SEMESTER I

Course Title	**Data Structure and Problem Solving Using C**							
Course Type	Hard Core	***Total Hours***	48	Hours / Week		03	***Credits***	03
							(L : T : P)	(3 : 0 : 0)
Course Code		***Evaluation***	***Internal***	C1 + C2 = 15 + 15			30 Marks	100 Marks
			External	C3	***Duration***	03 Hours	70 Marks	

COURSE PREREQUISITE

1. Basic understanding of programming concepts (preferably in C).
2. Familiarity with basic mathematical concepts, such as logic and set theory.
3. Introductory knowledge of computer systems and memory management.

COURSE OBJECTIVE: This course aims to enable learners:

1. Understand the foundational concepts of C programming and its application in problem-solving.
2. Learn the core data structures such as arrays, stacks, queues, and linked lists and their implementations.
3. Develop efficient algorithms for sorting, searching, and other operations using C.
4. Apply dynamic memory allocation and recursion to solve complex problems.
5. Explore fundamental tree structures and their applications in problem-solving.
6. Gain the ability to analyze and apply data structures in real-world scenarios, focusing on efficiency and optimization.

COURSE OUTCOME (CO): At the end of the course, the student will be able to

COURSE OUTCOMES	
CO1	Demonstrate proficiency in C programming concepts such as arrays, pointers, recursion, and dynamic memory allocation for solving computational problems.
CO2	Implement and apply abstract data types (ADT) such as arrays, strings, stacks, and queues to solve algorithmic problems.
CO3	Analyze and implement stack and queue operations, and understand their applications in expression evaluation, recursion, and algorithmic design.
CO4	Understand and implement linked lists (single, circular, and doubly linked lists) and apply them to practical problems involving dynamic data structures.

CO5	Implement binary trees, binary search trees, and graph data structures, and apply traversal, searching, and sorting techniques to real-world problems.

Course Content

Unit No	**Content**	**Hours**
1	**UNIT I - Introduction and Overview of C Programming** Introduction to C programming, Variables, Data types, Constants, Declarations, Operators, Precedence, Associativity, Order of evaluation. Input and output statements; Control Statements, Arrays – Single dimension, Two-dimensional, Multi-dimensional Arrays, Strings. Functions, Categories of functions. Examples: Pointers, Pointer arithmetic, Call by value, Pointer Expression, Pointer as function arguments, recursion, passing strings to functions, Call by reference, Functions returning pointers, Pointers to functions, Programming Examples. Structures and Unions.	10
2	**UNIT II - Introduction to Data Structures** Abstract Data Types (ADT), Sequences as Value Definitions, ADT for Varying-Length Character Strings, Pointers and Dynamic Memory Allocation (malloc, calloc, realloc, free). Array as ADT, Arrays as Parameters, String as ADT	10
3	**UNIT III - The Stack & Queues** **Stacks:** Definition and Examples, Primitive Operations, Stack as ADT, Representing Stacks, Implementing pop and push. Infix, Postfix, and Prefix Expressions. Applications of Stacks: Expression Evaluation and Conversion, Recursion, Binary Search, Towers of Hanoi **Queues:** Sequential Representation, Queue as ADT, Priority Queue, Circular Queue, Double Ended Queue.	10
4	**UNIT IV - Linked Lists** Linked Lists: Inserting/Removing Nodes, Linked Implementations of Stacks and Queues, Circular Lists, Doubly Linked Lists, Applications of Linked Lists (Stacks, Queues, Deques).	10
5	**UNIT V - Trees** **Trees:** Binary Tree, Properties of binary tree, Representation of binary tree, Common Binary Tree operations. Binary Search Tree-Definitions, ADT, Binary search Tree operations and implementation.	8

Reference Books

1. "Programming in ANSI C", Third Edition, E. Balaguruswamy. 6th Edition (2013).
2. "The complete reference C", Herbert Schildt, Fifth Edition, Tata McGraw Hill.
3. "Problem Solving With C", M T Somashekara, Eastern Economy Edition.

