SPPU B.E./B.Tech IT Sem 3 syllabus

Discrete Mathematics

214441: Discrete Mathematics

Unit I Sets And Propositions

Sets: Sets, Combinations of Sets, Venn Diagram, Finite and Infinite Sets, Countable Sets, Multisets,
Principle of Inclusion and Exclusion, Mathematical Induction.

Propositions: Propositions, Logical Connectives, Conditional and Bi-conditional Propositions, Logical
Equivalence, Validity of Arguments by using Truth Tables, Predicates and Quantifiers, Normal forms.
Applications of Sets and Propositions.

Unit II Combinatorics And Discrete Probability

Combinatorics: Rules of Sum and Product, Permutations, Combinations.

Discrete Probability: Discrete Probability, Conditional Probability, Bayes Theorem, Information and
Mutual Information, Applications of Combinatorics and Discrete Probability.

Unit III Graph Theory

Graphs: Basic Terminologies, Multi-Graphs, Weighted Graphs, Sub Graphs, Isomorphic graphs,
Complete Graphs, Regular Graphs, Bipartite Graphs, Operations on Graphs, Paths, Circuits, Hamiltonian
and Eulerian graphs, Travelling Salesman Problem, Factors of Graphs, Planar Graphs, Graph Colouring.

Trees: Tree Terminologies, Rooted Trees, Path Length in Rooted Trees, Prefix Codes, Spanning Trees,
Fundamental Cut Sets and Circuits, Max flow –Min Cut Theorem (Transport Network).
Applications of Graph Theory.

Unit IV Relations And Functions

Relations: Properties of Binary Relations, Closure of Relations, Warshall'sAlgorithm, Equivalence
Relations, Partitions, Partial Ordering Relations, Lattices, Chains and Anti Chains.

Functions: Functions, Composition of Functions, Invertible Functions, Pigeonhole Principle, Discrete
Numeric Functions.

Recurrence Relations: Recurrence Relation, Linear Recurrence Relations with Constant Coefficients,
Total Solutions, Applications of Relations and Functions.

Unit V Introduction To Number Theory

Divisibility of Integers: Properties of Divisibility, Division Algorithm, Greatest Common Divisor GCD and its Properties, Euclidean Algorithm, Extended Euclidean Algorithm, Prime Factorization Theorem,
Congruence Relation, Modular Arithmetic, Euler Phi Function, Euler's Theorem, Fermat's Little
Theorem, Additive and Multiplicative Inverses, Chinese Remainder Theorem.

Unit VI Algebraic Structures

Algebraic Structures: Introduction Semigroup, Monoid, Group, Abelian Group, Permutation Groups,
Cosets, Normal Subgroup, Codes and Group Codes, Ring, Integral Domain, Field.
Applications of Algebraic Structures.

Text Books:

1. C. L. Liu and D. P. Mohapatra, "Elements of Discrete Mathematics", 4th Edition, McGraw-Hill
2. Kenneth H. Rosen, "Discrete Mathematics and its Applications", & 7th edition, McGraw-Hill

Reference Books:

1. Bernard Kolman, Robert C. Busby, Sharon Cutler Ross, "Discrete mathematical structures", 6th edition, Prentice Hall of India
2. Edgar G. Goodaire, Michael M. Parmenter, "Discrete Mathematics with Graph Theory", 3rd Edition, Pearson Education
3. Tremblay J. S., "Discrete mathematical structures with application", 3rdEdition, Tata McGraw Hill

4. Lipschutz Seymour, “Discrete mathematics”, 4th Edition, Tata McGraw-Hill
5. Johnsonbaugh Richard, “Discrete Mathematics”, 7th edition, Pearson
6. Biggs Norman L, “Discrete mathematics”, 6th edition, Oxford
7. David M. Burton, “Elementary Number Theory”, &7th Edition, McGraw-Hill

Logic Design & Computer Organization

214442:Logic Design & Computer Organization

Credit Scheme: 3

Unit 1 Introduction To Digital Electronics

Digital Logic families: Digital IC Characteristics; TTL: Standard TTL characteristics, Operation of
TTL NAND gate; CMOS: Standard CMOS characteristics, operation of CMOS NAND gate;
Comparison of TTL & CMOS.

Signed Binary number representation and Arithmetic: Sign Magnitude, 1’s complement & 2’s
complement representation, unsigned Binary arithmetic (addition, subtraction, multiplication,
and division), subtraction using 2’s complement; IEEE Standard 754 Floating point number
representations.

