

Metropolitan University
School of Science & Technology

Department of Information & Communication Technology

Programme : B.Sc. Engineering in Computer Science & Engineering [CSE]

Duration : 4 Years, 12 Semesters

Total Credits : 148 credits

Program Structure and Duration

The academic year of course Computer Science & Engineering (CSE), under the Department of Information & Communication Technology is divided into three semesters as follows:

<u>Semester</u>	<u>Duration</u>
Spring	January to April
Summer	May to August
Autumn	September to December

The B. Sc. Engineering (CSE) program is a 48 (forty-eight)-month study of 12 semesters for regular students. A student has to complete at least 148 credit hours in order to be a graduate.

List of Courses:

Core Courses:

Code	Title	Credit
CSE 111	Computer Technology	3
CSE 121	Structured Programming	2
CSE 122	Structured Programming Lab	3
CSE 123	Basic Electrical Engineering	3
CSE 124	Basic Electrical Engineering Lab	1.5
CSE 125	Discrete Mathematics	2
CSE 131	Basic Electronics Engineering	3
CSE 132	Basic Electronics Engineering Lab	1.5
CSE 133	Data Structure	3
CSE 134	Data Structure Lab	2
CSE 200	Project	1
CSE 211	Digital logic Design	3
CSE 212	Digital logic Design Lab	1.5
CSE 213	Computer Organization and Architecture	3
CSE 215	Telecommunication Principles	3
CSE 221	Object Oriented Programming	3
CSE 222	Object Oriented Programming Lab	3
CSE 223	Database Management System	3
CSE 224	Database Management System Lab	3
CSE 231	Algorithm	3
CSE 232	Algorithm Lab	1.5
CSE 235	Microprocessor & Assembly Language	3
CSE 236	Microprocessor & Assembly Language Lab	1.5
CSE 239	Data Communication	3
CSE 300	Project	2
CSE 311	Computer Networks	3
CSE 312	Computer Networks Lab	1.5
CSE 315	Computer Peripherals & Interfacing	2
CSE 316	Computer Peripherals & Interfacing Lab	1
CSE 321	Operating System	3
CSE 322	Operating System Lab	1.5
CSE 323	Web Programming or Option I	2
CSE 324	Web Programming Lab or Option I Lab	1
CSE 327	Theory of Computation	3
CSE 413	Optical Communication or Option II	3
CSE 414	Optical Communication Lab or Option II Lab	1
CSE 415	Compiler Construction or Option I	3
CSE 416	Compiler Construction Lab or Option I Lab	1.5
CSE 421	Artificial Intelligence	3
CSE 422	Artificial Intelligence Lab	1.5
CSE 423	Software Engineering	3
CSE 433	Pattern Recognition or Option I	3
CSE 434	Pattern Recognition Lab or Option I Lab	1.5

CSE 417	<i>Embedded System Design</i> or Option II	3
CSE 418	<i>Embedded System Design Lab</i> or Option II Lab	1.5
CSE 327	<i>Theory of Computation</i> or Option II	3
CSE 426	Final Year Project (Compulsory)	2
CSE 436	Final Year Project (Compulsory)	4

Science & Mathematic Courses

PHY 111	Physics I/Waves, Oscillation and Thermodynamics	3
PHY 124	Physics II/Optics, Electricity and Magnetism	2
STA 215	Basic Statistics & Probability	3
MAT 112	Differential and Integral Calculus	3
MAT 123	Differential Eq. & Laplace transform.	3
MAT 135	Matrices, CV & Fourier analysis	3
MAT 216	Geometry & Vector Analysis	3
MAT 235	Numerical Methods	3

General Education

GED 113	Communicative English Language - I	3
GED 125	Communicative English Language - II	3
GED 233	Bangladesh Studies	3
GED 219	Engineering Economics	3
GED 321	Accounting	3
GED 421	Industrial Management	3
GED 431	Business Communication	2

Optional Courses:

Option I

CSE 425	Neural Network	3
CSE 426	Neural Network Lab	1.5
CSE 441	Digital Signal Processing	3
CSE 442	Digital Signal Processing Lab	1.5
CSE 455	Contemporary Course on Computer Science	3
CSE 456	Contemporary Course (Lab) on Computer Science	1.5
CSE 457	Parallel Processing	3
CSE 458	Parallel Processing Lab	1.5
CSE 461	Distributed System	3
CSE 462	Distributed System Lab	1.5
CSE 463	Advanced Database System	3
CSE 464	Advanced Database System Lab	1.5

Option II

CSE 413	Optical Communication	3
CSE 414	Optical Communication Lab.	1.5
CSE 431	VLSI Design	3
CSE 432	VLSI Design Lab	1.5
CSE 443	Contemporary Course on Computer Science	3
CSE 444	Contemporary Course (Lab) on Computer Science	1.5
CSE 465	Digital Image Processing	3
CSE 466	Digital Image Processing Lab	1.5
CSE 469	Bioinformatics Computing	3
CSE 470	Bioinformatics Computing Lab	1.5

Course Contents

Core courses

CSE 111 Computer Technology

2 Hours/week, 2 Credit

Objective: Learning of some fundamentals on computer technology.

