B.TECH (MSE-1 SYLLABUS)

3rd Semester

Object Oriented Programming using C++ (CS-14305)

Object-Oriented Programming Concepts: Introduction, Comparison between procedural programming paradigm and object-oriented programming paradigm, Basic data types, Derived data types, Constants, Tokens, Keywords, Identifiers and variables, Concepts of an object and a class, Abstraction, Encapsulation, Data hiding, Inheritance, Overloading, Polymorphism, Messaging.

Control Structures: Input and Output statements in C++, Various operators, Operator precedence, if statement, switch-case, break, goto, continue, for, while and do-while loops, Dynamic initialization, Type modifiers, Type casting

Classes and Objects: Implementation of a class, Operations on objects, Relationship among objects, Specifying a class, Creating class objects, Accessing class members, Access specifiers, Static members, Use of const keyword, Friends of a class, Empty classes, Nested classes, Local classes, Abstract classes, Container classes, Bit fields and classes.

Functions and Arrays: Function components, Passing parameters, Call by reference, Call by value, Return by reference, Inline functions, Default arguments, Function prototyping, Overloaded function, Recursion, Array of objects, Dynamic allocation operators, Dynamic objects, String handling.

Human values and Professional Ethics (HSMCS-101)

Ethics and values: Importance of Ethics and values, Difference between moral, ethics and values, Nature of Values, The Structure of Value Relations , Integrity, Work ethics, Service learning, Virtues, Respect for others, Living peacefully, caring , Sharing , Honesty, Courage, Valuing time, Cooperation, Commitment, Empathy, Self confidence, Challenges in the work place, spirituality.

Value education: Need for value education, Basic guidelines, Self Exploration, Values in family and Harmony in existence, Values across cultures.

Personality and behavior development: God and scientific attitude, positive thinking, Integrity and discipline, punctuality, Aware of self destructive habits, Association and cooperation, Doing best, motivation Theories and Case study, Johari Window, Leadership Styles and Theories, WinWin policy, SWOT Analysis

Digital Electronics (ESCS-101)

Number Systems: Binary, Octal, Decimal, Hexadecimal. Number base conversions, 1's, 2's, rth's complements, signed Binary numbers. Binary Arithmetic, Binary codes: Weighted BCD, Gray code, Excess 3 code, ASCII – conversion from one code to another.

Boolean Algebra: Boolean postulates and laws – De-Morgan's Theorem, Principle of Duality, Boolean expression – Boolean function, Minimization of Boolean expressions – Sum of Products (SOP), Product of Sums (POS), Minterm, Maxterm, Canonical forms, Conversion between canonical forms, Karnaugh map Minimization.

Logic GATES: AND, OR, NOT, NAND, NOR, Exclusive-OR and Exclusive-NOR. Implementations of Logic Functions using gates, NAND-NOR implementations. Study of logic families like RTL, DTL, DCTL, TTL, MOS, CMOS, ECL and their characteristics.

Combinational Circuits: Design procedure – Adders, Subtractors, Serial adder/Subtractor, Parallel adder/ Subtractor Carry look ahead adder, BCD adder, Magnitude Comparator, Multiplexer/Demultiplexer, encoder/decoder, parity checker, code converters. Implementation of combinational logic using MUX.

4th Semester

Microprocessor & Assembly Language Programming (BTCS-404)

Introduction: Introduction to Microprocessors, history, classification, recent microprocessors.

Microprocessor Architecture: 8085 microprocessor Architecture. Bus structure, I/O, Memory & System buses, concept of address Bus, Data Bus & Control Bus, Synchronous & Asynchronous buses, Instruction execution sequence & Data Flow, Instruction cycle.

Instruction set & Assembly Languages Programming: Introduction, instruction & data formats, addressing modes, status flags, 8085 instructions, Data transfer operations, Arithmetic operations, Logical operations, Branch operations.

Microprocessor Architecture and Programming (CS-14404)

Microprocessor Architecture: Introduction to microprocessors, 8085 microprocessor architecture – Bus structure, Register organization, Timing and control module. Timing diagrams – Memory and instruction execution sequence, T-states, Machine cycle, Instruction cycle.

Programming with 8085: Addressing modes, Instruction classification, Instruction formats, Data transfer operations, Arithmetic operations, Logical operations, Branch operations, Stack and subroutine operations, looping, counting and indexing operations.

System Programming (BTCS-405)

Introduction: Introduction to system programming and different types of system programs - editors, assemblers, macroprocessors, compilers, linkers, loader, debuggers.

