**Curriculum for UG Degree Course in BTech. Information Technology**
(Academic Year: 2024-25 Onwards)

**Second Year | Semester-III**

| Sr. No. | Course Code | Course Title | Teaching Scheme Hours /Week | | | Examination Scheme | | | | Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lecture | Tutorial | Practical | In Semester | End Semester | Oral | Practical | | |
| 1 | 23PCIT301 | Data Structures | 3 | 0 | 0 | 50 | 50 | 0 | 0 | 100 | 3 |
| 2 | 23PCIT302 | Computer Networks | 2 | 0 | 0 | 25 | 25 | 0 | 0 | 50 | 2 |
| 3 | 23PCIT303 | Digital Electronics and Computer Architecture | 3 | 0 | 0 | 50 | 50 | 0 | 0 | 100 | 3 |
| 4 | 23PCIT304 | Discrete Mathematics | 2 | 1 | 0 | 50 | 50 | 0 | 0 | 100 | 3 |
| 5 | 23OE301 | Open Elective-I | 3 | 0 | 0 | 50 | 50 | 0 | 0 | 100 | 3 |
| 6 | 23VSEC301 | Universal Human Values | 2 | 1 | 0 | 50 | 50 | 0 | 0 | 100 | 3 |
| 7 | 23AEC301 | Design Thinking | 1 | 1 | 0 | 50 | 0 | 0 | 0 | 50 | 2 |
| 8 | 23PCIT301L | Data Structures Laboratory | 0 | 0 | 4 | 25 | 0 | 0 | 25 | 50 | 2 |
| 9 | 23PCIT302L | Computer Networks Laboratory | 0 | 0 | 2 | 25 | 0 | 25 | 0 | 50 | 1 |
| 10 | 23PCIT303L | Digital Electronics and Computer Architecture Laboratory | 0 | 0 | 2 | 25 | 0 | 25 | 0 | 50 | 1 |
| | | Total = | **16** | **03** | **8** | **400** | **275** | **50** | **25** | **750** | **23** |

***23OE301: Open Elective-I**

A. Intellectual Property Rights
B. Digital Marketing
C. Law for Engineers
D. Organizational Behavior
E. Project Management

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For Women, Pune-411052

# 23PCIT301 Data Structures

**Teaching Scheme:**
**Lectures:**3 hours/week

**Examination Scheme:**
**In-Semester:** 50 marks
**End-Semester:** 50 marks
**Credits:** 3

**Prerequisites:** Programming Skills in C Language Lab

**Course Objectives:**

Familiarize students with

1. Linear and non-linear data structures
2. Iterative and recursive function implementations
3. Sorting and searching techniques.
4. Problem solving approach using data structures

**Course Outcomes:**

Students should be able to

1. Identify appropriate data structure for real world applications.
2. Apply appropriate linear data structures.
3. Apply appropriate nonlinear data structures.
4. Recommend an appropriate searching and sorting techniques for given application.

**Unit I Introduction to Data Structures and algorithms**

Concept solving and algorithms, revision of data types, operators, control structures, functions, structures, and arrays, sorting and searching algorithms, introduction to data structures and its various types, Abstract Data Types.

**Unit II Linked Lists**

Concept of linked organization, singly linked list, doubly linked list, circular linked list. Linked list as an ADT. Representation and manipulations of polynomials using linked lists, comparison of a sequential and linked memory organization, concept of Generalized Linked List.

Case study: Music Players, Polynomial representation using linked list.

**Unit III Stacks and Queues**

Concept of stack, stack as ADT, Implementation of stack using array and linked organization, stack as data structure. Concept of queues as ADT, implementation using array and linked organization. priority queue.

Case study: recursion, expression conversion and evaluation, printer queue, traffic queue.

**Unit IV Trees**

Concept of non-linear data structure, binary trees-concepts, and terminologies, Conversion of general tree to binary tree, binary tree as an ADT, expression tree, recursive and non-recursive algorithms for binary tree traversals, binary search trees, threaded binary tree.
Case study: Searching, hierarchical file systems.

