Syllabus for Uchcha Madhyamic Paper II STET 2024
Syllabus UNIT I Subject ----------Computer Science 100 Marks

Unit 1: Digital Logic
- Data and number systems;Binary, Octal and Hexa decimal representation and their conversions ;BCD,ASCII, EBDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic. Venn diagram, Boolean algebra; Various Logic gates-their truth tables and circuits; Representation in SOP and POS forms;Minimization of logic expressions by algebraic method, Kmap method
- Combinational circuits-Adder and Subtractor circuits;Applications and circuits of Encoder ,Decoder, Comparator ,Multiplexer, De-Multiplexe rand Parity Generator. Memory Systems:RAM ,ROM, EPROM, EEROM, Design of combinational circuits-using ROM, Programming logic devices and gate arrays. (PLAs and PLDs)
- Sequential Circuits-Basic memory element-S-R, J-K,D and T Flip Flops, various types of Registers and counters and their design,Irregular counter, State table and state transition diagram,sequential circuits design methodology.
- Different types of A/D and D/A conversion techniques. Logic families-TTL,ECL,MOS and CMOS, their operation and specifications.

Unit 2:Computer Organization and Architecture
- Introduction to Data Representation and Number System: Introduction to Decimal, Binary, Octal, Hexadecimal number system, Conversation of number from one number system to another number system (like Decimal to Binary etc.), Binary Arithmetic: - Addition (Simple Method, Using 1's Complement, Using 2'sComplement method), Subtraction (Simple Method), Multiplication (Simple Method), Division (Simple Method)
- Different Codes Representation of Error Detection Codes: Parity Bit Method, Checksum Method, Representation of Error Correction Code: Hamming Code, Alphanumeric Codes: ASCII, EBCDIC, Excess – 3 Code, BCD Addition Method, Gray Code: Gray to Binary Conversion, Binary to Gray Conversion
- Introduction to Ideal Microcomputer, An Actual Microcomputer: CPU, Address Bus, Data Bus, Control Bus, Memory: RAM - SRAM, DRAM, ROM - PROM, EPROM, UVEPROM, EEPROM, History of Microprocessor, Microcontroller (Application Only), Addressing Techniques, Introduction To Digital Electronics, Logic Gates: Inverter, OR Gate, AND Gate, NOR Gate, NAND Gate, EX-OR Gate, EX-NOR Gate, De'Morgan's Theorems
- Universal Gates (Only for Logic Conversion), K-Map Simplifications, Pair, Quad, Octet (upto 4 variables) Don't Care Condition, Arithmetic Logic Unit: Half Adder, Full Adder, Binary Adder,2's Complement Adder Subtractor

Unit 3:Programming and data structure
- Data, Entity, Information, Difference between Data and Information, Data type , Build in data type, Abstract data type, Definition of data structures, Types of Data Structures: Linear and Non-Linear Data Structure, Introduction to Algorithms: Definition of Algorithms, Difference between algorithm and programs, properties of algorithm, Algorithm Design Techniques, Performance

Analysis of Algorithms, Complexity of various code structures, Order of Growth, Asymptotic Notations.

- Definition, Single and Multidimensional Arrays, Representation of Arrays: Row Major Order, and Column Major Order, Derivation of Index Formulae for 1-D,2-D Array Application of arrays, Sparse Matrices and their representations. Recursion: recursion in C, example of recursion, Tower of Hanoi Problem, simulating recursion, Backtracking,, recursive algorithms, principles of recursion.
- Array Implementation and Pointer Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List. Insertion, Deletion, Traversal, Polynomial Representation and Addition Subtraction & Multiplications of Single variable.
- Abstract Data Type, Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Iteration and Recursion-Principles of recursion, Tail recursion, Removal of recursion Problem
- solving using iteration and recursion with examples such as binary search, Fibonacci numbers, and Hanoi towers.
- Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues in C, Dequeue and Priority Queue.
- Concept of Searching, Sequential search, Index Sequential Search, Binary Search. Concept of Hashing & Collision resolution Techniques used in Hashing.
- Insertion Sort, Selection Sort, Bubble Sort, Heap Sort, Comparison of Sorting Algorithms, Sorting in Linear Time: Counting Sort and Bucket Sort.
- Terminology used with Graph, Data Structure for Graph Representations: Adjacency Matrices, Adjacency List, Adjacency. Graph Traversal: Depth First Search and Breadth First Search, Connected Component.
- Basic terminology used with Tree, Binary Trees, Binary Tree Representation: Array Representation and Pointer (Linked List) Representation, Binary Search Tree, Complete Binary Tree, A Extended Binary Trees, Tree Traversal algorithms: Inorder, Preorder and Postorder, Constructing Binary Tree from given Tree Traversal, Operation of Insertion, Deletion, Searching & Modification of data in Binary Search Tree. Threaded Binary trees, Huffman coding using Binary Tree, AVL Tree and B Tree