Codes: Binary , BCD, octal , hexadecimal , Excess-3 , Gray code & their conversions

Logic minimization: Representation of logic functions: logic statement, truth table, SOP form,
POS form; Simplification of logical functions using K-Maps up to 4 variables.

Case Study:1) CMOS 4000 series ICs 2) practical applications of various codes in computers 3) four basic arithmetic operations using floating point numbers in a calculator.

Unit 2 Combinational Logic Design

Design using SSI chips: Code converters, Half- Adder, Full Adder, Half Subtractor, Full Subtractor,
n bit Binary adder.

Introduction to MSI chips: Multiplexer (IC 74153), Demultiplexer

(IC 74138), Decoder (74238)
Encoder (IC 74147), Binary adder (IC 7483)
Design using MSI chips: BCD adder & subtractor using IC 7483, Implementation of logic
functions using IC 74153 & 74138.
Case Study : Use of combinational logic design in 7 segment display interface

Unit 3 Sequential Logic Design
Introduction to sequential circuits: Difference between combinational circuits and sequential
circuits; Memory element-latch & Flip-Flop.
Flip- Flops: Logic diagram, truth table & excitation table of SR, JK, D, T flip flops; Conversion from
one FF to another , Study of flip flops with regard to asynchronous and synchronous, Preset &
Clear, Master Slave configuration ; Study of 7474, 7476 flip flop ICs.
Application of flip-flops: Counters- asynchronous, synchronous and modulo n counters, study of
7490 modulus n counter ICs & their applications to implement mod counters; Registers- shift
register types (SISO, SIPO, PISO &PIPO)& applications.
Case Study : Use of sequential logic design in a simple traffic light controller

Unit 4 Computer Organization & Processor
Computer organization & computer architecture, organization, functions & types of computer
units- CPU(typical organization ,Functions , Types), Memory (Types & their uses in computer),
IO(types & functions) & system bus(Address, data & control , Typical control lines, Multiple-Bus
Hierarchies); Von Neumann & Harvard architecture; Instruction cycle
Processor: Single bus organization of CPU; ALU(ALU signals, functions & types); Register (types
& functions of user visible, control & status registers such as general purpose, address registers,
data registers, flags, PC, MAR, MBR, IR)& control unit (control signals & typical organization of
hard wired & microprogrammed CU).
Micro Operations (fetch, indirect, execute, interrupt) and control signals for these micro

operations.
Case Study : 8086 processor , PCI bus

Unit 5 Processor Instructions &Processor Enhancements
Instruction : elements of machine instruction ; instruction representation (Opcode&
mnemonics, Assembly language elements) ; Instruction Format & 0-1-2-3 address formats,
Types of operands
Addressing modes; Instruction types based on operations (functions & examples of each); key
characteristics of RISC& CISC; Interrupt: its purpose, types , classes & interrupt handling (ISR ,
multiple interrupts), exceptions; instruction pipelining(operation & speed up)
Multiprocessor systems: Taxonomy of Parallel Processor Architectures, two types of MIMD
clusters & SMP (organization & benefits) & multicore processor (various Alternatives &
advantages 0f multicores), typical features of multicore intel core i7.
Case Study : 8086 Assembly language programming

Unit 6 Memory &Input / Output Systems
Memory Systems: Characteristics of Memory Systems, Memory Hierarchy, signals to connect
memory to processor, memory read & write cycle, characteristics of semiconductor memory:
SRAM, DRAM &ROM, Cache **Memory** – Principle of Locality, Organization, Mapping functions,
write policies, Replacement policies, Multilevel Caches, Cache Coherence,
Input / Output Systems: I/O Module, Programmed I/O, Interrupt Driven I/O, Direct Memory
Access (DMA).

