THIRD SEMESTER

CODE	COURSE TITLE	L	T	P	C
MA201	Discrete Mathematics	3	1	0	4
CS201	Object Oriented Programming	3	0	0	3
CS203	Data Communication	3	0	0	3
CS205	Data Structures and Algorithms	3	1	0	4
CS207	Digital Computer Fundamentals	3	0	0	3
CS209	Computer Organization and Architecture	3	0	0	3
CS211	Object Oriented Programming Laboratory	0	0	3	2
CS215	Data Structures Laboratory	0	0	3	2
TOTAL CREDITS **24**					

THIRD SEMESTER
MA201 - DISCRETE MATHEMATICS

Credits: 4

Objectives

- To get familiar and understand the fundamental notions in discrete mathematics.
- To understand and demonstrate the basic concept of an algorithm and its application in combinatorial mathematics

Unit 1 - Fundamentals: Sets, relations and functions, fundamentals of logic, logical inferences, first order logic, quantified propositions, mathematical induction.

Unit 2 - Elementary Combinatorics: Combinations and permutations, Enumeration - with repetitions, with constrained repetitions.

Unit 3 – Distribution: Distinct / non-distinct objects - Generating functions for combinations - Portion of integers

Unit 4 - Recurrence Relations: Generating functions, coefficients of generating functions, recurrence relations with constant coefficients, inhomogeneous recurrence relations - Solution by the technique of generating functions - Permutations with restrictions on relative positions.

Unit 5 - Algebraic Structures: Semi-groups, monoids, groups, subgroups and their properties - cyclic groups - cosets - permutation groups - Lagrange's theorem - Cayley's theorem - normal subgroups - homomorphism of groups - quotient groups- rings and fields

Outcomes

- Ability to distinguish between the notion of discrete and continuous mathematical structures
- Application of induction and other proof techniques towards problem solving

Teaching and Evaluation guidelines

- 30% on An Application (Higher Order Thinking), and 50% on diagrams and practice (Medium Order Thinking), and 20% on Definition and fundamentals (Lower Order Thinking).

Text Book

1. J.L.Mott, A.Kandel and T.P.Baker : Discrete Mathematics for Computer Scientists, Second Edition, Reston, 1986.

Reference Book

1. K.D.JOSHI, "Discrete Mathematics", Wiley Eastern Ltd. 1989.

CS201 - OBJECT ORIENTED PROGRAMMING

Credits: 3

Objectives

- To understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
- To impact the program using more advanced C++ features such as composition of objects, operator overloads, dynamic memory allocation, inheritance and polymorphism, file I/O, exception handling, etc.
- To understand and build C++ classes using appropriate encapsulation and design principles.

Unit I - Introduction

Object oriented programming concepts – Data types – Tokens – Expressions- Pointers – Arrays – Structures – Functions – Classes – Objects.

Unit II - Object Oriented Programming Concepts

Constructor and Destructor - Operator overloading - String Handling –Type Conversion- Inheritance.

Unit III - Advanced Object Oriented Programming Concepts

Polymorphism – Run time polymorphism – Virtual Functions- Manipulators - Templates– Exception Handling – I/O Streams.

Unit IV - Strings and File Handling

File Handling- Manipulation of Strings - Standard Template Library - Introduction algorithms - Sequence containers, iterators - Specialized iterators - Associative containers - Strong user - defined object - function objects.

Unit V - Java Programming

Introduction to JAVA – Features – Data Types –Classes, Objects and methods – Inheritance - Interface- Packages-Exception Handling- File I/O-Threads-Multithreading – Applets.

Outcomes

- Ability to implement language features used in C++ and Java
- Ability to design and implement object-oriented software to solve moderately complex problems.

Teaching and Evaluation guidelines

- 40% on knowledge and comprehension (Higher Order Thinking), 30 % on Application (Medium Order Thinking), and 40% on Analysis and synthesis (higher Order Thinking).

Text Books

1. P.J. Deitel, "C++ How to Program", Prentice-Hall of India Pvt. Ltd., Sixth edition, 2013,
2. H.M. Deitel and P.J. Deitel, "Java™ How to Program", Prentice-Hall of India, Seventh edition, 2012.

Reference Books

1. Robert Lafore, Object oriented programming in C++, Galgotia Publication.2008.
2. E. Balagurusamy, "Object Oriented Programming with C++", McGraw Hill Company Ltd., 2013.
3. B. Trivedi, "Programming with ANSI C++", Oxford University Press, 2012.
4. Ira Pohl, "Object Oriented Programming using C++", Pearson Education, Second Edition Reprint 2013.
5. S. B. Lippman, Josee Lajoie, Barbara E. Moo, "C++ Primer", Fourth Edition, Pearson Education, 2012.