SEMESTER I

Course Title	**Operating System and Linux**							
Course Type	Hard Core	***Total Hours***	52	Hours / Week		04	***Credits***	04
							(L : T : P)	(3 : 1 : 0)
Course Code		***Evaluation***	***Internal***	C1 + C2 = 15 + 15			30 Marks	100 Marks
			External	C3	***Duration***	03 Hours	70 Marks	

COURSE PREREQUISITE: NIL

COURSE OBJECTIVE: This course aims to enable learners:

1. To understand the basic structure of the operating system.
2. To acquire the knowledge of processes and threads.
3. To develop skills to manage memory and other resources.
4. To understand the structure of files and directories and to understand the various storage techniques.
5. To understand the various security issues and to acquire the knowledge of Linux operating systems.

COURSE OUTCOME (CO): At the end of the course, the student will be able to

COURSE OUTCOMES	
CO1	Recognize the structure of the operating system, interaction of an operating system and application programs.
CO2	Analyze the various programming paradigms viz. multi-process and multi-threaded programming.
CO3	Examine the various resources and memory management techniques.
CO4	Examine the file system and various storage techniques .
CO5	Identify current issues in system security; demonstrate various factors can influence the overall performance of an operating system.

Course Content

Unit No	Content	Hours
1	**UNIT-I-Computer and Operating Systems Structure:** Basic Elements, Processor Registers, Instruction Execution, The Memory Hierarchy, Cache Memory, I/O Communication Techniques, Introduction to Operating System, Mainframe Systems, Desktop Systems, Multiprocessor Systems, Distributed Systems, Clustered Systems, Real - Time Systems, Handheld Systems, Feature Migration, Computing Environments. System Structures: System Components, Operating–System Services, System Calls, System Programs, System Structure, Virtual Machines, System Design and Implementation, System Generation	12
2	**UNIT-II-Process Management and Mutual Execution:** Process, Process States, Process Description, Process Control, Execution of the Operating System, Security Issues, Processes and Threads, Symmetric Multiprocessing(SMP), Micro kernels, CPU Scheduler and Scheduling. Principles of Concurrency, Mutual Exclusion: Hardware Support.	10
3	**UNIT-III- Deadlock and Memory Management:** Principles of Deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, An Integrated Deadlock Strategy, Dining Philosophers Problem Memory Management: Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with Paging, Demand Paging, Process Creation, Page Replacement, Allocation of Frames, Thrashing	10
4	**UNIT-IV-File System and Secondary Storage:** File Concept, Access Methods, Directory Structure, File System Mounting, File Sharing, Protection, File – System Structure, File – System Implementation, Directory Implementation, Allocation Methods, Free–Space Management**,** Disk Structure, Disk Scheduling, Disk Management.	10
5	**UNIT-V- Computer Security and Shell Programming:** The Security Problem, User Authentication, Program Threats, System Threats. Linux System Linux history, Design Principles, Kernel modules, Process, management, scheduling, Memory management, File systems, Input and output, Inter-process communications. Shell Programming: Introduction, Shell as a Programming Language, Types of shells, shell syntax, pipes and Redirection, Environment variables, working with files.	10

Reference Books

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 8th edition, Wiley India, 2009.
2. William Stallings, “Operating System Internals and Design Principles” Pearson, 6th edition, 2012
3. Daniel P.Bovet & Macro Cesati(2006). Understanding Linux Kernel (3rd edition), O’reily Series
4. MichaelBeck, Harald Bohme, Robert Magnus, DirkVerwoner.(2002).LinuxKernelProgramming Pearson Education Ltd.

