Ramakrishna Mission Residential College
Narendrapur, Kolkata

Syllabus : 2012-2015

Semester – I

	PAPER	GROUP	TOPIC	Periods	MARKS
Theory	P-I	Group-A	Circuit Theory & Basic Electronics	40	
		Group-B	Digital Electronics	50	
			Total	**90**	**50**
	P- IIA	Group-A	Introduction To Computer	20	
		Group-B	Programming Through C	40	
			Total	**60**	**25**
Practical	P - IIB	Group-A	H/W lab(Digital electronics & Basic Electronics)	60	15
		Group-B	S/W lab(C programming)	40	10
			Total	**100**	**25**

Paper – I

GROUP – A (Circuit Theory &Basic Electronics) (40 Periods)

Circuit Theory: Passive circuit parameters and their equilibrium conditions – Kirchoff's law, Differential equation representation of passive circuits. Solution of circuit of differential equations for simple circuits, concept of impedance and reactance. Steady state response. Frequency domain analysis of RLC circuits. Amplitude and phase. Vector representation, resonance, circle diagram. Network equation, Y- DELTA transforms, network theorems – superposition, reciprocity, Thevnin, Nortan, Maximum power transform theorem, Fourier Series and Fourier transformation, Laplace transformation.

Energy Bands in Solids: Charged particles, Field Intensity, Potential, energy, Nature of atom, Atomic energy level, Electronic structure of element, Energy-Band Theory of Crystal, Insulator, Semiconductor and metals.

Transport Phenomena in Semiconductors: Mobility, conductivity, Electrons and Holes in Intrinsic semiconductor, Donor and acceptor, Electrical properties of Ge and Si, Hall effect, Generation and Recombination of Charges, Diffusion.

Junction Diode: p-n junction diode, forward and reverse bias, current components in p-n diode, volt – ampere characteristic, diode resistance, break down diodes (Zener, avalanche), Application of diode as rectifier (Half-wave, full-wave and bridge rectifier).

Transistor: Junction Transistor, current components, Transistor as an amplifier, Common base and common emitter configuration, active, cut off and saturation region.

Operational Amplifier: Basic OPAMP, Characteristic of Ideal OPAMP, Inverting and Non inverting amplifier, Differential amplifier, CMRR, OPAMP as adder, Integrator, differentiator.

GROUP – B (Digital System Design) (50 Periods)

Basic logic gates and their properties: Introduction (Functional behaviour of logic gates, truth table, timing diagram), Logic gates (AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR), Active levels of logic signal.

Boolean Switching Algebra: Introduction, postulates of Boolean algebra, differences from normal algebra, Theorems of Boolean algebra (Idempotent, boundness, equliaty,

complement, involution, absorption, associative, DeMorgan's, Shannon's theorem), Boolean function (Maxterm, Minterm, Cannonical form [SOP & POS, conversion between canonical forms], Standard form, conversion between standard and canonical form, Number of Boolean Functions).

Simplification of Boolean Function: Implicant, Implicate, Prime Implicant, Essential prime implicant, Optional prime implicants, Redundant Prime Implicant, Minimal cover Karnaugh Map minimization (Upto Four Variable), Incompletely Specified function (Don't care condition) & its minimization.

Implementation of Combinational logic: Two level and Multilevel implementation using basic gates, Universal logic gates (NAND & NOR), Two and Multilevel implementation using universal gates.

Combinational logic: Adders (Half and Full adder, their differences, Implementation using logic gates and universal gate), subtractor (Half and Full subtractor, their differences, Implementation using logic gates and universal gate), Parallel Adder and its disadvantage, Carry Look Ahead Adder, BCD Adder, Code Converter, Comparator, Decoder: 2X4 & 3X8 Decoder, Decoder with Enable line, BCD to Decimal Decoder, Logic circuit implementation, Expansion, Demultiplexer, Conversion of Decoder & DEMUX, Encoder, Priority Encoder, Multiplexer: 4X1 & 2X1 MUX, Expansion, Quad MUX, Logic circuit implementation, MUX Functionally complete, ROM, PLA and its advantage over ROM, SSD, Multiplexed display, Key board Encoder.

Sequential circuit: Difference from Combinational logic, Latch: RS, D, JK, T, Latch conversion, Flip-flop: RS, D, JK, T, Master slave, Edge trigger, Sequential circuit from State diagram, State Reduction, Design from state equation, FSM and its Design, Counter: Asynchronous (UP, DOWN, UP/DOWN), Synchronous (e.g. UP, DOWN, UP/DOWN, ODD,EVEN, PRIME, FIBONACCI), Register: SISO, SIPO, PISO, PIPO, Universal shift register.

A/D and D/A converter: D/A (Weighted register, R-2R Ladder), A/D (Counter, Successive approximation) converter, resolution, accuracy.

