Education to Eternity

JAIDEV EDUCATION SOCIETY'S
J D COLLEGE OF ENGINEERING AND MANAGEMENT
KATOL ROAD, NAGPUR
SESSION 2020-21

3rd Semester Information Technology

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	PCC	IT3T001	Data structure using OOPs	3	0	0	20	20	60	100	3
2	PCC	IT3T002	Graph Theory and Discrete Mathematics	3	1	0	20	20	60	100	4
3	HSMC	IT3T003	Organization Behavior	2	0	0	20	20	60	100	2
4	PCC	IT3T004	CAO	3	0	0	20	20	60	100	3
5	PCC	IT3T005	Computer Networks	3	0	0	20	20	60	100	3
6	PCC	IT3L006	Computer Networks(Lab)	0	0	2	40	0	60	100	1
7	PCC	IT3L007	Data structure using OOPs(Lab)	0	0	4	40	0	60	100	2
8	ESC	IT3L008	Web Technology Lab	0	0	4	40	0	60	100	2
9	PROJECT	IT3F009	Internship	0	0	0	0	0	0	0	1
				14	**1**	**10**	**220**	**100**	**480**	**800**	**21**

4th Semester Information Technology

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	PCC	IT4T001	Operating System	3	0	0	20	20	60	100	3
2	PCC	IT4T002	Embedded Systems	2	0	0	20	20	60	100	2
3	PCC	IT4T003	Computer Graphics	3	1	0	20	20	60	100	4
4	HSMC	IT4T004	Cyber Security & Cryptography	2	0	0	20	20	60	100	2
5	PCC	IT4T005	DBMS	3	1	0	20	20	60	100	4
6	PCC	IT4L006	Computer Graphics (Lab)	0	0	4	40	0	60	100	2
7	PCC	IT4L007	DBMS(Lab)	0	0	4	40	0	60	100	2
8	PCC	IT4L008	Cyber Security & Cryptography (Lab)	0	0	4	40	0	60	100	2
				13	**2**	**12**	**220**	**100**	**480**	**800**	**21**

Course Title	**:**	**Data structure using OOPs**	**Semester**	**:**	**III**
Course Code	**:**	**IT3T001**	**Course Type**	**:**	**Compulsory**
Pre-requisite	**:**	**C Programming**	**L – T – P**	**:**	**3 – 0– 0**
Stream	**:**	**Core**	**Credits**	**:**	**3**

COURSE OBJECTIVES

1	To understand the concepts of ADTs.
2	To learn linear data structures – lists, stacks, and queues.
3	To understand sorting, searching and hashing algorithms.
4	To apply Tree and Graph structures.

[Unit 1] **7 Hrs**

Complexity Analysis: Time and Space complexity of algorithms, asymptotic analysis, big O and other notations, importance of efficient algorithms, program performance measurement, data structures and algorithms.

Hashing: Implementation of Dictionaries, Hash Function, Collisions in Hashing, Separate Chaining, Open Addressing, Analysis of Search Operations

[Unit 2] **7 Hrs**

ADT Array: Searching and sorting on arrays: Linear search, binary search on a sorted arrays, Bubble sort, Insertion sort, merge sort and analysis; Emphasis on the comparison based sorting model, Counting sort, Radix sort, and bucket sort.

[Unit 3] **8 Hrs**

Stacks and Queues: Abstract data types, sequential and linked implementations, exception handling in classes, representative applications such as parenthesis matching, towers of Hanoi, wire routing in a circuit, finding path in a maze, simulation of queuing systems, equivalence problem.

[Unit 4] **8 Hrs**

Linked Lists: Abstract data type, sequential and linked representations, comparison of insertion, deletion and search operations for sequential and linked lists, list and chain classes, exception and iterator classes for lists, doubly linked lists, circular lists, linked lists through simulated pointers, lists in STL, skip lists, applications of lists in bin sort, radix sort, sparse tables.

[Unit 5] **8 Hrs**

Trees: Introduction to Trees, Implementation of Trees, Binary Trees, Tree Traversals with an Application, Binary Search Trees (BSTs), Query and Update Operations on BSTs, AVL Trees, Rotations, Search and Update Operations on Balanced BSTs, Splay Trees, B-trees.

[Unit 6] **7 Hrs**

Graphs: Graph Algorithms: Graphs and their Representations, Graph Traversal Techniques: Breadth First Search (BFS) and Depth First Search (DFS), Applications of BFS and DFS, Minimum Spanning Trees (MST), Prim's and Kruskal's algorithms for MST, Connected Components, Dijkstra's Algorithm for Single Source Shortest Paths, Warshall's Algorithm for finding Transitive Closure of a Graph, Floydd's Algorithm for All-Pairs Shortest Paths Problem.

Text Books:

1. Mark Allen Weiss, —Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 1997.
2. Reema Thareja, —Data Structures Using C, Second Edition, Oxford University Press, 2011.

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, —Introduction to Algorithms", Second Edition, Mcgraw Hill, 2002.
2. Aho, Hopcroft and Ullman, —Data Structures and Algorithms , Pearson Education,1983.
3. Stephen G. Kochan, —Programming in C , 3rd edition, Pearson Education.
4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, —Fundamentals of Data Structures in C, Second Edition, University Press, 2008.

COURSE OUTCOMES

At the end of the course the student will be able to:

1	Understand the concept of ADT.
2	Identify data structures suitable to solve problems.
3	Develop and analyze algorithms for stacks, queues.
4	Develop algorithms for binary trees and graphs.
5	Implement sorting and searching algorithms.
6	Implement symbol table using hashing techniques

Course Title	**:**	**Graph Theory and Discrete Mathematics**	**Semester**	**:**	**III**
Course Code	**:**	**IT3T002**	**Course Type**	**:**	**Compulsory**
Pre-requisite	**:**	**Basic Mathematics**	**L – T – P**	**:**	**3 – 1– 0**
Stream	**:**	**Core**	**Credits**	**:**	**4**

COURSE OBJECTIVES

1	To study mathematical , logic and set theory and their methods of solution
2	To learn graph theory, trees with simple applications
3	To introduce the essential concepts of probability and statistics.
4	To understand advanced counting techniques

[Unit 1] **8 Hrs**

Mathematical, Logic & Set Theory: Statement and Notation: Negation, Conjunction, Disjunction, Tautologies, Truth Tables, Basic Concepts of Set Theory, Inclusion & equality of set, Power Set, Ordered Pairs and n-tuples, Operations on Sets ,Partial order, Equivalence relations, mathematical induction. Propositions, Predicate logic, formal mathematical systems

[Unit 2] **7 Hrs**

Relations and Functions: Relation and Ordering, Properties of Binary in a set, Relation Matrix and Graphs,Partition and Covering of a set, Equivalence relation, Partial ordering, Partially Ordered sets, Function (Definition and Introduction), Composition of functions, Inverse Functions, Characteristics function of a set.