**Unit V Graphs**

Concept of graph as data structure, storage representation of graphs, graph as ADT, graph traversals, shortest path, Dijkstra's algorithm, minimum spanning tree, Prims and Kruskal's algorithm.

Case study: Transportation, social network

**Unit VI Hash Tables and Files**

Concept of hashing, Importance of hashing, hash function, collision resolution techniques- linear probing, rehashing, chaining without replacement and chaining with replacement, file operations.

Case study: Data searching and retrieving from a telephone directory.

**Textbooks**

1. R. Gilberg, B. Forouzan, "Data Structures: A pseudocode approach with C", Cengage Learning, 2nd edition.
2. Alfred Aho, John Hopcroft, Jeffrey Ullman, "Data Structures & Algorithms", Pearson Publication

**Reference Books**

1. E. Horowitz, S. Sahani, "Fundamentals of Data Structures", Universities press, 2nd edition.
2. Jean-Paul Tremblay & Paul G. Sorenson, "An Introduction to Data Structures with Applications" Publisher-Tata McGraw Hill, 2nd edition.
3. Data Structures using C & C++-By Tanenbaum Publisher–Prentice-Hall International.
4. Fundamentals of Computer Algorithms by Horowitz, Sahni, Galgotia Pub. 2001 ed
5. Fundamentals of Data Structures in C++-By Sartaj Sahani.

# 23PCIT302 Computer Networks

**Teaching Scheme:**

**Lectures:** 2 hours/week
**Tutorial**: -

**Examination Scheme:**
**In-Semester:** 25 Marks
**End-Semester:** 25 Marks
**Credits:** 2

**Prerequisite:** Network Essentials

**Course Objectives:**
Familiarize students with
1. Analysis of routing protocols
2. Comparison of the TCP and UDP functionalities
3. Evaluation of application layer protocols and their functionalities
4. Examination of wireless technology applications

**Course Outcomes:**
Students will be able to
1. Analyze different routing protocols.
2. Evaluate the usage of various protocols at the transport layer.
3. Recognize the usage of various protocols at the application layer.
4. Design a local area network (LAN) and WLAN.

**Unit – I: Internetworking**

Internetworking Basics, OSI Model, Data Encapsulation, Introduction to TCP/IP, Process/Application layer Protocols, Host-to-Host Layer Protocols, Internet Layer Protocols Internet Protocol

**Unit – II: Introduction to Routing and Packet Forwarding**

Inside the Router, Network Layer Command Line Interface Configuration and Addressing, Basic Router Configuration Building the Routing Table, IP Routing, Path Determination and Switching Functions Protocols

**Unit – III: IP Routing**

Routing Basics, Distance vector routing Protocols, Link state routing protocols. Routing Information Protocol, Open Shortest Path First. Virtual Local Area Networks, Network address translation.

**Unit – IV: Transport Layer**

Transport layer duties and functionalities, application expectations and IP delivery semantics.

UDP: UDP functionality TCP: TCP Features, byte-stream, Connection-oriented, 2-way, 3-way Handshake, TCP Sliding Window, Congestion Control Algorithms

**Unit – V: Application Layer**

Client/Server Model, HTTP, Telnet, DNS, FTP, TFTP, POP3, IMAP, SMTP

**Unit – VI: Wireless Technologies**

Introduction to wireless internetwork, IEEE 802.11, WLAN, SDN Introduction

**Textbooks:**

1. Andrew S. Tanenbaum, David J. Weatherall, "Computer Networks", Pearson (6th edition), (2021)
2. Behrouz Forouzan, "TCP/IP Protocol Suite", Mc-Graw Hill, (4th Edition) (2017)

**Reference Books:**

1. Theodore S. Rappaport, "Wireless Communications", Prentice Hall (2nd Edition) (2002)
2. Rick Graziani, Allan Johnson, "Routing Protocols and Concepts", Cisco Press (2012)

# 23PCIT303 Digital Electronics and Computer Architecture

**Teaching Scheme:**
**Lectures:** 3 hours/week

**Examination Scheme:**
**In-Semester:** 50 marks
**End-Semester:** 50 marks
**Credits:** 3

**Prerequisites:** Basics of Electrical and Electronics Engineering

**Course Objectives:**

Familiarize students with

1. Basic digital design techniques.
2. Combinational and sequential logic circuits.
3. Architecture of a microprocessor.
4. Fundamentals of assembly language programming.