Logic Families: TTL, MOS, CMOS, Comparison, Propagation delay, Power dissipation, Fan-In, Fan-Out, Noise margin, Open Collector type logic gates and its advantages

Paper – II (A)

GROUP – A (Introduction To Computer) (20 Periods)

Introduction: Motivation for development of computer & its historical background, Characteristics of computer, Generation of computer & their relative advantages and disadvantages, application of computers.

Classification of computers: according to task performed (General purpose and special purpose), according to logic (Analog, digital, Hybrid), according to size (Super computer, main frame, mini and micro computer), Personal computer, workstation, Portable computers (laptop, notebook, handheld computer, PDAs).

Components of digital computers and functions of each unit: CPU (ALU & CU), memory, Input and output device, block diagram of a digital computer.

Hardware and software: Purpose of H/W & S/W. Classification of S/W (System S/W, Application S/W), Firmware.

Problem solving using computers: Algorithm and its properties, simple algorithms as examples, flowchart, decision table, comparative study of machine level language, assembly language, high level language.

Number system: base or radix, Decimal, binary, octal and hexadecimal number system, Algorithm for conversion from any base to any base (for both Integral and floating point data).

Arithmetic operation: addition, subtraction, multiplication and division of binary, octal and hexadecimal number.

Signed number representation: signed magnitude, diminished radix complement [(R-1)′ s complement] and radix complement [R′s complement], relative advantages and disadvantages, addition and subtraction using complement representation.

Fixed and floating point representation: Fixed point number and its disadvantages, Floating point number and scientific representation (mantissa and exponent), Biased exponent and its advantages, IEEE 754 floating point representation.

Computer codes: advantages of codes, Weighted & non-weighted code, BCD code (BCD representation of decimal numbers, conversion of BCD to binary, addition and subtraction of BCD numbers), Unit distance code, Reflected code, Gray code (Binary code to gray code and vice-versa), ASCII code, Error detecting and correcting code (forbidden combination check code, M-out-of-N code, Biquinary code, Parity code, Block parity, checksum, CRC, Hamming code).

GROUP – B (Programming Through C Language) (40 Periods)

Introduction: Basic Structure; Character Set; Keywords, Identifiers, Constants, Variables; Data Types and Sizes, Type Casting, Floating Point Domain Error.

Operators and Expressions: Arithmetic, Relational, Logical, Assignment, Bitwise, Increment, Decrement, Ternary Operators and Expressions; Precedence and Association of Operators.

Instruction: Type Declaration, I/O (Formatted And Unformatted) And Control Instruction (If-Else, Else-If, Switch-Case, For Loop, While Loop, Do-While Loop, Break, Continue, Goto).

Functions: Declaration, Definition, Return; Storage Class (Auto, Static, Register, External); Scopes Rules; Header Files; Variables Number of Arguments; Recursion; Call by Value, Call by Address.

C Preprocessor: Macros; Difference with Function; Include-if, elif, undef, pragma Directives.

Arrays: One Dimensional and Two Dimensional Arrays; Memory Representation, Initialization, Bound Checking; Insertion and Deletion of Elements; Searching (Linear, Binary), Sorting (Bubble, Insertion, Selection); Passing Array to Function; Multidimensional Arrays; Matrix Implementation.

Pointers: &,* Operators; Pointer And Addresses; Pointer Expressions; Pointers as Function Arguments; const Qualifiers; Pointers And Arrays; pointer Arithmetic; Character Pointers and Functions; Pointer Arrays; Initialization of Pointer Arrays; Function Returning Pointers; Dynamic Allocation; Pointer to a Function.

Strings: One And Two Dimensional; Fixed Length and Variable Length Strings; Problem Solving like Text Processing; Conversion to other Types etc.; Strings and Pointers, Command Line Arguments.

Structure And Unions: Structure Types, Variables; Initialization; Array of Structures; Structures and Functions; Pointers and Structures; Self-Referential Structures; Table Lookup; typedef, Unions, Comparisons Of Structure And Union, Enumerated Data Types.

Input And Output: Standard I/O, Streams; printf, scanf, gets, puts, getc, putc etc Console I/O Functions; Disk I/O function Like fopen, fclose, fseek, ftell etc.; Text And Binary Files, Random Access; Files And Structures.

Bitwise Operations: One's Complement, >>, <<, &, |, XOR Operators; Bit Printing Of Variables, Hexadecimal Notations.