Case Study : USB flash drive

Text Books:

1. “Modern Digital Electronics”, R.P. Jain, Tata McGraw-Hill, Third Edition
2. “Computer organization and architecture, designing for performance” by William Stallings ,
Prentice Hall ,Eighth edition

Reference Books:

1. “Digital Design”, M Morris Mano, Prentice Hall, Third Edition
2. “Computer organization” , Hamacher and Zaky, Fifth Edition
3. “Computer Organization and Design: The Hardware Software Interface” D. Patterson, J.
Hennessy, Fourth Edition, Morgan Kaufmann
4. “ Microprocessors and interfacing-programming and hardware” Douglas V. Hall and SSSP Rao,
McGraw-Hill ,Third Edition

Data Structure & Algorithms

214443:Data Structure & Algorithms

Credit Scheme: 3

Unit- I Introduction

Introduction to Data Structures: Concept of data, Data object, Data structure, Concept of Primitive and non-primitive, linear and Nonlinear, static and dynamic, persistent and ephemeral data structures, Definition of ADT

Analysis of algorithm: Frequency count and its importance in analysis of an algorithm, Time complexity & Space complexity of an algorithm Big 'O', ‘Ω' and 'Θ' notations,

Sequential Organization: Single and multidimensional array and address calculation.

Linked Organization: Concept of linked organization, Singly Linked List, Doubly Linked List, Circular Linked List (Operations: Create, Display, Search, Insert, Delete).

Case Study Set Operation, String Operation

Unit- II Searching and Sorting

Searching and sorting: Need of searching and sorting, Concept of internal and external sorting, sort stability, Searching methods: Linear and binary search algorithms, Fibonacci Series.

Sorting methods: Bubble, insertion, Quick, Merge, shell and comparison of all sorting methods. Analyze Insertion sort, Quick Sort, binary search, hashing for Best, Worst and Average case.

Case Study Study and Analyze Selection sort, bucket sort,radix sort.

Unit- III Stack & Queue

Stack: Concept of stack, Concept of implicit and explicit stack, stack as an ADT using sequential and linked organization, Applications of stack: recursion, converting expressions from infix to postfix or prefix form, evaluating postfix or prefix form.

Queue: Concept of queues as ADT, Implementation of queue using array and linked organization, Concept of circular queue, double ended queue, Applications of queue: priority queue.

Case Study Reversing a string, balanced parentheses in algebraic expressions, Tower of Hanoi problem, double ended queue as Stack and Queue.

Unit- IV Trees

Tree : Trees and binary trees-concept and terminology, Expression tree, Binary tree as an ADT, , Binary search tree, Recursive and Non recursive algorithms for binary tree traversals ,Binary search tree as ADT(Insert Search Delete, level wise Display)

Threaded binary tree: Concept of threaded binary tree (inorder, preorder and postorder). Preorder and In-order traversals of in-order threaded binary tree, Applications of trees.

Case Study Construction of BST from pre and postorder traversal, Expression Tree construction

Unit- V Graph and Symbol Table

Graph -Concept and terminologies, Graph as an ADT, Representation of graphs using adjacency matrix and adjacency list, Breadth First Search traversal, Depth First Search traversal, Prim's and Kruskal's algorithms for minimum spanning tree, Shortest path using Dijkstra's algorithm, topological sorting.

Symbol Table -Notion of Symbol Table, OBST, AVL Trees

Heap: Heap data structure, Min and Max Heap, Heap sort, applications of heap

Case Study Consider a network of computers connected to each other. The connection has various parameters associated with it as distance, propagation delay, bandwidth (capacity of carrying data), etc. Based on these parameters, decide which path should be chosen to send data from one computer to every other on the network.

In a system, jobs are submitted for execution at different times. If the system is idle, the job is taken for executed immediately. If there is a job in execution, the newly submitted job is added to a queue. The jobs are assigned a number, which

indicates tells the priority of the jobs. The system must execute the high priority jobs first for execution. Implement the above said system using heap data structure.

Unit- VI Hashing and File Organization

Hashing: Hash tables and scattered tables: Basic concepts, hash function, characteristics of good hash function, Different key-to-address transformations techniques, synonyms or collisions, collision resolution techniques- linear probing, quadratic probing, rehashing, chaining with and without replacement.

File: Concept of File, File types and file organization (sequential, index sequential and Direct Access), Comparison of different file organizations.

Case Study What are the advantages of binary tree and binary search in file handling?

Study Hashing techniques for expandable Files(Extendible, Dynamic and Linear Hashing)

Text Books:

1. E. Horowitz, S. Sahni, D. Mehta, "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi, 1995, ISBN 16782928
2. Y. Langsam, M. Augenstin, A. Tannenbaum, "Data Structures using C and C++", 2nd Edition, Prentice Hall of India, 2002, ISBN-81-203-1177-9.