Unit 4:Algorithms

- Algorithm Analysis, Time Space Tradeoff, Asymptotic Notations, Conditional asymptotic notation, Removing condition from the conditional asymptotic notation, Properties of big-Oh notation.
- Recurrence equations, Solving recurrence equations, Analysis of linear search, Divide
- and Conquer: General Method, Binary Search, Finding Maximum and Minimum, Merge Sort.
- General Method, Multistage Graphs, All-Pair shortest paths, Optimal binary search trees.
- General Method, 8-Queens problem, Hamiltonian problem.
- Connected Components, Spanning Trees, Biconnected components, Introduction to NP Hard and NP-Completeness.

Unit 5:Operating System

- Introduction to OS – its functional behavior and responsibilities, Need for some of monitor / command interpreter, Types of operating systems, System structure, Hierarchical and layered organization of OS, I/O methods and interrupt structure.
- Process definition, Process states and state transitions, Parallel processes and constructs, Process interaction, Operating system kernel, Data structures for processes and resources, Context switching, Process control primitives, Process scheduling.
- The determinacy problem, Mutual exclusion, Semaphores, Process synchronization,
- Conditional critical regions and monitors, Inter-process communication, Deadlock problem and its solutions.
- Memory management concepts, Relocation, Linking, Multiprogramming with fixed
- partitions, Swapping, Variables partitions, Overlays, Virtual memory, Segmentation, Paging, Storage allocation strategies, Load control and thrashing
- Organization of file and I/O subsystems, Directory management, Basic file system, file descriptors, File manipulation, File organization methods, Management of auxiliary storage space, Command language and file system utilities, I/O subsystems, Programmed I/O, DMA, Interrupt driven I/O, Recovery procedures. Protection and Security: Safeguards, Penetration, Access and Information flow control, Protection problems, Formal models of protection.

Unit 6:Database Management System

- Introduction to Database, components and structure of DBMS – logical structure – the 3 level architecture and mapping among them. Comparison between traditional file based system and DBMS. Advantages and drawbacks of DBMS.
- Relational Model - What is relational model, Relational key constraints – candidate key, primary key, foreign key.ER Model – entities, attributes, relationship, and cardinality. Entity types, Entity sets Attributes and Keys Relationship types, Relationship Sets, converting ER diagram to relational tables. Database Schema
- Database Anomalies, CODD Rules and Normalization theory, 1 NF, 2 NF, 3 NF and BCNF.
- Introduction to transaction and concept of concurrency control. Transaction and system concepts, desirable properties of transactions, transaction support in SQL. Concurrency control techniques, the locking protocol, serializable schedules, locks, 2 phase commit. Techniques, concurrency control based on timestamp ordering

Unit 7:Computer Network

- Introduction to Data Communication and Computer Network, Network Topologies, classification of computer network, Parallel & Serial Transmission, Transmission Models, Transmission Channel, Data Rate, Bandwidth Signal Encoding Schemes, Data Compression, Transmission Impairments, Layering and Design Issues, OSI Model and TCP/ IP model.