Semester – II

	PAPER	GROUP	TOPIC	Periods	MARKS
Theory	P-III	Group-A	Data Structure	60	
		Group-B	Numerical Analysis	40	
			Total	**100**	**50**
	P- IVA	Group-A	Computer Organization	50	
			Total	**50**	**50**
Practical	P - IVB	Group-A	Numerical Analysis Lab	40	10
		Group-B	Data Structure Lab	60	15
			Total	**100**	**50**

Paper – III

Group – A (Data Structure) (60 Periods)

Introduction: Algorithm and its properties, simple algorithms as examples.
Algorithm and complexity: Asymptotic notation (O, Ω, θ), polynomial time, exponential time.
Data structure: Definition and Concepts of Linear and Non Linear Data Structures.
Arrays: Types, Memory Representations; Address Translations, Two Dimensional Arrays, Row Major and Column Major Forms; Sparse Matrix Representations and Address Translation, Polynomial Representation.
Linked List: Single, Double, Circular & Header Linked List; Operations Like Insertion, Deletion, Searching, Sorting, Inversion, Splitting, Merging Etc. ; Polynomial Representation, Addition, Multiplication.
Stacks And Queues : Concepts Of Stack And Queue; Insertion and Deletion of Elements; Array and Linked Representation; Prefix, Infix And Postfix Notation; Postfix Expression Evaluation, Infix To Postfix; Circular Queue Insertion and Deletion; Dqueue Insertion and Deletion; Priority Queue Implementation using Array or Linked List; Queue Using Circular Linked List; Stack Using Queues; Queue Using Stacks.
Recursion: Divide and Conquer; Direct and Indirect recursion; Use of System Stack, Recursion Tree; Elimination of Recursion using Stack, Tail Recursion, Recursion Vs. Iteration.
Searching: Algorithm of Sequential and Binary Search Techniques; Complexity Analysis.
Trees: Concepts of Different Types of Binary Trees; Quantitative Properties; Depth, Internal And External Nodes, Minimum And Maximum Path Length; Syntax Trees; Concepts Of Heap; Traversal of Binary Trees (In-Order, Preorder, Post-Order) Both

Recursive And Non Recursive; Array and Linked Representation of Binary Trees; BST Insertion and Deletion Algorithm; Threaded Binary Trees:Insertion, traversal Algorithm.
Sorting: Algorithm and Complexity Analysis of Bubble, Selection, Insertion, Quick, Merge, Radix, Heap Sorting Techniques; Concepts of External Sorting.
Hashing: Concepts, Advantages and Disadvantages; Different Hash Functions; Collision and Resolution Techniques – Open Addressing (Linear & Quadratic Probing, Rehashing), Chaining And Coalesced Chaining; Dynamic Hashing and Extendible Hashing; Perfect Hash Function; Applications (Symbol Table).

Group – B(Numerical Analysis) (40 Periods)

Errors: Concepts; Types of errors.
System of Linear Equations: properties of Set of Linear Equations -Linearly dependent and independent, Rank, Singularity of coefficient matrix; Ill condition matrix, Gaussian Elimination, Gauss-Jordon Elimination; iteration method and its convergence condition and testing; Gauss-Jacobi and Gauss-Seidal iteration algorithm and its applications.
Non-linear equation: Iterative methods and different types of convergence; divergence and its test condition; Bisection algorithm; Regular-falsi method, Secant and Newton-Raphson method; Problems and its graphical significance;
Solution of differential equations: Euler method; Taylor method; Runge-Kutta second and fourth order method for solving differential equations.
Interpolation: Newton forward and backward interpolation; Lagrange interpolation.
Curve fitting: Linear, Quadratic fitting.
Integration: Mathematical foundation for Trapezoidal and Simpson's 1/3 rules and its composite forms.

Paper – IV (A)

GROUP – A (Computer Organization) (50 Periods)

Basic computer organization: Accumulator based CPU, disadvantages, Improvements, CPU registers (IR, PC, SP, MAR, MDR, AC), IAS computer, Von Neumann computer.
Instruction: Machine instruction, Assembly language instruction, micro instruction, Instruction Cycle, Instruction Format, 0, 1, 2, 3-address instruction, instruction types, instruction set completeness, Addressing modes, Numerical problems on Instruction format.

Stack organization: Implementation of Stack using Shift register, Application of stack in Organization.

Memory: Types of Memory (RAM, ROM, DRAM, SRAM, SAM), characteristic of memory, Memory organization: Linear, 2D, Memory expansion (Horizontal, vertical and mixed).

Associative memory: Design and application.

Virtual memory: Concept, Mapping (Direct, Associative and Direct –associative mapping), Replacement algorithm (FIFO, LRU, LFU).

Cache memory: Concept of locality of reference, cache memory organization, Hit & miss, Write back & Write through Cache, Mapping (Direct, Associative and Set-associative mapping), Numerical problems on cache mapping.

Bus Organization: Bus structure, I/O interfacing, tri-state logic, Address decoding (Absolute & Partial), Memory mapped I/O & I/O mapped I/O, Data transfer (Programmed I/O, Interrupt initiated I/O, DMA), Bus contention and bus arbitration.

ALU Design: Functions of ALU, Bit sliced ALU, Implementation of Arithmetic operations (Fixed point data [Addition, subtraction, multiplication and division algorithm for signed number represented in signed magnitude and 2's complement], Floating point data [Addition, subtraction, multiplication and division algorithm for signed number], BCD arithmetic, Implementation of Logical operation.

