GENERAL ENGLISH

PAPER - I (FULL MARKS : 100)
(ESSAY TYPE)

(a) Essay Writing ..... 25 Marks

(b) Précis Writing ..... 15 Marks

(c) Letter Writing ..... 15 Marks

(d) Idioms & Phrases ..... 14 Marks

(e) Expansion of passages ..... 15 Marks

(f) Comprehension of given passages ..... 16 Marks

GENERAL ENGLISH

PAPER - II (FULL MARKS : 100)
(OBJECTIVE TYPE)

(a) Grammar ..... 40 Marks
Parts of Speech : Nouns, Adjective, Verb, Adverb, Preposition, etc.

(b) Composition ..... 30 Marks

i) Analysis of complex and compound sentences

ii) Transformation of sentences

iii) Synthesis of sentences

(c) Correct usage and vocabularies ..... 30 Marks

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General Aptitude Test (50 Marks)

(a) Numerical And Figurework Tests: (16 Marks)

These tests are reflections of fluency with numbers and calculations. It shows how easily a person can think with numbers. The subject will be given a series of numbers. His/Her task is to see how the numbers go together to form a relationship with each other. He/She has to choose a number which would go next in the series.

(b) Verbal Analysis And Vocabulary Tests: (14 Marks)

These tests measure the degree of comfort and fluency with the English language. These tests will measure how a person will reason with words. The subject will be given questions with alternative answers, that will reflect his/her command of the rule and use of English language.

(c) Visual And Spatial/3-D Ability Tests: (10 Marks)

These tests are used to measure perceptual speed and acuity. The subject will be shown pictures where he/she is asked to identify the odd one out; or which comes next in the sequence or explores how easily he/she can see and turn around objects in space.

(d) Abstract Reasoning Tests: (10 Marks)

This test measures the ability to analyse information and solve problems on a complex, thought based level. It measures a person's ability to quickly identify patterns, logical rules and trends in new data, integrate this information, and apply it to solve problems.

ELECTRICAL ENGINEERING

PAPER-I

1. EM Theory

Electric and magnetic fields, Gauss's Law and Amperes Law, Fields in dielectrics, conductors and magnetic materials. Maxwell's equations. Time varying fields. Plane – Wave propagating in dielectric and conducting media. Transmission lines.

2. Electrical Materials

Band Theory, Conductors, Semi-conductors and Insulators, Super-conductivity, Insulators for electrical and electronic applications. Magnetic materials. Ferro and ferri magnetism, Ceramics, Properties and applications. Hall effect and its applications. Special semi conductors.

3. Electrical Circuits

Circuits elements, Kirchoff's Laws, Mesh and nodal analysis. Network Theorems and applications, Natural response and forced response, Transient response and steady state response for arbitrary inputs, Properties of networks in terms of poles and zeros. Transfer function, Resonant circuits, Three phase circuits, Two-port networks, Elements of two-element network synthesis.

4. Measurements and Instrumentation

Units and Standards, Error analysis, measurement of current, Voltage, power, Power-factor and energy. Indicating instruments, Measurement of resistance, inductance, Capacitance and frequency, Bridge measurements, Electronic measuring instruments. Digital Voltmeter and frequency counter. Transducers and their applications to the measurement of non-electrical quantities like temperature, pressure, flow-rate displacement, acceleration, noise level etc. Date acquisition systems, A/D and D/A converters.

PAPER-II

1. Control Systems

Mathematical modeling of physical systems, Block diagrams and signal flow graphs and their reduction. Time domain and frequency domain analysis of linear dynamical system, Errors for different type of inputs and stability criteria for feedback systems, Stability analysis using Routh-Hurwitz array, Nyquist plot and Bode plot. Root locus and Nicols chart and the estimation of gain and phase margin. Basic concepts of compensator design, State variable matrix design. Sampled data system and performance of such a system with the samples in the error channel. Stability of sampled data system. Elements of non-linear control analysis, Control system components, electromechanical, hydraulic, pneumatic components.

2. Electrical Machines and Power Transformers

Magnetic Circuits – Analysis and Design of Power transformers, Construction and testing. Equivalent circuits, Losses and efficiency, Regulation, Auto-transformer, 3-phase transformer, Parallel operation.