Assemblers: Description of single pass and two pass assemblers, use of data structures like OPTAB and SYMTAB, etc.

Macroprocessors: Description of macros, macro expansion, conditional and recursive macro expansion.

Compilers: Various phases of compiler - lexical, syntax and semantic analysis, intermediate code generation, code optimization techniques, code generation, Case study:LEX and YACC.

Data structure and algorithms (CS-14304)

Basic concepts: Concept of data type, Linear and non-linear data structures, Data structures versus data types, Operations on data structures, Algorithm complexity andasymptotic notations.

Arrays: Linear and multi-dimensional arrays and their representation, Operations on arrays, Sparse matrices and their storage.

Stacks: Sequential representation of stacks, Operations on stacks, Application of stacks – parenthesis checker, Evaluation of postfix expressions, Conversion from infix to postfix, Conversion from infix to prefix representation, Tower of Hanoi problem, implementing recursive functions.

Queues: Sequential representation of queue, Linear queue, Circular queue, Operations on linear and circular queue, Deque, Priority queue, Applications of queues.

Linked List: Linear linked list, Doubly linked list, Circular linked list and Header linked list and their operations, Application of linked lists, Garbage collection and compaction, Linked representation of Stack and Queues.

Discrete Structures (CS-14401)

Fundamentals of Sets, Relations and Functions: Sets – Operations on sets, Subsets, Types of sets, Ordered pairs, Proofs of general identities of sets, Classes of sets and partitions. Relations – Representations of relations, Types of relations, Composition of relations, Closure properties of relations, Equivalence relations, Compatibility relations, Partial order relations. Functions – Introduction and types of functions, Hashing functions, Recursively defined functions.

Prepositional and Predicate Logic: Prepositions and compound prepositions, Logical connectives, Truth tables, Logical implication and logical equivalence, Normal forms– Conjunctive and Disjunctive, Validity of well-formed formula, Propositional inference rules– Modus ponens and modus tollens. Predicate logic, Universal and existential quantification, Limitations of propositional and predicate logic.

Combinatorial Mathematics: Basic counting principles, Permutations and combinations, Pigeonhole principle, Inclusion and exclusion principle, Recurrence relations – Solving homogeneous and non-homogeneous recurrence relations, Sequences, Generating function.

Operating System (CS-14402)

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS-Layered, Monolithic, Microkernel Operating Systems,

Process management: Concept of processes and threads, Definition, Process and Program, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR.

Deadlocks: Introduction to deadlocks, Conditions for deadlock, Resource allocation graphs, Deadlock prevention and avoidance, Deadlock detection and recovery.

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging, Segmentation.

Java programming (CS-14405)

Introduction: History of Java, Importance of Java to the internet, Java's Magic – The Byte code features of Java, Overview of Java.

Java Basics: Data-types, Variables, Arrays, Operators, Expressions, Control statements, Type conversion, Concepts of classes and objects, Constructors, Methods, Access control, this keyword, Garbage collection, Overloading methods and constructors, Parameter passing, Recursion, Understanding static, Introducing nested and inner classes, Using command line arguments, Introduction to string handling.

Inheritance: Basics of inheritance, Types of inheritance, Member access rules, Using super, Using final with inheritance, Method overriding, Dynamic method dispatch, Using abstract classes.

Packages and Interfaces: Defining a package, Accessing a package, Understanding CLASSPATH, Importing packages, Differences between classes and interfaces, Defining an interface, implementing interface, Variables in interface, Extending interfaces.

Exception Handling: Concepts of exception handling, Exception types, Using try, catch, throw, throws and finally, Java's built in exceptions, Creating own exception subclasses.

5th Semester

Relational Database Management System (CS-14501)

Introduction to Database System: Database systems versus file systems, Characteristics of the Database approach, Database users and administrators, Advantages and disadvantages of using DBMS approach, Data models, Data independence, Database languages, Classification of DBMS, Client- Server architecture.

Entity Relationship Model: Entity types, Entity sets, Attributes and keys, Relationship types, Relationship sets, Roles and structural constraints, Weak entity types, Design choices for ER conceptual design, UML class diagrams.

Relational Model: Relational model concepts, Constraints, Update operations, Transaction and dealing with constraint violations. Relational Algebra –Unary relational operations, Operations from Set theory, Binary relational operations, DIVISION operation and additional relational operations. Relational Calculus – Tuple relational calculus and Domain relational calculus, Queries related to Relational Algebra and Relational Calculus.