[Unit 3] **7 Hrs**

Statistics : Sampling Distributions ,Introduction to Sampling Distributions, Central Limit Theorem, Sampling Distribution of c2 ,Student's t Distribution , F Distribution.

[Unit 4] **7 Hrs**

Advanced counting Techniques: Pigeonhole principle, Generating functions, Binomial identities using generating functions, Solutions of Recurrence relations using generating functions

[Unit 5] **8 Hrs**

Random variables and probability distribution: Random variables: discrete and continuous; probability density function of one and two variables; Probability distribution function for discrete and continuous random variables (one and two variables), Joint distributions, conditional distributions. Applications of Probability

[Unit 6] **8 Hrs**

Graphs: Introduction to Graphs, Graph technology, Representing graphs, Multigraphs & weighted graphs, Paths & Circuits, Shortest path problems, Euler & Hamiltonian paths & Circuits, Factors of graph, Planar graph, Graph coloring. Trees: Trees, Rooted trees, Path length in rooted trees, Binary search trees, Spanning Trees & Cut sets, Minimum spanning trees.

Text Books:

1. Discrete Mathematics Structure with application to Computer Science, J. P. Tremblay & R. Manohar, 23rd reprint, 2005, Tata McGraw-Hills Publication Company Limited, New Delhi.

2. Probability and Statistics M R Spiegel, John Schiller, R. Alu Shrinivasan 2nd edition, Tata McGraw-Hills Publication Company Limited, New Delhi.
3. Advanced Engineering Mathematics H.K. Dass 8th revised edition, 2007 S. Chand and Company Limited , Delhi

Reference Books:

1. Discrete Mathematics Lipschutz Schaums's Outline series 2nd edition Tata McGraw-Hills Publication Company Limited, New Delhi.
2. Discrete Mathematical structures Bernard Kolman, Robert C. Busby, Sharon Ross 3rd edition, 2001 Prentice Hall of India, New Delhi.

COURSE OUTCOMES

At the end of the course the student will be able to:

1	Use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, functions, and integers.
2	Reason mathematically about basic data types and structures (such as numbers, sets, graphs, and trees) used in computer algorithms and systems
3	Apply principles of probability distribution to calculate probabilities and expectations of simple random processes.
4	Analyze model and solve real world problems using graphs and trees
5	Use the Knowledge of descriptive statistics to solve the real problem

Course Title	**:**	**Organizational Behavior**	**Semester**	**:**	**III**
Course Code	**:**	**IT3T003**	**Course Type**	**:**	**Compulsory**
Pre-requisite	**:**	**Basic Knowledge of general Management**	**L – T – P**	**:**	**2 – 0– 0**
Stream	**:**	**Core**	**Credits**	**:**	**2**

COURSE OBJECTIVES

1	To help the students to develop cognizance of the importance of human behavior.
2	To enable students to describe how people behave under different conditions and understand why people behave as they do.
3	To provide the students to analyze specific strategic human resources demands for future action.
4	To enable students to synthesize related information and evaluate options for the most logical and optimal solution such that they would be able to predict and control human behavior and improve results

[Unit 1] **5 Hrs**

Introduction to organization Behavior: Meaning, Fundamental concepts, Definition, Approaches to OB, Characteristics and limitations of OB, Challenges and Opportunities of OB, Models of OB, Impact of technology on organizational behavior.

Organization Culture: Meaning and dimensions, Role of founders' values and vision in creating and sustaining culture, Types of organizational cultures, Impact of culture on image and performance of the organization

[Unit 2] **5 Hrs**

Organizational Design, Change And Innovation: Designing an organizational structure, Division of labour, Delegation of authority, Departmental biases, Span of control, Dimensions of structure, Organizational design models, Multinational Structure and Design, Virtual Organizations.

Communication: The importance of communication, The communication process, Communicating within organizations, Information richness, How technology affects communication, Interpersonal communication, Multicultural communication, Barriers to effective communication, Improving Communication in organizations, Promoting ethical communications

Technical Report Writing : Characteristics of Technical Communication, Types of Technical Documents, Establishing Goals in Technical Writing, Technical Writing Process: Prewriting, writing, rewriting, Examples of Industries user manuals.

[Unit 3] **5 Hrs**

Personality : Meaning of personality, Nature and Determinants of Personality, Personality Traits - Big Five, Locus of Control, Self-esteem, Type A/ Type B Personality, Risk Taking, Machiavellianism, Self Monitoring, Personality and OB.

Attitude: Attributes of personality- Transactional Analysis – Ego states – Johari window - Nature and dimensions of attitude – Developing the right attitude, ABC model of Attitude, Managerial Implications of Attitude

[Unit 4] **5 Hrs**

Groups and Organizations: Groups and Teams, Group Dynamics - Groups versus teams, Nature and types of groups and teams, Five stages of group/team development, Determinants of group behaviour, Typical teams in organizations.

Leadership: Leadership as a concept and its essence, Leaders versus managers, Blake and Mouton's managerial grid, Hersey and Blanchard's situational leadership, Transactional versus Transformational leadership, Women as leaders, Leadership in entrepreneurial and family business, organizations.

[Unit 5] **5 Hrs**

Motivation: Power and purpose of motivation, Theories of motivation - Locke's goal setting theory, Vroom's expectancy theory, Porter and Lawler's model, Adam's equity theory, McClelland's theory of needs, Motivational Techniques – Job design/enlargement /enrichment / rotation, Managing rewards - Job status based rewards, Competency based rewards, performance based rewards, Empowerment and Self Managed Teams.