Basic concepts in rotating machines, EMF, torque, basic machine types. Construction and operation, leakage losses and efficiency. B.C. Machines, Construction, Excitation methods, Circuit models, Armature reaction and commutation,

Characteristics and performance analysis, Generators and motors. Starting and speed control, Testing, Losses and efficiency.

Synchronous Machines, Construction, Circuit model, Operating Characteristics and performance analysis. Synchronous reactance, Efficiency, Voltage regulation, Salient-pole machine, Parallel operation. Hunting, Short circuit transients.

Induction Machines, Construction, Principle of operation, Rotating Fields, Characteristics and performance analysis, Determination of Circuit model, Circle diagram, Starting and speed control.

Fractional KW motors. Single-phase synchronous and induction motors.

3. Power systems

Types of Power Stations, Hydro, Thermal and Nuclear Stations, Pumped storage plants, Economics and operating factors.

Power transmission lines, Modeling and performance characteristics, Voltage control, Load flow studies, Optimal power system operation, Load frequency control, Symmetrical short circuit analysis, Z-Bus formulation, Symmetrical Components, Per Unit representation, Fault analysis, Transient and steady-state stability of power systems. Equal area criterion.

Power system Transients, Power system Protection Circuit breakers. Relays, HVDC transmission.

PAPER-III

1. Analog and Digital Electronics and circuits

Semiconductor device physics, PN junctions and transistors, circuit models and parameters, FET, Zener, tunnel, Schottky, photo diodes and their applications, rectifier circuits, voltage regulators and multipliers, switching behavior of diodes and transistors.

Small signal amplifiers, biasing circuits, frequency response and improvement, multistage amplifiers and feed-back amplifiers, D.C. amplifiers, coupling methods, push pull amplifiers, operational amplifiers, wave shaping circuits, Multivibrators and flip-flops and their applications. Digital logic gage families, universal gates combinational circuits for arithmetic and logic operational, sequential logic circuits. Counters, Registers, RAM and ROMs.

2. Microprocessors

Microprocessor architecture Instruction set and simple assembly language programming. Interfacing for memory and I/O. Applications of Micro-processors in power system.

3. Communication Systems

Types of modulation; AM, FM and PM. Demodulators, Noise and bandwidth considerations. Digital communication systems, Pulse code modulation and demodulation, Elements of sound and vision broadcasting, Carrier communication. Frequency division and time division multiplexing, Telemetry system in power engineering.

4. Power Electronics

Power Semiconductor devices, Thyristor, Power transistor, GTOs and MOSFETs Characteristics and operation, AC to DC Converters; 1-phase and 3-phase DC to DC Converters. AC regulators. Thyristor controlled reactors; switched capacitor networks.

Inverters; single-phase and 3-phase. Pulse width modulation. Sinusoidal modulation with uniform sampling, Switched mode power supplies.

5. Aptitude test : 50 Marks

COMPUTER SCIENCE & ENGINEERING

PAPER-I

1. Discrete Mathematics:

Set Theory foundation mapping (bijective, surjective, injective); Relations – equivalence; Poset; Lattice; Mathematical Induction; Proposional Logic; Logical Equivalence; Permutation and Combination; generation functions; Recurrence relation; Concept of Graph Theory (Sub-Graphs; Cyclic Graphs); Trees (Spanning Trees); Algorithms (Kruskal's, Prim's, Dijstra's, Flyod's, Warshall's, DFS, BFS); Isomorphism; Homomorphism of Graphs; Finite Automata (Construction & Conversion of NFA, DFA, State minimization, Mealy machine, Moore machine); Definition of Grammars (Type 0,1,2,3); Fuzzy sets – Basic properties.

2. Digital Electronics Circuit:

Transistor as switching element; Boolean Algebra, simplification of Boolean functions, Karnaugh map and applications; IC Logic gates and their characteristics; IC logic families: DTL, TTL, ECL, NMOS, PMOS and CMOS gates and their comparison; Combinational logic circuits; Half adder, Full adder; Digital Comparator; Multiplexer, Demultiplexer; ROM and their applications; Flip flops; R-S, J-K, D and T flip flops; Different types of counters and registers Waveform generators; A/D and D/A converters; Semiconductor memories.