Introduction to basic concepts; Nature of computers and its evolution; Generation of computers; Capabilities of computers and their applications and limitations; Computer hardware and software components, Data recording media; Computer system software; Number system: Binary, octal and hexadecimal number systems, binary arithmetic, 2's complement arithmetic; Data representation; Conversion of fractions; Algorithms and flowcharts; Loops, counters, accumulators and switches.

CSE 112 Computer Technology Lab.

2 Hours/week, 1 Credit.

Laboratory works based on CSE111 and operations of Microsoft Windows 2000 and Linux operating systems.

CSE 121 Structured Programming

2 Hours/week, 2.00 Credit

Objective: Introduction to computer programming especially structured programming concepts

Programming concepts; Program development stages; Flow charts; Number systems: binary, octal, decimal and hexadecimal systems; Structured programming language: data types, operators, expressions, control structures; Functions and program structure: function basics, parameter passing conventions, scope rules and storage classes, recursion; Header files; Preprocessor; Pointers and arrays; 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.

Reference language: C

CSE 122 Structured Programming Lab.

6 Hours in a week, 3 Credit

Laboratory works based on CSE121.

CSE 123 Basic Electrical Engineering

3 Hours/week, 3.00 Credit

Objective: To meet up the requirement of electrical background in computer engineering.

Fundamental electrical concepts and measuring units. Direct current: voltage, current, resistance and power. Laws of electrical circuits and methods of network analysis; Introduction to magnetic circuits. Alternating current: instantaneous and r.m.s. current, voltage and power, average power for various combinations of R, L and C circuits, phasor representation of sinusoidal quantities.

CSE 124 Basic Electrical Engineering Lab.

3 Hours in a week, 1.50 Credit

Laboratory works based on CSE123

CSE 125 Discrete Mathematics

3 Hours in a week, 3.00 Credit

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

CSE 131 Basic Electronics Engineering

3 Hours/week, 3.00 Credit

Objective: To meet up the requirement of electronic background in computer engineering.
Introduction to semiconductors; p-type and n-type semiconductors; p-n junction diode characteristics; Diode applications: half and full wave rectifiers; Clipping and clamping circuits; Regulated power supply using zener diode; Bipolar Junction Transistor (BJT): principle of operation, I-V characteristics; Transistor circuit configurations (CE, CB, CC), BJT biasing, load lines; BJTs at low frequencies; Hybrid model, h parameters, simplified hybrid model; Small-signal analysis of single and multi-stage amplifiers, frequency response of BJT amplifier; Field Effect Transistors (FET): principle of operation of JFET and MOSFET; Depletion and enhancement type NMOS and PMOS; biasing of FETs; Low and high frequency models of FETs, Switching circuits using FETs; Introduction to CMOS; Operational Amplifiers (OPAMP) : linear applications of OPAMPs, gain, input and output impedances, active filters, frequency response and noise; Introduction to feedback, Oscillators, Silicon Controlled Rectifiers (SCR), TRIAC, DIAC and UJT: characteristics and applications.

CSE 132 Basic Electronics Engineering Lab.

3 Hours in a week, 1.5 Credit

Laboratory works based on CSE 131

CSE 133 Data Structures

3 Hours/week, 3.00 Credit

Objective: Implementation and testing of elementary data structures.

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.

CSE 134 Data Structures Lab.

4 Hours/week, 2 Credit

Laboratory works based on CSE133

CSE 211 Digital Logic Design

3 Hours/week, 3.00 Credit

Objective: understanding the operations of digital logic circuits.

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; 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.

CSE 212 Digital Logic Design Lab.

2 Hours in a week, 1 Credit

Laboratory works based on CSE 211

CSE 213 Computer Architecture and Organization

3 Hours/week, 3.00 Credit

Objective: Understanding the architecture and organization of digital computers.

Information representation; Measuring performance; Instructions and data access methods: operations and operands of computer hardware, representing instruction, addressing styles; Arithmetic Logic Unit (ALU) design: arithmetic and logical operations, floating point operations, designing ALU; Processor design: data paths - single cycle and multicycle implementations; Control Unit design - hardware and microprogrammed; Hazards; Exceptions; Pipeline: pipelined data path and control, superscalar and dynamic pipelining; Memory organization: cache, virtual memory; channels; DMA and Interrupts; Buses; Multiprocessors: types of multiprocessors, performance, single bus multiprocessors, multiprocessors connected by network, clusters; Design using MSI and LSI components; Design of memory subsystem using SRAM and DRAM; Design of various components of a computer.

CSE 215 Telecommunication Principles

3 Hours/week, 3.00 Credit

Introduction to Telecommunications: Beginning of Telecommunications; Evolution of Telecommunications; Telecommunications legislative history; Telecommunications PSTN Technology.

Basic Principles: Signals - Analog and Digital; Bandwidth - Narrowband, wideband; Telecommunication Systems, Line System Characteristics, Radio System Characteristics, and Switching System Principles.

Some Fundamentals: The decibel, Frequency, Waveforms and filters, Voice frequencies, Attenuation and noise, Amplitude Modulation, Frequency Modulation, Pulse Modulation; bauds, bits, bytes and codes; protocols, architectures, LAN, WAN, MAN.

Telephone Systems and Cabling: From stand-alone to connect telephones; What is PBX? Connecting Telephone lines to PBXs; PBX Telephones; Centrex; Key systems.

Switching and Signaling: Step-by-step telephone exchanges, Reed relay and crossbar exchanges, Stored program control, Signaling, Digital exchanges.