Power and Politics: The concept of power, Sources of power, Interdepartmental power, Illusion of power, Political strategies and tactics, Ethics, power and politics, using power to manage effectively.

Empowerment and Participation: The nature of empowerment and participation, How participation works, Programs for participation, Important considerations in participation.

[Unit 6] **5 Hrs**

Conflict Management: Definition. Traditional vs Modern view of conflict – Types of conflict – Intrapersonal, Interpersonal, and Organizational, Constructive and Destructive conflict, Conflict management

Stress and Counseling: What is stress? Stress model, Work stressors, Stress outcomes, Stress moderators, Stress prevention and management, Employee counseling, Types of counseling

Text Books:

1. Uma Sekaran, "Organization Behaviors", McGraw Hill Company, New Delhi, 2011.
2. LM Prasad, "Organization Behavior", S. Chand and Co. Ltd, New Delhi, 2008.
3. Nair, Banerjee, Agarwal, "Organization Behavior", Prgathi Prakashan, New Delhi, 2006.

Reference Books:

1. Rosy Joshi and Sashi K Gupta, "Organization Behaviors". Kalyani publishers, New Delhi, 2005
2. S.S. Khanka, "Organization Behavior", S. Chand and Co. Ltd, New Delhi, 2008.
3. Fred Luthans, "Organizational Behavior", McGraw Hill Book Co., 2005.

COURSE OUTCOMES

At the end of the course the student will be able to:

1	Outline the applicability of the concept of organizational behavior to understand the behavior of people in the organization.
2	Categorizing the applicability of analyzing the complexities associated with management of individual behavior in the organization.

3	Analyze the complexities associated with management of the group behavior in the organization
4	Validate how the organizational behavior can integrate in understanding the motivation (why) behind behavior of people in the organization.

Course Title	**:**	**Computer Architecture & Organization**	**Semester**	**:**	**III**
Course Code	**:**	**IT3T004**	**Course Type**	**:**	**Compulsory**
Pre-requisite	**:**	**Digital Electronics Circuits**	**L – T – P**	**:**	**3 – 0– 0**
Stream	**:**	**Core**	**Credits**	**:**	**3**

COURSE OBJECTIVES

1	To understand the relationship between instruction set architecture, micro architecture, and system architecture and their roles in the development of the computer.
2	Be aware of the various classes of instruction: data movement, arithmetic, logical and flow control. Explain how interrupts are used to implement I/O control and data transfers.
3	Understand how a CPU's control unit interprets a machine –level instructions.
4	Identify various types of buses in Computer systems.
5	Understand memory hierarchy.
6	Understand various peripheral devices.

[Unit 1] **8 Hrs**

Basic Structure of Computers: Functional Units, Basic Operational Concepts, Bus Structures, Software, Multiprocessors and Multicomputers

Machine Instructions: Instruction Sets: Machine Instruction Characteristics, Types of Operands, Intel x86 and ARM Data Types, Types of Operations, Intel x86 and ARM Operation Type, Memory Locations and Addresses, Memory Operations, Machine program sequencing, addressing modes and encoding of information, Assembly Language, Stacks, Queues and Subroutine

[Unit 2] **6 Hrs**

Instruction Sets: Addressing, x86 and ARM Addressing modes, Instruction Formats, x86 and ARM Instruction Formats, Assembly language

[Unit 3] **8 Hrs**

Micro-programmed Control: Control Unit Operation: Micro-operations, Control of the Processor, Hardwired Implementation, and Micro-programmed control, Basic Concepts, Microinstruction Sequencing & Execution, Microinstructions, grouping of control signals, Micro program sequencing, Micro Instructions with next Address field, Perfecting microinstruction, Emulation, Bit Slices, Introduction to Microprogramming, Macro Processor.

[Unit 4] **8 Hrs**

Arithmetic: Number Representation, Addition of Positive numbers, Logic Design for fast adders, Addition and Subtraction, Arithmetic and Branching conditions, Multiplication of positive numbers, Signed Operand multiplication, fast Multiplication, Booth's Algorithm, Integer Division, Floating point numbers and operations. Reduced Instruction Set Computers (RISCs): Instruction Execution Characteristics, the Use of Large Register File, Compiler-Based Register Optimization, RISC Architecture, RISC Pipelining, RISC versus CISC

[Unit 5] **7 Hrs**

The Memory System: Some Basic Concepts, Semiconductor RAM Memories, Memory system considerations, Semiconductor ROM Memories, Memory interleaving, Cache Memory, Mapping techniques, Virtual memory, Memory Management requirements.

[Unit 6] **8 Hrs**

Computer Peripherals: I/O Devices, DMA, Interrupt handling, online storage, File services, Processors: Families of microprocessors Chips, Introduction to RISC & CISC Processors, Introduction to Pipelining. Parallel Processing: The Use of Multiple Processors, Symmetric Multiprocessors, Multithreading and Chip Multiprocessors, Clusters, Multicore Organization, Intel x 86 Multi-Core Organization

Text Books:

1. Computer Organization 4 th Edition, 2001 V. Carl Hamacher, McGraw Hill
2. William Stallings: "Computer Organization and Architecture", (8/e) Pearson Education.

Reference Books:

1. Behrooz Parhami: "Computer Architecture", Oxford University Press
2. J. P. Hayes: "Computer Architecture and Organization" , McGraw Hill
3. D. A. Patterson, J. L. Hennessy: "Computer Architecture" Morgan Kauffmann, 2002
4. Hwang and Briggs: "Computer Architecture and Parallel Processing" McGraw-Hill

COURSE OUTCOMES

At the end of the course the students will be able to:

1	Outcome- Interpret the functional architecture of computing systems. (Understanding) Classify and compute the performance of machines.
2	Explain addressing modes, instruction formats and program control statements
3	Relate to arithmetic for ALU implementation. Understand the basics of hardwired and micro-programmed control of the CPU.
4	Build large memories using small memories for better performance. Write ISA level code for RISC and CISC machines.
5	Identify, compare and assess issues related to ISA, memory, control and I/O functions. (Applying, Analyzing, Evaluating)
6	Appreciate advancements to architecture like pipelining and superscalar operation

Course Title	**:**	**Computer Networks**	**Semester**	**:**	**III**
Course Code	**:**	**IT3T005**	**Course Type**	**:**	**Compulsory**
Pre-requisite	**:**	**CAO, Data Communication**	**L – T – P**	**:**	**3 – 0– 0**
Stream	**:**	**Core**	**Credits**	**:**	**3**

COURSE OBJECTIVES

1	Discuss the physical and logical as well as the electrical characteristics of digital signals and the basic methods of data transmission.
2	Identify the importance of the ISO 7-layer reference model.
3	Identify and requirements hosted in communication protocols and give an overview of data communication standards, how these standards were developed and under which assumptions they were adopted.
4	Establish a solid knowledge of the layered approach that makes design, implementation, and operation of extensive networks possible.
5	Acquire the knowledge of the basic protocols involved in wired/wireless communication process.

