

types of risks, Risk planning and control, Risk assessment, Hazard identification, Hazard analysis, PERT and Monte Carlo simulation techniques.

Monitoring and Control: Collecting data, Review techniques, Project termination review, Visualizing progress, Cost monitoring, Earned value analysis, Change control, Software Configuration Management (SCM), Managing contracts and acceptance.

People Management: Introduction, Understanding behaviour, Organizational behaviour, Recruitment process, Motivation, The Oldman – Hackman Job Characteristics model, Stress, Health and safety. Working in teams, Decision making, Leadership, Organization and team structures.

Software Quality Management: ISO Standards, Process capability models, Testing and software reliability, Quality plans, Test automation, Overview of project management tools.

B.Tech.: 8th Sem.

Advanced Computer Networks (CS-14701)

Switching: Overview of switch, Unmanaged and managed switches, Switch administrative configurations, Viewing, Saving and erasing configurations, Spanning tree protocol, VLAN Basics, Static VLAN, Dynamic VLAN, Frame tagging, Trunking protocol, Routing between VLANs, Configuring VLANs, Configuring VLAN trunk ports, Configuring Inter-VLAN routing.

Network Routing: Overview of router, Static and dynamic routing, Introduction to classless routing, Distance vector routing Protocols, Router administrative configurations, Router interfaces, Viewing, Saving and erasing configurations, Routing Information Protocol, Configuration of EIGRP (Enhanced IGRP) and OSPF (Open Shortest Path First).

Adhoc Networks: Features, Advantages and applications, Adhoc versus cellular networks, Network architecture, Protocols –MAC protocols, Routing protocols, Technologies, Applications of mobile adhoc networks.

Compiler Design (CS-14702)

Syntax Parsing- Bottom-up parsing – Shift reduce parsing, Operator precedent parsing, LR parsers, SLR parser, Canonical LR parser, LALR parser.

Symbol Tables: Symbol table format, Storage allocation information, List data structure for symbol tables, Hash tables, Representation of scope information, Runtime environment, Activation tree, Activation record, Parameter passing. Storage allocation strategies 1 – Static allocation, Stack allocation and Heap allocation.

Intermediate Code Generation: Intermediate languages, Declarations, Assignment statements, Boolean expressions, Case statements.

Code Generation: Issues in the design of code generator, The target machine, Runtime storage management, Basic blocks and flow graphs, Next-use information, DAG representation of basic blocks, Peephole optimization.

Code Optimization: Introduction, Principal sources of optimization, Optimization of basic blocks, Global data flow analysis – Reaching definitions and Live variable analysis.

Cyber Laws & Intellectual Property Rights (CS-14703)

Intellectual Property Rights: IPR regime in the digital society, International treaties and conventions, Business software patents, Domain name disputes and resolution, Intellectual property issues in cyber space – Domain names and related issues, Copyright in the digital media.

Patents: Objectives, Rights, Assignments, Defences in case of infringement, Copyright – Objectives, Rights, Transfer of copyright. Work of employment infringement, Defences for infringement. Trademarks – Objectives, Rights, Protection of Goodwill, Infringement, Passing off, Patents in the cyber world.

IT ACT 2000: Aim and objectives, Overview of the Act, Information Technology Act-2000-1 Information Technology Act-2000-2, Information Technology Act-2000-3, Information Technology Act-2000-4, Information Technology Act-2000-5, Information Technology Act-2000-6, Amendments in IT Act. Jurisdiction, Role of certifying authority, Regulators under IT Act, Cyber crimes – offences and contraventions. Grey areas of IT Act.

Case Study: Case studies of infringement of cyber laws and IPR in Government sector, Corporate sector, Financial sector.

Cloud Computing DECS-14706 (Elective –III)

Cloud Architecture and Services: Cloud computing reference model architecture, Common cloud management platform, Cloud service models – Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). Cloud-based services and applications – Healthcare, Energy systems, Transportation systems, Manufacturing industry, Government, Education. Cloud deployment models – Public, Private, Community, and Hybrid cloud.

Security in Clouds: Cloud security issues and challenges, Cloud security reference model, Encryption techniques – Symmetric key encryption, Asymmetric key encryption. Identity and key management, Digital signature, Secure Socket Layer (SSL).

Cloud Computing Platforms: Study and comparison of various open source and commercial cloud platforms, Open source cloud platforms – Openstack, Eucalyptus, Nebula. Commercial cloud platforms – Amazon Elastic Compute Cloud (EC2), Google App engine, MS Azure.

Big Data and Business Analytics DECS-14707 (Elective -III)

Working with Hadoop: Interacting with HDFS, Steps to read and write into HDFS. Anatomy of MapReduce Program – Hadoop data type, Mapper and Reducer, Partitioner, Combiner, Reading and writing format, Word count with predefined mapper and reducer. Introduction to Hive and Spark.

Big Data Management: In-database Analytics – Introduction to NoSQL– Aggregate data models, Graph databases, Graph-less databases, Distribution models, Introduction to HBase, MongoDB, and Cassandra.

Business Analytics: Decision making in business analytics, Business analytics in practice – Financial analytics, Healthcare analytics, Sport and web analytics. Categorization of analytics methods and models – Descriptive analytics, Predictive analytics, Perspective analytics.

Advanced Analytical Theory and Methods– Linear regression, Logistic regression, K-menas clustering, Decision tree classification.