3. Computer Architecture and Organisation:

Digital Computer - Introduction, General Organisation, Functional Units, Basic Computer Organisation and Design; Computer Registers, Register Transfer, Micro Operation, Bus System, Timing And control Signals, Generation of Control Signals, Instruction Cycle; Determination and Execution of different types of Instructions; Machine Language; Assembly Language; Assembler; Program Loops and Subroutines; Control Unit (Hardware and Microprogrammed Control); Elements of the Design of control unit from Control Flow Diagram; Signed Magnitude Representation; Floating Point Representation of numbers; BCD Representation; Addition; Subtraction; Multiplication and Division of numbers in different types of representation; General register Organisation, Stack Organisation; Instruction Formats; Addressing Modes; RISC; Input/Output; Peripheral Devices; Necessity of Interfacing; Asynchronous function of I/O and I/O bus; Modes of I/O transfer; Memory Hierarchy, Main Memory, Virtual Memory System; Pipeline and Vector Processing; Parallel processing; Arithmetic and instruction Pipelining; Vector Processing-array processor.

4. Data Structures and Algorithm

Array and Strings; Packing; Space array; Algorithm development; complexity; simple example of Algorithm development; recursion; Sequential Search; Divide and conquer binary search; selection and insertion sort; merge sort; quick sort; complexity of sorting; Linear list; Stack; Stack use – postfix notation, recursion removal; operation on stack; Arithmetic Expression Evaluation; Recursion; Queue; Implementation of Queue in Computer memory; Queue as an Abstract data type; operation on queue; Application of Queue; dequeue; Priority Queue; Graphs and Representation Sets – UNION and FIND operations; Graph Algorithms; Optimisation and Greedy Method; minimum spanning tree; Shortest path; Trees; AVL Trees; threaded trees; heap sort; trees and B-trees; external search.

PAPER-II

1. Operating System

Introduction of OS objective and function; The Evaluation of OS; Batch; interactive; time-sharing and real time system; Protection; OS Structure; System components; OS service; System Structure; Concurrent Processes; Process Concept; Principles of concurrency; The Producer/consumer problem; The critical section problem; Semaphore; Classical problems on concurrency; interprocess Communication; Process Generation; Process Scheduling; CPU Scheduling; Scheduling Concepts; Performance Criteria; Scheduling Algorithms; Algorithm evaluation; multiprocessor scheduling; Deadlocks; System model; Deadlock characterization; Prevention; avoidance and detection; Recovery from deadlock combined approach; Memory management; Base Machine; Resident Monitor; Multiprogramming with fixed partitions; Multiprogramming with variable partitions; Multiple Based Registers; Paging; segmentation; Virtual Memory concept; Demand paging; Performance; Page replacement algorithm; Allocation of frames; Thrashing; cache memory organization; impact performance; I/O Management and Disk Scheduling: I/O devices and the organisation of the I/O function; I/O buffering; Disk I/O; Operating System Design issues; File system; File concept- File Organisation and access mechanism; File directories

2. Object Oriented Programming

Introduction of OOP; application of OOP; process of OOP; Classes and Objects; Overview of Classes and Objects; Class definition; class specifiers; defining member functions; Memory allocation for objects; array of objects; constructor; destructor; Polymorphism; Function of Overloading; uses in program; operator overloading; defining operator overloading; limitations of operator overloading; overloading unary and binary operators; Inheritance and its types with examples; virtual functions; pointers to object; pure Virtual Functions and its implementation in program; managing I/O operations; I/O streams; File handling with OOP; Error handling in file operations; random file access; exception handling methods; throwing mechanism; catching mechanism; string characteristics and uses.

3. Computer Graphics

Points, Lines, Planes, Vectors, Pixels, Frame Buffers, Vectors and character Generation; Graphic Primitives – Display device, Primitive Operations, Display Files Structure, Display Control Text; Polygons – Polygons Representation, entering polygons, Filling polygons; transformations – Metrics transformations, Transformation Routines, Display Procedures; Segments – Segments Table, Creating, Deleting and renaming a segment visibility, image transformation; Windowing and Clipping – Viewing transformation, Clipping, Generalised Clipping, multiple windowing; Interaction – Hardware input device handling algorithms, Event handling Echoing, interactive techniques; Three Dimensions – 3-D Geometry Primitives, Transformations, Projection, Clipping; Hidden line and Surfaces – Back-face Removal Algorithms, Hidden line Methoods, Rendering and Illumination, introduction to curve generation, Bezier, Hermite and B-spline algorithms and comparisons.