[Unit 1] **8 Hrs**

Basics of Digital Communications: Signals, noise, Nyquist's rate, Fourier transform of signals, harmonics. Baseband and broadband transmission: Modulation techniques fundamentals of modems local loop implementation, Introduction, history and development of computer networks, networks topologies. Layering and protocols.

Physical Layer: Different types of transmission media, errors in transmission: attenuation, noise. Repeaters. Encoding (NRZ, NRZI, Manchester, 4B/5B, etc.)..

[Unit 2] **8 Hrs**

Data Link Layer and Logical Link Control (LLC) sub-layer: Framing; Error control including Bit-parity, CRC and Hamming Codes; Reliable transmission and Automatic Repeat Request (ARQ) protocols including Stop-and-Wait, Go-back-N, and Selective Repeat. Performance analysis of ARQ protocols. Example protocols such as HDLC and PPP.

Medium Access Control (MAC) sub-layer: Shared media systems; Bus, Star and Ring topologies; TDMA, FDMA, CSMA, CSMA/CD, Ethernet and IEEE 802.3; IEEE 802.11 including CSMA/CA protocols; Performance analysis; Shared and Switched Ethernet; Related protocols such as ICMP, NAT, ARP and RARP.

[Unit 3] **8 Hrs**

Network Layer: Design issues, store and forward packet switching connection less and connection oriented networks-routing algorithms-optimality principle, shortest path, flooding, Distance Vector Routing, Control to Infinity Problem, Hierarchical Routing, Congestion control algorithms.

[Unit 4] **8 Hrs**

Transport Layer: Reliable end-to-end transmission protocols; UDP header; Details of TCP header and operation including options headers, Connection establishment and termination, sliding window revisited, flow and congestion control, timers, retransmission, TCP extensions, etc.

[Unit 5] **6 Hrs**

Application Layer: Application protocols for email, ftp, web, DNS

[Unit 6] **7 Hrs**

Advanced Networking: overview to network management systems; security threats and solutions – Firewalls, Access Control Lists, IPSec, IDS

Text Books:

1. Data Communications and Networking - Behrouz A. Forouzan, Fifth Edition TMH, 2013.
2. Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education.
3. Kurose and Ross, "Computer Networking - A top-down approach", Seventh Edition, Pearson, 2017.
4. Peterson and Davie, "Computer Networks, A Systems Approach'', 5th ed., Elsevier, 2011

Reference Books:

1. An Engineering Approach to Computer Networks - S. Keshav, 2nd Edition, Pearson Education.
2. Understanding communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning.

COURSE OUTCOMES

At the end of the course the student will be able to:

1	Defining, using and implementing Computer Networks and the basic components of a Network system, explain the importance of data communications, how communication works in data networks.
2	Evaluate data communication link considering elementary concepts of data link layer protocols for error detection and correction.
3	Apply various network layer techniques for designing subnets and supernets and analyse packet flow on basis of routing protocols.
4	Estimate the congestion control mechanism to improve quality of service of networking application
5	Analyze the features and operations of various application layer protocols such as Http, DNS, Telnet, FTP and SMTP
6	Apply the knowledge for finding security threats and solutions

Course Title	**:**	**Computer Networks (Lab)**	**Semester**	**:**	**III**
Course Code	**:**	**IT3T006**	**Course Type**	**:**	**Compulsory**
Pre-requisite	**:**	**CAO, Data Communication**	**L – T – P**	**:**	**0 – 0 – 2**
Stream	**:**	**Core**	**Credits**	**:**	**1**

List of Experiments:

1. Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped using NS

2. Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion using NS

3. Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination using NS

4. Implement and study the performance of CDMA on NS2/NS3 (Using stack called Call net) or equivalent environment using NS

5. Write a Program for ERROR detecting code using CRC-CCITT (16bit).

6. Write a program to find the shortest path between vertices using bellman-ford algorithm

7. Study of Network simulator (NS) and simulation of Congestion Control Algorithms using NS

8. Configure Host IP, Subnet Mask and Default Gateway in a System in LAN (TCP/IP Configuration).

Course Title	**:**	**Data Structure using OOP's (Lab)**	**Semester**	**:**	**III**
Course Code	**:**	**IT3T007**	**Course Type**	**:**	**Compulsory**
Pre-requisite	**:**	**C Programming**	**L – T – P**	**:**	**0 – 0 – 4**
Stream	**:**	**Core**	**Credits**	**:**	**2**

List of Experiments:

1. Write a program to implement stack using arrays.
2. Write a program to evaluate a given postfix expression using stacks.
3. Write a program to convert a given infix expression to postfix form using stacks.
4. Write a program to implement circular queue using arrays.
5. Write a program to implement double ended queue (de queue) using arrays.
6. Write a program to implement a stack using two queues such that the push operation runs in constant time and the pop operation runs in linear time.
7. Write a program to implement a stack using two queues such that the push operation runs in linear time and the pop operation runs in constant time.
8. Write a program to implement a queue using two stacks such that the enqueue operation runs in constant time and the dequeue operation runs in linear time.
9. Write a program to implement a queue using two stacks such that the enqueue operation runs in linear time and the dequeue operation runs in constant time.
10. Write programs to implement the following data structures: (a) Single linked list (b) Double linked list
11. Write a program to implement a stack using a linked list such that the push and pop operations of stack still take O(1) time.
12. Write a program to implement a queue using a linked list such that the enqueue and dequeue operations of queue take O(1) time.
13. Case Study:-

Example (01): Simulation Case Study

Problem definition:

In this case study, consider the situation in which you are waiting in line for a service at a bank. In general, the more clerks there are, the faster the line moves. The bank manager wants to keep his customers happy by reducing their waiting time but at the same time he does not want to employ any more service clerks than he has to. Being able to simulate the effect of adding more clerks during peak business hours allows the manager to plan more effectively.