**Course Outcomes:**

Students should be able to

1. Solve problems using basic binary arithmetic operations and codes.
2. Construct combinational logic circuits.
3. Model sequential logic circuits.
4. Explain architectural details of a microprocessor.
5. Develop a program using assembly language constructs.

**Unit I: Number Systems**

Introduction to Boolean algebra and Number Systems. Signed Binary number representation and Arithmetic: Signed and True Magnitude, 1"s complement, 2"s complement representation and arithmetic. Codes: BCD, Excess-3, Gray code, Binary Code and their conversion. Logic minimization: Representation of truth-table, Simplification of logical functions, Minimization of SOP and POS forms, don't care Conditions, K-Maps.

**Unit II: Combinational Logic Design**

CLC design using SSI chips – Code converters, Adder, Subtractor, n bit Binary adder, Introduction to MSI functions and chips - Multiplexers, Decoder / Demultiplexer, Encoder, Binary adder. CLC design using MSI chips – BCD and Excess 3 Adder and Subtractor.

**Unit III: Sequential Logic Design using Counters**

Introduction to sequential circuits. Difference between combinational circuits and sequential circuits, memory element – latch. Flip- Flops: Design, truth table, excitation table of SR, JK, D, T flip flops. Study of flip flops with asynchronous and synchronous Preset and Clear, conversion from one type to another type of flip flop. Application of flip-flops – Counters- asynchronous, synchronous and modulo counters. Study of modulus n counter ICs and their applications to implement mod counters.

**Unit IV: Sequential Logic Design using Shift Registers**

Registers- Buffer register, shift register types - SISO, SIPO, PISO and PIPO, applications of shift registers - ring counter, twisted ring counter, Sequence generators using counters and shift register, Sequence Detectors using Mealy and Moore model.

**Unit V: Processor Architecture**

Introduction to 8086: internal Architecture, generation of physical address, minimum/maximum mode, study of 8086 supporting chips 8288(Latch), 8284(Clock Generator), 8286(trans receiver), 8288(Bus controller), Timing diagram read Write machine cycle. Introduction to microcontrollers.

**Unit VI: Assembly Language Programming and Interrupt Structure**

Introduction to assembly language programming- Instruction Descriptions, Assembler Directives addressing modes, Examples of programming, Procedures and Macros. Interrupt Structure, Interrupt service routine, Interrupt vector table, hardware, and software interrupts, INTR, NMI, Interrupt response, Execution of ISR, Priorities of interrupt.

**Textbooks:**

1. R.P. Jain, "Modern Digital Electronics", 4th Edition, Tata McGraw-Hill, ISBN: 0–07049492–4
2. Douglas Hall, "Microprocessors and Interfacing, Programming and Hardware", 3rd edition, McGraw-Hill, ISBN: 0–07–100462–9 Book 2

**Reference Books:**

1. Malvino Leach, "Digital Principles and Applications", Tata Mc-Graw Hill, (5th Edition)
2. 8086 Intel Manual

**Web References:**

1. NPTEL Series: Digital Systems Design, Prof. Roychoudhary, IIT Kharagpur
2. NPTEL NOC: Microprocessors and Microcontroller, Prof. Santanu Chattopadhyay, IIT Kharagpur
3. NPTEL NOC: Microprocessors and Interfacing, Prof. Shaik Rafi Ahamed, IIT Guwahati

# 23PCIT304 Discrete Mathematics

**Teaching Scheme:**
**Lectures:** 2 hours/week
**Tutorial:** 1 hour/week

**Examination Scheme:**
**In-Semester:** 50 Marks
**End-Semester:** 50 Marks
**Credits:** 3

**Prerequisites:** Basic Mathematics

**Course Objectives:**

Familiarize students with

1. Sets and propositions.
2. Relations and functions.
3. Graphs.
4. Trees.

**Course Outcomes:**

Students should be able to

1. Prove mathematical theorems with logical reasoning and appropriate proof techniques.
2. Apply discrete mathematics concepts to computer science problems.
3. Solve problems using relations and functions.
4. Solve problems using graphs and trees.