PAPER-III

1. Database Management Systems

Introduction to Database System concepts and Architecture; data models; schemes and instances; data independence; Database language and interface; Data Modelling using the Entity-Relationship model; ER Model concepts; Notation for ER diagram; Extended ER Model; Relationship of Higher degree; Relationship data model and language; Relation Data concepts; constraints; relational algebra; Relational calculus; tuple and Domain calculus; SQL; Basic Query Statement; Database Design; Functional dependencies; Normal forms; First, second, third, fourth and BCNF; Inclusion dependencies; Query Processing and Optimisation; Algorithm for executing query Operations; Heuristics for query optimization; Transaction processing Concepts; transaction and system concepts; Schedules and Recoverability; serializability of schedules; Concurring Control Techniques; Locking techniques for concurrency control; Time Stamping and concurrency control.

2. Computer Networks

Introduction to Networks and Layered Architecture – Protocol Hierarchies; Design issues for the layers, Data Communication Concepts; Serial and Parallel Communication; Simplex; Half duplex and Full duplex Communication;

Multiplexing – TDM; FDM; Demand Multiplexing; Error detection and correction; Forward and Backward error correction; Checksum Automatic Repeat Request; Protocols; Relationship of Services to Protocols; NETBIOS; TCP/IP; SMTP; FTP; TELNET; IPX; SPX; NETBEUL;

Transmission Media – Advantages and disadvantages of Transmission Media; Modem; Principles and Techniques; Amplitude; Frequency Shift Keying; Phase Shift Keying; Operating Speed; Network Topology; Star; Ring; Bus & Tree; Physical and logical topologies; Guidelines to select a topology; Access Methods and Topologies, Ethernet Concepts, Token Ring Media ground rules, LAN, HUBS, etc., FDDI;

Network Operating System – Selection Criteria, Performance, fault Tolerence, Application compability, Security Manageability, memory requirement, client support, internetworking capabilities, OS support, Database Services, IBM'S LAN Server, Windows for Workgroup and Windows NT, Peer-to-Peer LAN; LAN Management – Simple Network Management Protocol, Remote Monitoring Performance management, Security Management Access control; LAN administrator Network reliability – Modelling, Standards, fault analysis and Rectification, Introduction to ISDN.

3. Software Engineering

Introduction to Software Engineering; Software development life-cycle; Requirements analysis; Software design; coding; testing; maintenance; Software Requirements Specification; Waterfall Model; prototyping; interactive enhancement; spiral model, Role of management in software development; Role of Metrices and measurement; Problem analysis requirement specification, validation, metrics, monitoring and control; System design – Problem partitioning, abstraction, top-down and bottom-up design, Structured approached, Functional versus Object Oriented approach; design specification and verification metrices; monitoring and control; Coding - Top-down and bottom-up, structure programming, information hiding, programming style and internal documentation, verification, metrices, monitoring and control; Testing – Levels of testing, functional testing, structural testing, test plane, test cases specification reliability

assessment; Software Project Management – Cost estimation, Project scheduling, Staffing, Software configuration management, Quality assurance, Project Monitoring, Risk Management.

4,. Aptitude test : 50 Marks

ELECTRONICS & TELECOMUNICATION ENGINEERING
PAPER -I

1. Materials and Components:
Structure and properties of Electrical Engineering materials; Conductors, Semiconductors and insulators, magnetic, Ferroelectric, Piezoelectric, Ceramic, Optical and Super -conducting materials. Passive components and characteristics: Resistors, Capacitors and Inductors; Ferrites, Crystals, Electromagnetic and Electromechanical Components.

2. Physical Electronics, Electron Devices and ICs:
Electrons and holes in Semiconductors, Carrier Statistics, Mechanism of current flow in a semiconductor, Hall effect; Junction theory; Different types of diodes and their characteristics; Transistor, Bipolar junction transistor; Field effect transistors; Power switching devices like SCRs, FETs, MOSFETs; ICs-bipolar, MOS and CMOS; basics of Opto-electronics.

