

Syllabus

BPSC, BCS, NTRCA & Others

BPSC/BCS (WRITTEN) EXAMINATION

COMPUTER SCIENCE

Subject Code: 971 Total Marks-200

Part-I Marks-100

(a) Computer Programming: Introduction to computer programming. Assembling language programming. Problem solving techniques, algorithm specification and development. Programming style, testing and debugging. Program design techniques: Structured and modular program design. Programming languages and paradigms: classification.

Programming in C: Data type, statements, control structures, arrays, pointers, strings, functions, preprocessor directives, structures, unions and bit-fields, files.

Introductory programming with C++/JAVA. Introduction to object oriented programming: Encapsulation, inheritance and polymorphism, Mechanic Language Programming, Template functions and classes multi-threads exceptions, Class and object.

(b) Digital System: Number system: binary, octal, hexadecimal and BCD. Data representation. Logic gates and Boolean algebra: Combinational circuits. Circuit design using logic gates. Circuit and expression minimization: Karnaugh map and Quine-McCluskey. Basic flip-flops (FF), Design of half and full adder. Basic counters and register. Basic decoders, encoders, multiplexers and demultiplexers. ADC and DAC circuits. PLA design, Pulse mode and fundamental mode logic, Pulse & switching units, Newtrivibrations , Digital LC: DTL, TTL, III, CMOS MOS gates, Memory system, LED, LCD applications of Op-Amps. Cooperators.

(c) Discrete Mathematics: Propositional and predicate calculus: Basic concept. Theory of sets: set operations, algebra of sets. Mathematical induction. Basic concept of relations and its representation. Functions and its classification and pictorial representation. Graph theory and its application. Elementary number system. Principles of counting. Reversion, generating functions, recurrence relation.

(d) Numerical Analysis: Solving linear systems with Gaussian elimination and Gauss-Jordan elimination method. Interpolation: Newton's formula, Lagrange's formula. Numerical differentiations and integrations: Trapezoidal, Simpson's 1/3rd and 3/8 th rule. Romberg integration. Solutions and Newton-Ralphson's method. Solution of ordering differential equation and least square approximation of functions.

(e) Data Structures: Arrays: Representation and operations. Sparse and dense matrices: Concept and operation. Stacks and queues: Concept, structures and basic operations. Quick-sort and Polish notation: Applications of stack. Recursion: Concept and applications. Linked lists: Representation and various operations. Trees: Binary trees, traversing binary trees. Binary search trees: Various operations. Binary heaps: Heap sort. Huffman's algorithm. Graphs: Representations and operations. Spanning trees, shortest path and topological sorting. Internal sorting: Insertion sort, selection sort, merge-sort, radix sort, Basic hashing techniques.

(f) Microprocessor and Interfacing: Microprocessor and microcomputers. Evolution of microprocessor. Architecture of a general purpose microprocessor and its operation. Addressing modes. Common instruction types: Basic assembly instruction set. Intel 8086 microprocessor: Internal

architecture, register structure, programming model, addressing modes and instruction sets. Interrupts its classification and interrupt handling, Memory management in Intel 80x86 family: Real-mode memory management, segmentation and segmented to physical address translation. Protected mode memory management: Segmentation and virtual addressing, segment selectors and descriptors and tables. Intel 80386 and 80486 register formats. Paged memory operation and TLB structure I/O port organization and accessing. Interfacing the keyboard, printer and monitor. Structure and operation of certain chips as 8255A, 8253, 8272, 8259A, 8237. Bus interfaces and micro controllers.

(g) Computer Organization and Architecture: Fundamentals of computer design. Processor and ALU design. Control design: Hardware control and micro-programmed control. Caches Memory organization. Exceptions System organization Bus and hazards I/O subsystem and I/O processor. Parallel processing: Concept, pipeline processors. Interrupts systolic arrays and fault-tolerant computers.

(h) Compiler and theory of computation: Introduction to compiliary. Basic issues, logical analysis, hexical analysis, syntax analysis. Semantic analysis, type checking, run-time environments, code generation, code optimization and language theory.