CU Design: Hardwired and Micro-programmed CU design and their relative advantages & disadvantages, Horizontal and vertical microinstruction, parallelism in Microinstruction.

Semester – III

	PAPER	GROUP	TOPIC	Periods	MARKS
Theory	P-V	Group-A	Operating System	60	
		Group-B	Micro Processor	40	
			Total	**100**	**50**
	P- VIA	Group-A	Object Oriented Programming	50	
			Total	**50**	**25**
Practical	P - VIB	Group-A	H/W lab(Microprocessor)	35	10
		Group-B	Operating System Lab	25	5
		Group-C	Object Oriented Programming	40	10
			Total	**100**	**25**

Paper – V

GROUP – A (Operating System) (60 Periods)

Introduction: Concepts of System S/W and Application S/W, Concept of Compiler, Interpreter, Assembler (One Pass and Two Pass Concepts), Loader, Linker.

Operating System Fundamentals: Concepts of Batch, Multiprogramming, Time Sharing, Multiprocessing, Multithreading, Distributed, Real Time, Handheld Systems; I/O and CPU Protection Methods; Concepts of Process.

Processor Scheduling : Basic Concepts; Preemptive And Non-Preemptive Scheduling; Scheduling Criteria; FCFS, SJF, SRTF, Priority, Round Robin, Multilevel Feedback Queue Scheduling Algorithms; Gantt Chart Representation of Scheduling, Calculation of Waiting and Turnaround Time.

Concurrent Processes: Concurrent Processes**;** Precedence Graphs, Fork And Join Notation; Critical Section Problem; Two Process Software Solution (Peterson Algorithm); Multi-Process Solution (Bakery Algorithm); Semaphores; Critical Section Problem and Semaphores: Busy Waiting, Deadlock, Starvation, Mutex, Monitors; Classical Problem Of Synchronization (Bounded Buffer, Reader Writer, Dining Philosopher) and Semaphore Solution; Critical Regions.

Deadlocks: System Model, Necessary Conditions; Resource Allocation Graph; Deadlock Prevention; Deadlock Avoidance, Safe State, Resource Allocation Graph Algorithm, Banker's Algorithm; Deadlock Detection; Recovery from Deadlock.

Memory Management: Concepts Address Binding; Logical and Physical Address Space; Overlays, Swapping; Contiguous Memory Allocation Concepts, Fragmentation and Compaction; Basic Method of Paging and H/W Support, Memory Protection, Structure of Page Table, Shared Pages; Segmentation, Segmentation with Paging.

Virtual Memory: Concepts of Virtual Memory; Demand Paging; Page Replacement Basic Schemes: FIFO, Optimal, LRU Page Replacement Techniques, Belady's Anomaly; LRU Approximation, Global And Local Allocation Of Frames; Thrashing; Working Set Model; Prepaging; Page Size; Inverted Page Table.

Disk Scheduling: Concepts of Seek Time and Latency; FCFS, SSTF, SCAN, Look Algorithms; Concept Of RAID, SAN.

File System: File Attributes; Operations and Types; File Access Methods (Sequential, Direct, Index Sequential); Directory Structure (Single Level, Two Level, Tree and Acyclic Graph Structured);

Protection And Security: Domain of Protection; Access Matrix; User Authentication (Password, Encrypted Password, One Time Password, Biometric); Program Threats (Trojan Horse, Trap Door, Stack and Buffer Overflow); System Threats (Worms, Viruses), Concepts of Cryptography.

Case Study: UNIX/ Linux System Commands and Shell Programming.

Group – B (Microprocessor)_ (40 Periods)

Introduction: Microprocessor and microcontroller, Organization of microprocessor based system, Application of Microprocessor.
Microprocessor Architecture: Registers, Address bus, data bus, control bus, Multiplexing and demultiplexing of Address-data bus, Function of different pins of 8085A, 8085A Microprocessor functional block diagram, Timing diagram (Opcode fetch, Memory read, Memory write, I/O read, I/O write)
Interfacing Of Memory and I/O: Address decoding (Absolute & Partial decoding), Concept of Memory mapped I/O and I/O mapped I/O.
Instruction set of 8085A: Instruction format, opcode format, data format, addressing modes, Instruction Types (Data transfer, arithmetic, logical, branch operation), Counter and delay routine, Delay calculation, Stack operation (PUSH, POP), Subroutine call, Conditional CALL and RETURN, Restart instruction.
Programming With 8085A: Simple Assembly language programming using 8085A instruction set.
Interrupt: 8085A Interrupt process, S/W and H/W interrupts, Vectored and non-vectored Interrupt, RIM and SIM instruction, DMA.
8255A programmable Peripheral interface: Block diagram, control word, I/O and BSR mode, Normal I/O mode, Handshaking I/O mode, Bidirectional mode, Illustration using LED, SSD and Matrix keyboard Interfacing.

