## Second Year – First Semester

## Engineering Mathematics III (BSC-211)

## Basic Science Course (BS); 4 Credits (3-1-0)

**Objectives:**

1. Basic idea of the Subject will be to introduce the basic concept of differential calculus (ordinary and partial both), multiple integrals, vector calculus and matrices to understand the different subjects of engineering as well as basic sciences.

| Unit | Contents | No. of Lectures |
|---|---|---|
| **Unit 1** | Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables. | **14** |
| **Unit 2** | Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality. Continuous random varibales and their properties, distribution functions and densities, normal, exponential and gamma densities.Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.( | **12** |
| **Unit 3** | Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances - Chisquare test for goodness of fit and independence of attributes | **12** |
| | | **38** |

**Reference/Text Books:**


1. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing CompanyLtd., 2008.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.
3. Babu Ram, Engineering Mathematics, Pearson.

4. E.Kreyszig, Advance Engineering Mathematics, John Wiley & Sons,2005.
5. Peter V. O'Neil, Advance Engineering Mathematics, Thomson (Cengage)Learning,2007.
6. Maurice D. Weir, Joel Hass, Frank R.Giordano, Thomas, Calculus, Eleventh Edition,Pearson.
7. R. K. Jain & S. R. K. Iyenger, Advance Engineering Mathematics, Narosa Publishing -House, 2002.

## Object Oriented Programming with C++ (PCCS-211)

## Professional Core (PC); 4 Credits (3-0-2)

**Objectives:**

The course will introduce standard tools and techniques for software development, using object oriented approach, use of a version control system, an automated build process, an appropriate framework for automated unit and integration tests..

| Unit | Contents | No. of Lectures |
|---|---|---|
| **Unit 1** | Detailed contents Abstract data types and their specification | **06** |
| **Unit 2** | How to implement an ADT. Concrete state space, concrete invariant, abstraction | **12** |
| **Unit 3** | Detailed function. Implementing operations, illustrated by the Text example. Features of object | **05** |
| **Unit 4** | Features of object-oriented programming. Encapsulation, object identity, polymorphism, Inheritance in OO design. | **06** |
| **Unit 5** | Design patterns. Introduction and classification. The iterator pattern. Model-view-controller pattern. | **06** |
| **Unit 6** | Implementing OO language features. Commands as methods and as objects. | **06** |
| **Unit 7** | Memory management. Generic types and collections. The software development GUIs. Graphical programming with Scala and Swing process. | **08** |
| | | **49** |

**Reference/Text Books :**

1. Herbert Schildt, "C++ the Complete Reference ", III edition, TMH 1999
2. Balagurusamy, Entrepreneurial "Object Oriented programming with C++", TMH
3. Barkakatin "objects oriented programming in C++" PHI 1995
4. Barbara Liskov, Program Development in Java, Addison-Wesley, 2001

## Operating System (PCCS -212)

## Professional Core (PC); 4 Credits (3-1-0)

**Objectives:**

To learn the fundamentals of Operating Systems:

1. To learn the mechanisms of OS to handle processes and threads and their communication
2. To learn the mechanisms involved in memory management in contemporary OS
3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To know the components and management aspects of concurrency management
5. To learn to implement simple OS mechanisms

| Unit | Contents | No. of Lectures |
|---|---|---|
| **Unit1** | **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, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System. | **04** |
| **Unit2** | **Processes:** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, 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; Multiprocessor scheduling: Real Time scheduling: RM and EDF. | **04** |
| **Unit3** | **Inter-process Communication:** Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc. | **12** |

| | | |
|---|---|---|
| **Unit4** | **Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery. | **08** |
| **Unit5** | **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.<br>**Virtual Memory:** Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU). | **08** |
| **Unit6** | **I/O Hardware:** I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms<br><br>**File Management:** Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.<br>**Disk Management:** Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks | **12** |
| | | **48** |

**Reference/Text Books:**


1. Operating Systems Design and implementation Andrew S. Tanenbam, Albert S. Woodhull Pearson
2. Operating System Concepts (7th Ed) by silberschatz and Galvin, Wiley, 2000.
   Operating Systems (5th Ed) - Internals and Design Principles by William Stallings, Prentice Hall, 2000 4.Unix Shell Programming - YashwantKanetkar, BPB publications.

