CA201

DISCRETE MATHEMATICS

1. **Set Theory** - Set operations, properties - power set - methods of proof - relations, graph and matrix of a relation - partial and total orders, well ordering - equivalence relations, classes and properties - functions, 1-1, onto and bijective - composition of relations and functions - inverse functions.
2. **Induction and Combinatorics** - Peano's axioms - Mathematical induction (simple and strong) - pigeon-hole principle - principle of inclusion and exclusion - review of permutations and combinations - distribution problems - derangements - bijection principle.
3. **Algebraic Structures** - Semi-groups, monoids, groups, subgroups and their properties - cyclic groups - cosets - permutation groups - Lagrange's theorem - Cayley's theorem - normal subgroups - homomorphism of groups - quotient groups - rings and fields.
4. **Recurrence Relations and Generating Functions** - Homogeneous and inhomogeneous recurrences and their solutions - solving recurrences using generating functions - Repertoire method - Perturbation method - Convolutions - simple manipulations and tricks.
5. **Graph Theory** - Definitions and basic results - Representation of a graph by a matrix and adjacency list - Trees - Cycles - Properties - Paths and connectedness - Subgraphs - Graph Isomorphism - Operations on graphs - Vertex and edge cuts - Vertex and edge connectivity.

TEXT BOOKS:

- K.D.JOSHI, "Discrete Mathematics", Wiley Eastern Ltd.

REFERENCE:

- ARTHUR GILL, "Applied Algebra for Computer Science", Prentice Hall
- R.BALAKRISHNAN, K.RANGANATHAN, "A Text Book of Graph Theory", Springer
- THOMAS KOSHY, "Discrete Mathematics with Applications", Elsevier.

CS203

NUMERICAL COMPUTING

1. **Non-Linear Systems** - Various types of errors - Bisection method - Regula falsi method - Newton-Raphson method - Horner's Method - Graffe's method - Bairstow's method - Newton's method for solving $f(x,y) = 0$ and $g(x,y) = 0$.

2. **Linear Systems** - Gaussian elimination - Iterative methods - Sufficient conditions for convergence - LU decomposition method - Power method to find the dominant eigen value and eigen vector.

3. **Interpolation and Curve Fitting** - Newton's forward and backward interpolation - Method of least squares to fit equations of the form $y = ab^2$ and $y = ax^2 + bx + c$.

4. **Numerical Differentiation and Integration** - Simpson's one-third rule - Simpson's three-eighth rule - Double integration using trapezoidal and Simpson's ont-third rule.

5. **Numerical Solution of Differential Equations** - Euler's method - Taylor's method - Runge-Kutta method of fourth order - Numerical solution of Laplace equation - One-dimensional heat flow equation and wave equation by finite difference methods.

REFERENCE:

- C.F.GERALD and P.O.WHEATLEY, "Applied Numerical Analysis", Mc Graw-Hill, 1981
- CHENEG and KINCAID, "Introduction to Numerical Computing", Tata McGraw-Hill, 1998

CS207

DIGITAL COMPUTER FUNDAMENTALS

1. Binary codes - Weighted and non-weighted - Binary arithmetic conversion algorithms - Error detecting and error correcting codes - Canonical and standard boolean expressions - Truth tables.

2. K-map reduction - Don't care conditions - Adders / Subtractors - Carry look-ahead adder - Code conversion algorithms - Design of code converters - Equivalence functions.

3. Binary/Decimal Parallel Adder/Subtractor for signed numbers - Magnitude comparator - Decoders / Encoders - Multiplexers / Demultiplexers - Boolean function implementation using multiplexers.

4. Sequential logic - Basic latch - Flip-flops (SR, D, JK, T and Master-Slave) - Triggering of flip-flops - Counters - Design procedure - Ripple counters - BCD and Binary - Synchronous counters.

5. Registers - Shift registers - Registers with parallel load - Memory unit - Examples of RAM, ROM, PROM, EPROM - Reduction of state and flow tables - Race-free state assignment - Hazards.