Paper – VI (A)

Group – A (Object Oriented Programming) (50 Periods)

Introduction: Basis of Object model, OOP, OOD, OOA; Abstraction; Encapsulation; Modularity; Hierarchy; Typing; Concurrency; Benefits of object models.
Class modeling: Object and class; State ; Behaviour; Relationships among objects; Link and associations; Generalization, inheritance, polymorphism ; N-ary associations; Aggregations; Meta-class; Abstract class; Multiple Inheritance; Metadata; measuring the quality of abstraction; Constraints; Packages; class diagram; object diagram; example class models;
State Modeling: Events; States; Transitions and Conditions; State diagram; example of state diagrams; Nested state diagram; Nested state; Signal Generalization; Concurrency; Relation of class and state model.

Interaction Modeling: Use case models; Sequence models; Activity models; Use case relationship; Procedure sequence models;
System Conception: Development life cycle; devising a system concept; preparing a problem statement.
Domain Analysis: Domain class model; Domain state model; Domain interaction model;
Application analysis: application interaction model; application class model; application state model.
System design: Making a reuse plan; Breaking the system into subsystem; Identifying concurrency; Allocation of subsystem; Management of data storage; Handling global resources; Choosing a s/w control strategy; Handling boundary condition; Common architectural styles;
Class design: overview; realizing use cases; designing algorithms; Refactoring; Design optimization; adjustment of inheritance; organizing a class design.
Legacy system: Reverse engineering; Building class model, interaction model and state models; Wrapping.
OO language: case study Java.

Semester – IV

	PAPER	GROUP	TOPIC	Periods	MARKS
Theory	P-VII	Group-A	Database Management System	60	
		Group-B	S/W Engineering	40	
			Total	**100**	**50**
	P-VIIIA	Group-A	Optimization Techniques	50	
			Total	**50**	**25**
Practical	P-VIIIB	Group-A	DBMS Lab	100	25
			Total	**100**	**25**

Paper – VII

Group–A (DBMS) (60 Periods)

Introduction: Drawbacks of Legacy System; Advantages of DBMS; Layered Architecture of Database, Data Independence; Data Models; Schemas And Instances; Database Languages; Database Users, DBA; Data Dictionary; Functional Components of a DBMS.

ER Model: Entity, Attributes and Relationship; Structural Constraints; Keys; ER Diagram of Some Example Database; Weak Entity Set; Symbolic Conventions; Specialization and Generalization; Constraints of Specialization and Generalization; Aggregation.

Relational Model: Basic Concepts of Relational Model; Relational Algebra; Tuple Relational Calculus; Domain Relational Calculus.

Integrity Constraints: Domain Constraints, Referential Integrity, Assertions, Triggers.

Relational Database Design: Problems of Un-Normalized Database; Functional Dependencies, Derivation Rules, Closure Of FD Set, Membership Of A Dependency, Canonical Cover; Decomposition to 1NF,2NF,3NF Or BCNF Using FD; Lossless Join Decomposition Algorithm; Dependency Preservation.

SQL: Basic Structure, Data Definition, Constraints and Schema Changes; Basic SQL Queries (Selection, Insertion, Deletion, Update); Order by Clause; Complex Queries, Aggregate Function and Group by Clause; Nested Sub Queries; Correlated Sub Queries; Views (Insert-Able and Updatable), Joined Relations; Set Comparisons (All, Some); Derived Relations Etc; Grant and Revoke, Transaction in SQL.

Record Storage and File Organization: Fixed Length and Variable Length Records; Concepts of Disk Blocks; Spanned and Un-Spanned Organization of Records; Primary File Organizations and Access Structures Concepts; Unordered, Sequential, Hashed; Concepts of Primary and Secondary Index; Dense and Sparse Index; Index Sequential Files; Multilevel Indices.

Query Processing: Query Processing Steps**;** Translating Different SQL Queries to Relational Algebra; Using Heuristics in Query Optimization; General Transformation Rules for Relational Algebra; Cost Estimation Functions of Select, Join.

Transaction Processing: ACID Properties; Transaction States, Concurrent Execution; Serializability (Conflict and View), Recoverability, Test for Serializability.

Group – B (Software Engneering) (40 periods)

Introduction: S/W engineering discipline – evolution and impact, Program Vs S/W, Emergence of S/W engineering (Introduction to Control based design, Data structure oriented design, data flow oriented design, object oriented design).
S/W life cycle: Usefulness, Life cycle Model (Classical water fall model, Iterative waterfall model, prototype model, spiral model, comparisons).
S/W Requirement Specification: Need, Components and characteristic of SRS, SRS document for Simple problems.
S/W design: Cohesion & Coupling, S/W design Approach (Function oriented approach [DFD, Structure chart, Transformation of DFD into Structure chart], Object oriented approach [UML diagram, Use case model, class diagram, Interaction diagram])
Coding: Coding standards, Code review (Code walk through, Code Inspection, Clean room testing).
***Testing*:** Unit Testing (Driver and Stub Module, Black box testing [Equivalence class Partitioning and Boundary value analysis], White box testing [Statement coverage, Edge/branch coverage, condition coverage, path coverage), Integration Testing (Big bang, Top down, Bottom up, Mixed approach).
Maintenance: Characteristics, Types (corrective, adaptive and perfective), S/W maintenance process model (Reverse engineering cycle followed by forward engineering model).