**Unit I: Sets and Propositional Logic**

Sets, combinations of sets, Venn diagram, finite and infinite sets, countable sets, multisets, principle of inclusion and exclusion, mathematical induction.
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: Relations and Functions**

Relations and their properties, n-ary relations and their applications, representing relations, closures of relations, equivalence relations, partial orderings, lattices, chains and anti-chains. functions, composition of functions, invertible functions, and pigeonhole principle.

**Unit III: Graphs**

Graphs and graph models, graph terminology and special types of graphs, representing graphs and graph isomorphism, connectivity, Euler and Hamilton paths, shortest-path problems, planar graphs, graph coloring.

**Unit IV: Trees**

Introduction, binary search trees, prefix codes, tree traversal: preorder, in-order and post-order traversals, minimum spanning trees, Prim's algorithm, Kruskal's algorithm.

**Textbooks:**

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

# 23VEC301 Universal Human Values

**Teaching Scheme**
**Lectures:** 2 Hours / Week
**Tutorial:** 1 hour/week

**Examination Scheme**
**In Semester:** 50 Marks
**End Semester:** 50 Marks
**Credits:** 3

**Course Objectives:**

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature

**Course Outcomes:**

After completion of the course, students will be able to

1. Understand the significance of value inputs in formal education and start applying them in their life and profession
2. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
3. Analyze the value of harmonious relationship based on trust and respect in their life and profession
4. Examine the role of a human being in ensuring harmony in society and nature.
5. Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession.

**Unit I: Introduction to Value Education**

Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity which is the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Current Scenario for Happiness and Prosperity, Method to Fulfill the Basic Human Aspirations.

**Unit II: Harmony in the Human Being**

Understanding Human being as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Program to ensure self-regulation and Health.

**Unit III: Harmony in the Family and Society**

Harmony in the Family, Family being the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, Trust which is the Foundational Value in Relationship, Respect as the Right Evaluation, Understanding Harmony in the Society, Vision for the Universal Human Order.

**Unit IV: Harmony in the Nature or Existence**

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels and the Holistic Perception of Harmony in Existence

**Unit V: Implications of the Holistic Understanding, a Look at Professional Ethics**

Natural Acceptance of Human Values, Definiteness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models, Typical Case Studies with Strategies for Transition towards Value-based Life and Profession.

**Textbooks:**

1. R. R. Gaur, R. Asthana, G. P. Bagaria, "The Textbook A Foundation Course in Human Values and Professional Ethics", Excel Books, New Delhi, (2nd Revised Edition), (2019).
2. R. R. Gaur, R. Asthana, G. P. Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", Excel Books, New Delhi, (2nd Revised Edition), (2019).

**Reference Books:**

1. A. Nagaraj,"Jeevan Vidya: EkParichaya", Jeevan Vidya Prakashan, Amarkantak, (1999).
2. A.N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, (2004).
3. Mohandas Karamchand Gandhi, "The Story of My Experiments with Truth", Prakash books Publishers, Daryaganj, New Delhi, (1983).
4. Annie Leonard, "The story of stuff", Little, Brown Book Group, (2005).
5. Cecile Andrews, "Slow is Beautiful", New Society Publishers, Canada, (2006).

**Online Resources:**

1 NPTEL course on Humanities and social sciences
https://nptel.ac.in/courses/109/104/109104068/

# 23AEC301 Design Thinking

**Teaching Scheme:**
**Lectures:** 1 hour/week
**Tutorial:** 1 hour/week

**Examination Scheme:**
**In-Semester:** 50 marks
**Credits:** 2

**Prerequisites:** -

**Course Objectives:**

Familiarize students with

1. Design Thinking process
2. User centric approach for designing a solution.
3. Problem analysis with various methods
4. Applications of Design Thinking

**Course Outcomes:**

Students should be able to

1. Apply the design process for real world problems.
2. Apply types of thinking ideas into visuals or prototypes.
3. Analyze problems with various methods and approaches for innovative user centric solutions.
4. Recommend a solution based on stages of Design Thinking.