SEMESTER I

<table>
<tr><td><b><i>Course Title</i></b></td><td colspan="9"><b>Computer Networks</b></td></tr>
<tr><td rowspan="2"><b><i>Course Type</i></b></td><td rowspan="2">Hard Core</td><td rowspan="2"><b><i>Total Hours</i></b></td><td rowspan="2">48</td><td rowspan="2" colspan="2">Hours / Week</td><td rowspan="2">03</td><td><b><i>Credits</i></b></td><td colspan="2">03</td></tr>
<tr><td><b><i>(L : T : P)</i></b></td><td colspan="2">(3 : 0 : 0)</td></tr>
<tr><td rowspan="2"><b><i>Course Code</i></b></td><td rowspan="2"></td><td rowspan="2"><b><i>Evaluation</i></b></td><td><b><i>Internal</i></b></td><td colspan="3">C1 + C2 = 15 + 15</td><td>30 Marks</td><td rowspan="2" colspan="2">100 Marks</td></tr>
<tr><td><b><i>External</i></b></td><td>C3</td><td><b><i>Duration</i></b></td><td>03 Hours</td><td>70 Marks</td></tr>
</table>

COURSE PREREQUISITE

1. Basic Understanding of Computer Hardware and Software
2. Familiarity with Operating Systems
3. Problem Solving and Analytical skills
4. Basic programming Skills
5. Familiarity with mathematical concepts, such as logic , Different number systems

COURSE OBJECTIVE: This course aims to enable learners:

1. To familiarize the fundamental concepts of computer networking models.
2. To understand different components of computer networks and various protocols with their applications
3. To understand basics of Cryptography and methods to secure a message over insecure channels by various classical encryption techniques.
4. To learn about modern cryptographic techniques
5. such as DES, AES and Secure Hash Algorithms(SHA)
6. Analyze various symmetric ciphers and data integrity algorithms.

COURSE OUTCOME (CO): At the end of the course, the student will be able to

COURSE OUTCOMES	
CO1	Explore the basic concepts, principles and techniques of Data Communication along with the layers of OSI and TCP / IP models.
CO2	Discuss various error detection and correction techniques in data link layer and analyze the performance of network layer
CO3	Demonstrate the services of transport layer and the basic concepts of Application-Layer Paradigms.
CO4	Explore the fundamental concepts of Cryptography by applying various Encryption techniques.

CO5	Analyze various symmetric ciphers and data integrity algorithms.

Unit No	Course Content	Hours
1	**UNIT-I: Basics of Data Communications and Physical Layer** Data Communications , Components, Data Representation, Data Flow Networks; Network Criteria, Physical Structures. Network Types: LAN, WAN, Switching. Network Models: Protocol Layering: Scenarios , Principles of Protocol Layering, Logical Connections. TCP/IP Protocol Suite: Layered Architecture, Layers in the TCP/IP Protocol Suite, Description of each layer, Encapsulation and Decapsulation , Addressing, Multiplexing and De- multiplexing, The OSI Model. Introduction to Physical Layer: Data and Signals: Analog and Digital data , Analog and Digital Signals ,Periodic and Non Periodic. Periodic Analog Signals: Sine wave , Phase , Wavelength , Time and frequency domains , Bandwidth , Digital Signals : Bit Rate, Bit length. Transmission Impairment, Data Rate Limits, Performance	10
2	**UNIT-II- Data Link Layer and Network Layer** Introduction to Data-Link Layer, Link-Layer Addressing: Address Resolution Protocol (ARP). Error Detection and Correction: Introduction, Types of Errors, Redundancy, Detection versus Correction, Coding, Block coding , Cyclic Codes : Cyclic redundancy check. Introduction to Network Layer, Network-Layer Services: Packetizing, Routing and Forwarding, Other services, Packet Switching: Datagram Approach, Virtual-Circuit Approach, Network Layer performance, Routing Algorithm: Distance Vector Routing , Congestion Control Algorithm : Leaky bucket algorithm	10
3	**UNIT-III-Transport layer and Application layer** Introduction to Transport-Layer: Transport- Layer Services.Transport-Layer Protocols: Simple Protocol, FSMs, Stop & wait Protocol, FSMs, Go Back N Protocol and Selective repeat Protocol. Introduction to Application Layer, Providing Services, Application-Layer Paradigms, , Client Server Programming. World Wide Web and HTTP: FTP: Two Connections, Control Connection, Data Connection, Domain Name System (DNS): Name Space, DNS on the Internet, Resolution. Self-Learning Component: Caching, Resource Records, DNS Messages, Registrars , DDNS, Security of DNS.	10
4	**UNIT-IV-Introduction to Cryptography** Security Goals , Attacks, Services & techniques , Security Mechanisms, Model for Network Security, Standards, Classical Encryption techniques, Traditional block cipher structure, DES, DES Example.	10