Paper – VIII (A)

Group – A (Optimization Techniques) (50 periods)

Introduction: origin and development of operation research, Nature and characteristic features, models in O.R., application of O.R.

Linear Programming Problem: Introduction, mathematical formulation of the problem and graphical solution method.

Simplex Method: Introduction, computational procedure, artificial variable, problem of degeneracy, application of simplex method.

Duality: Concept, formulation of primal – dual, duality and simplex method, Dual Simplex method.

Transportation Problem: Introduction, mathematical formulation, finding initial basic feasible solution, optimality, degeneracy, unbalanced transportation problem.

Assignment Problem: Introduction, mathematical formulation and solution.

Integer Programming Problem: Introduction, All integer programming problem, mixed integer programming problem, Branch and Bound method.

Queueing Theory: Introduction, queueing system, M/M/1 queue.

Network Scheduling: Introduction, Critical Path Method (CPM), PERT calculation.

Information Theory: Introduction, Entropy and its properties, joint and conditional entropies, Mutual information, Encoding.

Semester –V

	PAPER	GROUP	TOPIC	Periods	MARKS
Theory	P-IX	Group-A	Automata Theory	40	20
		Group-B	Compiler	20	10
		Group-C	Discrete Mathematics	35	20
			Total	**100**	**50**
	P-X	Group-A	Data Communication & Networking	65	
			Total	**65**	**50**
Practical	PXI	Group-A	Network programming through Java/Unix	40	30
		Group-B	Compiler Lab	20	20
			Total	**60**	**50**
	PXII	Group-A	Web application Lab :HTML, JavaScript/VB Script, JSP/ASP	60	50
				60	**50**

Paper-IX

Group – A (Automata Theory) (40 Periods)

Introduction: Synchronous & Asynchronous Sequential Circuit, Storage Element, Melay and Moore Machines, Design Technique of State Machine.
Finite State Model: Synchronous Sequential Machine; State Successor in Sequential Machine; Capabilities and Limitations of FSM; State Equivalence and Machine Minimization.
Theory Of Automata: Definition of Automation; Description of Finite Automation; Transition System; Properties of Transition Function; NDFA, DFA, Conversion from NDFA to DFA, Minimization Of States (Equivalence Partition);Conversion From Moore to Mealy machine and Vice Versa.
Formal Languages: Basic Definition of Grammar and Languages; Examples; Chomsky Classification of Languages; Languages and their Relations; Operation on Languages; Language and Automata.
Regular Set And Regular Grammar: Regular Expression; Finite Automata and Regular Expression; Regular Grammars and Regular Languages; Pumping Lemma for Regular Sets, Application of Pumping Lemma, Closure Properties of Regular Languages.
Context-Free Languages: Basics of CFL; Sentential Forms; Derivation Trees; Ambiguity in CFG; Simplification of CFG; CNF And GNF;
Pushdown Automata: Basic Definition; Language Acceptance by PDA; Deterministic PDA.
Turing Machine: Turing Machine Model; Representation of Turing Machine; Language Acceptability by TM; Design of TM; Nondeterministic TM; Universal TM; Halting Problem of TM, Church Turing Thesis; Unsolvable Problems about TM,NP Completeness, Polynomial Time Reduction; Some NP Completeness Problems.

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Group – B (Compiler Theory) (20 Periods)

Introduction: Compilers & translators, the structure of a compiler (ideas of 6 phases)
Lexical Analysis: Need, tokens, regular expression, strings and languages, use of finite automata, text editing.
Parsing : derivation and parse trees, representation of parse trees, shift reduce parsing, handles, stack implementation of shift-reduce parsing, operator precedence parsing (operator precedence relations, associativity and precedence, operator precedence grammar, operator precedence parsing algorithm), top-down parsing, elimination of left

recursion, recursive descent parsing, left-factoring, Predictive parsers(FIRST , FOLLOW rules, Construction of parsing tables, LL(1) grammars.
LR-Parsers: Stack model of LR parser, Parsing table, Canonical Collection of LR (0) items (closure, goto, valid items), Construction of SLR parsing tables. Construction of canonical LR parsing table.

