**MIZORAM ENGINEERING SERVICE (MES)**

**SYLLABUS**

**GENERAL ENGLISH - 100 Marks**

The question paper in General English will be designed to test the candidate’s ability of understanding English.

The pattern of question will be as follows :

(i) Comprehension of given passage - 20 marks

(ii) Precis writing - 20 marks

(iii) Usage and vocabulary - 40 marks

(iv) Short Essay. - 20 marks

**GENERAL STUDIES - 100 Marks**

The nature and standard of questions in the General Studies will be such that a well-educated person will be able to answer them without any specialized study. The questions will be such as to test a candidate’s general awareness of a variety of subjects, which will have relevance for a career in Engineering Services. The questions are likely to test the candidate’s basic understanding of all relevant issues, and ability to analyze, and take a view on conflicting socio-economic goals, objectives and demands.

**COMPUTER SCIENCE & ENGINEERING**

**PAPER-I - 200 Marks**

**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 – 200 Marks**

**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 - 200 Marks**

**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.

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