5	**UNIT-V- Asymmetric Ciphers and Data Integrity Algorithms** Principles of Public-key Cryptosystems, RSA Algorithms, Diffie-Hellman Key exchange, Applications of Cryptographic hash functions, two simple hash functions, Hash functions based on Cipher block chaining, Secure hash Algorithm(SHA), Message Authentication Requirement, Message authentication Functions, Message authentication codes.	8

Reference Books:

1. B. A. Forouzan, “Data Communications and Networking”, 5th Edition, McGraw Hill Education (India) Private Limited, 2016.
2. William Stallings, “Cryptography and Network Security”, 7th Edition, Pearson, 2018
3. William Stallings, Data and Computer Communications, 10th Edition, Pearson, 2015.
4. Behrouz A. Forouzan, “Cryptography and Network Security”, Tata McGraw-Hill Publishing, 2010.

SEMESTER I

Course Title	**Computer Organization and Architecture**							
Course Type	Hard Core	*Total Hours*	52	Hours / Week		04	*Credits*	04
							(L : T : P)	(3 : 1 : 0)
Course Code		*Evaluation*	*Internal*	C1 + C2 = 15 + 15			30 Marks	100 Marks
			External	C3	*Duration*	03 Hours	70 Marks	

COURSE PREREQUISITE:

1. Problem Solving and Analytical skills
2. Familiarity with Fundamental mathematical concepts, such as logic , Different number systems etc.

COURSE OBJECTIVE: This course aims to enable learners

1. To understand the basic structure and operation of a digital computer.
2. Study different number system representation and conversion from one number system to another and Boolean algebra.
3. To Learn the working of flip-flops, logical gates, multiplexers, and adders.
4. Study the memory system, cache memories and virtual memory.
5. Explain the different ways of communicating with I/O devices and standard I/O interfaces.

COURSE OUTCOME (CO): At the end of the course, the student will be able to

COURSE OUTCOMES	
CO1	Understand the basics of Combinational logic.
CO2	Realize the concept of Computer System Organization
CO3	Knowledge about Assembly Language & concepts of Input/output Organization.
CO4	Implement Assembly language programming concepts
CO5	Analyze the Performance of Memory System and Memory Management . Analyze the performance benchmarks .