Cable, Radio and Transmission: Local distribution networks, Carrier working: Groups and super groups, Submarine cables, Optic fibers, Radio propagation, Antennae, Satellites, Mobile radio Systems.

Traffic Theory: The Erlang, Erlang's lost call formula, Queueing systems.

Maintenance and Operation: Centralized Maintenance Systems, Telephone tariffs and System Viability, Forecasting future demands.

Digital Services: Analogue versus digital, Pulse code modulation, Primary PCM Systems and time-division multiplexing, Data services, Digital strategies for national telephone systems, Integrated services digital networks.

Digital Fundamentals: Bits, bytes, words, Integrated circuits, Logic gates, Memories and stores, Magnetic tapes and discs, Computers and microprocessors.

Today and Tomorrow: Electronic mail, Teletext, Viewdata, Perstel, Cable television, High-definition television, Direct broadcasting by satellite, Travel or communicate? Advances in Telecommunications, Evolution in Telecommunications, Telecommunications and Applications, Integrating Voice, Data, and Video, Multimedia, Compact Disk Read Only Memory, CD-ROM, Electronic Communications, Local Area Networks, Internet.

CSE 221 Object Oriented Programming

3 Hours/week, 3.00 Credit

Objective: Preliminary OOP concepts with example language C++ / Java

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.

CSE 222 Object Oriented Programming Lab.

6 Hours/week, 3.00 Credit

Laboratory works based on CSE 221, small programs using OOP concepts and a ½ semester project in C++/Visual C++ using MFC/ Java using JFC.

CSE 223 Database Management System

3 Hours/week, 3.00 Credit

Objective: study of some fundamental database concepts.

Data base system architecture, Models: Entity-Relationship model, Relational model; Relational algebra; SQL; Integrity constraint; Relational database design; File organization and retrieval, file indexing; Transaction manager; Concurrency controller; Recovery manager; Security system; Database administration; Query processing and optimization; Distributed database; Object-oriented database.

CSE 224 Database Management System Lab

2 Hours in a week, 1.00 Credit

Laboratory works based on CSE 223

CSE 231 Algorithms

3 Hours/week, 3.00 Credit

Objective: Implementation and testing of fundamental algorithms and solving some example problems relevant to fundamental algorithms

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.

CSE 232 Algorithms Lab.

3 Hours/week, 1.5 Credit

Laboratory works based on CSE 231

CSE 235 Microprocessor & Assembly Language Programming

3 Hours/week, 3.00 Credit

Objective: To learn low-level or System-level programming.

Introduction to microprocessors, Event driven programming, API calls/System calls, Assembly language programming, architectures and Assembly Language of 8086, 80286, 80386, 80486 and Pentium microprocessors, memory management. Disk management: boot loaders, file allocation tables; Programming I/O devices: interrupt service routines, device drivers; Interfacing between programs/subroutines of different programming languages; The windows programming architecture, event driven programming and API calls. Introduction to different fundamental APIs; Unix C programs and Unix system calls.

CSE 236 Assembly Language and System Programming Lab.

3 Hours in a week, 1.5 credit

Objective: Small system level programs in assembly language.

Laboratory works based on CSE235

CSE 311 Computer Networks

3 Hours/week, 3.00 Credit

Objective: Fundamental concepts of Computer Networking.

Protocol hierarchies; Data link control: HDLC; DLL in Internet; DLL of ATM; LAN Protocols: Standards IEEE 802.*; Switches and Hubs, Bridges, 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; Gigabit Ethernet.

CSE 312 Computer Networks Lab.

3 Hours/week, 1.5 Credit

Laboratory works based on CSE 311 and implementing some simple network protocol, developing network applications using TCP/IP, UDP/IP or other protocols, performance analysis of network protocols by simulation.

CSE 315 Computer Peripherals and Interfacing

2 Hours/week, 2.00 Credit

Introduction to 8-bit, 16-bit, and 32-bit microprocessors: architecture, addressing modes, instruction set, interrupts, multi-tasking and virtual memory; memory interface; Bus interface; Arithmetic co-processor; Microcontrollers; Integrating microprocessor with interfacing chips; Programmable peripheral interface (interface to A/D and D/A converter); Keyboard/display interface; Programmable timer; Programmable interrupt controller, DMA controller; Floppy and Hard-disk controller; Serial communication interface; Sound card interface; Printer interface; ISA, PCI, AGP, PS/2 and USB interfaces.

CSE 316 Computer Peripherals and Interfacing Lab

2 Hours in a week, 1.00 Credit

Laboratory works based on CSE 315.

CSE 321 Operating Systems

3 Hours/week, 3.00 Credit

Objective: Study of Operating Systems concepts with simple examples from UNIX & Windows 2000.

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.

CSE 322 Operating Systems Lab

3 Hours/week, 1.5 Credit

Laboratory works based on CSE 321

CSE 323: Web Programming

2 hours/week, 2.00 credit

Introduction to Web page design:

HTML and DHTML - Concepts, tags, commands, form design, table design, build www home page, online request, dynamic functions, buttons, animations and multimedia.

Java Script, introduction to scripts language, advantages, programming concepts with Java Scripts, variables, control structures, embedding java scripts in HTML, multimedia

Introduction to Internet technology, Web pages, web servers, HTTP, VRML, Global databases and digital libraries,

Commerce : Paying money over the network, Entertainment, Enterprise, Information economies.