CS203 - DATA COMMUNICATION

Credits: 3

Objectives

- To understand the fundamental concepts of computer networking
- To familiarize with the basic taxonomy and terminology of the computer networking area
- To gain expertise in design and maintenance of individual networks

Unit – I Introduction to Waveform Encoding

Pulse Code Modulation: Sampling, Quantization, Transmission, Reception, Error, SNR, Differential Pulse Code Modulation, Delta Modulation, Adaptive Delta Modulation, Sigma Delta Modulation, Linear Predictive Coder (LPC)

Unit – II Physical Layer

Digital and Analog Signals, Periodic Analog Signals, Signal Transmission, Limitations of Data Rate, Digital Data Transmission, Performance Measures, Line Coding, Digital Modulation, Media and Digital Transmission System

Unit – III Multiplexing

Multiplexing Techniques: FDM, TDM, STDM, Transmission Media: Classification and Selection of Media, Switching Networks: Packet, Circuit, Massage, Telephone Networks: Packet and Circuit Switching in telephone network

Unit – IV Error Detection and Correction

Types of Errors, Two dimensional parity check, Detection verses correction, Block Coding, Linear Block Coding, Cyclic Codes, Checksum, Standardized Polynomial Code, Error Correction Methods, Forward Error Correction

Unit – V Case Study

Wireless Data Transfer, Remote Weather Monitoring System, Energy Management in Wireless System, Emission Monitoring System, Railway Information and Surveillance System, Central Distribution Hub

Outcomes

- Ability to identify the different types of network topologies and protocols
- Ability to design and develop layers of the OSI model and TCP/IP
- Ability to identify different types of network devices and their functions

Text Books

1. Behrouz A. Forouzan, Sophia Chung Fegan, "Data Communications and Networking", 5th edition, Science Engineering & Math Publications, 2012

Reference Books

1. William Stallings, "Data and Computer Communications", 8th edition, Pearson Education India, 2007

CS205 - DATA STRUCTURES AND ALGORITHMS

Credits: 4

Objectives

- To introduce basic data structures and their applications in the real world scenario.
- To introduce the concepts of algorithmic paradigms such as greedy method, divide-and-conquer, backtracking, and dynamic programming.
- To analyze the complexity of different algorithms for a specific application.

Unit-I Introduction to Basic Data Structures

Arrays, Stacks, Queues, Linked List, doubly linked list, applications, searching and sorting techniques.

Unit-II Development of Algorithms

Notations and analysis - Storage structures for arrays - Sparse matrices.

Unit-III Linked Lists and Binary Trees

Binary search trees - Tree traversal - Expression manipulation - Symbol table construction - Height balanced trees - Red-black trees. Graphs - BFS, DFS - Topological sort - Shortest path problems. String representation and manipulations - Pattern matching.

Unit-IV Divide and Conquer method

Strassen's matrix multiplication - Greedy method - Knapsack problem - Job sequencing with deadlines - Minimum spanning trees.

Unit-V Dynamic Programming

Multistage graphs - All pair's shortest paths - Optimal binary search trees - Travelling salesman problem, Backtracking – Nqueens Problem.

Outcomes

- To be able to analyze and choose the best data structure for a given application.
- To be able to assess on the suitability of a programming paradigm for an application.
- Ability to analyze the complexity of different algorithms for a specific application.

Teaching and Evaluation Guidelines

- 60% on conceptual understanding (Low Level Thinking) and 40 % on analysis (Medium or High Level Thinking).

Text Books

1. J.P.Tremblay and P.G.Sorenson, "An Introduction to Data Structures with applications", Second Edition, Tata McGraw Hill, 1981

CS207 - DIGITAL COMPUTER FUNDAMENTALS

Credits: 3

Objectives

- To impart the essential knowledge on the fundamentals and applications of digital circuits and digital computing principles
- To provide an overview on the design principles of digital computing systems
- To provide technical knowledge on various digital hardware components

Unit-I Binary Codes

Weighted and non-weighted - Binary arithmetic conversion algorithms - Error detecting and error correcting codes. Canonical and Standard boolean expressions - Truth tables.

Unit-II Karnaugh (K)-Maps

K-map reduction - Don't care conditions – Code conversions: Binary to Gray and Excess-3 code and vice-versa. Design of code converters and Equivalence functions.

Unit-III Combinational Logic

Adders/Subtractors: Carry look-ahead adder, Binary/Decimal Parallel Adder/Subtractor for signed numbers. Magnitude comparator - Decoders/Encoders - Multiplexers/Demultiplexers: Boolean function implementation using multiplexers.

Unit-IV Sequential Logic

Basic latch - Flip-flops (SR, D, JK, T and Master-Slave) - Triggering of flip-flops - Counters - Design procedure - Ripple counters – Binary Coded Decimal (BCD) and Binary - Synchronous counters.