# Data Structures and Algorithm (PCCS -213)
# Professional Core (PC); 4 Credits (3-0-2)

**Objectives:**

1. To impart the basic concepts of data structures and algorithms.
2. To understand concepts about searching and sorting techniques
3. To understand basic concepts about stacks, queues, lists, trees and graphs.
4. To enable them to write algorithms for solving problems with the help of fundamental data structures.

| Unit | Contents | No. of Lectures |
|---|---|---|
| **Unit 1** | **Introduction:** Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis. | **09** |
| **Unit 2** | **Stacks and Queues:** ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis. | **12** |
| **Unit 3** | **Linked Lists:** Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis. Trees: Basic Tree Terminologies, Different types of **Trees:** Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis. | **12** |
| **Unit 4** | **Sorting and Hashing:** Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing. Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and | **12** |

| | | |
|---|---|---|
| | complexity analysis. | |
| | | **45** |

**Reference/Text Books**


1. Horowitz and Sahani, "Fundamentals of data Structures", Galgotia Publication Pvt. Ltd., New Delhi.
2. M. Tenenbaum, "Data Structures using C and C++", Prentice-Hall of India Pvt. Ltd., New Delhi.
3. Schaum's Outlines Data structure Seymour Lipschutz Tata McGraw Hill 2nd Edition


**Objectives:**

1. To understand the basics of logic gates and digital design. To comprehend knowledge of operational/combinational/sequential circuits (Adder, Counter, and Memory etc.) in digital design.

| Unit | Contents | No. of Lectures |
|---|---|---|
| **Unit 1** | **Overview Of Boolean Algebra And Logic Gates:** Number Systems and Codes, Binary Arithmetic, Boolean Algebra, Minimisation of Switching Function, DE Morgan's Theorem, Karnaugh's Map Method (limited up to 4-variables), QuineMcCluskey's Method, Cases with Don't care conditions and multiple output switching functions. | **10** |
| **Unit 2** | **Combinational Circuits:** NAND/NOR gates, Realization of switching functions, Half/full adders, Half/full substractors, Series and parallel additions, BCD adders, Look ahead carry generators ,Decoders and encoders, BCD to 7 segment decoders, Multiplexers and Demultiplexers, Parity bit generator and detector , Error detection. | **12** |
| **Unit 3** | **Sequential Circuits:** Introduction to registers and Counters: Flip-Flops and their conversion, Excitation Tables, synchronous and asynchronous counters and designing of sequential circuits: code converter and | **12** |

| | | |
|---|---|---|
| | counters. Mode-k and divide by K counters, counter applications. | |
| **Unit 4** | **Memories:** Introduction to various semiconductor memories and designing of ROM and PLA. Memory organization and operation, expanding memory size, classification andcharacteristicsof memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).<br><br>A/D and D/A Converters: Digital to analog converters: weighted resistor/converter, R-2R Ladder D/Aconverter,specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit,analog to digital converters: quantization and encoding, parallel comparator A/Dconverter,successive approximation A/D converter, counting A/D converter, dual slope A/Dconverter,A/Dconverterusing voltagetofrequencyandvoltagetotimeconversion,specificationsofA/Dconverters , example of A/D converterICs | **12** |
| **Unit 5** | **Logic Family:** Characteristics of digital ICs, CMOS Logic Family, Implementation of logic using CMOS. | **04** |
| | | **50** |

**Reference/Text Books:**


1. M.M. Mano : “Digital logic and computer design”, PHI.
2. R. P. Jain : “Modern Digital electronics”, TMH
3. Computer organization and architecture: Hamacher “McGraw Hill
4. MillmanTaub , “ Pulse , Digital and Switching Waveforms “ TMH
5. Floyd: “Digital fundamentals”, UBS.
6. Anand Kumar, “Fundamental of digital Electronics”, 2nd Edition.