## Unit I: Introduction to Design thinking

Human Centred Design approach, Concept of Design Thinking. Features of Design Thinking, Process of thinking, Creative thinking, Lateral thinking, User centric approach and personas, Thinking hats.

## Unit II: Stages of Design Thinking

Empathy: Difference Between Empathy and Sympathy, Empathy Techniques, Empathy Maps, define: Identification of Problem, Defining and Refining of Problem Statement, Ideate: Process of Ideation, Prototyping, Testing.

## Unit III: Design thinking approaches

Visualization, Journey Mapping, Value Chain Analysis, Mind Mapping, Development, Assumption Testing, Prototype, Co-Creation, Learning Launches, Story Telling.

## Unit IV: Design Thinking for Strategic Innovations and its applications

Strategic Management, Innovation Management, Frameworks for Innovation, Types of Innovations: Disruptive vs. Sustaining innovation, Radical vs. incremental innovation, Architectural vs. Modular Innovation, The Innovation Matrix, Business Model Innovation Applications: Product Development, Process Development, Service Management.

**Textbooks:**

1. Bryan Lawson, "How designers think: The design process demystified", 4th Edition, Butterworth Architecture
2. Nigel Cross, "Design Thinking", Berg Publishers – 2011

**Reference Books:**

1. Makarand Ramesh Velankar, Leena Manojkumar Panchal, "Design Thinking Primar", Techknowledge Publications- September 2023, ISBN: 978-93-5563-711-6
2. Ben Crothers, "Design Thinking Fundamentals", O'Reily
3. Tim Brown, "Change by Design: How Design Thinking Transforms Organizations", HarperCollins – 2009
4. Susan Weins Chenk, "Hundred things every designer needs to know about people", New Riders Publication
5. Vijay Kumar, "101 Design Methods: A Structured Approach for Driving Innovation in Your Organization", Wiley Publication
6. Roger L. Martin, "Design of Business: Why Design Thinking is the Next Competitive Advantage" Harvard Business Press
7. Karl Ulrich, "Design: Creation of Artifacts in Society" - 2011
8. Bala Ramadurai, "Karmic Design Thinking"
9. T. Amabile, "How to kill creativity", SAGE Publication - 2006
10. William Lidwell, Kritina Holden, Jill Butler, "Universal principles of Design ", Rockport Publishers
11. Bella Martin, Bruce Hanignton, Bruce M Hanington "Universal methods of design", Rockport Publishers - 2012
12. Roman Kizanie, "Empathy: Why it matters, how to get it", Tarcher Perigee Publishers
13. Karla McLaren, "The Art of Empathy: A complete Guide to life's most essential skill", Sounds True Publishers

# 23PCIT301L Data Structures Laboratory

**Teaching Scheme:**
**Practical:** 4 hours/week

**Examination Scheme:**
**In-Semester:** 25 Marks
**Practical:** 25 Marks
**Credits:** 2

**Prerequisites:** Programming Skills in C Language Lab

**Course Objectives:**

Familiarize students with

1. Significance of data structures and its use
2. Problem solving approach using data structures.
3. Linear data structures to solve real world problems.
4. Non-Linear data structures to solve real world problems.

**Course Outcomes:**

Students should be able to

1. Solve a given problem using linear data structures.
2. Solve a given problem using nonlinear data structures.
3. Choose appropriate sorting and searching techniques.
4. Develop an application using appropriate data structures.

**Suggested List of Laboratory Assignments**

The suggested laboratory assignments are designed in a set of groups A, B and C such that students will be able to design and implement solutions for a given problem. The laboratory assignments of group A, B and C are to be implemented using C programming language.

**Group A**

**1. Sorting and searching algorithm.**

a. Implement bubble sort algorithm and test it for various inputs.
b. Implement Linear search algorithm and validate for different test cases.
c. Implement Binary search algorithm and validate for different test cases.

**2. Operations on set**

Accept sets from users and implement the union, intersection, difference, symmetric difference operations on the given sets.