Example (02): Binary Tree Search *f*

Problem definition:

a. Write a function binaryTreeSearch.
b. Attempt to locate a specified value in a binary search tree.
c. Input: a pointer to the root node of the binary tree and a search key to be located
d. Output: a pointer to that node (if found) or NULL (not found)

Course Title : Web Technology Lab **Semester: III**
Course Code: IT3L008 **Course Type: Mandatory**
Pre-requisite: Basic Programming **L – T - P: 0 – 0 - 4**
Stream : Core **Credits: 2**

COURSE OBJECTIVES

1	To learn the basics in web designing using HTML, CSS, and XML,Drupal
2	To develop web applications using JSP, servlet, PHP, and Net Beans.

List of Experiments:

1. Designing static web pages using HTML.
2. Write an HTML code to display your CV on a web page.
3. Designing dynamic web pages using different cascading style sheets.
4. To create a JavaBean so that it converts value ofINR(IndianRupees) into equivalentAmerican/Canadian/Australian Dollar value.
5. Write a JavaScript to design a simple calculator to perform various arithmetic operations.
6. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings
7. Implement the given web applications by using PHP, servlets and JSP that takes a name as input and on submit it shows a hello<name>page where <name> is taken from the request. It shows the start time at the right top corner of the page and provide sthe logout button. On clicking this button, it should show a logoutpage with Thank You<name> message with the duration of usage.(Use session to store name and time)
8. Develop a web based application using Drupal for online purchasing of products with payment facility and also manage ,update and publish the content in the website

COURSE OUTCOMES

At the end of the course the student will be able to:

1	Ability to design and develop web pages using HTML, CSS, and XML,Drupal
2	Ability to design and deploy real world applications using client side and server side scripting languages.

Course Title	**:**	**Operating Systems**	**Semester**	**:**	**IV**
Course Code	**:**	**IT4T001**	**Course Type**	**:**	**Compulsory**
Pre-requisite	**:**	**CAO, Data Structure**	**L – T – P**	**:**	**3 – 0– 0**
Stream	**:**	**Core**	**Credits**	**:**	**3**

COURSE OBJECTIVES

1	To understand the services provided by and the design of an operating system.
2	To understand the structure and organization of the file system.
3	To understand what a process is and how processes are synchronized and scheduled.
4	To understand different approaches to memory management.
5	Students should be able to use system calls for managing processes, memory and the file system.
6	Students should understand the data structures and algorithms used to implement an OS.

[Unit 1] **6 Hrs**

Evolution of operating systems: Evolution of operating systems, Types of operating systems. The process concept, system programmer's view of processes, operating system's views of processes, operating system services for process management.

[Unit 2] **8 Hrs**

Processes and Threads: Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Inter process Communication, Communication in Client – Server Systems, Multithreading Models, Threading Issues.

CPU Scheduling: Scheduling concepts, scheduling algorithms, algorithm evaluation, multiple processor scheduling, real time scheduling.

[Unit 3] **8 Hrs**

Concurrent programming and Deadlocks :- Critical regions, Conditional critical regions, Monitors, Inter process communication, Messages, Pipes, Semaphores, Modularization, Synchronization, Concurrent languages. Deadlocks: Characterization, Prevention, Avoidance, Detection and Recovery, Combined approach to Deadlock Handling, precedence graphs

[Unit 4] **8 Hrs**

Memory Management: Memory Management, Contiguous allocation, static-swapping, overlays, dynamic partitioned memory allocation, demand paging, page replacement, segmentation. Non-contiguous allocation, paging, Hardware support, Virtual Memory.

[Unit 5] **7 Hrs**

File systems: A Simple file system, General model of a file system, Symbolic file system, Access control verification, Logical file system, Physical file system, Allocation strategy module, Device strategy module, I/O initiators, Device handlers, Disk scheduling

[Unit 6] **6 Hrs**

Networks, Security and Design Principles: Network operating system, distributed operating system, external security, operational security, password protection, access control, security kernels, hardware security, layered approach, design principle.

Text Books:

1. J.L. Peterson and A. Silberchatz, "Operating System Concepts", Addison Wesley.
2. Harvey M. Dietel, "An Introduction to Operating System", Addison Wesley.
3. C. Crowley, "Operating Systems - A Design Oriented Approach", Irwin Publishing

Reference Books:

1. W. Stallings, "Operating systems", Prentice Hall.
2. A.S. Tannenbaum, "Modern Operating system", PHI

COURSE OUTCOMES

At the end of the course the student will be able to:

1	Identify the significance of operating system in computing devices.
2	Exemplify the communication between application programs and hardware devices through system calls
3	Compare and illustrate various process scheduling algorithms
4	Apply appropriate memory and file management schemes
5	Illustrate various disk scheduling algorithms.
6	Understand the need of access control and protection in an operating system

Course Title : Embedded Systems Semester : IV

Course Code	**:**	**IT4T002**	**Course Type**	**:**	**Compulsory**
Pre-requisite	**:**	**CAO, OS**	**L – T – P**	**:**	**2 – 0– 0**
Stream	**:**	**Core**	**Credits**	**:**	**2**

COURSE OBJECTIVES

1	To understand the fundamental concepts in Embedded Systems.
2	To learn Real Time Operating Systems.
3	To get acquainted with hardware & interfaces.
4	To know Embedded System Design Techniques.

[Unit 1] **4 Hrs**

An Introduction to Embedded Systems: Introduction to embedded systems overview, design challenges, common design metrics, processor technology, IC technology, Design technology. Design productivity gap.

[Unit 2] **6 Hrs**

Processor And Memory Organization: Structural Units in a Processor, Processor selection for an embedded system, memory devices, memory selection for an embedded systems, allocation of memory to program cache and memory management links, segments and blocks and memory map of a system, DMA, interfacing processors, memories and Input Output Devices.