Unit No	Course Content	Hours
1	**UNIT- I -Binary Systems and Combinational Logic** Digital Computers and Digital Systems, Binary Numbers, Number Base Conversion, Octal and Hexadecimal Numbers, subtraction using r's and r-1 complements, Binary Code, Binary Storage and Registers, Binary Logic, Integrated Circuits. Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Canonical and Standard Forms, Other Logic Operations, Digital Logic Gates, The map Method, Two – and Three – Variable Maps, Four – Variables Map.	12
2	**UNIT- II-Arithmetic Circuits and Sequential Logic:** NAND and NOR Implementation, Other Two- Level Implementations, Don't Care Conditions. Introduction, Adders, Subtractors, Binary Parallel Adder, Decimal Adder, Magnitude Comparator, Decoders, Multiplexers, BOOTH algorithm for signed numbers with example. Sequential Logic: Introduction, different types of Flip – Flops, Triggering of Flip- Flops.	10
3	**UNIT- III -Assembly Language and Input /Output Organization:** Computer types , functional units , basic operational concepts , Bus structure , software , Performance. Multiprocessing and Multi computers, Machine Instruction: Memory Locations and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes.	10
4	**UNIT- IV- Assembly Language Programming & Accessing I/O Devices** Basics of Assembly Language Program, Examples from Assembly Language Programming. Accessing I/O Devices, Interrupts, Enabling & Disabling Interrupts, Handling Multiple devices.	10
5	**UNIT- V- The Memory System and Performance Evaluation** Basic Concepts, Semiconductor RAM Memories, Internal organization of memory chips, static memories, dynamic RAM, Synchronous D-RAM, Structure of larger Memories. Read – Only Memories, Speed, Size, and Cost, Cache Memories, Virtual Memories, Memory Management Requirements. Performance evaluation-SPEC marks, Transaction Processing benchmarks.	10

Reference Books

1. M.Morris Mano, “Digital Logic and Computer Design”, Pearson, 2012.
2. CarlHamacher, Zvonko Vranesic Safwat Zaky, ”Computer Organization”, 5th edition, TataMcGraw-Hill, 2011
3. Soumitrs Kumar Mandal,“Digital Electronics Principles and Applications”, Tata McGraw-Hill,2010

SEMESTER I

<table>
<tr><td>Course Title</td><td colspan="8">Data Structure and Problem Solving Using C Laboratory</td></tr>
<tr><td rowspan="2">Course Type</td><td rowspan="2">Hard Core</td><td rowspan="2">Total Hours</td><td rowspan="2">24</td><td rowspan="2" colspan="2">Hours / Week</td><td rowspan="2">01</td><td>Credits</td><td>01</td></tr>
<tr><td>(L : T : P)</td><td>(0 : 0 : 1)</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2"></td><td rowspan="2">Evaluation</td><td>Internal</td><td colspan="3">C1 + C2 = 15 + 15</td><td>30 Marks</td><td rowspan="2">100 Marks</td></tr>
<tr><td>External</td><td>C3</td><td>Duration</td><td>03 Hours</td><td>70 Marks</td></tr>
</table>

COURSE PREREQUISITE

1. Basic understanding of C programming concepts such as variables, data types, loops, and functions.
2. Familiarity with fundamental problem-solving techniques.
3. Knowledge of basic mathematics, including logic and set theory.

COURSE OBJECTIVE: This course aims to enable learners:

1. Provide hands-on experience in implementing core data structures such as arrays, stacks, queues, linked lists, trees, and heaps using C programming.
2. Enable students to develop problem-solving skills by applying data structures to real-world applications.
3. Strengthen understanding of dynamic memory allocation and recursion through practical implementation.
4. Implement efficient algorithms for searching, sorting, and expression evaluation in C.
5. Familiarize students with advanced topics like binary trees, heaps, and searching techniques, preparing them for complex computational problems.

COURSE OUTCOME (CO)

COURSE OUTCOMES	
CO1	Implement fundamental C programming concepts such as arrays, functions, pointers, and dynamic memory allocation in solving computational problems.
CO2	Develop and implement various data structures such as stacks, queues, and linked lists to solve algorithmic challenges.
CO3	Apply sorting, searching, and tree traversal techniques to solve complex data manipulation problems.
CO4	Analyze and solve real-world problems using binary trees, heaps, and recursion.

CO5	Evaluate and implement efficient algorithms for expression evaluation, including infix to postfix conversion and postfix evaluation.