- Data Link Layer: Need for Data Link Control, Frame Design Consideration, Flow Control & Error Control. MAC sublayer, contention based and polling based MAC protocols.
- Network Layer: Routing, Congestion control, Internetworking principles, Internet Protocols (IPv4, packet format, Hierarchal addressing sub netting, ARP, PPP), Bridges, Routers. Classless IP address.
- Datalink Layer: Process to process communication. Socket meaning and socket address. Upward and downwards multiplexing. UDP and TPDU.
- Application Layer: HTTP, FTP, Telnet, SMTP, SNMP

Unit 8: <u>Software Engineering</u>

- Introduction to Software Engineering: Characteristics, Emergence of Software Engineering, Software Metrics & Models, Process & Product Metrics. Software Life Cycle Models: Waterfall, Prototype and Spiral Models and their Comparison.
- Software Project Management: Size Estimation- LOC and FP Metrics, Cost Estimation-Delphi and Basic COCOMO, Introduction to Halstead's Software Science, Staffing Level Estimation- Putnam's Model. Software Requirements Specification: SRS Documents, their Characteristics and Organization.
- Software Design: Classification, Software Design Approaches, Function Oriented Software Design, Structured Analysis- Data flow Diagrams and Structured Design, Introduction to Object Oriented Design.
- Coding and Testing of Software: Unit Testing, Block Box Testing, White Box Testing, Debugging, Program Analysis Tools, System Testing. Software Reliability and Quality Assurance: Reliability Metric- Musa's Basic Model.
- Software Quality Assurance: ISO 9000 and SEI CMM and their Comparison. Software Maintenance: Maintenance Process Models and Reverse Engineering, Estimation of Maintenance Costs.

Unit 9: Object Oriented Programming

- Review of Fundamentals of Procedural Programming,
- Class and Objects,
- Data Abstraction,
- Information Hiding & Encapsulation,
- Constructors, destructors, and object creation,
- Name space and references ,
- Class Methods , Methods Overloading ,
- Inheritance ,
- Polymorphism ,
- Abstract Classes,
- Abstract Methods ,
- Exceptions , Exception Handling.

Unit 10: Web-Based Application Development

- Internet Basics,
- Introduction to Web Development,
- Node.js and Git,
- HTML, CSS, JQuery,
- JavaScript and HTTP (forms),
- Sessions and HTTP,

- Javascript & Document Object Model – DOM,
- Extensible Markup Language – XML,
- Document Type Definition - DTD   Dreamweaver,
- PHP HyperText PreProcessor - PHP SQL & MySQL,
- Integrating PHP and MySQL,Database Interaction

Unit 11: Theory of Computatio

- Introduction; Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Non-deterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, Distinguishing one string from other.
- Regular expression (RE) , Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages . Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.
- Context free grammar (CFG) and Context Free Languages (CFL): Definition, Examples, Derivation ,Derivation trees, Ambiguity in Grammer, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure properties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Memership, Pumping lemma for CFLs.
- Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA
- Turing machines (TM): Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory

Unit 12:Internet of Things

- Definitions and Functional Requirements - Motivation - Architecture - Web 3.0 View of IoT - Ubiquitous IoT Applications - Four Pillars of IoT - DNA of IoT -The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview -Communication middleware for IoT - IoT Information Security.
- Protocol Standardization for IoT - Efforts - M2M and WSN Protocols - SCADA and RFID Protocols- Issues with IoT Standardization - Unified Data Standards -Protocols -IEEE 802.15.4 - BACNet Protocol Modbus - KNX - Zigbee-Network layer - APS layer –Security.
- Web of Things versus Internet of Things - Two Pillars of the Web - Architecture standardization for WoT Platform Middleware for WoT - Unified Multitier WoT Architecture - WoT Portals and Business Intelligence. Cloud of Things:

Grid/SOA and Cloud Computing - Cloud Middleware - Cloud Standards - Cloud Providers and Systems - Mobile cloud Computing - The Cloud of Things Architecture.

- Industrial Internet of Things - Introduction to Industrial Internet of Things - Industrie 4.0 - Industrial Internet of Things (IIoT) - IIoT Architecture - Basic Technologies - Applications and Challenges - Security and Safety - Introduction to Security and Safety -Systems Security - Network Security - Generic Application Security - Application Process Security and Safety - Reliable-and-Secure-by-Design IoT Applications - Run-Time Monitoring - The ARMET Approach - Privacy and Dependability
- The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments -Resource Management in the Internet of Things: Clustering, Synchronization and Software Agents. Applications - Smart Grid -Electrical Vehicle charging