Reference Books:

1. G. A.V, PAI , “Data Structures and Algorithms “, McGraw Hill, ISBN -13: 978-0-07-066726-6
2. A. Tharp ,"File Organization and Processing", 2008 ,Willey India edition, 9788126518685
3. M. Folk, B. Zoellick, G. Riccardi, "File Structure An Object Oriented Approach with C++", Pearson Education, 2002, ISBN 81 - 7808 - 131 - 8.

4. M. Welss, “Data Structures and Algorithm Analysis in C++", 2nd edition, Pearson Education, 2002, ISBN- 81-7808-670-0

Object-Oriented Programming

214444: Object-Oriented Programming

Credit Scheme: 3

Unit I Foundations of Object Oriented Programming

Introduction OOP : Software Evolution, Introduction to Procedural, Modular, Object-Oriented and Generic Programming Techniques, Limitations of Procedural Programming, Need of Object-Oriented Programming, Fundamentals of Object-Oriented Programming: Objects, Classes, Data Members, Methods, Messages, Data Encapsulation, Data Abstraction and Information Hiding, Inheritance, Polymorphism, Static and Dynamic Binding, Message Passing.

Case Study Model a real world scenario (vehicle class, fruit class, student management in university etc.) using Object Oriented Paradigm

Unit II Classes, Objects and Methods

Class: Creating a Class, Visibility/Access Modifiers, Encapsulation, Methods: Adding a Method to Class,
Returning a Value, Adding a Method That Takes Parameters, The 'this' Keyword, Method Overloading, Object Creation, Using Object as a Parameters, Returning Object, Array of Objects, Memory Allocation: 'new', Memory Recovery: 'delete', Static Data Members, Static Methods, Forward Declaration, Class as Abstract Data Types (ADTs), Classes as Objects.

Case Study Represent a vector using class and include appropriate methods to perform various tasks.

Unit III Constructors and Destructors

Constructors: Introduction, Use of Constructor, Characteristics of Constructors, Types of Constructor, Constructor Overloading, Dynamic Initialization of an Object, Constructor with Default Arguments, Symbolic Constants, Garbage Collection: Destructors and Finalizes.

Case Study A book shop inventory

Unit IV Inheritance and Polymorphism

Inheritance: Introduction, Need of Inheritance, Types of Inheritance, Benefits of Inheritance, Cost of Inheritance, Constructors in derived Classes, Method Overriding, Abstract Classes and Interfaces. Polymorphism and Software Reuse: Introduction, Types of Polymorphism (Compile Time and Run Time Polymorphism), Mechanisms for Software Reuse, Efficiency and Polymorphism

Case Study A bank account system

Unit V Exception Handling and Generic Programming

Exception: Errors, Types of Errors, Exception and its Types,

Exception-Handling Fundamentals, Uncaught Exception, Using try and Catch, Multiple Catch Clauses, Nested Try Statements, User Define Exception using Throw.
Generics: What are Generics? Introduction to Language Specific Collection Interface: List Interface and Set Interface, Collection Classes: ArrayList Class and Linked List Class.
Case Study Exception handling and generic programming using array list (ArrayList class)

Unit VI File Handling and Design Patterns
File Handling: Introduction, Concepts of Stream, Stream Classes, Byte Stream Classes, Character Stream, Classes, Using Stream, and Other Useful I/O Classes, Using the File Class, Input/output Exceptions, Creation of Files, Reading/Writing Character, Reading/Writing Bytes, Handling Primitive Data Types, Concatenating and Buffering Files, Random Access Files.
Design Patterns: Introduction, Types of Design Patterns, Adapter, Singleton, Iterator
Case Study Student Management System

Text Book:

1. An Introduction to Object Oriented Programming (3rd Ed), by Timothy A. Budd, published by Addison-Wesley,2002

2. E. Balaguruswamy, “Object Oriented Programming Using C++ and Java”, Tata McGraw Hill

Reference Books:

1. Object-Oriented Programming and Java by Danny Poo (Author), Derek Kiong (Author), Swarnalatha Ashok (Author)Springer; 2nd ed. 2008 edition (12 October 2007), ISBN-10: 1846289629, ISBN-13: 978-1846289620,2007
2. Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.
3. Object-Oriented Design Using Java, Dale Skrien, McGraw-Hill Publishing, 2008, ISBN - 0077423097, 9780077423094. 4. UML for Java Programmers by Robert C. Martin, Prentice Hall, ISBN 0131428489,2003.