Security privacy and authentication: Encryption and digital signature.

CSE 324 Web Programming Lab

2 classes per week, 1 credit

Sessional based on CSE 323

CSE 337 Data Communication

3 classes per week, 3.00 credit

Introduction to layered approach to communication systems; properties of various transmission media; calculation of channel capacity; modulation techniques and modems; multiplexes and concentrators, public services, circuit and packet switching facilities; error detection methods; local area networks and internetworking.

Frequency Ranges: Frequency Ranges of Telegraph speech, music and video base band signals, commercial bandwidth, application for long distance transmission

Multiplexing: Frequency Division Multiplexing (FDM), Time division Multiplexing (TDM), PAM, PCM. Radio wave propagation: effect of ionosphere and earth-curvature, Radar and its application.

Modulation and Modulation System: Amplitude Modulation (AM), Phase Modulation (PM), Frequency Modulation (FM), Radiation-aerials and lines. Telephonic traffic, signaling, basic principles. Requirements of a telecommunication systems.

Introduction to mobile communication, Cellular concepts, Communication satellites, Multiple access techniques.

CSE 413 Optical Communication

3 classes per week, 3.00 credit

Introduction to optical communication. Elementary theory of propagation through optical fibers.

Reflection, Refraction, Dispersion and attenuation of signals propagation through Fiber Cables.

Propagation characteristics of different kinds of fibers.

optical transmitter: Laser in the field of optical communication. optical detector, receivers, and amplifiers. Unguided and guided optical communication system. Economy of optical fiber system in Telecommunications, Local data distribution, data transmission and telemetry. Optical fiber digital communication.

CSE 415 Compiler Construction

3 Hours in a week, 3.00 Credit

Introduction to compiling; Basic issues; Lexical analysis; Syntax analysis; Syntax-directed translation;

Semantic analysis: type-checking; Run-time environments; Intermediate code generation; Code generation; Code optimization.

CSE 416 Compiler Construction Lab

3 Hours in a week, 1.5 Credit

Laboratory works based on CSE 415 and project works using some lexical analyzer and parser designing tools.

CSE 417 Embedded System Design

3 Hours in a week, 3 Credit

Hardware design for embedded systems; Software development for embedded systems; Network based embedded systems; Sensors and Transducers for embedded systems; Case study on embedded system; Co-design using FPGAs; Multiprocessor systems; Case study on multiprocessor

systems; Introduction to digital control; Its use within embedded systems; Case study on digital control in embedded systems; Design examples: a telephone PBX, Personal Digital Assistant (PDA).

CSE 417 Embedded System Design Lab

3 Hours in a week, 1.5 Credit

Laboratory works based on CSE 417 and project works.

CSE 327 THEORY OF COMPUTATION

2 Hours/Week , 2.0 Credits

Finite Automata: Deterministic and nondeterministic finite automata and their equivalence. Equivalence with regular expressions. Closure properties. The pumping lemma and applications.
Context-free Grammars: Definitions. Parse trees. The pumping lemma for CFLs and applications. Normal forms. General parsing. Sketch of equivalence with pushdown automata. **Turing Machines:** Designing simple TMs. Variations in the basic model(multi-tape, multi-head, nondeterminism). Church-Turing thesis and evidence to support it through the study of other models. **Undecidability:** The undecidability of the halting problem. Reductions to other problems. Reduction in general.

CSE 421 Artificial Intelligence

3 Hours in a week, 3.00 Credit

Objective: Implementation and testing of AI algorithms using a logic programming language (Prolog) and general purpose programming language. Introduction; Knowledge representation; Propositional and first order logic, inference in first order logic; Frame problem; Search techniques in AI; Game playing; Planning; Probabilistic reasoning; Learning in symbolic and non-symbolic representation; Natural language processing.

CSE 422 Artificial Intelligence Lab.

2 Hours in a week, 1.00 Credit

Laboratory works based on CSE 421 and programming in some logic programming language.

CSE 423 Software Engineering

3 Hours in a week, 3.00 Credit

Objective: To know about the software engineering concepts and methodologies.

Concepts of software engineering; Software engineering paradigms; Different phases of software; Synthesis vs. iterative design; Top-down and bottom-up design; Different design tools; Structured and non-Structured programming; Data-directed design techniques; Modular design; Design of automatic, redundant and defensive programs; Influences of languages in design process; Concepts of complexity measures; COCOMO model; Tree model; PNR curve; Statistical model; Zipf's laws and their application in computer languages; Halstead program length formula; Graphical analysis for complexity measures; Memory requirements analysis; Processing time analysis; Testing philosophy; Test methods; Debugging; Verification, validation and certification; Choice of test data; Simulator; Arthur Laemmel's scheme; Concepts of software reliability and availability; Software repair, downtime, error and faults, specification and correction; New error generation hypothesis; Estimating number of bugs in a computer program; Reliability models; Availability models; Quality assurance; Quality measures; Different cost estimation models and their comparisons; Software maintenance; Maintenance-cost models; Growth dynamic models; Documentation; Software project organization; Management and communication skills.