Part-II Marks-100

(a) Algorithm: Algorithm and complexity: Asymptotic notations. Basic algorithm techniques and analysis: Divide and conquer, dynamic programming, greedy method, branch and bound, string matching, computational geometric problems, graph algorithms, spanning trees, shortest paths, max-flow problem, searching algorithms. Techniques for analysis of algorithms, approximation algorithms, parallel algorithms.

(b) Operating System: Introduction, evolution, goals and components of OS. Types of OS Process management: Process states PCB, job and process scheduling. CPU scheduling algorithms, critical section problems and solutions. Semaphores, Inter-process communication techniques. Deadlock handling methods. Memory management techniques: Paging, segmentation and page replacement policies. Secondary storage management: Disk scheduling algorithms. File management: File system structure, organization, FCB, space allocation, tree structured file system. Protection and security: classification and handling techniques.

(c) Database Management System: Definition of DBMS, types of DBMS, its advantages and disadvantages, Data model: ER model and relational model. Integrity constraints. Functional dependencies. Assertions and triggers. File organization: Definition of various file organization, classification and Representation. Indexing techniques: sparse and dense indexing. B+ tree indexing, hash indexing. Relational database design: normalization, 2NF, 3NF and BCNF. Query processing: Various notations, cost estimation of selection operation and join operation. Transaction concept and concurrency control: Lock based protocol, deadlock handling. SQL and application using SQL.

(d) Software Engineering: Introduction, Software process. Project management. Requirements engineering processes. System models: Context data, behavioral and object models. Object oriented design techniques. Real-time software design. System design with reuse. Critical system design dependability, software maintenance, critical system specification and development Verification and validation. Software testing. Software cost estimation: COCOMO model Halstead formula, Graph: Cel analysis of complexity measures, software reliability and availability, Quality assurance.

(e) Data Communication: Introduction to OSI and TCP/IP protocol. Data transmission basics: analog and digital data, spectrum and bandwidth. Transmission impairments. Data rate channel capacity.

Transmission media: Twisted pair, coaxial cable and optical fiber, wireless transmission. Data encoding: NRZ, NRZI, Manchester and differential Manchester modulation techniques-AM, FM, PM, DSSS modulation, compounding Equations, ASK, PSK, FSK, QPSK, QAM sampling theorem, PCM, PPM, PAM. Data transmission: Synchronous and asynchronous and asynchronous. NULL modem configuration. Data link control error and flow control CRC and HDLC. Multiplexing: FDM, TDM, statistical TDM. Basic circuit switching and packet switching techniques.

(f) Computer Network and the Internet: Protocol, fundamentals of control protocol, Introduction and network types, LAN, MAN, WAN. Topologies: Star, switched, bus, ring. Ethernet LAN standards. Internetworking: Network interconnection, bridges, routers. Network layer protocols: IP, ARP, ICMP, IP addresses. Unicast and multicast routing protocols. IPV6 congestion control, Transport layer protocol: TCP and UDP. Introduction to wireless LAN, VSAT, analog and digital cellular system. Network security: Types of attack, encryption techniques and digital signatures. ATM switches, ATM protocol; DNS, HTTP, Email.

(g) Artificial Intelligence: Overview of AI. General concepts of knowledge. Introduction to PROLOG. Knowledge representation. Intelligent agents. First order logic. Knowledge organization and manipulation: Search strategies, matching techniques and game planning. Natural language processing, Probabilities reasoning, expert systems and computer vision, Knowledge acquisition: Learning in symbolic and non-symbolic representation.