Basics of Computer Network

214445: Basics of Computer Network

Credit Scheme: 3

Unit I Data Communication and Network Models
Introduction to communication Theory - Basics of data communication, Types of Signals, A/D, D/A, A/A, D/D Signal Conversion Methods, Bandwidth Utilization and Data Rate Limits, Multiplexing Techniques, Data rate limits, Topologies, Noise, types of noise, Shannon Hartley Theorem, Channel capacity, Nyquist and Shannon Theorem, Bandwidth S/N trade off.
Network Models And addressing - OSI Model TCP/IP Model (Data Format, Addressing Mechanisms, Devices)
Case Study Study of Physical layer components such as Cable, NIC, hub, etc. available in the computers /laboratories of your department

Unit II Error Detection, Correction and Data Link Control
Data Link Layer: Data Link Layer Services, Error Detection and Correction: Introduction, Error Detection and Error Correction. Linear Block Codes: hamming code, Hamming Distance, parity check code. Cyclic Codes: CRC (Polynomials), Advantages of Cyclic Codes, Other Cyclic Codes (Examples: CHECKSUM: One's Complement, Internet Checksum). Framing: fixed-size framing, variable size framing. Flow control: flow control protocols. Noiseless channels: simplest protocol, stop-and-wait protocol.
Noisy channels: stop-and-wait Automatic Repeat Request (ARQ), go-back-n ARQ, Selective repeat ARQ, piggybacking.
Case Study Draw PPPoE connection diagram with multiple devices, FFTH connection diagram

Unit III Multi-Access Mechanism and Ethernet Standards
Random Access Techniques: CSMA, CSMA/CD, CSMA/CA, Controlled Access Techniques: Reservation, Polling, Token Passing, Channelization: FDMA, TDMA, CDMA, Ethernet: IEEE Standards-802.3, 802.4, 802.5, 802.6 Comparison of Ethernet Standards: Standard Ethernet, Fast Ethernet, Gigabit Ethernet with reference to MAC layer and Physical Layer (Wired Network Only)
Case Study Campus network design case study

Unit IV Network Layer: Services and Addressing
Network Layer : Network Layer Services, IPv4 Addresses: Static and Dynamic Configuration Classful and Classless Addressing, Special Addresses, NAT, Subnetting, Supernetting, Delivery and Forwarding of IP Packet, Structure of Router, IPv4: Datagrams, Fragmentation,

Options, Checksum,
IPv6Addressing: Notations, Address Space, Packet Format, Transition from Ipv4 to IPv6
Case Study Visit server room of campus and understand how IP addressing is done for your respective Campus→Institute→Department

Unit V Network Layer : Routing Protocols
Routing: Metric, Static vs Dynamic Routing Tables, Routing Protocol, Unicast Routing Protocols - Optimality Principle, Intra and Inter Domain Routing, Shortest Path Routing, Flooding, Distant Vector Routing, Link State Routing, Path Vector Routing Interior Gateway Routing Protocol- OSPF, EIGRP, RIP, Exterior Gateway Routing Protocol– BGP
Case Study Case study on network simulation tools such as Packet tracer

Unit VI TRANSPORT LAYER - SERVICES AND PROTOCOLS
Transport layer : Transport layer services(Duties), TCP: COTS, TCP header, Services, Segments, Connection Establishment, Flow control, Congestion Control, Congestion Control Algorithms, Leaky Bucket, Token Bucket and QoS, Timers, UDP: CLTS, UDP header, Datagram, Services, Applications,
Socket: Primitives, TCP & UDP Sockets.
Case Study Case study on Client server model using simple socket programming, Case Study on Transport Layer Security - Firewall (Stateless Packet Filtering), Stateful, Application

Text Books:

1. Behrouz A. Forouzan, TCP/IP Protocol Suite, McGraw Hill Education, ISBN: 978-0-07-070652-1, 4th Edition
2. Andrew S. Tanenbaum, David J. Wethrall, Computer Network, Pearson Education, ISBN: 978-0- 13-212695-3

Reference Books:

1. Kurose Ross, Computer Networking: A Top Down Approach Featuring the Internet, Pearson Education, ISBN: 978-81-7758-878-1
2. Behrouz A. Forouzan, Data Communication and Networking, McGraw Hill Education, ISBN: 978- 1-25-906475-3, 5th Edition
3. Mayank Dave, Computer Network, Cengage Learning, ISBN: 978-81-315-0986-9