CSE 433 Pattern Recognition

3 classes per week, 3.00 credit

Introduction to pattern recognition: features, classification, learning. Applications to speech recognition, remote sensing and biomedical area. Learning algorithms. Syntactic approach: Introduction to pattern grammars and languages. Parsing techniques. Pattern recognition in computer aided design. Recent trends.

Introduction to pattern recognition, classification, Description. Patterns and Feature extraction. PR approaches, Training and Learning in PR, Common Recognition Problems.

Statistical PR, The gaussian case and class dependence, Discriminant Function, classifier performance, Risk and Errors, Supervised Learning, Parametric Estimation and Supervised learning, Maximum likely hood estimation, The Bayesian Parameter Estimation Approach. Supervised Learning Using Non parametric Approaches, Parzen windows.

Linear Discriminant Function and the Discrete and Binary Feature cases, Unsupervised Learning and clustering, Syntactic Pattern Recognition(SPR), Syntactic Pattern Recognition via parsing and other grammars, Graphical approaches to Syntactic Pattern Recognition, Graph based structural presentation, graph Isomorphism, similarity measurements, Learning via grammatical Inference. Introduction to Neural Recognition and Neural Pattern associators and Matrix approaches.

CSE 434 Pattern Recognition Lab

2 classes per week, 1.00 credit

Sessional based on CSE 433

Optional Courses:

CSE 425 Neural Network

3 hours per week, 3.00 credit

Fundamentals of Neural Networks; Backpropagation and related training algorithms; Hebbian learning; Cohen-grossberg learning; The BAM and the Hopfield Memory; Simulated Annealing; Different type of Neural Networks: Counterpropagation, Probabilistic, Radial Basis Function, Generalised Regression, etc; Adaptive Resonance Theory; Dynamic Systems and Neural Control; The Boltzmann Machine; Self-organising Maps; Spatiotemporal Pattern Classification, The Neocognition; Practical Aspects of Neural Networks.

Books Recommended:

1. Simon Haykin "Neural Networks: A Comprehensive Foundation"
2. Larry Peterson, Bruce S. Davie "Computer Networks: A Systems Approach"

CSE 431 VLSI Design

3 Hours in a week, 3.00 Credit

VLSI design methodology: top-down design approach, technology trends. NMOS, CMOS inverters, pass transistor and pass gates: dc and transient characteristics. Brief overview of fabrication process: NMOS, CMOS, Bi-CMOS process. NMOS and CMOS layout, stick diagram and design rules. CMOS circuit characteristics and performance estimation: resistance and capacitance rise and fall time, power estimation. Buffer circuit design. Introduction to Bi-CMOS circuits. Complex CMOS gates. CMOS building block: multiplexer, barrel shifter, adder, counter, multipliers. Data Path and memory structures. Design style: FPGA and PLDs. Introduction to HDL: basic digital design using VHDL.

CSE 432 VLSI Design Lab

2 Hours in a week, 1.00 Credit

Sessional based on CSE431

CSE 441 DIGITAL SIGNAL PROCESSING

3 Hours/Week , 3.0 Credits

Discrete Signals and systems. Z transform. Fourier transform, FFT, DFT, Digital filter design technique, interpolation, Decimation.

CSE 442 DIGITAL SIGNAL PROCESSING LAB

3 Hours/Week , 1.5 Credits

Laboratory works based on theory classes.

CSE 457 Parallel Processing

3 Hours/Week , 3.0 Credits

Parallel Computing architectures: Overview of the major classes of architectures and their evolution. **Parallel programming models and performance analysis:** Modeling, performance analysis, efficiency, and benchmarking. **Programming parallel computers:** Overview of parallel programming, parallel languages, parallelizing compilers, message passing and data parallel Programming models. **Message passing programming and MPI:** Uses; historical background and use on MIMD machines; current implementations; programming using the Message Passing Interface

(MPI). **Data parallel programming and HPF** : Data parallel programming paradigm; historical background and use on SIMD machines; array syntax; Fortran 90 and High Performance Fortran (HPF). **Shared memory programming, threads and OpenMP** : Use of shared memory machines; threads; mutual exclusion; locks, semaphores and monitors; parallel Java; programming using OpenMP. **Case Study** : Monte Carlo Simulation of the Ising Model - Case study from computational physics; different approaches to parallelism; regular vs irregular problems; techniques and tricks for parallel implementation in MPI, HPF, OpenMP and threads. **Distributed computing**: Distributed and concurrent computing on loosely coupled distributed systems; motivation and applications; transparency and metacomputing; networks and clusters of workstations; cluster management systems. **Distributed computing middleware**: Middleware; RPC; DCE; CORBA; Java RMI. Middleware, DCE CORBA Java RMI. **Grid computing**: The Grid; Grid computing (metacomputing over wide-area networks); grid computing environments (Globus, Legion, DISCWorld, ...); Internet computing (SETI@Home, etc). Grid computing: Internet computing.

CSE 458 PARALLEL PROCESSING LAB

3 Hours/Week , 1.5 Credits

Laboratory works based on theory classes.

CSE 461 DISTRIBUTED SYSTEM

3 Hours/Week , 3.0 Credits

Fundamental Distributed Algorithms: Clock synchronization, partial order of events, election algorithms, distributed shared memory, process synchronization. **File and Directory Systems**: Naming and name resolution; name, directory, and file servers; caching. **Distributed Databases**: Locking and concurrency control, deadlock handling, stable storage, two-phase commit. **Security and Protection**: Encryption, public and private keys, authentication, privacy. **Distributed Services**: File transfer, electronic mail, World-Wide Web. **Examples of Distributed Systems**: Some of: Mach, Amoeba, OSF DCE, CORBA, DCOM.

