**SYLLABUS FOR COMPETITIVE EXAMINATION FOR THE POST OF JUNIOR ENGINEER (Diploma in Computer Science Engineering) UNDER RURAL DEVELOPMENT DEPARTMENT, GOVERNMENT OF MIZORAM, 2016**

# SUBJECTS

(a) General English (Conventional / Objective Type) ..... 100 Marks
(b) Technical Paper - I (MCQ/Objective Type)..... 150 Marks
(c) Technical Paper - II (MCQ/Objective Type)..... 150 Marks

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## GENERAL ENGLISH

**(Full Marks : 100)**

(a) Essay Writing (Conventional)..... 20 Marks
(b) Idioms & Phrases (Objective Type)..... 16 Marks
(c) Comprehension of given passages (Objective Type)..... 16 Marks
(d) Grammar (Objective Type) ..... 16 Marks
Parts of Speech : Nouns, Adjective, Verb, Adverb, Preposition, etc.
(e) Composition (Objective Type)..... 16 Marks
i) Analysis of complex and compound sentences
ii) Transformation of sentences
iii) Synthesis of sentences
(f) Correct usage and vocabularies (Objective Type) ..... 16 Marks

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**PAPER I**

| | | |
|---|---|---|
| Unit I | Computer Architecture & Organization | 30 |
| Unit II | Introduction to Computer Programming using C | 30 |
| Unit III | Digital Circuits | 30 |
| Unit IV | Computer Communication and Networking | 30 |
| Unit V | Software Engineering | 30 |

**PAPER II**

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|---|---|---|
| Unit I | Data Structure & Algorithm | 30 |
| Unit II | Operating System | 30 |
| Unit III | Internet & Web Technology | 40 |
| Unit IV | Database management System (DBMS) | 30 |
| Unit V | Aptitude Test | 20 |

# PAPER I

## Unit I Computer Architecture & Organization (30 Marks)

a) **Evolution of computers :**Brief history of development; Babbage's machines, Von Neumann Concept,Difference between calculators and computers, Generations of Computer -SSI, LSI, VLSI, Classification - micro, mini, main frames and supercomputers,PC's and portable systems.

b) **Number representation :**Positional Number Systems – Decimal, Binary, Octal, HexadecimalSigned numbers, Signed - magnitude 1's complement, 2's complement and excess notations, numbers, Fixed and floating point numbers and operations, Booth's Algorithm, Common errors in arithmetic truncation errors, round of errors. Codes: weighted and non-weighted, BCD, ASCII, EBCDIC, 8421, Excess-3, 2421, Gray, Seven-segment codes.

c) **Central processing unit :** Components of Arithmetic Logic Unit (in block diagram only), Different types of instructions, Instruction format, addressing modes, different CPUregisters - Accumulator, Flag, Program Counter, Instruction Register and General Purpose registers. Hardware control unit - its different functions

d) **Microprocessor :** Intel 8085 architecture and simple assembly language programming concept, Brief introduction to Intel 8086/8088 and Pentium processor (relative study), Brief introduction to RISC processor

e) **Memory:**Concept of bits, bytes and words; Storage of numbers and characters, RAM, ROM, EPROM; Concept of cache memory - its role in performance improvement, memory hierarchy

f) **I/Odevices:** Printers - Dot Matrix, Ink Jet, Line, Laser; Visual display unit – alphanumeric and graphic, Keyboard, Graphics devices - mouse, joy-stick, Scanners and digitizers, Auxiliary storage devices - floppy and Hard disk: Sectors, tracks and cylinders, accessing mechanisms (brief idea) Magnetic tapes - description and accessing mechanisms, CD ROM

## Unit II Introduction to Computer Programming using C (30 Marks)

a) **Introduction**: C language and its compilers, Keywords, expressions, constant, Primitive data types in C, Header files and library functions, Types of Variable, Pre-processor directive and Macro

b) **Using Program Control:** Conditional Statements, Iterative Statement, Unconditional jump and its restrictive usage, Importance of initialisation

c) **Working with Array**: Overview of array, One dimensional array, Multidimensional array, String representation, String manipulation

d) **Creating User defined Function**: Writing functions in C language, Function definition and function declaration, Writing void function, Writing parameter passing and global declaration, Scope of variables in function, Recursion: Binary search, quick sort

e) **Using Pointers**: Overview of pointer; Pointer and array; Dynamic allocation using pointers; Pointer to pointer, Parameter passing using pointer, Using command line argument

f) **Application of Structure and Union**: Overview of structure; Array of structure; Pointer to structure; User defined data type; Representation linked list: Stacks, Queues; Representation of binary tree; Representation of generalized tree; Union

g) **Low Level Programming in C**:Bitwise operation;Register handling;Enumerated data type

h) **File Handling in C**:Modes of file handling, Linking file pointer, Working with binary file, Building own header file, Linking multiple source files