Group – C (Discrete Mathematics) (35 Periods)

Mathematical Induction: First and second (Strong) principle of Induction with examples.
Sets: Definition, Universal set, subset, Power set, Operations on Set (Union, Intersection, Complement, Cartesian product, Computer representation of Sets.
Function: Definition, One to one and onto function, Inverse function, Composition of Function.
Principle of Inclusion And Exclusion: Proof, some simple problems, Application of PIE (To determine the number of solution in integers of an equation with constraint, to find number of primes of a positive number).
Relation: Introduction, functions as relation, relation on set, properties of relation, combining relation, n-ary relation, database and relation – an application, Equivalence relation & equivalence classes, Partial ordering, Hasse diagram, Lattices, topological sorting.
Counting Theory: Multiplication Rule, Proof and simple problems on Order sample with repetition, Order sample without repetition, unordered sample without repetition, Unordered sample with repetition.
Pigeon hole principle: Statement and proof of Pigeon hole principle, Generalized Pigeon hole principle, Application
Recurrence Relation: Definition, Modeling with recurrence relation (Tower of Hanoi and similar simple problems), Solving Recurrence relation (Linear Homogeneous & Inhomogeneous with constant coefficient), Divide and conquer algorithm and Recurrence relation (Illustration with binary search, merge sort, quick sort and similar simple problems).
Generating Function: Definition, Generating function to solve recurrence relation.
Logic: Proposition, Connectives (Conjunction, Disjunction, Negation, Implication), Simple logic Puzzles, Well Formed Formula, logical equivalence, Predicates and Quantifier (Universal and Existential).

Paper-X

Group – A (Data Communication And Computer Network) (65 Periods)

Data Communication: Components, Data Representation; Direction of Data Flow; Types of Connections; Categories Of Networks; Concepts Of Protocols.
Signals: Analog and Digital; Periodic and aperiodic Signals; Time Frequency Domains, Composite Signals; Concepts Of Frequency, Bandwidth , Bit Rate, Baud Rate, Channel Capacity; Nyquist & Shannon's Theorem; Attenuation, Distortion and Noise, concept of modulation
Multiplexing: FDM (Multiplexing and Demultiplexing Process, Applications), TDM(Time Slot and Frames, Interleaving, Bit Padding, Applications),WDM.
Transmission Media: Guided Media(Twisted Pair, Co-Axial Cable, Fiber Optics Cable); Unguided Media(Radio Waves, Microwaves, Infrared, Satellite Communication); NIC.
Switching: Circuit, Packet and Message Switching; Comparisons.
Modems: DSL, Cable Modems.
Network Software: OSI and TCP/IP Models.
Data Link Layer: Error Detection and Correction (Parity, Checksum, CRC, Humming Code); MAC Layer; Stop-And-Wait ARQ, Sliding Window Protocol, Selective Repeat ARQ, HDLC Protocol; ALOHA (Pure And Slotted), CMSA/CD Protocol, Polling; Token Passing; CDMA; Ethernet, Token Bus, Token Ring, ATM.
Network Layer: IP Addressing and Classes of IP Address; Subnet; Static and dynamic routing; ARP; IP; ICMP; unicast and multicast routing protocols;
Transport layer: process-to-process delivery; UDP; TCP; Congestion control protocols.
Connecting Devices: Repeaters, Hub, Bridges, Switch, Router and Gateway.
Application Layer: client server model; FTP, HTTP, SMTP, Telnet etc protocols; Servers and Clients; Ports; DNS; Accounts, ISP; Email: Account, Sending, Receiving, Mailing List, IRC, Voice and Video Conferencing, WWW, Browsers.
Security: Basics of cryptography; message security; digital signature;
Miscellaneous: Concepts of LAN, MAN and WAN; Concepts of Centralized and Distributed Networks; Connections: Dial Up, ISDN, ADSDN; Bluetooth network concept.

Paper-XI

Network Lab:

One of the 2 options 1) UNIX networking programming
2) Java network programming

Compiler Lab

Paper-XII

Web Application Lab:

HTML: Different HTML tags use, header, paragraphs, hyperlinks, anchors, formatting, image, sound ,video, text elements, tables, lists, forms etc.

Ideas of practical Web servers : IIS, Tomcat

JavaScript / VB script:

ASP/JSP/PHP

Semester -VI

	PAPER	GROUP	TOPIC	Periods	MARKS
Theory	P-XIII	Group-A	Analysis of algorithm	40	
		Group-B	Graph Theory	40	
			Total	**80**	**50**
	P-XIV	Group-A	Graphics & Multimedia	50	50
				50	
Practical	P-XV	Group-A	Graph Algorithms	30	25
		Group-B	Graphics Algorithms	30	25
			Total	**60**	**50**
	P-XVI	Group-A	Project work		
					50
			Total		**50**

Paper-XIII

Group – A (Analysis of Algorithm) (40 Periods)

Growth of Functions: Asymptotic notation, Big-O, Theta, Omega notations.

Recurences: Mathematical notation and recurrence, solving recurrence by substitution , iteration, change of variable, master method.

Divide and Conquer Algorithm: Binary search, Merge sort, Quick sort analysis, Strassen's matrix multiplication.