[Unit 3] **6 Hrs**

Devices And Buses For Device Networks: I/O devices, timer and counting devices, serial communication using the "I2 C" CAN, profibus foundation field bus. and advanced I/O buses between the network multiple devices, host systems or computer parallel communication between the networked I/O multiple devices using the ISA, PCI, PCI-X and advanced buses. Bluetooth, IEEE 802.11, Device Driver programming

[Unit 4] **4 Hrs**

Programming Concepts: Programming concepts: State m/c & concurrent process model, FSM m/c, FSMD, PSM model & concurrent process model, Scheduling process, Data flow model, Embedding programming in C++, JAVA and program modeling concepts.

[Unit 5] **5 Hrs**

ARM Microcontroller Architecture & Programming:

Introduction to ARM Microcontroller, ARM Coretex-M3 Microcontroller Architecture, ARM Coretex-M3 Microcontroller Architecture, ARM Microcontroller Register Modes, ARM-Cortex Microcontroller Programming, The ARM Microcontroller Assembly Level Programming, The ARM Coretex-M3 Microcontroller Embedded C Level Programming, Arduino Based Projects on Security System with Wireless Technology, Steps to Make a Raspberry pi Supercomputer and it's Latest Applications**.**

[Unit 6] **5 Hrs**

Design Examples And Case Studies: Personal Digital Assistants, Digital thermometer, Case Studies of digital camera, Smart card, Case study of coding for sending application layer byte stream on TCP/IP network using RTOS VxWorks.

Text Books:

1. Frank Vahid/ Tony Givargis, "Embedded Systems Design", Wiley, 2002.

2. Raj Kamal, “Embedded Systems Architecture, and Programming”, TMH Publication, 3rd Edition,2015.
3. Andrew N. Sloss, “ARM System Developers Guide”, ELSEVER Publication.

Reference Books:

1. Embedded system design by Arnold S Burger, CMP
2. An embedded software primer by David Simon, PEA
3. Embedded systems design: Real world design by Steve Heath; Butter worth Heinenann, Newton mass, USA 2002
4.Data communication by Hayt.
5. Wayne Wolf, “Computer as Components – Principles of Embedded Computing System Design”, Gulf Professional Publishing, 2nd Edition, 2008.
6. David E Simon, “An Embedded Software Primer”, Addison Wesley Publication, 2004.

COURSE OUTCOMES

At the end of the course the student will be able to:

1	To demonstrate & explain embedded systems hardware & software components.
2	To define embedded systems using real time operating system – VxWorks/ µCOS II RTOS.
3	To design & develop embedded applications using C language.
4	To apply design techniques in real-life application.

Course Title	**:**	**Computer Graphics**	**Semester**	**:**	**IV**
Course Code	**:**	**IT4T003**	**Course Type**	**:**	**Compulsory**
Pre-requisite	**:**	**Data Structure and DAA**	**L – T – P**	**:**	**3 – 1– 0**
Stream	**:**	**Core**	**Credits**	**:**	**4**

COURSE OBJECTIVES

1	To introduce the use of the components of a graphics system and become familiar with building approach of graphics system components and algorithms related with them.
2	To learn the basic principles of 3- dimensional computer graphics.
3	Provide an understanding of how to scan convert the basic geometrical primitives, how to transform the shapes to fit them as per the picture definition.
4	Provide an understanding of mapping from a world coordinates to device coordinates, clipping, and projections.

[Unit 1] **8 Hrs**

Introduction to Computer Graphics : Overview of Computer Graphics, Computer Graphics Application and Software, Graphics Areas, Graphics Pipeline, Graphics API's, Numerical issues, Efficiency Display and Hardcopy Technologies, Display Technologies – Raster scan Display System, Video Controller – Vector scan display system, Random Scan Display Processor, Input Devices for Operator Interaction, Image Scanners

[Unit 2] **7 Hrs**

Basic Raster Graphics: Algorithms for Drawing 2D primitives, aliasing and ant aliasing, Polygon filling methods: Scan Conversion Algorithms: Simple Ordered edge list, Edge Fill, Fence fill and Edge Flag Algorithm, Seed fill Algorithms: Simple and Scan Line Seed Fill Algorithm, Halftoning techniques

[Unit 3] **7 Hrs**

Graphics Programming using OPENGL: Why OpenGL, Features in OpenGL, OpenGL operations, Abstractions in OpenGL – GL, GLU & GLUT, 3D viewing pipeline, viewing matrix specifications, a few examples and demos of OpenGL programs, Amimations in openGL.

[Unit 4] **8 Hrs**

2-D geometric transformations: Basic transformations, matrix representations, composite transformations, other transformations, transformations between coordinate systems, affine transformations, transformation functions, Raster methods for transformations. Two- Dimensional viewing : viewing coordinates, Window-to viewport coordinate transformation, viewing functions, clipping : point, line, polygon, curve, text, exterior.

[Unit 5] **8 Hrs**

Normalized Device Coordinates and Viewing Transformations: 3D System Basics and 3D Transformations, 3D graphics projections, parallel, perspective, viewing transformations.3D graphics hidden surfaces and line removal, painter's algorithm, Z -buffers, Warnock's algorithm.

Animations & Realism 10 Animation Graphics: Design of Animation sequences – animation function – raster animation – key frame systems – motion specification –morphing – tweening.

[Unit 6] **7 Hrs**

Light sources: basic illumination models , halftone patterns and dithering techniques; Properties of light, Standard primaries and chromaticity diagram; Intuitive colour concepts, RGB colour model, YIQ colour model, CMY colour model, HSV colour model, HLS colour model; Colour selection.

Text Books:

1. Fundamentals of Computer Graphics, Peter Shirley and Steve Marschner, Third Edition. (A.K.Peters Publication house)

2. Procedural Elements of Computer Graphics III Edition, Rogers, McGraw Hill.

3. Computer Graphics - Principles and Practice, J. D. Foley, A. Van Dam, S. K. Feiner and J. F. Hughes, Second Edition in C, Pearson Education.

Reference Books:

1. Computer Graphics with OpenGL, Donald D. Hearn, M. Pauline Baker, Warren Carithers, Fourth Edition, Pearson Education.

2. Computer Graphics, Hearn and Baker, PHI, India.

COURSE OUTCOMES

At the end of the course the student will be able to:

1	Understand the scope of computer graphics and also identified the field related to computer Graphics.
2	Demonstrate on the concepts on transforms including translation, rotation, scaling, shearing and reflection.
3	Design algorithms for different geometric shapes, lines , circle, ellipse.

