SYLLABUS FOR BCS (WRITTEN) EXAMINATION

INFORMATION AND COMMUNICATION TECHNOLOGY (POST RELATED)

Subject Code: 281
Total Marks-200

PART-I
Marks: 100

Basic Physics

Basic elements: charge, Coulomb's law, electric field, Gauss's law, electric potential, magnetic field; Faraday's law, Maxwell's equations, Waves and oscillations, Theory of special relativity, Electromagnetic waves, Photoelectric effect, Quantum theory of light, X-ray and X-ray diffraction, Compton effect; De Broglie waves, Phase and group velocity, Wave function and wave equation.

Introduction to Computer Systems

Introduction to computations; Early history of computing devices; Computers; Major components of a computer; Hardware: processor, memory, I/O devices; Software: Operating system, application software; Basic architecture of a computer; Basic Information Technology; The Internet; Number system: binary, octal, hexadecimal, binary arithmetic.

Electrical Circuits

Circuit variables and elements: voltage, current, power, energy, independent and dependent sources, resistance; Basic laws of electrical circuits: Ohm's law, Kirchoff's current law (KCL) and Kirchoff's voltage law (KVL); Simple resistive circuits: series and parallel circuits, voltage and current division, source transformation; Methods of analysis: nodal and mesh analysis; Circuit theorems: Thevenin's, Norton's and superposition theorems, maximum power transfer and reciprocity theorem; Capacitors and inductors: inductors and capacitors, their characteristics, series-parallel combination of inductors and capacitors; RLC Transients.

Series and parallel AC circuits: impedance and phasor diagram, series and parallel networks, voltage divider rule, admittance and susceptance; mesh and nodal analysis, wye-delta and delta-wye conversions; superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem.

Digital Logic Design

Digital logic: Boolean algebra, De Morgan's Theorems, logic gates and their truth tables, canonical forms, combinational logic circuits, minimization techniques; Arithmetic and data handling logic circuits, decoders and encoders, multiplexers and demultiplexers; Combinational circuit design; Flip-flops, race around problems; Counters: asynchronous counters, synchronous counters and their applications; PLA design; Synchronous and asynchronous logic design; State diagram, Mealy and Moore machines; State minimizations and assignments; Pulse mode logic; Fundamental mode design.

Basic Electronics

Diode circuit: current-voltage characteristics of a diode, DC and AC models, dynamic resistance and capacitance, load line, Zener regulator, half wave and full wave rectifier, voltage multiplier, clipper and clamper; Bipolar junction transistors: construction and operation, amplifying action, common base, common emitter, common collector, load line, different biasing, stability factor, small signal equivalent circuit models, BJT as a switch; Single stage amplifier: voltage and current gain, input and output impedance of a common base, common emitter and common collector, h-parameter; Field effect transistor (FET): JFET structure, operation and characteristics. MOSFET construction, operation and characteristics.

Microprocessor and Interfacing

Introduction to microprocessor: overview of computer architecture, evolution of microprocessors, difference between microprocessor and microcontroller; Introduction to 8086/8088: basic architecture of 8086, memory segmentation, flags, addressing modes, pins & signals, single and multi-processor systems; Microprocessor programming: instruction sets, introduction to assembly language programming; Tools: assemblers, debuggers, development systems; Clock and bus controller interfacing: clock generator, bus demultiplexer, bus controller interfacing; Memory Interfacing: SRAM and EEPROM interfacing, Types of I/O: parallel I/O, programmed I/O, interrupt driven I/O, I/O port address decoding, programmable peripheral interface (8255A), interface examples– Keyboard matrix, LCD/7-Segment display, printer, stepper motor, A/D and D/A converter; Timer interfacing: The 8254 programmable interval timer (PIT), timing applications; Serial I/O interface: asynchronous and synchronous communication, physical communication standard-EIA RS232, programmable communication interface, interfacing serial I/O devices- mouse, modem, PC Keyboard; Interrupts: interrupt driven I/O, software & hardware interrupts, interrupt vectors and vector table, interrupt processing, programmable interrupt controller (8259A), DMA: DMA controller (8237).

Computer Architecture

Information representation; Measuring performance; Instructions and data access methods: operations and operands of computer hardware, representing instruction, addressing styles; Arithmetic Logic Unit (ALU) operations, floating point operations, designing ALU; Processor design: datapaths & single cycle and multicycle implementations; Control Unit design - hardwared and microprogrammed; Hazards; Exceptions; Pipeline: pipelined datapath and control, superscalar and dynamic pipelining; Memory organization: cache, virtual memory, channels.

Communication Theory

Spectral analysis: Fourier series, sampling function, power spectrum, Fourier transform, convolution, Parseval's theorem; Information theory: entropy, information rate, Shannon's theorem, channel capacity;Analog communication system: different modulations, modulation circuits and detectors; Digital modulation: different standard modulation schemes; Pulse and digital signals: pulse amplitude modulation (PAM), pulse code modulation (PCM), delta modulation (DM), adaptive delta modulation (ADM); Multiplexing: time-division

multiplexing (TDM) frequency-division multiplexing (FDM), multiple-access network- time-division multiple-access (TDMA), frequency-division multiple access (FDMA); code-division multiple-access (CDMA).

Computer Networking and Security

Protocol hierarchies; Data link control: HLDC; DLL in Internet; DLL of ATM; LAN Protocols: Standards IEEE 802.*; Hubs, Bridges, and Switches, FDDI, Fast Ethernet; Routing algorithm; Congestion control; Internetworking, WAN; Fragmentation; Firewalls; IPV4, IPV6, ARP, RARP, Mobile IP, Network layer of ATM; Transport protocols; Transmission control protocol: connection management, transmission policy, congestion control, timer management; UDP; AAL of ATM; Network security: Cryptography, DES, IDEA, public key algorithm; Authentication; Digital signatures; Gigabit Ethernet; Domain Name System: Name servers; Email and its privacy; SNMP; HTTP; World Wide Web.