SQL: SQL Data Definition and data types, Specifying constraints in SQL, Schema change statements, Basic queries in SQL.

Computer Graphics (CS-14502)

Introduction: Overview of computer graphics, Computer graphics applications, Different I/O devices with specialized graphics features, Display technologies- Storage tube graphic displays, Raster scan systems, Random scan systems, LCD and LED displays, Cathode ray tube, Color CRT, Video basics – Video controller, Random-scan display processor.

2D Primitives: Scan conversion basics, Algorithm for scan converting a point, Scan converting a line – Digital differential analyser algorithm, Bresenham's line algorithm, Scan converting circle – Bresenham's circle drawing algorithm, Midpoint circle drawing algorithm, Scan converting ellipse.

2D Viewing: Window to viewport transformations, 2D transformations– Scaling, Translation, Rotation, Reflection, Shear, Matrix representations and homogeneous coordinates, Composite transformations.

Clipping and Filling Techniques: Algorithm for point clipping, Line clipping (Cohen Sutherland, Weiler Atherton, Liang Barsky algorithms), Polygon clipping, Text clipping. Boundary fill, Floodfill, Edgefill and Fencefill algorithms.

Design & Analysis of Algorithms (CS-14503)

Introduction: Algorithm and its importance, Mathematical foundations– Growth functions, Complexity analysis of algorithms.

Divide and Conquer: Basic technique and its application on Binary Search, Finding maximum and minimum and on sorting techniques such as merge sort, Quick sort.

Greedy Algorithms: General method, Using greedy algorithm to solve Knapsack problem, Minimum-cost spanning tree problem, Single source shortest path problem and Travelling salesperson problem.

Web technologies (CS-14504)

Introduction to Internet and Web: History and evolution of internet protocols, Internet addressing, Internet Service Provider (ISP), Introduction to WWW, DNS, URLS, HTTP, HTTPS, SSL, Web browsers, Cookies,Web servers, Proxy servers, Web applications

HTML and DHTML: Introduction to HTML and DHTML, Basic structure of an HTML document, Working with – Text, Lists, Tables, Frames, Hyperlinks, Images and multimedia, Forms and controls, Audio and video, Creating Style Sheet, Style definitions, CSS font properties, Text formatting, Types of CSS – Inline, Internal and External CSS style sheets.

Java Script: Introduction, JavaScript's history and versions, Basic syntax, Variables, Data types, Statements, Operators, Functions, Arrays, Objects, Dialog boxes, JavaScript DOM.

Advanced Computer Architecture (DECS-14505)

Introduction: Elements of modern computers, Taxonomy of MIMD computers, Speedup performance laws – Amdahl's law for a fixed workload, Gustafson's law for scaled problems, Memory-bounded speedup model.

Pipelining: Basic concepts, Pipelining hazards– Data, control and structural, Techniques for resolution of hazards, Pipeline performance analysis, Arithmetic pipelines, Instruction pipelines, Instruction level parallelism, Pipeline collision prevention and pipeline chaining, Case study of pipelined systems.

Hierarchical Memory Technology: Inclusion, Coherence and locality properties, Cache memory – Cache performance, Reducing cache miss penalty and miss rate, Techniques for reducing cache misses, Virtual memory organization, Mapping and management techniques, Memory replacement policies.

6th Semester

Simulation and Modeling (BTCS-601)

Module1: Introduction- When simulation is appropriate and when not, advantages and disadvantages of simulation, application areas in communication, computer and software design, systems and systems environment, components of a system, discrete and continuous systems, model of a system, types of models, discrete-event simulation, steps in a simulation study. Simulation Examples- Simulation of queueing systems, on-demand and inventory systems, simulation for reliability analysis etc

Module 2: General Principles- Concepts in discrete event simulation: event scheduling/time advance algorithms, world views. List Processing: properties and operations, data structures and dynamic allocation, techniques;

Module 3: Simulation Software- Integrated environments. Examples and review of some existing software popular and useful in the industry, e.g., Arena, AutoMod, Extend, Flexsim, Micro Saint, ProModel, Quest, SIMUL8, WITNESS etc. Simulation using languages and environments like C++/Java/GPSS/SSF etc. Experimentation and Statistical-Analysis Tools: common features and relevant current products.