Dynamic programming: Introduction, principle of optimality**,** components, dynamic programming solution, examples, Longest common subsequence, Warshall's and Floyd's Algorithm , knapsack Problem

Greedy algorithm: Characteristics and features of problem solving by greedy algorithm, basic structure, feasibility, Huffman code, Dijkstra, Spanning tree and minimum spanning tree(Kruskal and Prim algo).

Branch and Bound Technique: Traveling salesman problem, Lower Bound Theory

Pattern matching algorithm: preliminary string matching algorithm, Rabin Karp algorithm, string matching with Finite automation, Knuth Morris Pratt algorithm.

Maximum flow: max flow network, Residual network, Ford-Fulkerson algorithm.

NP Completeness: P, NP concepts, Description of some NP complete problems (Boolean satisfiability problem (Sat.),N-puzzle ,Knapsack problem ,Hamiltonian path problem ,Travelling salesman problem ,Subgraph isomorphism problem Subset sum problem ,Clique problem ,Vertex cover problem ,Independent set problem ,Dominating set problem ,Graph coloring problem), Reductions

Group – B (Graph Theory) (40 Periods)

Introduction: Definition of linear graph, self loop, Parallel edges, simple graph, multi graph, Pseudo graph, directed graph, Application of graph, Finite and Infinite graph, Incidence and degree, Indegree and outdegree of directed graph and their relation, Isolated vertex, Pendant vertex and Null graph,

Walk, Path & Circuit: Isomorphic Graph, Subgraph (Edge and Vertex disjoint), Walk path circuit and their differences, Connected & Disconnected Graph, Components, Operation On Graphs (Union, Intersection, Ring sum, Decomposition, Deletion of edge and vertex, Fusion, Euler Graph, Arbitrarily Traceable Graph, Hamiltonian paths and circuit, Complete graph, Bipartite graph, complete bipartite graph.

Tree: Definition of tree, Distance, Eccentricity, Center, Radius and diameter, rooted tree, Binary tree and its properties, Spanning tree, Breadth First Search and Depth First Search, Minimum spanning tree, Algorithm for finding Minimum Spanning Tree (Prim's and Kruskal).

Shortest Path Problem: Dijkstra Algorithm, Traveling Salesman Problem, Floyd and Warshall algorithm.

Searching : BFS, DFS

Planar Graph: Euler formula, Kuratowski's theorem.

Cut Set & Cut Vertices: Cut set and its properties, All Cut-sets in a graph, Fundamental circuit and Cut set, Connectivity (Edge & Vertex), Separability.

Representation of Graph: Adjacency matrix and adjacency list, Incidence matrix, Path matrix, Circuit matrix, their relative advantage & disadvantages.

Paper-XIV

Group – A (Graphics & Multimedia) (50 Periods)

Vector Space: vector, vector space and its properties, vector subspace, linear combination of vectors, linear span, complementary subspace, linear dependence and independence, bases and dimension, coordinates, dimension of a sub space.

Introduction: VDU; Raster Scan and Random Scan Displays; Video Controller, Display Processor;

Output Primitives : Points and Lines, Line Drawing Algorithms (Bresenham, DDA); Circle Generating Algorithms (Properties Of Circle, Midpoint Circle Algorithm); Midpoint Ellipse Algorithms, Other Curves, Scan Line Polygon Fill Algorithms; Inside-Outside Test; Scan Line Fill of Curved Boundary Areas; Boundary fill Algorithms, Flood Fill Algorithm; Anti-Aliasing.

2D Geometric Transformations: Translation, Rotation , Scaling; Matrix Representation, Homogeneous Coordinates; Composite Transformation(General Pivot Point Rotation, General Fixed Point Scaling, General Scaling Directions); Reflection, Shear; Transformations Between Coordinates Systems.

2D Viewing: The Viewing Pipeline; Viewing Coordinate Reference Frame; Window-To-View port Coordinate Transformation; Point and Line Clipping, Cohen Sutherland Line Clipping Algorithm; Polygon Clipping; Text Clipping.

3D concepts: Three-Dimensional Object Representations – Three-Dimensional Geometric and Modeling Transformations – Three-Dimensional Viewing – Color models –Animation.

Multimedia systems design : An Introduction – Multimedia applications – Multimedia System Architecture – Evolving technologies for Multimedia – Defining objects for Multimedia systems – Multimedia Data interface standards – Multimedia Databases.

Multimedia file handling : Compression & Decompression – Data & File Format standards – Multimedia I/O technologies - Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval Technologies.

Hypermedia: Multimedia Authoring & User Interface – Hypermedia messaging - Mobile Messaging – Hypermedia message component – Creating Hypermedia message – Integrated multimedia message standards – Integrated Document management –

Practical

Paper-XV

Graphs algorithms in C /Java
Graphics algorithms C/Java

Paper-XVI

Project work