NTRCA ICT (Written) Syllabus
কম্পিউটার বিজ্ঞান (Computer Science)
Subject Code: 431 Marks: 100

- 1. Introduction to Computer System:** History, Basic organization of computer, Computer generations, Types of computer.
- 2. Programming Language:** Overview of C, C++ and JAVA; Constants, variables and data types; Operator & Expression; Managing Input & Output Operators; Decision making and branching; Decision making and looping. Arrays; Handling of character string; User-defined function; Structure and union; Pointers; File management.
- 3. Data Structure:** Array, Linked lists: Stacks, Queues, Recursion: Trees: Graphs:
- 4. Discrete Mathematics:** Set Theory, Relations, Functions, Graph Theory, Algebraic Systems, group theory, homomorphism, Mathematical reasoning, Theories with induction. Recurrence functions.
- 5. Object Oriented Programming:** Principles of Object-Oriented Programming; Tokens, Expressions and Control Structure; Functions; Classes and objects; Constructors and Destructors; Operator Overloading, Inheritance, Polymorphism and Encapsulation.
- 6. Operating System:** Definition and types OS, OS Structures: Processes: CPU scheduling: Process Synchronization: Deadlocks: Memory management: Virtual Memory: File Concept: File System Implementation:
- 7. Digital Logic Design:** Number systems and codes, Boolean algebra, De Morgan's theorems, logic gates and their truth tables, combinational logic circuits, karnaugh map method, decoder, encoder, multiplexed, and demultiplexer, Flip flop, Asynchronous and synchronous counters, D/A converter circuitry, A/D converter circuitry.
- 8. Algorithm:** Analysis of algorithm, design of algorithm, mathematical foundation of algorithm, asymptotic notations, summations, recurrences, sets etc. Divide and Conquer Algorithms: The Greedy method: Dynamic programming: Basic Traversal & Search technique: Backtracking: Branch and Bound.

9. Database Management System: Database system concept, Data abstraction; Database languages: Data management; Database system structure. Database model, Relational algebra and SQL. Database design, Indexing, Normalization.

10. Computer Organization and Architecture: Instruction sets, Addressing modes; Types of Instruction; Computer System: Computer Arithmetic: Memory Organization, Caching, Input-Output Organization: Central Processing Unit, Control Units, Fundamentals of parallel and distributed processing.

11. Software Engineering: Paradigms, Requirements Analysis Fundamentals, Software Design Fundamentals, Software Testing Techniques and Strategies, Software Management and Maintenance Technique, CASE.

12. Numerical Analysis: Numerical solution of polynomials, Numerical solution of simultaneous linear equation: Numerical solution of ordinary differential equation, Direct methods for systems of linear equations, Iterative techniques for systems of linear equations.

13. Computer Graphics: Graphics Hardware, Scan Conversion, Geometric Transformations, Projection, Visible Surface Determination, Illumination and Shading.

14. Computer Design: Introduction to compiler, A simple one pass compiler, Lexical analysis, Basic parsing technique, Syntax Directed Translation, Runtime Environment, Intermediate code generation, Code generation, Code optimization.

15. Computer Network: Basic computer network concept; Network structure; Network software; Reference model; OSI Model, TCP/IP Model, X.25 Networks. Frame Relay, ATM Network, Medium Access sub-layer, Network Layer, Optical Fiber Network, Application Layer. Cryptography and cryptographic algorithms, Cryptography and network security.

NTRCA ICT (Written) Syllabus

কম্পিউটার অপারেশন-বিএম (Computer Operation-BM)

Subject Code: 432 Marks: 100

আধুনিক ডিজিটাল কম্পিউটার কম্পিউটারের বেসিক অর্গানাইজেশন, স্টোরেজ ডিভাইস, ইনপুট/ আউটপুট ডিভাইস সিস্টেম সফটওয়্যার সি প্রোগ্রামিং ল্যাংগুয়েজ ডাটা টাইপ, এয়ারে সংক্রান্ত প্রোগ্রাম এ্যালগরিদম এবং ফ্লোচার্ট। ফাংশনাল প্রোগ্রাম মাইক্রোপ্রসেসর, মাইক্রোপ্রসেসর ইনপুট ও আউট পুট, মেমোরি ইত্যাদির সাপোর্টিং চিপ। ক্যাশ মেমোরি, RAM এবং ROM, কম্পিউটার হার্ডওয়্যার মেইনটেন্যান্স এবং ট্রাবল সূটিং। ডাটা প্রসেসিং এবং সিকিউরিটি। ডাটা ডাটাবেজ ম্যানেজমেন্ট, ডাটাবেজ ডিজাইন ও ডিজাইন টেবিল। ডাটা কমিউনিকেশন ও কমিউনিকেশন মিডিয়া কম্পিউটার নেটওয়ার্ক ও নেটওয়ার্কের প্রয়োগ। কম্পিউটার ভাইরাস ও এন্টি ভাইরাস।