**3. Operations on Singly linked list:**

Create a linked list and implement operations like traversal, add a new node (as a head node, in between by position/value, at the end), delete a node (head node, in between by position/value, end node), and reverse the linked list.

**4. Operations on Doubly linked list:**

Create a Doubly linked list and implement operations like traversal, display in reverse order, add a new node (as a head node, in between by position/value, at the end), delete a node (head node, in between by position/value, end node), and reverse the linked list.

**5. Operations on Stack:**

a. Implement Stack as ADT with Push, Pop, Stack empty, Display Top operations.
b. Using the stack ADT - implement expression conversion algorithms like – infix_to_postfix, infix_to_prefix, and evaluation of postfix expression.

**6. Operations on Queue:**

a. Implement priority queue as an ADT for applications like - Vehicle traffic management at Toll Plaza, Hospital management.

**7. Operations on binary tree:**

a. Construct an expression tree from a postfix expression and perform recursive and non-recursive traversals – inorder, preorder and postorder.
b. Implement binary search tree and perform the following operations -Create, Insert, Delete, Search, Display the inorder, preorder and postorder traversals.
c. Construct a binary tree and perform recursive/non-recursive traversals – inorder, preorder and postorder.

**8. Operations on hash table:**

a. Implementation of hash function for generation of Hash table with collision handling and search using Linear Probing.
b. Implementation of hash function for generation of Hash table with collision handling and search without replacement with chaining.
c. Implementation of hash function for generation of Hash table with collision handling and search with replacement with chaining.

**9. Operations on Graphs:**

a. Implement graph as an ADT using adjacency matrix/adjacency list and show the various traversals.
b. Represent any real-world graph adjacency matrix/adjacency list to find a minimum spanning tree using Kruskal's algorithm.
c. Represent any real-world graph using adjacency matrix/adjacency list find minimum spanning tree using Prim's algorithm.
d. Represent a given graph using an adjacency matrix /adjacency list and find the shortest path using Dijkstra's algorithm (single source all destination).

**10. Operations on Files:**

Write a program to implement operations on sequential file such as open, read, write, etc.

**Group B (Open Ended Assignment: Any 1)**

Design an application using different data structures to provide a solution for any real-world problem. Few suggested applications are mentioned below:

1. Library management system
2. Blood bank management system
3. Student Attendance management system

**Group C (Additional list of assignments)**

1. Implement Huffman coding.
2. Implement Heap sort.
3. Implement sorting algorithms like insertion sort, selection sort.
4. Implement threaded binary tree.

**Textbooks**

1. R. Gilberg, B. Forouzan, "Data Structures: A pseudocode approach with C", Cengage Learning, 2nd edition.
2. Alfred Aho, John Hopcroft, Jeffrey Ullman, "Data Structures & Algorithms", Pearson Publication

**Reference Books**

1. E. Horowitz, S. Sahani, "Fundamentals of Data Structures", Universities press, 2nd edition.
2. Jean-Paul Tremblay & Paul G. Sorenson, "An Introduction to Data Structures with Applications" Publisher-Tata McGraw Hill, 2nd edition.
3. Data Structures using C & C++-By Tanenbaum Publisher–Prentice-Hall International.
4. Fundamentals of Computer Algorithms by Horowitz, Sahni, Galgotia Pub. 2001 ed
5. Fundamentals of Data Structures in C++-By Sartaj Sahani.

# 23PCIT302 Computer Networks Laboratory

**Teaching Scheme:**
**Practical:** 2 hours/week

**Examination Scheme:**
**In Semester:** 25 marks
**Oral:** 25 marks
**Credit:** 1

**Prerequisites:** Network Essentials

**Course Objectives:**

Familiarize students with

1. Analyze the principles of routing at the network layer and VLANs.
2. Evaluating the key functions of TCP and UDP at the transport layer.
3. Implementing congestion control, fairness, and stability principles of the Internet.
4. Evaluating wireless technologies for network implementation.

**Course Outcomes:**

Students will be able to

1. Configure routers with different routing protocols, both static and dynamic.
2. Implement virtual LANs (VLANs) for network segmentation.
3. Implement local area networks (LANs) using switches and routers.
4. Build functional computer networks to evaluate the performance.