PART-II

Marks: 100

Programming Language

Structured programming language: data types, operators, expressions, control structures; Functions and program structure: parameter passing conventions, scope rules and storage classes, recursion; Header files; Preprocessor; Pointers and arrays; Strings; Multidimensional array; User defined data types: structures, unions, enumerations; Input and Output: standard input and output, formatted input and output, file access; Variable length argument list; Command line parameters; Error Handling; Graphics; Linking; Library functions.

Object Oriented Programing language: Philosophy of Object Oriented Programming (OOP); Advantages of OOP over structured programming; Encapsulation, classes and objects, access specifiers, static and non-static members; Constructors, destructors and copy constructors; Array of objects, object pointers, and object references; Inheritance: single and multiple inheritance; Polymorphism: overloading, abstract classes, virtual functions and overriding; Exceptions; Object Oriented I/O; Template functions and classes; Multi-threaded Programming.

Theory: Discrete Mathematics, Theory of Computation and Basic Graph Theory

Set theory; Relations; Functions; Graph theory; Propositional calculus and predicate calculus; Mathematical reasoning: induction, contradiction and recursion; counting; Principles of inclusion and exclusion; Recurrence relations; Algebraic structures: rings and groups.

Graphs: simple graphs, digraphs, subgraphs, vertex-degrees, walks, paths and cycles; Trees, spanning trees in graphs, distance in graphs; Complementary graphs, cut-vertices, bridges and blocks, k-connected graphs;

Theory of Computation: Language theory; Finite automata: deterministic finite automata, nondeterministic finite automata, equivalence and conversion of deterministic and nondeterministic finite automata, pushdown automata; Context free languages; Context free grammars; Turing Machines: basic machines, configuration, computing with Turing machines

Data Structures and Algorithms

Internal data representation; Abstract data types; Elementary data structures: arrays, lists, stacks, queues, trees, graphs; Advanced data Structures: heaps, Fibonacci heaps, B-trees; Recursion, sorting, searching, hashing, storage management.

Techniques for analysis of algorithms; Methods for the design of efficient algorithms: divide and conquer, greedy method, dynamic programming, back tracking, branch and bound; Basic search and traversal techniques; Topological sorting; Connected components, spanning trees, shortest paths; Flow algorithms; Approximation algorithms; Parallel algorithms; Algebraic simplification and transformations; Lower bound theory; NP-completeness, NP-hard and NP-complete problems.

Database Systems

Concepts of database systems; Data Models: Entity-Relationship model, Relational model; Query Languages: Relational algebra, SQL; Constraints and triggers; Functional dependencies and normalization; File organization and data storage; Indexing: primary and secondary indexes, B+ trees, hash tables; Query optimization; Transaction management; Recovery; Concurrency control; Access control and security; Semi-structured database: XML, XPath, XQuery; Object oriented and object relational databases.

Software Engineering and Information System Design

Concepts of Software Engineering, Software Engineering paradigms, Different phases of software System Development, Different types of information, qualities of information. Project Management Concepts, Software process and project Metrics, Software Project Planning, Risk Analysis and management, Project Scheduling and Tracking. Analysis Concepts and principles: requirement analysis, Analysis modeling, data modeling. Design concepts and principles, Architectural design, User Interface design, Object Oriented software development and design: Iterative Development and the Unified Process. Sequential waterfall life cycles, Inception. Use case model for requirement writing, Elaboration using System Sequence Diagram, Domain Model. Visualizing concept classes. UML diagrams, Interaction and Collaboration Diagram for designing Software.

Designing Objects with responsibilities. GRASP patterns with General Principles in assigning responsibilities: Information expert, Creator, Low Coupling and High Cohesion, Creating design class diagrams and mapping design to codes. Software Testing: White Box and Black Box testing. Basis Path Testing. Testing for specialized environment. Software testing strategies: Unit Testing, Integration Testing, Validation Testing, System Testing, Art of debugging.

Analysis of System Maintenance and upgrading: Software repair, downtime, error and faults, specification and correction, Maintenance cost models, documentation. Software Quality Assurance, Quality factors. Software quality measures. Cost impact of Software defects. Concepts of Software reliability, availability and safety. Function based metrics and bang metrics. Metrics for analysis and design model. Metrics for source code, testing and maintenance

Operating System

Operating System: its role in computer systems; Operating system concepts; Operating system structure; Process: process model and implementation, Inter-Process Communication (IPC), classical IPC problems, process scheduling, multiprocessing and time-sharing; Memory management: swapping, paging, segmentation, virtual memory; Input/Output: hardware, software, disk, terminals, clocks; Deadlock: resource allocation and deadlock, deadlock detection, prevention and recovery; File Systems: files, directories, security, protection; Case study of some operating systems.

Artificial Intelligence

Introduction to old and new AI techniques; Knowledge representation; Propositional and first order logic; Search techniques in AI; Probabilistic reasoning; Natural language processing. Introduction to expert system. Introduction to machine learning; Learning algorithms: supervised and unsupervised; Practical application of machine learning; Regression; Clustering.

আ.ই.ম. নেছার উদ্দিন
পরীক্ষা নিয়ন্ত্রক (ক্যাডার)
সরকারী কর্ম কমিশন সচিবালয়, ঢাকা