**Unit III Digital Circuits (30 Marks)**

a) **Review of the number system**:A brief review of various number systems and codes, e.g., Decimal, Binary, Octal, Hexadecimal, 8421, Ex~3, 2421, Gray, Alphanumeric, BCD etc.
b) **Boolean algebra and logic gates**:Postulates and different theorems. SOP and POS forms of expression and their conversion. Simplification: using Boolean theorems and k-map (up to 4 variables)Basic logic gates - their symbols, truth table and logic ' expression for the output simple circuit realization using the logic gates. Realization of any expression either using all NAND or NOR gates
c) **Combinational logic circuits**:Arithmetic circuit (Adder/ Subtractor), Multiplexers and their uses, Decoder/demultiplexers and their uses, code converter, Encoder, parity generator/checkers.
d) **Families of logic circuit**:TTL and CMOS family, open collector and tri-state logic gates.
e) **Storage devices & sequential circuits**:Latches and Flip-flops, Timing diagrams of latches and flip flops, conversion of one flipflop to another, Counters - Binary ripple counters, Asynchronous module counters, UP/Down counter, Synchronous counters (binary, different modulo and UP/Down), Timing diagram of all types of counters. Brief introduction to a few commercially available counter ICs (asynchronous and synchronous).
**Shift-registers**-Different types of shift registers and their functional details, A few applications of shift-registers**.Memory** -Memory types and terminology, Memory organization, Semiconductor memory, reading and writing, RAM, ROM, PROM cells and circuits, EPROM (Programming and erasing), Dynamic RAM, Memory expansion, PLA.
f) **Data converters:**Digital-to-Analog Conversion - Weighted resistor, R-2R ladder, DAC performance and their characteristics.Analog-to-Digital Conversion - Counter type ADC, dual slope type, successive approximation type, tracking type and flash type, ADC performance and their characteristics.
g) **Display and display drives:**Introduction to LED, LCD, 7-segment displays, Bar graph display and Dot matrix displays. Decoder drivers for 7-segment display, Bar graph display and LCD. Multiplexing of display.

**Unit IV Computer Communication & Networking (30 Marks)**

a) **Introduction:**Fundamental Concepts, Network Structures, Network Architecture, The O.S.I Reference Model, Network Services, Example Network, Concepts of internet and www , Html, TCP/IP
b) **The physical layer:** Transmission Median, Wireless TransmissionTelephone System ,ISDM, Transmission and switching
c) **The medium access sub layer :**ALOHA, CSMA, Collision Free protocols, IEEE Standard 802 for LANEthernet, Token Bus,Token ring, Bridges
d) **The data link layer:** Data Link Layer Design Issue, Error Detection and Correction, Elementary Data Link Protocols, Sliding windows protocols
e) **The network layer:** Network Layer Design Issues, Ponting Algorithms, Congestion Control Algorithms
f) **The transport layer:** The Transport Services, Elements of Transport Protocols, A simple Transport Protocols
g) **The session layer:** Session Layer Design Issues, Remote Procedure Call
h) **The presentation layer :** Design Issue, Data Compression Techniques, Elementary idea of cryptography
i) **The application layer:** Design Issue, File Services, E Mail

**Unit V** **Software Engineering** **(30 Marks)**

a) **Introduction:**The evolving role of software, Software crisis-problems and causes,Software engineering paradigms,Classic life cycle,Prototyping,Spiral Model,Generic view of software engineering

b) **Software Requirement Analysis:**Requirement analysis fundamentals, Structured analysis: Basic notation and its extension, object oriented analysis and data modeling, process modeling

c) **Software Design:** Evolution of software design, Design fundamentals: Abstraction, refinement, modularity, software architecture,Flow oriented design and object-oriented design

d) **Quality Assurance:** Software quality factor, Software quality Assurance (SQA),SQA activities, Software reliability, errors and faults, Software reliability models

e) **Verification and Validation:** Software testing strategies & techniques, Elementary ideas of black box & white box testing,Software Evaluation&Software Documentation

f) **Software Project Management:** Basic concepts of software project management process objectives, scope, estimation, COCOMO model**,** Project planning, Project scheduling, Gantt chart, pert chart, Managing people, project staffing, group working, working environment, Project monitoring, milestone, methods of project monitoring,Risk analysis, tracking and control, version management