Course Title	**:**	**Cyber Security & Cryptography**	**Semester**	**:**	**IV**
Course Code	**:**	**IT4T004**	**Course Type**	**:**	**Compulsory**
Pre-requisite	**:**	**Linear Algebra, Algorithms, Programming, Database, Computer Network, Web**			
			L – T – P	**:**	**2 – 0– 0**
Stream	**:**	**Core**	**Credits**	**:**	**2**

COURSE OBJECTIVES

1	The objective of this course is to cover the concept of security, types of attacks, encryption and authentication techniques and their application to OS security, Network Security and Web security

[Unit 1] **6 Hrs**

Cyber Threat Intelligence: The Need for Cyber Threat Intelligence: The menace of targeted attacks, The monitor-and-respond strategy, Cyber Threat Intelligence Defend, Key Characteristics: Adversary based, Risk focused, Process oriented, The Benefits of Cyber Threat Intelligence.

Adversaries: Cybercriminals, Competitors and cyber espionage agents, Activists.

Intelligence Consumers: Tactical users, Operational users, Strategic users, Issues of Jurisdiction in Cyberspace: Jurisdiction Principles under International law, Jurisdiction in different states, Position in India. Conflict of Laws in Cyberspace, International Efforts for harmonization Privacy in Cyberspace.

[Unit 2] **5 Hrs**

Introduction to Security: Need for security, Security approaches, Principles of Security, Types of attacks.

Encryption Techniques: Plaintext, Cipher text, Substitution & Transposition Techniques, Encryption & Decryption, Key range & Size.

[Unit 3] **5 Hrs**

Symmetric Key Cryptography: Algorithm types & Modes, AES and its analysis, Differential & Linear Cryptanalysis.

Asymmetric Key Cryptography: Trapdoor one way function, RSA and its analysis, The Diffie-Hellman method, Elliptic Curve Arithmetic, ECC operations, Applications of ECC in asymmetric key cryptography, Kerberos.

[Unit 4] **5 Hrs**

Cryptographic Hash Function: Random Oracle Model, Cryptographic Hash Function: SHA-512, MD5, Pseudo Random Number Generation using Hash Function, Message Authentication Code: HMAC, Digital Signature.

[Unit 5] **5 Hrs**

Network Defenses: Network defense tools, Secure protocols, Firewalls, VPNs, Tor, I2P, Intrusion Detection and filters, Host-Based IDS Vs Network-Based IDS, Dealing with unwanted traffic: Denial of service attacks.

User Authentication Mechanism: Authentication basics, Passwords, Authentication tokens, Certificate based & Biometric authentication.

[Unit 6] **4 Hrs**

Network and Web Security: Network Security Attacks, Distributed Denial of Service (Botnet), Browser Attacks, Wireless Security,Honeypots, Obtaining user or website data, Web attack

targeting users, SSL protocol ,User interface attacks, Pretty Good Privacy , S/MIME ,E-mail attacks and security , IP, TCP, Routing protocols, DNS,Web Service Security – Motivation, Technologies for Web Services, WS- Security, SAML, Other Standards.

Text Books:

1. Douglas R. Stinson, Cryptography: Theory and Practice, 3rd Edition, CRC press, 2005.

2. Charles P. Pfleeger, Shari L. Pfleeger, and Jonathan Margulies, Security in Computing, 5th Edition, Prentice Hall, 2015.

3. Elliptic curves: number theory and cryptography, Lawrence C. Washington, (Chapman & Hall/CRC 2003)

4. Dr. Farooq Ahmad, Cyber Law in India, Allahbad Law Agency- Faridabad.

5. Jon Friedman. Mark Bouchard, CISSP. Foreword by John P. Watters, Cyber Threat Intelligence, Definitive Guide TM, 2015.

Reference Books:

1. William Stallings, Cryptography and Network Security: Principles and Practice, 6th Edition, Pearson, 2014.

2. B. A. Forouzan, D. Mukhopadhaya, Cryptography and Network Security, 2nd Edition, McGraw Hill, 2010.

3. Bruce Schneier, Applied Cryptography: Protocols, Algorithms, and Source Code in C, 2nd Edition, Wiley, 2007.

4.Guide to elliptic curve cryptography Hankerson, Menezes, Vanstone (Springer, 2004)

5.Cyber Law simplified- Vivek Sood, Mc-GrawHill, 11th reprint , 2013

COURSE OUTCOMES

At the end of the course the student will be able to:

1	Classify symmetric encryption Techniques and Illustrate various public key cryptography Techniques.
2	Evaluate authentication and hash techniques.
3	Provide security of the data over the network & Protect any network from the threats in the world.
4	Summaries the intrusion detection & it's solutions to overcome the attacks.
5	Do research in the emerging areas of cryptography and network security
6	Apply on the technique to Develop Cyber Threat Intelligence Requirements.

Course Title	**:**	**Database Management Systems**	**Semester**	**:**	**IV**
Course Code	**:**	**IT4T005**	**Course Type**	**:**	**Compulsory**
Pre-requisite	**:**	**Data structures and algorithm**	**L – T – P**	**:**	**3 – 1– 0**
Stream	**:**	**Core**	**Credits**	**:**	**4**

COURSE OBJECTIVES

1	To learn and understand fundamentals of database management system.
2	To exhibit the query development knowledge.
3	To learn modeling and normalization of databases.
4	To learn query processing and exhibit file organization.
5	To exhibit the knowledge of transaction and concurrency control.
6	To learn and understand Big Data and Hadoop

[Unit 1] **8 Hrs**

Introduction to Database Systems: Significance and advantages, Types of Databases, Limitations of File processing system, the DBMS Environment, Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).

Data models: Evolution of Data Models, Entity-relationship model, Relational integrity constraints, data manipulation operations.

[Unit 2] **7 Hrs**

Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS – MYSQL, ORACLE, DB2, SQL server.

[Unit 3] **7 Hrs**

Relational database design: Normalization of Database Tables: Need and Significance, Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.

[Unit 4] **8 Hrs**

Query processing: Evaluation of relational algebra expressions, Query equivalence, Join strategies.