CSE 462 DISTRIBUTED SYSTEM LAB

3 Hours/Week , 1.5 Credits

Laboratory works based on theory classes.

CSE 463 ADVANCED DATABASE SYSTEM

3 Hours/Week , 3.0 Credits

Introduction : Object oriented Database, Data Model, Design, Languages; **Object Relational Database**: Complex data types, Querying with complex data types, Design; **Distributed Database**: Levels of distribution transparency, Translation of global queries to fragment queries, Optimization of access strategies, Management of distributed transactions, Concurrency control, reliability, Administration; **Parallel Database**: Different types of parallelism, Design of parallel database; **Multimedia Database Systems**: Basic concepts, Design, Optimization of access strategies,

Management of Multimedia Database Systems, Reliability; **Database Wire-housing/Data mining:** Basic concepts and algorithms.

CSE 464 ADVANCED DATABASE SYSTEM LAB

3 Hours/Week , 1.5 Credits

Laboratory works based on theory classes.

CSE 465 Digital Image Processing

3 Hours/Week , 3.0 Credits

Digital Image Fundamentals: Digital Image Fundamentals, A Simple Image Model, Sampling and Quantization, Basic Relationship between Pixels, Image Geometry. **Image Transform:** Introduction to the Fourier Transform, The Discrete Fourier Transform, Properties of 2D Fourier Transform, The Fast Fourier Transform, Other Separable Image Transform. **Image Enhancement:** Background, Enhancement by Point-Processing, Spatial Filtering, Enhancement in Frequency Domain, Color Image Processing. **Image Restoration:** Degradation Model, Diagonalization of Circulant and Block-Circulant Matrices, Algebraic Approach to Restoration, Inverse Filtering, Geometric Transformation. **Morphological Image and Signal Processing:** The principle of Mathematical Morphology, Erosion and Dilation in the Euclidean Space, Closings and Openings, Grayscale Morphology, Links between Links and Sets, Grayscale Morphological Transformations, **Image Segmentation:** Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Oriented Segmentation, The use of Motion in Segmentation.

CSE 466 DIGITAL IMAGE PROCESSING LAB

3 Hours/Week , 1.5 Credits

Laboratory works based on theory classes.

CSE 469: Bioinformatics Computing

3 Hours in a week, 3 Credits

Introduction to the genome: DNA, RNA, amino acids, and proteins; Information flow from the genome: genes, transcription, and translation; Integration of biological data: data integration systems, biological queries, query processing, data warehouses, and data visualization; Genome and protein sequencing and analysis, spectrum graphs; Clustering and classification: microarrays, gene expression analysis, hierarchical clustering, k-means clustering, clustering and classification algorithms; Drug discovery: technologies and strategies, identification of drug target molecules, drug design approaches.

CSE 470: Bioinformatics Computing Lab

1.5 Hours in a week, 3 Credits

Laboratory works based on theory classes.

Basic Science & Mathematics Courses:

Title : Physics – I: Waves, oscillation and thermodynamics

Course Code : PHY 111

Credit hours : 03

Forces and Motion: Newton's law of motion, Kinetic energy and work, Conservation of energy, Potential energy, Gravitation: Laws of gravitation, Kepler's laws.

Wave motion: Transverse and longitudinal waves, Wavelength and frequency, Traveling wave, sinusoidal waves, phase and phase constant, group speed. Wave speed. The wave equation. Power and intensity in wave motion, Doppler Effect.

Oscillations: Simple harmonic motion (SHM), time period, frequency, energy consideration in SHM. SHM and uniform circular motion. Resonance.

Heat and first law of thermodynamics. Heat capacity and specific heat, heat capacities of ideal gas. Second law of thermodynamics, entropy. Reversible and irreversible process.

Title : Differential & Integral Calculus

Course Code : MAT 112

Credit hours : 03

Calculus: Basic Theorems: Successive differentiation, Roll's Theorem, Mean Value Theorem, Taylor's Theorem, and Maclaurin's series, Intermediate forms, Maxima and Minima.

Calculus of several variables: Limit, Continuity, Partial derivatives, Differentials, Partial derivatives of composite functions, Implicit functions, Jacobian, Taylor's Theorem, Maxima and Minima, Lagrange's method.

Application of Calculus: Curvature, Convexity, and concavity.

Riemann Integration: Definition and Properties. Fundamental Theorem of Integral Calculus, Improper Integrals, Beta and Gamma functions. Multiple integrals, Rectifications, Volumes and areas of solids and revolutions.

Differential Calculus: Function and Limit: Function, Limit, Continuity and differentiability. Differentiation of explicit and implicit functions and parametric equations; Significance of derivatives.

Differentials: Successive differentiation of various types of functions, Leibnitz's theorem, Rolle's theorem. Mean value theorem. Taylor's theorem in finite and infinite forms. Maclaurin's theorem in finite and infinite forms. Lagrange's form of remainder. Expansion of function by differentiation and integration.