TEXT:

- MORRIS MANO, "Digital Design", Prentice Hall of India, 2001
- W.H.GOTHMANN, "Digital Electronics - An Introduction to Theory and Practice", Prentice Hall of India, 2000

CS209

COMPUTER ORGANISATION AND ARCHITECTURE

1. **Basic structure of Computers** - Operational concepts - Bus structures - Arithmetic operations - Memory operations - Addressing modes - Basic I/O operations - Performance.
2. **Arithmetic** - Addition & subtraction of signed numbers - Multiplication - Integer division - Floating point operations.
3. **Processing unit** - Control unit - Pipelining - Multiple bus organization - Hardwired control - Micro programmed control - Hazards - Data path - Embedded systems.
4. **Memory System** - Basic concepts - Semiconductor RAM memory - Cache memory - Performance considerations - Virtual memory - Secondary storage.
5. **I/O Organisation** - Accessing I/O devices - Interrupts - DMA -Buses - Interface circuits - Serial communication links.

TEXT:

- C.HAMACHER, Z.VRANESIC, S.ZAKY, "Computer Organization", V Edition, McGraw Hill, 2002
- W.STALLINGS, "Computer Organization and Architecture", I Edition,Pearson education,2002

CS201

PRINCIPLES OF PROGRAMMING LANGUAGES

1. **Introduction to Language Paradigms** - Criteria for good language design - Data types - Abstraction - Imperative languages - Pascal, C - design issues.

2. **Object-Oriented Programming** - Data encapsulation - Classes in C++ - Over loading - Derived classes - Information hiding - Inheritance and polymorphism - Generic functions.

3. **Functional Programming** - Introduction to LISP - Lists - Storage allocation for lists - Some useful functions - Error handling.

4. **Logic Programming** - Computing with relations - Introduction to Prolog - Data structures in Prolog - Programming techniques - Control in Prolog - Cuts.

5. **Parallel Programming** - Synchronizations - Concurrency - Deadlocks - Mutual exclusion - Concurrent programming - Communicating sequential processes: input-output commands.

TEXT:

- R.SETHI, "Programming Languages: Concepts and Constructs", II Ed., Pearson Education, 1996

REFERENCE:

- Robert W.Sebesta, "Concepts of Programming languages", IV Ed., Pearson Education 1999

CS211

PROGRAMMING LANGUAGES LABORATORY

- UNIX shell programming
- Programming tools and windows
- Network File Systems
- Network Information Systems
- Message Passing Interface
- Functional programming techniques through LISP
- Object-oriented programming techniques through C++/Java
- Logic programming through techniques PROLOG
-

CS213

DATA STRUCTURES LABORATORY

Problems in C/C++/ Java using data structures involving arrays, stacks, queues, strings, linked lists, trees, graphs.

- Operations on stacks, queues and linked lists
- Conversion of infix expressions to postfix and evaluation of postfix expressions
- Implementation of priority queue

CS205

DATA STRUCTURES

1. **Development of Algorithms** - Notations and analysis - Storage structures for arrays - Sparse matrices - Stacks and Queues: Representations and applications.

2. **Linked Lists** - Linked stacks and queues - Operations on polynomials - Doubly linked lists - Circularly linked lists - Dynamic storage management - Garbage collection and compaction.

3. **Binary Trees** - Binary search trees - Tree traversal - Expression manipulation - Symbol table construction - Height balanced trees - Red-black trees.

4. **Graphs** - Representation of graphs - BFS, DFS - Topological sort - Shortest path problems. String representation and manipulations - Pattern matching.

5. **Sorting Techniques** - Selection, Bubble, Insertion, Merge, Heap, Quick, and Radix sort - Address calculation - Linear search - Binary search - Hash table methods.

TEXT:

- J.P.TREMBLAY and P.G.SORENSON, "An Introduction to Data Structures with applications", Second Edition, Tata McGraw Hill, 1981