NTRCA ICT (Written) Syllabus

Information and Communication Technology (ICT)

Subject Code: 452 Marks: 100

Structured and Object Oriented Programming (OOP) Concept (Answer 02x10=20):

Fundamentals of C programming; Introducing C's Program Control Statements; Data types, Variables and Expressions; Exploring Arrays and Strings; Understanding Pointers and Functions; Console and File I/O; Structures and Unions.

Topics include object-oriented programming concepts, such as classes, objects, methods, interfaces, packages, inheritance, encapsulation, and polymorphism.

Introduction to Software Engineering(Answer 01x10=10): history, nature, relation of software engineering to other discipline, software development life cycle, Programming language; Software nature and qualities: product qualities, project qualities, correctness, robustness, usability,

maintainability, portability, quality measurements; Software development life cycle: requirement, design, development, testing, maintenance; Software development model: waterfall, agile, spiral, RDD, V model; Software engineering principles: modularity, abstraction, generality, object oriented, component oriented, structured.; Specification and Verification: requirement specification, descriptive specification, testing, analysis, debugging; Modeling and Design: basics of modeling diagram, UI design. Software Project Management: concepts, project metrics, estimation, risks management.

Data Structure and Algorithm & Combinatorial Optimization (Answer 02x10=20): Introduction - Data Structures and Complexity of Algorithms, Time Space Tradeoff, Searching Techniques- Linear and Binary Searching; Sorting and Recursion - Discussion of Common Sorting Techniques: Insertion Sort, Selection Sort, Bubble Sort, Quick Sort, Merge Sort, Radix Sort; Factorial and Tower of Hanoi Problem; Linked Lists - Abstract Data Types, List ADTs, and Linked Lists: Singly, Two Way and Circular Linked Lists; Stacks and Queues - Stacks and Queues and their Implementation Strategies; Prefix, Infix and Postfix Expressions, their Transformation and Evaluation Algorithms; Hashing - Hash Indices and Hash Functions, Static and Dynamic Hashing, Collisions in Hash Indices and Collision Resolving Techniques; Trees - Tree Concepts, Binary Tree, BST, Heaps, Heap Sort, Huffman Encoding Technique, AVL Tree, B Tree and B+ Tree; Graphs - Graph Terminologies, Representing Graphs, Graph Searching: BFS and DFS, Shortest Path Problems, Minimum Spanning Tree, Minimum Spanning Tree Algorithms, and Topological Sorting; Problem Solving Strategy - Greedy Algorithms, Divide and Conquer Strategy, Dynamic Programming and Backtracking. Introduction - Algorithms, Analyzing & Designing Algorithms, Correctness of Algorithms; Greedy Algorithms - Introduction to Greedy Algorithms, Greedy Choice Property, Greedy vs. Dynamic Programming, Fractional Knapsack Problem, Activity Selection Problem, Huffman Encoding, Task Scheduling Problem, Coin Changing Problem, Kruskal's and Prim's Minimum Spanning Tree Algorithms; Divide and Conquer Algorithms - Introduction to Divide and Conquer Design Technique, Quick Sort, Merge Sort, Proof of Correctness, and Run Time Analysis; Dynamic Programming - Introduction to Dynamic Programming Technique, Principle of Optimality, Optimal Substructure Property, Assembly Line Scheduling, Matrix Chain Multiplication, LCS, Viterbi Algorithm, Bitonic Euclidean Traveling Salesperson Problem and Runtime Analysis; Graph Searching and Shortest Path Problems - Breadth First Search, Depth First Search, Flow Networks, Single Source and All Pair Shortest Path Algorithms