Unit 13:Artificial Intelligence

- INTRODUCTION TO Al AND PRODUCTION SYSTEMS: Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics - Specialized productions system- Problem solving methods – Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first, Constraints satisfaction – Related algorithms, Measure of performance and analysis of search algorithms.
- REPRESENTATION OF KNOWLEDGE: Game playing – Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge.
- KNOWLEDGE INFERENCE: Knowledge representation -Production based system, Frame based system. Inference – Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning – Certainty factors, Bayesian Theory-Bayesian Network-Dempster – Shafer theory.
- PLANNING AND MACHINE LEARNING: Basic plan generation systems – Strips -Advanced plan generation systems – K strips - Strategic explanations - Why, Why not and how explanations. Learning- Machine learning, adaptive Learning.
- EXPERT SYSTEMS: Expert systems – Architecture of expert systems, Roles of expert systems – Knowledge Acquisition – Meta knowledge, Heuristics. Typical expert systems – MYCIN, DART, XOON, Expert systems shells.

Unit 14: Fundamental of E-Commerce

- Introduction to Electronic Commerce: Introduction of commerce, Electronic commerce framework, electronic commerce and media convergence, the anatomy of e-commerce application.
- The Network for Electronic Commerce: Need of network, market forces influencing the I-way, components of I-way, network access equipment, and global information distribution network.
- The Internet as a Network Infrastructure: Introduction, the Internet terminology, NSFNET: Architecture and Components, Internet governance: The Internet Society.

- Network Security & Firewalls: Client-Server network security, security threats in client-server, firewalls and network security, data & message security, encrypted documents and electronic mail.
- Electronic Commerce & World Wide Web: Introduction, architectural framework for electronic commerce, WWW as an architecture, security in the web.
- Consumer Oriented Electronic Commerce: Introduction, consumer oriented application, mercantile process models, mercantile models from the consumer's perspective, mercantile models from the merchant's perspective.
- Electronic Payment Systems: Introduction, types of electronic payment system, digital token based electronic payment systems, smart cards and electronic payment systems, credit cards systems, Threat on electronic payment system.
- Inter-organizational Commerce & Electronic Data Interchange: Introduction, EDI application in business, EDI: legal, security, and privacy issues, EDI and electronic commerce.
- The Corporate Digital Library: Introduction, dimensions of electronic commerce systems, types of digital documents, Issues behind document infrastructure, corporate data warehouses.

Unit 15: Multimedia
- Definition - Classification - Multimedia application -Multimedia Hardware - Multimedia software - CDROM - DVD.
- Multimedia Audio: Digital medium - Digital audio technology - sound cards - recording - editing - MP3 - MIDI fundamentals - Working with MIDI - audio file formats - adding sound to Multimedia project.
- Multimedia Text: Text in Multimedia -Multimedia graphics: coloring - digital imaging fundamentals - development and editing - file formats - scanning and digital photography.
- Multimedia Animation: Computer animation fundamentals - Kinematics - morphing - animation s/w tools and techniques. Multimedia Video: How video works - broadcast video standards - digital video fundamentals – digital video production and editing techniques - file formats.
- Multimedia Project: stages of project - Multimedia skills - design concept - authoring - planning and costing –Multimedia Team. Multimedia-looking towards Future: Digital Communication and New Media, Interactive Television, Digital Broadcasting, Digital Radio, Multimedia Conferencing

Syllabus for Art of Teaching and Other Skills STET 2023

Unit II   Art of Teaching, Other skills   Marks   50
(A) Art of Teaching   Marks 30
(B) Other skills   Marks 20

A. **Art of Teaching**
1. Teaching & Learning:- Meaning, Process & Characteristics.
2. Teaching Objectives and Instructional objectives: Meaning & Types, Blooms Taxonomy.
3. Teaching Methods: - Types and its Characteristics, Merit, and demerits of Methods.
4. Lesson Plan: - Types and Format & Various Model.
5. Microteaching & Instructional analysis.
6. Effective ecosystem of Classroom.

7. Textbook and library
8. Qualities of Teacher.
9. Evaluation & Assessment for learning.
10. Curriculum.
11. Factors affecting teaching and learning.
12. Teaching Aids and Hands on learning.

B. Other skills
1. General Knowledge,
2. Environmental Science
3. Mathematical aptitude,
4. logical Reasoning