# PAPER II

## Unit I Data Structure & Algorithm (30 Marks)

a) **Introduction and overview:** Introduction, Basic Terminology, Elementary Data Organization, Data Structures, Data Structure Operation, Algorithms; Complexity; Time- space Tradeoff
b) **Preliminaries:** Introduction, Mathematical notation and Functions, Algorithmic Notation, Control Structures, Complexity of Algorithms, Sub algorithms, Variables, Data Types
c) **String processing:** Introduction, Basic Terminology, Storing Strings, Character Data Type, String Operation, Work Processing, Pattern matching Algorithms
d) **Arrays, records and pointers:** Introduction, Linear Arrays, Representation of Linear Arrays in Memory, Traversing Linear Arrays, Inserting and Deleting, Sorting; Bubble Sort, Search; Linear Search, Binary Search, Multidimensional Arrays, Pointers; Pointer Arrays, Records; Record Structures, Representation of Records in Memory; parallel Arrays, Matrices, Sparse Matrices
e) **Linked lists:** Introduction, Linked Lists, Representation of Linked Lists in Memory, Traversing a Linked List, Searching a Linked List, Memory Allocation Garbage Collection, Insertion into a linked list, Deletion from a Linked List, Header Linked Lists, Two –Ways Lists
f) **Stacks, queues, recursion:** Introduction, Stacks, Array Representation of Stacks, Arithmetic Expression; Polish Notation, Quicksort, an Application Stakes, Recursion, Towers of Hanoi, Implementation of Recursive Procedures by Stacks,Queues, Defuse, Priority Queues
g) **Trees:** Introduction, Binary Trees, Representing Binary Trees in Memory, Traveling Binary Trees, Traversal Algorithms using Stacks, Header Nodes; Threads, Binary Search Trees, Trees, Searching and Inserting in a Binary Search Tree, Deleting in a Binary Search Tree, Heap, Heapsort, Path Lengths; Huffman's AlgorithmGeneral Trees
h) **Graphs and their application:** Introduction, Graph Theory Terminology, Sequential Representation of Graphs; Adjacency matrix, path matrix, Warshall's Algorithm, Shortest Paths, Linked Representation of a Graph, Operations on Graphs, Traversing a Graph
i) **Sorting and searching:** Introduction, Sorting, Inserting Sort, Selection Sort, Merging, Merge-sort, Radix Sort, Linear searching, Binary searching, Interpolation searching, Hashing
**j) Introduction to file organization:**Sequential, Index-Sequential and Direct fileOrganization

## Unit II Operating System (30 Marks)

a) **Introduction:** Definition of O.S, History of O.S, Concepts, Structure
b) **Processes:** Definition of process & thread, Inter-process communication, Classical I.P.C. problems, Process Scheduling
c) **Process scheduling algorithm:** Resident Monitor(Single user),Multi-user system, Time sharing system, FIFS, Round Robin Fashion/Time quantum. Concept. Multiple queues, Priority queues, Shortest job first
d) **Memory management:** Resident Monitor, Multiple Partition, Garbage collection and compaction, Paged memory management, Page Replacement Algorithms, Swapping, Segmentation, Segmented paged memory management, Demand paged memory management, Virtual Memory.
e) **File systems:** Concept of Files & Directories, File System Implementation, Security Issues in Files, Protection Mechanisms, Case studies of Unix file system
f) **Input/output:** Principles of I/O Hardware, Principles of I/O Software, Disk, Clocks, Serial and Parallel port access,Terminal Access
g) **Device management:** Techniques for Device Management – Dedicated, shared, virtual, Device allocation considerations I/O traffic control & I/O Schedule, I/O Device handlers, Spooling
h) **Dead locks:** Concept of deadlock, Resources, Dead lock Prevention:Blanker Algorithm & Safety Algorithm, The Ostrich Algorithm, Deadlock Detection and Recovery, Deadlock Prevention
i) **Distributed Operating Systems:** Definition, Types of Distributed O.S, Workstation server model, The processor pool model, The hybrid model, Case study SUN NFS File Server