Web Technology (Answer 01x10=10): Introduction to Html, Java Script & CSS, Server Side Programming: HTTP Server, Application Server, MVC Web Framework, Web Services, Database Access: Object Relational Mapping, Lambda Expression, Language Integrated Query, Data Reader, Writer, Web Security: Denial of Service, Buffer Overflow, Cross Site Scripting, Authentication and Access Control

Operating System (Answer 01x10=10): Overview of operating systems, functionalities and characteristics of OS. Hardware concepts related to OS, CPU states, I/O channels, memory hierarchy, and microprogramming. The concept of a process, operations on processes, process states, concurrent processes, process control block, process context. UNIX process control and management, PCB, signals, forks and pipes. Interrupt processing, operating system organization, OS kernel FLIH, dispatcher. Job and processor scheduling, scheduling algorithms, process hierarchies. Problems of concurrent processes, critical sections, mutual exclusion, synchronization, deadlock. Mutual exclusion, process co-operation, producer and consumer processes. Semaphores: definition, init, wait, signal

operations. Use of semaphores to implement mutex, process synchronization etc., implementation of semaphores. Critical regions, Conditional Critical Regions, Monitors, Ada Tasks. Interprocess Communication (IPC), Message Passing, Direct and Indirect, Deadlock: prevention, detection, avoidance, banker's algorithm. Memory organization and management, storage allocation. Virtual memory concepts, paging and segmentation, address mapping. Virtual storage management, page replacement strategies. File organization: blocking and buffering, file descriptor, directory structure, File and Directory structures, blocks and fragments, directory tree, inodes, file descriptors, UNIX file structure.

Database Management System (Answer 02x10=20): Introduction to Database Systems: Evolution of file processing systems, role of databases in organizations, core components of a database environment; Data Modeling: the Entity-Relationship Diagram and its symbols and constructs; The Relational Model and Normalization: relational model, normalization, transformation of an entityrelationship data diagram into a relational model; SQL - A Standard Navigation Language for Relational

Databases; Overview of Object-Oriented Databases: object-oriented data model, implementation of object persistence using relational databases. Indexing and Hashing: Basic Concepts, Ordered Indices, B+-Tree Index Files, B-Tree Index Files, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing; Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Evaluation of Expressions; Query Optimization: Introduction, Transformation of Relational Expressions, Catalog Information for Cost Estimation, Statistical Information for Cost Estimation, Cost-based optimization; Transactions: Transaction Concept, Transaction State, Concurrent Executions, Serializability; Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols; Recovery System: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery With Concurrent Transactions; Data Analysis and Mining: Data Mining, Decision tree, Bayes theory, Randomize tree; Database System Architectures: Centralized and Client-Server Systems, Server System Architectures, Parallel Systems, Distributed Systems, Network Types; Parallel Databases: Introduction, I/O Parallelism, Interquery Parallelism, Intraquery Parallelism, Intraoperation Parallelism, Interoperation Parallelism; Distributed Databases: Heterogeneous and Homogeneous Databases: Distributed Data Storage, Distributed Transactions, Commit Protocols; Additional should be included: Database Design, Database Tuning Security and Authorization, Multidimensional query.

Data Communications and Networking(Answer 01x10=10): Introduction: Overview of the Internet, Overview of Networking Protocols, Network Edge, Network Core, Protocol Layers / Service Model, General Networking Example; Application Layer: Principles of Networking Applications, Web and HTTP, FTP, E-mail, DNS; Transport Layer: Transport Layer Services, Multiplexing and De multiplexing, Connectionless Transport: UDP, Principles of Reliable Data Transport, Connection-Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control; Network Layer: Datagram Networks, Inside a Router, Details of the Internet Protocol (IP), IP Sub netting, Routing Algorithms (Link State, Distance Vector), Routing in the Internet (Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Border Gateway Protocol (BGP)).

Note: NTRCA এর সিলেবাস ৪৫২ রেখে বাকী সিলেবাস বাদ যাবে,
কারণ ১৮তম থেকে শুধু ৪৫২ কোড এর সিলেবাসে এক্সাম হবে।

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