Partial differentiation. Euler's theorem. Tangent, sub tangent, Normal, subnormal. Cartesian and polar coordinates. Determination of maximum and minimum values of functions and points of inflection. Application, Evaluation of indeterminate forms by L'Hospital's rule, curvature, center of curvature and chord of curvature, Evaluate involutes, Asymptotes, Envelopes, curve tracing.

Title : Differential Equations & Laplace Transform.

Course Code : MAT 123

Prerequisite : MAT 112: Differential & Integral Calculus

Credit hours : 03

Degree and order of ordinary differential equations; Formation of differential equations; Solution of first order differential equations by various methods; Solution of first order but higher degree ordinary differential equations; Solution of general linear equations of second and higher orders with constant co-efficient; Solution of homogeneous linear equations and its applications; Solution of differential equations of higher order when

dependent and independent variables are absent; Solution of differential equation by the method based on factorization of operators.

Laplace transformations: definition, elementary transformation, and properties, solution of differential and integro-differential equations by Laplace transform. Simple application in circuit problems.

Title : Physics II / Optics, electricity and magnetism.

Course Code : PHY 124

Prerequisite : PHY 111: Physics I

Credit hours : 03

Electricity and magnetism: Coulomb's law, electric field, electric potential, Gauss's law and its application, electric dipole, ohm's law, Kirchhoff's law and application. Faraday's and Lenz's laws, self and mutual induction, Biot-Savart law, examples, magnetic force on charge and current. Ampere's law, examples.

Light: Interference of Light, Newton's Rings. Diffraction of Light, Diffraction by Single slit, Double slit and Diffraction Gratings. Polarization of light, Optics of Crystals.

Modern physics: Bohr's atom model, atomic spectra, photoelectric effect, Compton Effect, X-rays, Bragg's law.

Title : Matrix, Complex Variable & Fourier Analysis.

Course Code : MAT 135

Prerequisite : None

Credit hours : 03

Matrices: Definition of a matrix, algebra of matrices, Types of matrices, determinant of a square matrix; equivalence, adjoint and inverse of a square matrix; rank and elementary transformation of matrices, normal and canonical forms, linear equations; the characteristic roots and the characteristic equation of a matrix, diagonalization of a matrix, eigen values and eigen vectors; diagonalization; orthogonalization; linear transformations; similarity transformation.

Fourier Series: Sequence and infinite series; their convergence and divergence; Comparison test, De Alambert's test and Cauchy's root test. Periodicity of functions and Fourier series; real and complex form; Fourier series in the intervals $(-\pi, \pi)$, $(0, 2\pi)$,

$(-i, i)$ and $(0, 2i)$ etc. Dirichlet's conditions, Half-range sine and cosine series; Partial differential equations and solutions of 1-D wave and diffusion equations and 2-D Laplace equation; Finite transform, Fourier integral, Fourier transforms and its applications in solving boundary value problems.

Includes standard first and second order methods, introductory linear algebra, systems, difference equations, power series, Laplace transforms, numerical methods and nonlinear methods, with applications for all of these.

Title : Coordinate Geometry & Vector Analysis.

Course Code : MAT 216

Prerequisite : MAT 112: Differential & Integral Calculus.

Credit hours : 03

Vector algebra and calculus: definition, addition, subtraction, dot and cross products, triple products, vector integration and differentiation, line surface and volume integrals. Vector operator DEL, divergence, curl and gradient and their physical significance, divergence and Gauss's theorem, Stoke's theorem. Poisson's and Laplace's equations.

Geometry: review of equation of straight line, circle, parabola, ellipse and hyperbola. Pair of straight lines, equation for a plane, sphere, cylinder and cone.

Title : Numerical Methods & Theory of Algebra.

Course Code : MAT 235

Prerequisite : MAT 216: Coordinate Geometry

Credit hours : 03

Numerical Methods: Numerical methods and software; Introduction to the methods, tools and ideas of numerical computation; Problem solving using standard mathematical software such as MATLAB, IMSL and LINPACK; Interpolation; Linear and nonlinear equations; Numerical Integration and Differentiation.

Linear Algebra: Systems of linear equations and matrices; Determinants; Vectors in 2-D and 3-D space; Euclidian vector spaces; General vector spaces; Inner product spaces; Applications of Linear algebra.

Abstract Algebra: Mathematical reasoning; sets and set operations; De Morgan's Law; Cartesian product of sets; Binary relations; Equivalence relations, functions; Lattice theory; Boolean algebra, groups and semi groups, cyclic groups; Homomorphism and Isomorphism theorems; rings and fields; Finite fields; Polynomial extension of a ring; Galois fields and their simple properties.

Title : Basic Statistics and Probability

Course Code : STA 215

Prerequisite : None

Credit hours : 03

Element of Statistics: Nature and scope of statistics, nature and representation of statistical data, attributes and variables, discrete and continuous variables, methods of data collection.

Measures of Location: Characteristics of an ideal measure; arithmetic mean; geometric mean; harmonic mean; median; mode; quartiles; deciles; percentiles.

Measure of Dispersion: Characteristics of an ideal measure; absolute and relative measures; range; standard deviation; mean deviation; quartile deviation; coefficient of dispersion; coefficient of variation; skewness and kurtosis.

Regression and Correlation: Relationship between variables, fitting of regression lines, simple correlation, multiple correlation and regression, correlation and regression coefficients.