File Organization and Indexing: Indices, B-trees, hashing.

[Unit 5] **8 Hrs**

Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

[Unit 6] **7 Hrs**

Big Data and Hadoop: The rise of Big Data, What is Big Data, Big Data and it's Challenges, Hadoop as a solution, What is Hadoop, Components of Hadoop, Use case of Hadoop.

Text Books:

1. Henry Korth, Abraham Silberschatz & S. Sudarshan, *Database System Concepts*, McGraw-Hill Publication, 6th Edition, 2011.
2. Bipin Desai, An Introduction to Database System, West Publishing Company, College & School Division, 1990.
3. Raghu Ramakrishnan, Johannes Gehrke, *Database Management Systems*, McGraw-Hill Publication, 3rd Edition, 2003.
4. Big Data Simplified, Sourabh Mukherjee, Pearson India

Reference Books:

1. Joel Murach, *Murach's Oracle SQL and PL/SQL for Developers,* Mike Murach & Associates, 2nd Edition, 2014.
2. Wiederhold, *Database Design*, McGraw-Hill Publication, 2nd Edition, 1983.
3. Navathe, *Fundamentals of Database System*, Addison-Wesley Publication, 6th Edition, 2012.
4. J. D. Ullman, "Principles of Database and Knowledge – Base Systems", Vol 1, Computer Science Press.

COURSE OUTCOMES

1	Student shall be able to learn and understand fundamentals of database management system
2	Student shall be able to exhibit the query development knowledge
3	Student shall be able to learn modeling and normalization of databases.
4	Student shall be able to learn query processing and file organization.
5	Student shall be able to exhibit the knowledge of transaction and concurrency control.
6	Students shall be able to learn Big Data and Hadoop.

Course Title	**:**	**Computer Graphics (Lab)**	**Semester**	**:**	**IV**
Course Code	**:**	**IT4L006**	**Course Type**	**:**	**Compulsory**
Pre-requisite	**:**	**Data Structure and DAA**	**L – T – P**	**:**	**0 – 0– 4**
Stream	**:**	**Core**	**Credits**	**:**	**2**

List of Experiments:

Experiment No.	Aim of Experiments
1	Write a program to draw a rectangle using line function.
2	Write a program to draw a line using DDA's line drawing algorithm.
3	Write a program to draw a line using Bresenham'sline drawing algorithm.
4	Write a program to draw a circle using equation of circle
5	Write a program to draw a circle using Bresenham's circle drawing algorithm.
6	Write a program to draw a line using Cohen Sutherland algorithm
7	Write a program to translate triangle about origin
8	Write a program to fill a circle using flood fill algorithm
9	To design poster using photoshop software.
10	To Create Animated video using photoshop software.

Course Title	**:**	**Database Management Systems (Lab)**	**Semester**	**:**	**IV**
Course Code	**:**	**IT4L007**	**Course Type**	**:**	**Compulsory**
Pre-requisite	**:**	**Data Structures and Algorithms**	**L – T – P**	**:**	**0 – 0– 4**
Stream	**:**	**Core**	**Credits**	**:**	**2**

List of Experiments:

1. Defining schema for applications.
2. Creating tables, Renaming tables, Data constraints (Primary key, Foreign key, Not Null), Data insertion into a table.
3. Grouping data, aggregate functions, Oracle functions (mathematical, character functions).
4. Sub-queries, Set operations, Joins.
5. Creation of databases, writing SQL and PL/SQL queries to retrieve information from the databases.
6. Assignment on Triggers & Cursors.
7. Normal Forms: First, Second, Third and Boyce Codd Normal Forms.
8. Assignment in Design and Implementation of Database systems or packages for applications such as office automation, hotel management, hospital management.
9. Deployment of Forms, Reports Normalization, Query Processing Algorithms in the above application project.
10. Large objects – CLOB, NCLOB, BLOB and BFILE.
11. Distributed data base Management, creating web-page interfaces for database applications using servlet.

Course Title	**:**	**Cyber Security & Cryptography (Lab)**	**Semester**	**:**	**IV**
Course Code	**:**	**IT4T008**	**Course Type**	**:**	**Compulsory**
Pre-requisite	**:**	**C/C++ programming in Linux environment**	**L – T – P**	**:**	**0 – 0– 4**
Stream	**:**	**Core**	**Credits**	**:**	**2**

Objectives

The objective of the course is to give the students hands on experience on implementing different ciphers (algorithms) and simulation of some cryptographic protocols. The laboratory experiments shall cover some of the topics covered in the theory syllabus.

List of Experiments

1	Implementation of Caesar, Multiplicative, Affine ciphers
2	Implementation of Playfair, Vigenere cipher , Hill cipher
3	Implementation of Symmetric and Asymmetric cryptograph
4	Implementation of ECC algorithm
5	Implementation of Cryptographic Hash functions
6	Implementation of Digital Signature Algo
7	Implementation of Elliptic Curve Digital Signature Algorithm(ECDSA)
8	Implementation of Cyber Forensics tools for Disk Imaging, Data acquisition, Data extraction and Data Analysis and recovery.

Text Books:

T1. Douglas R. Stinson, ***Cryptography: Theory and Practice***, 3rd Edition, CRC press, 2005
T2. Charles P. Pfleeger, Shari L. Pfleeger, and Jonathan Margulies, ***Security in Computing***, 5th Edition, Prentice Hall, 2015

Reference Books:

R1. William Stallings, ***Cryptography and Network Security: Principles and Practice***, 6th Edition, Pearson, 2014
R2. B. A. Forouzan, D. Mukhopadhaya, ***Cryptography and Network Security***, 2nd Edition, McGraw Hill, 2010
R3. Alfred J. Menezes, Paul C. van Oorschot, Scott A. Vanstone, ***Handbook of Applied Cryptography***, 1st Edition, CRC press, 1996
R4. Bruce Schneier, ***Applied Cryptography: Protocols, Algorithms, and Source Code in C***, 2nd Edition, Wiley, 2007

Online Reference Materials:

1. A Survey of Web Security: https://www.cs.bgu.ac.il/~dsec121/wiki.files/j21.pdf
2. Network Security: A Simple Guide to Firewalls : www.uky.edu/~dsianita/390/firewall1.pdf