**Group A: Suggested List of Laboratory Assignments (Any 5)**

1. Build a small network and verify connectivity.
2. Configure a router with different routing protocols.
3. Configure a switch for network connectivity.
4. Install Wireshark and analyze live network traffic with various filters.
5. Configure VLANs and trunking to segment a network.
6. Implement DHCPv4 to automate IP address assignment.
7. Develop a socket program for network communication.
8. Implement a wireless network for data transmission.

**Group B: Mini Project Options (Any 1)**

1. Implement router-on-a-stick inter-VLAN routing to enable communication between VLANs.
2. Configure EtherChannel for link aggregation and fault tolerance.
3. Implement DHCPv6 or IPv6 on a small network to explore next-generation IP addressing.
4. Implement switch security configurations in VLANs to enhance network security.
5. Configure network devices with SSH for secure remote management.
6. Evaluate the quality of service (QoS) of a network using NS2 simulation.

**Textbooks**

1. Rick Graziani, Allan Johnson, Routing Protocols and Concepts**,** Cisco Press (2011)

**Reference Books**

1. Andrew S. Tanenbaum, David J. Weatherall**,** "Computer Networks**",** Pearson (6th edition), (2021)
2. Behrouz Forouzan, "TCP/IP Protocol Suite", Mc-Graw Hill, (4th Edition) (2017)

## 23PCIT303L Digital Electronics and Computer Architecture Laboratory

**Teaching Scheme**:
**Practical:** 2 hours/week

**Examination Scheme**:
**In-Semester:** 25 marks
**Oral:** 25 marks
**Credits:** 1

**Prerequisites:** Basic Electrical and Electronics Engineering

**Course Objectives:**

Familiarize students with

1. Basic digital Integrated Circuits (IC).
2. Analyze and test digital circuits.
3. Writing assembly language program.
4. Executing Assembly Language Program.

**Course Outcomes:**

Students should be able to

1. Use appropriate ICs for designing digital circuits.
2. Design combinational digital circuits.
3. Design sequential digital circuits.
4. Develop an assembly language program.

**Suggested List of Laboratory Assignments**

1. Design (truth table, K-map) and implement 4-bit BCD & Excess 3 Adder using IC7483.
2. Implementation of logic functions using multiplexer IC 74153 & decoder IC 74138.
3. Design (State diagram, state table & K map) and implement 3-bit up and down synchronous counter using master slave JK flip-flop IC 7476.
4. Design and implement Mod-n counter with IC7490.
5. Design (State Diagram, State Table, K Map) and implement sequence generator.
6. Write assembly language program for addition and subtraction of two 8-bit numbers.
7. Write assembly language program for converting two-digit BCD number to its equivalent HEX and vice- versa.
8. Write ALP to perform string operations like
    a. Find length of string
    b. Compare two strings.
    c. Concatenation of two strings
    d. Reverse string

**List of Additional laboratory assignments:**

1. Design (truth table, K-map) and implement code converters. (BCD to Ex-s and Ex-3 to BCD)
2. Design (State diagram, state table & K map) and implement 3 bit up and down ripple counter using master slave JK flip-flop IC 7476.
3. Design and implement Mod-n counter with IC74191.
4. Design (State Diagram, State Table, K Map) and implement Sequence Generator using counters with and without bushing.

**Textbooks:**

1. R.P. Jain, "Modern Digital Electronics", 3rd Edition, Tata McGraw-Hill, ISBN: 0–07–049492–4
2. Douglas Hall, "Microprocessors and Interfacing, Programming and Hardware", McGraw-Hill, ISBN: 0–07–100462–9Book 2

**Reference Books:**

1. Mavino Leach, "Digital Principles and Applications", Tata Mc-Graw Hill, (5th Edition)
2. 8086 Intel manual.

**Web References:**

1. NPTEL Series: Digital Systems Design, Prof. Roychoudhary, IIT Kharagpur
2. NPTEL NOC: Microprocessors and Microcontroller, Prof. Santanu Chattopadhyay, IIT Kharagpur
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