Elements of Probability: Meaning and definition of probability; a priori probability and a posteriori probability; basic terminology of probability; random variables; probability function; expectation of sum and products. Concept of stochastic process; binomial, Poisson, Normal distributions.

General Education Courses

CSE 115 Communicative English Language-I

2 Hours in a week, 2.00 Credit

Objective: We think students should at least come across an English language course so that their deficiency in technical English can be met up .Grammar: Tenses, articles, prepositions, subject-verb agreement, clauses, conditionals, word classes.

Transformation of sentences: Active-passive transformations, reported speech.

Phonetics: How to use a dictionary, IPA symbols, word transcriptions, intonations, and stress.

Vocabulary building: Correct and precise diction, affixes, idiomatic expressions, level of appropriateness, colloquial and informal, standard and formal.

Developing writing skills: Sentences, sentence variety, generating sentences, sentence clarity and correctness, linking sentences to form paragraphs; Essays: Essay structure, thesis sentence, writing good introductions and conclusions, strategies for development; Comprehension writing; Paragraph writing; Precis writing; Amplification; Report writing; Business communication and tenders; Informal letter writing.

Developing reading skills: Strategies of reading, skimming, scanning, predicting, inferencing, analyzing and interpreting variety of texts and text types; Comprehension and summary.

Listening and note taking: Listening to recorded texts and class lectures and learning to take useful notes based on the listening.

Developing spoken skills: Different form of debating and conversation on previously selected topics or instant selected topic.

CSE 127 Communicative English Language-II

2 hours per week, 2.00 credit.

Prefixes and suffixes, Synonyms and antonyms, Homonyms, homograph and Homophone, Punctuation, commonly confused words, letter writing- business letter, Applications, Social letters, paragraphs, report writing, dialogue writing etc.

CSE 219 Engineering Economics

2 classes per week, 2.00 credit.

Introduction to engineering economics decision, cash flow analysis and basic concepts of discounting, cost of capital, required ROR equivalence.

Business mathematics: Investment appraisal criteria for economic decisions, present worth, internal rate of return, social consideration in investment, benefit –cost ratio. Decisions involving depreciation and inflation, taxes, sensitivity analysis.

Title : Bangladesh Studies

Course Code : GED 233

Credit hours : 03

History of Bangladesh: From ancient time to the beginning of Mughal Era, Mughal Reign, British Period, Pakistani period, Independence.

Constitution of Bangladesh, fundamental rights, Administration: Local government, Parliament, Judiciary, different cadres, Foreign Policy of Bangladesh, relationship with other countries.

Mineral Resources: Description, current status, production sharing treaties with foreign companies.

Coal, Boropukuria field, Open mine, closed mine system of coal extraction, Natural Resources of Bangladesh: Water resources, solar irradiance and wind, manpower.

Economy of Bangladesh: RMG industry, Ship building and IT industry, employment Scenario.

Education System of Bangladesh, Law enforcement agencies in Bangladesh, brief description.

Tourism in Bangladesh. Aspects, advantages, problems.

Climate Change and its affect on Bangladesh, how to coup with the adverse affects, use renewable energy resources, like wind, solar, biogas. Stock Markets and industrialization.

Title : Engineering Economics

Course Code : GED 219

Credit hours : 03

Introduction to engineering economics decision, cash flow analysis and basic concepts of discounting, cost of capital, required ROR equivalence.

Business mathematics: Investment appraisal criteria for economic decisions, present worth, internal rate of return, social consideration in investment, benefit –cost ratio. Decisions involving depreciation and inflation, taxes, sensitivity analysis.

CSE 321 Accounting

3 Hours in a week, 3.00 Credit

Financial Accounting: Objectives and importance of accounting; Accounting as an information system; Computerized system and applications in accounting. Recording system: double entry mechanism; accounts and their classification; Accounting equation; Accounting cycle: journal, ledger, trial balance; Preparation of financial statements considering adjusting and closing entries; Financial statement analysis and interpretation: ratio analysis; Accounting concepts(principles) and conventions.

Cost and Management Accounting: Cost concepts and classification; Overhead cost: meaning and classification; Distribution of overhead cost; Overhead recovery method/rate; Job order costing: preparation of job cost sheet and quotation price; Inventory valuation: absorption costing and marginal/variable costing technique; Cost-Volume-Profit analysis: meaning, breakeven analysis, contribution margin approach, sensitivity analysis. Short-term investment decisions: relevant and differential cost analysis; Long-term investment decisions: capital budgeting, various techniques of evaluation of capital investments.

Title : Engineering Management

Course Code : GED 421

Prerequisite : None

Credit hours : 03

Introduction, evolution, management function, organization and environment.

Organization: Theory and structure; Coordination; Span of control; Authority delegation; groups; Committee and task force; Manpower planning. Personal Management: Scope; Importance; Need hierarchy; Motivation; Job redesign; Leadership; Participative management; training; Performance appraisal; Wages and incentives; Informal groups; Organizational change and conflict. Cost and Financial Management: Elements of costs of products depreciation; Break-even analysis; Investment analysis; Benefit cost analysis. Management Accounting: Cost planning and control; Budget and budgetary control, Development planning process; Project management; Network models for project time estimation; Estimation of confidence level; Simplex method for minimization of project time; Project effort analysis methods; Marketing management: Concepts; strategy; sales promotion; Patent laws. Technology management: Management of innovation and changes; Technology life cycle, Case studies.