Natural Language Processing DECS-14709 (Elective -IV)

Introduction: Introduction to natural language and speech processing, Steps for processing natural languages, Issues and challenges for processing of natural languages, Elements of information theory, Brief history of natural language processing.

Morphological Analysis: Inflectional and Derivational morphology, Morphological parsing, Lexicon and Morphotactics, Finite state transducers, N-gram language models, N-gram smoothing, Entropy.

Part-of-Speech Tagging: Word classes, Part-of-speech tagging, Tagsets, POS tagging Techniques – Rule-based, Stochastic, Transformation-based.

Syntactic Analysis: Introduction to parsing, Basic parsing strategies, Top-down parsing, Bottom-up parsing, Issues in basic parsing methods, Parsing with context-free grammars, Earley algorithm, Finite-state parsing methods.

Semantic Analysis: Lexical semantics, Lexemes, Relations among lexemes and their senses, WordNet, Word Sense Disambiguation.

Pragmatics: Discourse, Discourse structure. Dialogue – Acts, structure, conversational agents. Language generation, Architecture for generation.

Applications: Different application areas of natural language processing – Machine translation, Machine learning, Text categorisation and summarisation, Speech synthesis, Speech recognition, Optical character recognition, Database access, etc.

Soft Computing DECS-14713 (Elective -IV)

Fuzzy Logic: Crisp and fuzzy sets, Fuzzy sets– Membership functions, Basic operations, Properties and fuzzy relations. Fuzzy rule based system–Linguistic hedges, Aggregation of fuzzy rules, Fuzzy inference system. Applications of fuzzy logic.

Genetic Algorithms: Working principle– Crossover, Mutation, Encoding, Fitness function and Reproduction, Classification of genetic algorithm, Multi-objective genetic algorithm. Genetic Programming, Application of GA in search and optimization.

Optimization Techniques: Simulated annealing, Particle Swarm Optimization, Bee Colony Optimization, Ant Colony Optimization, Tabu search, Teaching-learning based optimization.

M.Tech.: 2nd Sem.

Advance Algorithms MCS-103

Flow Networks and Matching: Definitions of Flow networks and flows, Ford-Fulkerson method to compute maximum flow, Max-flow min-cut theorem, Edmonds-Karp algorithm, Maximum bipartite matching problem, Push-relabel algorithm. String Matching: Naive string matching algorithm, Rabin-Karp algorithm, Longest Common Subsequence (LCS), Knuth-Morris-Pratt pattern searching algorithm, String matching with finite automata.

NP-Completeness and Approximation Algorithms: Introduction to NP, NP- hard and NP complete problems, polynomial-time verification, proof of NP-completeness. Vertex-cover problem and Traveling-Salesman problem.

Case study: Case study on recent trends in problem solving paradigms using searching and sorting by applying data structures.

Soft Computing MCS-104

Fuzzy Logic: Concept of fuzziness, Fuzzy vs crisp, Crisp sets, Operations on crisp sets, Properties of crisp sets, Fuzzy sets, Features of fuzzy sets, Basic fuzzy set operations, Properties of fuzzy sets, Fuzzy relations, Fuzzy membership functions, linguistic hedges, Fuzzy rule-based system, Defuzzification methods, Fuzzy extension principle

Genetic Algorithms and Multi-objective Optimization: Concept of natural evolution, Generation of population, Encoding, Fitness Function, Reproduction, Crossover, Mutation, probability of crossover and probability of mutation, convergence. Concept of multi-objective optimization problems (MOOPs), Multi-Objective Evolutionary Algorithm (MOEA), Non-Pareto

approaches to solve MOOPs, Pareto-based approaches to solve MOOPs, Some applications with MOEAs.

Cryptography MCS-131

Public Key Cryptography and RSA: Principles of public key cryptosystems, Diffie Hellman key exchange, RSA algorithm and its attacks, Key management – Needham Schroeder protocol, Otwayrees protocol.

Authentication and Key Management: Entity Authentication – Password based authentication, Challenge-response protocols, Biometrics. Symmetric Key Distribution and Management, Public key Distribution, Kerberos.

Integrity: Message Integrity, Hash Function, Message Authentication -MAC, HMAC. MD5 algorithm, Secure Hash Algorithm, Public Key Infrastructure, Digital Signature, Digital Signature Standard algorithm, Attacks on digital signature.

Natural Language Processing MCS-143

Morphology and Phonology: N-gram language models, phonetics fundamentals, phoneme and phonological rules, machine learning of phonology, phonological aspects of prosody and speech synthesis.

Part-of-Speech Tagging and Parsing: Word Classes, Part of speech tagging, Tagsets, Rule based, Stochastic and Transformation based POS tagging. Basic parsing strategies, top down parsing, bottom up parsing, parsing with context free grammars, a basic top down parser, Earley parser, CYK parser, Finite state parsing methods, Unification of feature structures.

Semantic Analysis and Pragmatics: Lexical Semantics, Lexemes, Relations among lexemes and their senses, WordNet, Internal structure of words, metaphor and metonymy & their computational approaches, Word Sense Disambiguation. Discourse, Reference resolution, syntactic and semantic constraints on coreference, pronoun resolution reference, text coherence, discourse structure, Dialogue- Acts, structure, conversational agents, Introduction to language generation, architecture, discourse planning.