Course Content

1. Program to calculate the mean, median, LCM, GCD, minimum, and maximum of a set of numbers.
2. Program to calculate the salary of an employee given basic pay, HRA, TA, and IT deductions.
3. Program to solve a quadratic equation and find its roots.
4. Program to calculate the average marks of students using arrays and structures.
5. Program to perform matrix operations (addition and multiplication).
6. Program to implement dynamic memory allocation using `malloc`, `calloc`, `realloc`, and `free`.
7. Program to evaluate the validity of a mathematical expression (balanced parentheses).
8. Program to evaluate a postfix expression.
9. Program to convert an infix expression to postfix.
10. Program to implement multiple stacks of integers.
11. Program to perform basic operations on a queue of integers (enqueue, dequeue, handling overflow/underflow).
12. Program to implement a circular queue for storing student information (registration number, course title, year).
13. Program to implement a double-ended queue (deque) with insertion and deletion at both ends.
14. Program to implement stack operations using a linked list (push, pop, display).
15. Program to implement queue operations using a linked list (enqueue, dequeue, display).
16. Program to create a student mark list based on rank, with student-id, name, and total marks.
17. Program to perform the following operations on a singly linked list:
    a. Insertion (at front, rear, and based on position).
    b. Deletion (at front, rear, and based on position).
    c. Display, replace, and swap nodes.
18. Program to perform the following operations on a doubly linked list:
    a. Insertion (at beginning, end, and in between).
    b. Deletion (at beginning, end, and in between).
    c. Display and swap nodes.
19. Program to represent a binary tree using an array and perform the following operations:
    a. Print left and right child of a specified node.
    b. Print ancestors, nodes at specific levels, and leaf nodes.
20. Program to represent a binary tree using a linked list and perform the same operations as the array-based tree.

21. Program to traverse a binary tree using recursive routines:
    a. Pre-order traversal, In-order traversal and Post-order traversal.
22. Program to construct a heap and sort it using heap sort.
23. Program to perform linear search on a dataset.
24. Program to perform binary search on a sorted array of integers.

SEMESTER I

Course Title	**Computer Networks Laboratory**							
Course Type	Hard Core	***Total Hours***	24	Hours / Week		01	***Credits***	01
							(L : T : P)	(0 : 0 : 1)
Course Code		***Evaluation***	***Internal***	C1 + C2 = 15 + 15			30 Marks	100 Marks
			External	C3	***Duration***	03 Hours	70 Marks	

COURSE PREREQUISITE

1. Basic Understanding of Computer Hardware and Software
2. Familiarity with Operating Systems
3. Problem Solving and Analytical skills
4. Basic programming Skills
5. Familiarity with mathematical concepts, such as logic , Different number systems

COURSE OBJECTIVE: This course aims to enable learners:

1. To understand the working principle of various communication protocols.
2. To analyze the various routing algorithms
3. To know the concept of data transfer between nodes

COURSE OUTCOME (CO)

COURSE OUTCOMES	
CO1	To understand the working principle of various communication protocols.
CO2	To analyze the various routing algorithms
CO3	To know the concept of data transfer between nodes

LIST OF LAB PROGRAMS

PART A

1. Write a program for a distance vector algorithm to find a suitable path for transmission.
2. Using TCP/IP sockets, write a client-server program to make the client send the file name and to make the server send back the contents of the requested file if present.
3. Write a program for Hamming code generation for error detection and correction.
4. Write a Program for error detection using CRC
5. Write a program for congestion control using a leaky bucket algorithm.
6. Implement RSA algorithm to illustrate Encryption & Decryption.

PART B

Introduction to NS2

1. Simulate a three node point — to — point network with duplex links between them. Set the queue size and vary the bandwidth and find the number of packets dropped.
2. Simulate the network with five nodes n0, n1, n2, n3, n4, forming a star topology. The node n4 is at the center. Node n0 is a TCP source, which transmits packets to node n3(a TCP sink) through the node n4. Node n1 is another traffic source, and sends UDP packets to node n2 through n4. The duration of the simulation time is 10 seconds
3. Simulate to study transmission of packets over Ethernet LAN and determine the number of packets drop at destination
4. Simulate the different types of internet traffic such as FTP and TELNET over a wired network and analyze the packet drop and packet delivery ratio in the network.
5. Simulate the transmission of ping messages over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.