**Unit III** **Internet & Web Technology** **(40 Marks)**

a) **Internet Fundamentals:** Motivation for internetworking, History and scope of internet, Internet protocol and standardization, Role of ISP & Factors for choosing an ISP, Internet service providers in India, Types of connectivity such as Dial Up, Leased, VSAT etc. Internet server and client modules on various operating systems

b) **TCP/IP**:TCP/IP internet layering model, Reliable stream transport service (TCP)-(Basic concepts, slide window, port connections and end points, segment stream, sequence number, TCP segment format, TCP header, TCP check sum computation etc.).Connection less data gram delivery (Internet Protocol) (Basic concepts, IP header, source and destination address, protocol number, check sum, routing, delivery, roots etc.)Subnet Address Extension (Basic concepts, network number minimization, transparent routers, subnet addressing, flexibility, masks etc.).User Data gram Protocol (Basic concepts, identification of ultimate destination, UDP message format etc.)Domain Name System (Basic concepts, domain name to address mapping, translation, abbreviation, authority of sub-domain etc.)

c) **Internet Applications and Services:** Email (Basic concepts, protocol, format, routing etc.) FTP (FTP servers, FTP clients etc.)Telnet (Protocol, domain, clients, terminal emulation). Internet Relay Chat (Networks, servers, channels)

d) **Internet Security:** Overview of Internet Security threats & Vulnerability,Firewalls: introductory concepts & its necessity, Specific intruder approach, Security strategies, Security tools,Antivirus

e) **E – Commerce**: Introduction (Basic concepts of Electronic Commerce environment and opportunities, electronic data interchange, OPEN ODI)Electronics Cash Payment System(Types of electronics payment system, digital token, smart card, credit card, risk factors, payment & purchase order process, on-line electronic cash) Master Card / Visa secure ElectronicTransaction (Business requirement, concepts, payment processing)

f) **HTML & Interactive tools:** Document overview, Header elements, Section headings, Block oriented elements, Lists ,Inline elements, Visual markup, Hypertext links, Uniform Resource Locator, Imagers, Tables, Special characters, CGI (Common Gateway Interface),Active X,VB Script, Java Script and java, PERL

g) **Introduction to ASP:**Concepts of ASP, Benefits of using ASP, Creating ASP pages, generating web pages dynamically with ASP

h) **Search Engines:**Technology overview, popular search engines, Registration of web site in a search engines

## Unit IV Database Management System (30 Marks)

a) **Introduction to Database Management System:** Database System environment, File oriented Approach, Database Approach, Users of DBMS, Intended use of DBMS, Benefit of using database approach, Concepts of Client Server Architecture and distributed system
b) **Database System Concept and Application:** Date Models, Schemes and instances, DBMS architecture and Independence, Database Languages and Interfaces, The database system environment, Classification of DBMS
c) **E-R diagram:** Defining relations, Entity Set, E-R Model concept with examples
d) **SQL:** Data definition in SQL, Queries in SQL, Create, Update, Insert statements in SQL, Views in SQL, Specifying additional constraints as assertions, Specifying indexes
e) **Functional Dependencies and Normalization for Relational Database:** Functional dependencies, Normal forms based on primary keys, General Definitions of second and third normal forms, Boyce Codd normal form
f) **Transaction Processing Concepts:** Introduction to transaction processing, Transaction and System concept, Desirable properties of transactions, Schedules and recover ability
g) **Concurrency Control Techniques:** Basic Concepts; Concepts of Locks: live lock, dead lock; Serializability
h) **Security and Integrity:** Security and integrity violation, Authorization, Authorization and Views, Granting of Privileges, Security specification in SQL, Encryption
i) **Distributed Databases:** Principles of distributed database; data fragmentations, transparency, integrity, allocation of fragments, translation of global query to fragment query; concurrency control – elementary ideas

## Unit – V Aptitude Test (20 Marks)

**a) Numerical and Figure work Test: (4 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 (6 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 (4 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 and Reasoning Test: (6 marks)**
This test measures the ability to analyze 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