Code	Subject	Class Number	Date
281 & 971	**Programming**	04	
	Class-01		
	Class-02		
	Class-03		
	Class-04		
	Exam-01+02		**Programming** **বাংলা-০১**
	Digital System	03	
281 & 971	Class-01		
	Class-02		
	Class-03		
	Exam-02		**Digital System** **বাংলা-০২**
	Discrete Mathematics	02	
971	Class-01		
	Class-02		
	Exam-03+04		**Discrete Mathematics** **বাংলা-০৩**
	Numerical Analysis	02	
971	Class-01		
	Class-02		
	Exam-04+05		**Discrete Mathematics** **বাংলা-০৪**
	Data Structure	03	
971 & 281	Class-01		
	Class-02		
	Class-03		
	Exam-06+07		**Data Structure** **ইংরেজি-০১**
	Microprocessor and Interfacing	03	
971 & 281	Class-01		
	Class-02		
	Class-03		
	Exam-06 +08		**Microprocessor and Interfacing** **ইংরেজি-০২**
	Computer Organization and Architecture	02	
971 & 281	Class-01		
	Class-02		

	Exam-07		**Computer Organization and Architecture** **ইংরেজি-০৩**
	Compiler Design	01	
971	Class-01		**Compiler Design** **ইংরেজি-০৪**
	Exam-08		
281	**Theory of computation**	02	
	Class-01		
	Class-02		
	Exam-09		**Theory of computation** **ইংরেজি-০৫**
281& 971	**Algorithm**	02	
	Class-01		
	Class-02		
	Exam-10		**Algorithm** **ইংরেজি-০৬**
281& 971	**Operating System**	04	
	Class-01		
	Class-02		
	Class-03		
	Class-04		
	Exam-11		**Operating System** **গাণিতিক যুক্তি -০১**
281& 971	**Database Management System**	04	
	Class-01		
	Class-02		
	Class-03		
	Class-04		
	Exam-12		**Database Management System** **গাণিতিক যুক্তি -০২**
281& 971	**Software Engineering**	03	
	Class-01		
	Class-02		
	Class-03		
	Exam-13		**Software Engineering** **গাণিতিক যুক্তি -০৩**
971	**Data Communication**	03	
	Class-01		
	Class-02		
	Class-03		

	Exam-14		**Data Communication** **গাণিতিক যুক্তি -০৪**
281& 971	**Computer Network and Internet and Security**	03	
	Class-01		
	Class-02		
	Class-03		
	Exam-15		**Computer Network and Internet and Security** **মানসিক দক্ষতা -০১**
281& 971	**Artificial Intelligence**	02	
	Class-01		
	Class-02		
	Exam-16		**Artificial Intelligence** **মানসিক দক্ষতা -০২**
281	**Introduction to Computer Systems**	02	
	Class-01		
	Class-02		
	Exam-17		**Introduction to Computer Systems** **মানসিক দক্ষতা -০৩**
281	**Electrical Circuits**	04	
	Class-01		
	Class-02		
	Class-03		
	Class-04		
	Exam-18		**Electrical Circuits** **সাধারণ জ্ঞান- ০১**
281	**Basic Electronics**	03	
	Class-01		
	Class-02		
	Class-03		
	Exam-19		**Basic Electronics** **সাধারণ জ্ঞান- ০২**
281	**Communication Theory**	03	
	Class-01		
	Class-02		
	Class-03		
	Exam-20		**Communication Theory** **সাধারণ জ্ঞান- ০৩**
281	**Basic Physics**	02	
	Class-01		
	Class-02		

COMPUTER SCIENCE (POST RELATED) Subject

Code: 971 (324-CSE, CS-114, C-304)

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

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. Comparators.

Discrete Mathematics: Prepositional 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.

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 3/8th rule. Romberg integration. Solutions and Newton-Raphson's method. Solution of ordering differential equation and least square approximation of functions.

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.

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.

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.

Compiler Design and theory of computation: Introduction to compiler. Basic issues, lexical analysis, logical analysis, syntax analyses. Semantic analysis, type checking, run-time environments, code generation, code optimization and language theory.

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.

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. deadlock, banker's algorithm. Memory management techniques**:** Paging, segmentation and page replacement policies. (FIFO, LIFO, LRU) Secondary storage management, Disk scheduling algorithms. Kernel, Shell File management: File system structure, organization, FCB, space allocation, tree structured file system. Protection and security: classification and handling techniques.

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.

Software Engineering

Introduction, Software process. Project management**.** Requirements engineering processes. System Models: Context, data, behavioral and object models: agile, waterfall model ,prototype, SCRUM,Spiral;Object oriented design techniques: Model , UML use case, class, 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.

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, Della 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.

Computer Network and 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, ARJP, 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, Cryptography= encryption, decryption, ATM protocol; DNS, HTTP, Email.

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.

INFORMATION AND COMMUNICATION TECHNOLOGY
(POST RELATED)
Subject Code: 281
(ICT-132, SE-332, ECE-349, ETE-351, CS&TE-363, IT-364, AP&ETE 365, AP&TE-366)

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, Kirchhoff’s current law (KCL) and Kirchhoff’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: data paths & single cycle and multicycle implementations; Control Unit design - hardwired 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.

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 nonstatic 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; Multithreaded 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.

References: BPSC Website – BCS Written Syllabus