   Note : Students may be asked to simulate other protocols and analyze the working.

SEMESTER I

Course Title	**Mathematical Foundations for Computer Science**							
Course Type	Soft Core	***Total Hours***	52	Hours / Week		04	***Credits***	04
							(L : T : P)	(3 : 1 : 0)
Course Code		***Evaluation***	***Internal***	C1 + C2 = 15 + 15			30 Marks	100 Marks
			External	C3	***Duration***	03 Hours	70 Marks	

COURSE PREREQUISITE: NIL

COURSE OBJECTIVE: This course aims to enable learners:

1. To analyze statistical data through different techniques
2. To understand various types of errors in numerical computations and different operations on matrices.
3. To study the different techniques to solve linear equations.
4. To use the properties of relations and functions in real life problems.
5. To understand the applications of graphs and trees in solving problems.

COURSE OUTCOME (CO): At the end of the course, the student will be able to

COURSE OUTCOMES	
CO1	Implement statistical measures and explore its applications
CO2	Analysis of computational errors and design of algorithms to solve a set of linear equations.
CO3	Applying the concepts of vector and linear functions in real time applications.
CO4	Apply the notion of relations on finite structures, like strings and analyze algorithms using the concept of functions.
CO5	Explore the properties of Graph theory and its applications in computer science.

Course Content

Unit No	Content	Hours
1	**UNIT- I-Statistics** Univariate data – different measures of location, dispersion, relative dispersion, skewness and kurtosis, Moments, Measures based on them – comparison with moment measures, Correlation and Regression Analysis.	12
2	**UNIT- II-Number Systems and Vector & Matrix Algebra** Errors in Numerical Computations, Types of Errors, Analysis and Estimation of Errors, Vector Algebra: Vector spaces with real field, Basis and dimension of a vector space, Orthogonal vectors, Properties of Matrices and Determinants: Matrix Operations, Elementary Matrices, Inverse Matrix, Diagonal Matrix, Symmetric Matrix, and Determinant Matrix.	10
3	**UNIT- III-Linear Algebraic Systems** Numerical methods for Linear Systems, Direct Methods for Linear Systems: Cramer's Rule, Gauss Elimination Method, Gauss Jordan Elimination Method, Pivoting Strategies, Gauss- Jordon Method, LU Decomposition Method, Tridiagonal Systems of Linear Equations, Iterative Methods for Solving Linear Systems, Jacobis Iteration Method, Gauss-Seidel Iterative Method, Convergence Criteria, EigenValues and EigenVectors.	10
4	**UNIT- IV-Relations and Functions** Cartesian products and Relations, Properties of Relations, Functions: Plain and One-to-One, Onto Functions: Stirling Numbers and the Second Kind, Special functions, The Pigeon-hole principle, Function composition and inverse functions.	10
5	**UNIT- V-Graph Theory** Definitions and Examples, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree: Euler Trails and Circuits, Planar Graphs, Hamilton Paths and Cycles, Graph Coloring and Chromatic Polynomials.	10

Reference Books

1. Sant Sharan Mishra, “Computer Oriented Numerical and Statistical Methods”, PHI Learning Private Limited, 2013.
2. Rizwan Butt, “Introduction to Numerical Analysis Using Matlab”, Infinity Science Press LLC, 2008
3. Ralph P Grimaldi, B.V.Ramana, “Discrete & Combinatorial Mathematics, An Applied Introduction” 5th Edition, Pearson Education, 2009.
4. D.S. Chandrasekharaiah, Discrete Mathematical Structures, 4th Edition, PRISM Pvt. Ltd. 2012.
5. Bondy and U.S.R.Murty: Graph Theory and Applications (Freely downloadable from Bondy's website; Google-Bondy)
6. S. Kumarsean, “Linear Algebra A geometric approach”, Prentice Hall of India Private Limited, 2001
7. Kenneth H Rosen, “Discrete Mathematics & its Applications" 7th edition, McGraw- Hill, 2010.