3. Network theory:
Network analysis techniques; Network theorems,transient response, steady state sinusoidal response; Network graphs and their applications in network analysis; Tellegen's theorem, Two port network; Z,Y h and transmission parameters; Combination of two ports, analysis of common two ports; Networks functions; parts of network functions, obtaining a network function from a given port; Transmission criteria; delay and rise time, Elmore's and other definitions effect of cascading; Elements of network synthesis.

4. Oscillators:
Condition for oscillations. RC and LC type Oscillators, Crystal Oscillators, Frequency and amplitude stability oscillators, Generalized analysis of LC oscillators, Quartz, Hartley and Colpitts Oscillators, RC-phase shift and Wien- bridge oscillators.

5. Electronic Measurements and Instrumentation:
Basic concepts, standards and error analysis; Measurements of basic electrical quantities and parameters, Electronic measuring instruments and their principles of working: analog and digital,comparison, characteristics, and applications. transducers; Eletronics measurement of non-electrical quantities like temperature, pressure, humidity, etc.; basics of telemetry for industrial use.

PAPER-II

1. Amplifiers:
Small signal low frequency transistor amplifier circuits; h-parameter representation of a transistor, analysis of single stage transistor amplifier using h-parameters; voltage gain, current gain, input impedance and output impedance, FET and MOSFET small signal model, RC coupled amplifiers using BJT and JFET.

2. Analog Electronic Circuits:
Transistor biasing and stabilization. Small signal analysis. Power amplifiers. Frequency response. Wide banding techniques. Feedback amplifiers. Tuned amplifiers. Oscillators, Rectifiers and power supplies. Op Amp, PLL, other linear integrated circuits and applications. Pulse shaping circuits and waveform generators.

3. Digital Electronic Circuits:
Transistor as a switching elements; Boolean algebra, simplification of Boolean function Karnaugh map and applications; IC Logic gates and their characteristics; IC logic families: DTL, TTL, ECL, NMOS, PMOS and CMOS gates and their comparison; Combinational logic circuits; Half adder, Full adder; Digital comparator; Multiplexer De-multiplexer; ROM and their applications. Flip-flops. R-S, J-K, D and T flip-tops; Different types of counters and registers. Waveform generators. A/D and D/A converters. Semi-conductor memories.

4. Control System:
Transient and steady state response of control systems; Effect of feedback on stability and sensitivity; Root locus techniques; Frequency response analysis. Concepts of gain and phase margins; Constant-M and Constant-N Nichol's Chart; Approximation of transient response from Constant-N Nichol's Chart; Approximation of transient response from closed loop frequency reponse; Design of Control System; Compensators; Industrial controllers.

5. Computer Engineering:
Number Systems. Data representation; Programming; Elements of a high level programming language PASCAL/C; Use of basic data structures; Fundamentals of computers architecture; Processor design, Control unit design; Memory organisation, I/o System Organisation. Microprocessors: Architecture and instruction set of Microprocessor's 8085 and 8086, Assembly language Programming. Microprocessor Based system design: typical examples. Personal computers and their typical uses.

PAPER-III

1. Electromagnetic Theory:
Analysis of electrostatic and magneto-static fields; Laplace's and Poisson's equations; Boundary value problems and their solutions; Maxwell's equations; application to wave propagation in bounded and unbounded media;Transmission lines: basic theory, standing waves, matching applications, microstrip lines; Basics of wave guides and resonators; Elements of antenna theory.

2. Communication Systems:
Basic information theory; Modulation and detection in analogue and digital systems; Sampling and data reconstructions; Quantization and coding, Time division and frequency division multiplexing; Equalization; Optical Communication: in free space and fiber optic; Propagation of signals at HF, VHF, UHF and microwave frequency; Satellite Communication.

3. Microwave Engineering:
Microwave tubes and solid state devices, Microwave generation and amplifiers, Wave guides and other Microwave Components and Circuits, Microstrip circuits, Microwave Antennas, Microwave measurements, Masers, Lasers; Micro-wave propagation. Microwave Communication Systems-terrestrial and satellite based.

4. Aptitude Test : 50 Marks