Module 4: Statistical Models in Simulation- Terms and concepts. Statistical Models. Review of discrete and continuous distributions. Review of Poisson (stationary and non-stationary) processes. Empirical Distributions; Elementary Queueing Theory- Basic Structure of Queueing Models. Input Source (Calling Population). Queue, Queue Discipline, Service Mechanisms. Notations and relationships between L, W, Lq, and Wq. Little's Formula. Role of Exponential Distribution and Properties. Birth and Death Processes. M/M/s queues. Finite queue variation in M/M/s/K models with different s values. Finite Calling Population cases. Queueing Models involving Non-Exponential Distributions: M/G/1, M/D/s, M/Ek/s (involving Erlang distribution), Models without a Poisson Input, Models involving hyperexponential distributions, Priority Discipline Queueing Models: Preemptive and Non- Preemptive with results, properties and server number variations, Queueing Networks:Equivalence Property. Infinite Queues in Series and Product Form Solutions. Jackson Networks,

Theory of Computation (CS-14601)

Finite Automata: Deterministic Finite Automata, Acceptance by Finite Automata, Transition systems, Non-Deterministic Finite Automata, Equivalence of DFA and NDFA, Moore and Mealy machines, Equivalence of Moore and Mealy machine, Minimization of Finite Automata, Applications and limitations of Finite Automata.

Formal Languages: Basics of strings, Alphabets, grammar, Formal language, Chomsky classification of languages, Languages and their relation, Operations on languages, Closure properties of language classes.

Regular Grammar: Regular grammars, Regular expressions, Algebraic method using Arden's theorem, Equivalence of Finite Automata and Regular expressions, Properties of regular languages, Pumping lemma.

Advanced database System (CS-14602)

PL/SQL Concepts: Overview, Environment, Basic syntax, Data Types, Variables, Constants, Operators, Conditions, Loops, Strings, Arrays, Procedures, Functions, Cursors, Records, Exceptions, Triggers, Packages, Collections, Transactions, Date & Time, DBMS Output.

Transaction Processing and Concurrency Control: Transaction processing concepts, Concurrency control techniques – Two-phase locking, Timestamp ordering, Multiversion, Validation, Multiple granularity locking.

Query Processing and Optimization: Query processing, Syntax analyzer, Query decomposition, Query optimization, Heuristic query optimization, Cost estimation, Cost functions for Select, Join, Query evaluation plans.

Software Engineering (CS-14603)

Evolution and impact of software engineering: Software myths, Software application domains, Software crisis – Problem and causes.

Software Process Models: Software process, Software process models – Waterfall model, Prototype model, Spiral model, Evolutionary model, RAD model, Concurrent development model and Component based model.

Requirements Engineering: Feasibility study, Problem analysis, Requirement elicitation and specification, Functional and non-functional requirements, Software requirements specification document, Requirement validation and management.

Project Management and Risk Analysis: Project planning, Cost estimation techniques– Size metrics, Empirical estimation, Heuristic estimation and analytical estimation, Project monitoring and control– Work breakdown structure, Activity chart, Gantt charts, PERT charts, Critical path method, Manpower management, Risk management- Identification, Analysis, Planning and monitoring.

Digital Image Processing (DECS-14605)

Introduction: Fundamental steps in digital image processing, Components of an image processing system, Applications of image processing, Sampling, Quantization.

Digital Image Processing Operations: Pixel relationships and distance metrics – Image coordinate system, Image topology, Connectivity, Relations, Distance measures. Classification of image processing Operations – Arithmetic, Logical, Geometrical (Translation, Scaling, Zooming, Linear Interpolation, Mirror or Reflection, Shearing, Rotation, Affine and Inverse transformation) Operations, Image interpolation Techniques (Down-sampling and up- sampling), Set operations, Statistical operations, Convolution and Correlation operations.

Image Enhancement in Spatial Domain: Image enhancement point operations– Linear and non-linear functions, Piecewise linear functions, Histogram processing. Spatial filtering – Basics of filtering in the spatial domain, Smoothing linear and non-linear filters, sharpening filters.

Software Project Management (OECS-14601)

Project Evaluation and Planning: Activities in Software project management, Project evaluation – Cost benefit analysis, Cash flow forecasting, Cost benefit evaluation techniques, Risk evaluation. Project planning – Stepwise project planning, Software processes and process models. Project costing, COCOMO II, Staffing pattern, Effect of schedule compression, Putnam's equation, Capers Jones estimating rules of thumb.

Project Scheduling and Risk Management: Project sequencing and scheduling activities, Scheduling resources, Critical path analysis, Network planning, Risk management – Nature and types of risks, Risk planning and control, Risk assessment, Hazard identification, Hazard analysis, PERT and Monte Carlo simulation techniques.