Unit-V Registers and Memory units

Registers: Shift registers - Registers with parallel load. Memory units: Examples of Random Access Memory (RAM), Read Only Memory (ROM) and Programmable Read Only Memory (PROM), Erasable Programmable Read Only Memory (EPROM) - Reduction of state and flow tables - Race-free state assignment - Hazards.

Outcomes

- Gain knowledge on the basic logics and techniques related with digital computers
- Expertise to design and implement various complicated digital systems

Teaching and evaluation guidelines

- 70% on Problems, 30% on Design and Techniques

Text Books

1. M. Morris Mano, Michael Ciletti, "Digital Design", Prentice Hall of India, Fifth Edition, 2012.
2. Anand Kumar, “Fundamentals of Digital Circuits”, Prentice Hall of India Learning private Limited, Second Edition, 2009.
3. W. H. Gothmann, "Digital Electronics - An Introduction to Theory and Practice", Prentice Hall of India, Second Edition, 2009.

CS209 - COMPUTER ORGANIZATION AND ARCHITECTURE

Credits: 3

Objective

- To understand the basic components and its interaction in a computer system.
- To understand fundamental in building a basic computer.

Unit-I Basic structure of Computers

Operational concepts - Bus structures - Arithmetic operations - Memory operations - Addressing modes - Basic I/O operations – Performance-RISC – CISC.

Unit-II Arithmetic Unit

Addition & subtraction of signed numbers – Binary Multiplication: Booth's algorithm - Bit pair recoding - Carry save addition- Unsigned Integer multiplication & division algorithm- Floating point operations.

Unit-III Processing unit

Control unit – Pipelining - Multiple bus organization - Hardwired control - Micro programmed control - Hazards - Data path - Embedded systems.

Unit-IV Memory System

Basic concepts - Semiconductor RAM memory - Cache memory - Performance considerations - Virtual memory - Secondary storage.

Unit-V I/O Organisation and Logic Circuits

Accessing I/O devices - Interrupts - DMA -Buses - Interface circuits - Serial communication links – Logic Circuits – Practical Implementation of Logic Gates.

Outcomes

- Ability to understand digital computers and their fundamental architecture.
- Ability to understand functionalities and organization of processor units and their types.

Teaching and Evaluation guidelines

- 30% on Problem Solving (Higher Order Thinking), and 40% on Structural design (Medium Order Thinking), and 30% on Basic design (Lower Order Thinking).

Text Books

1. C.HAMACHER, Z.VRANESIC, S.ZAKY, "Computer Organization", Fifth Edition, McGraw Hill, 2011
2. W.STALLINGS, "Computer Organization and Architecture", Ninth Edition, Pearson education, 2013.

Reference Books

1. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Fourth edition, Elsevier 2011.

CS211 - OBJECT ORIENTED PROGRAMMING LABORATORY

Credits: 2

Objectives

- To understand the advanced concepts in C++ programming
- To impact to express computational solutions in C++ and Java
- To understand and use the Java SDK environment to create, debug and run simple Java programs.

EXPERIMENETS

PROGRAMS USING C++

1. Structures
2. Arrays
3. Classes and objects
4. Functions
5. Operator Overloading
6. Pointers
7. Inheritance
8. Virtual Functions
9. Input-Output File handling

PROGRAMS USING JAVA

1. Applets
2. String Handling
3. Use of interfaces
4. Using inheritance
5. Exception handling

Outcomes

- Ability to write program in specific language (C, Java)
- Ability to test and debug the programs for critical errors
- Ability to analyze and optimize programs.

CS215 - DATA STRUCTURES LABORATORY

Credits: 2

Objectives

- To apply the data structures for real world Applications and analyze the algorithmic complexity.

EXPERIMENTS

Problems in C/C++/ Java using data structures involving arrays, stacks, queues, strings, linked lists, trees, graphs.

1. Operations on stacks, queues and linked lists
2. Conversion of infix expressions to postfix and evaluation of postfix expressions.
3. Implementation of Tower of Hanoi.
4. Implementation of priority queue.
5. Doubly Linked List and Circular Linked List Implementation.
6. Polynomial Evaluation.
7. Searching : Linear Search, Binary Search
8. Sorting: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort.
9. Implementation of Binary Trees - Height and Depth of a Binary Trees.
10. Implementation of Binary Search Tree.
11. Tree Traversal: Pre-Order, Post-Order, In-Order, and Level Order Traversals.
12. Graph Representation-Breadth First Search, Depth First Search
13. Prim's and Kruskal's algorithm for Shortest Spanning Tree using Greedy Method.
14. Strassen's matrix multiplication and quick sort with Divide and Conquer Method.
15. 0/1 Knapsack Problem using Dynamic Programming.
16. N-Queens Problem using Backtracking.
17. Travelling Salesman Problem using Branch and Bound.

Outcomes

- To be well versed with data structures and different programming paradigms to tackle with real world problems.