SEMESTER I

<table>
<tr><td><b><i>Course Title</i></b></td><td colspan="8"><b>Business Systems</b></td></tr>
<tr><td rowspan="2"><b><i>Course Type</i></b></td><td rowspan="2">Soft Core</td><td rowspan="2"><b><i>Total Hours</i></b></td><td rowspan="2">52</td><td rowspan="2" colspan="2">Hours / Week</td><td rowspan="2">04</td><td><b><i>Credits</i></b></td><td>04</td></tr>
<tr><td><b><i>(L : T : P)</i></b></td><td>(3 : 1 : 0)</td></tr>
<tr><td rowspan="2"><b><i>Course Code</i></b></td><td rowspan="2"></td><td rowspan="2"><b><i>Evaluation</i></b></td><td><b><i>Internal</i></b></td><td colspan="3">C1 + C2 = 15 + 15</td><td>30 Marks</td><td rowspan="2">100 Marks</td></tr>
<tr><td><b><i>External</i></b></td><td>C3</td><td><b><i>Duration</i></b></td><td>03 Hours</td><td>70 Marks</td></tr>
</table>

COURSE PREREQUISITE

1. Basic understanding of information technology and business principles.
2. Familiarity with management practices and organizational structures.
3. Introductory knowledge of e-business systems (Recommended).

COURSE OBJECTIVE: This course aims to enable learners:

1. Provide an in-depth understanding of the role of information systems (IS) in modern businesses.
2. Explore the integration of information technology (IT) with business strategies and processes.
3. Enable students to develop IT-driven solutions for business challenges and opportunities.
4. Introduce key concepts in e-business and the integration of business processes through information systems.
5. Equip students with skills to analyze and design business/IT strategies for improving business operations.

COURSE OUTCOME (CO): At the end of the course, the student will be able to

COURSE OUTCOMES	
CO1	Understand the fundamental role of information systems in enhancing business operations and decision-making.
CO2	Analyze the managerial challenges associated with implementing information technology in business environments.
CO3	Apply strategic planning techniques such as SWOT analysis and business/IT architecture planning to align IT solutions with business goals.
CO4	Design and evaluate cross-functional enterprise applications, including transaction processing systems and enterprise collaboration systems.

CO5	Explore the role of e-business systems in areas such as marketing, human resources, accounting, and financial management.

Course Content

Unit No	Content	Hours
1	**UNIT I - Information Systems in Business** The fundamental roles of information systems in business, Trends in information systems, The role of e-business in business, Types of information systems (Operations Support Systems, Management Support Systems), Other classifications of information systems.	12
2	**UNIT II - Information Technology in Business** Managerial challenges of information technology, Components of information systems, Information system resources, Information system activities, Recognizing information systems.	10
3	**UNIT III - Developing Business/IT Strategies** Planning fundamentals, Organizational planning: Scenario approach, SWOT analysis, Business models and planning, Business/IT architecture planning, Identifying business/IT strategies, Business application planning, Change management.	10
4	**UNIT IV - Designing Business/IT Solutions** Introduction to cross-functional enterprise applications, Enterprise application integration, Transaction processing systems, Enterprise collaboration systems.	10
5	**UNIT V - e-Business Systems** Information technology in business, Marketing systems, Manufacturing systems, Human resource systems, Accounting systems, Financial management systems.	10

Reference Books

1. James A. O’Brien and George M. Marakas, "Management Information System", Tenth Edition, Tata McGraw Hill, 2013.
2. W.S. Jawadekar, "Management Information Systems", Tata McGraw Hill Private Limited, New Delhi, 2009.