SCHEME FOR EXAMINATION
B.TECH (FOUR YEAR) DEGREE COURSE
SECOND YEAR, INFORMATION TECHNOLOGY
SEMESTER III
EFFECTIVE FROM SESSION 2023-24 (NEP)

SL. NO.	SUBJECT CODE	SUBJECTS	PERIODS/ WEEK			EVALUATION SCHEME			CREDITS
			L	T	P	IA	ESE	TOTAL	
THEORY									
1	ITUCTT1	DATA STRUCTURE & ALGORITHMS	3	0	0	40	60	100	3
2	ITUCTT2	OBJECT ORIENTED PROGRAMMING	3	1	0	40	60	100	4
3	ITUCTT3	DIGITAL ELECTRONICS	3	0	0	40	60	100	3
4	ITUCTE1	MATHEMATICS-III	3	0	0	40	60	100	3
5	ITUCTKX	DEPARTMENT ELECTIVE-I	3	0	0	40	60	100	3
6		INSTITUTE CORE-I	3	0	0	40	60	100	3
PRACTICAL									
1	ITUCLT1	DATA STRUCTURE LAB	0	0	3	25	25	50	1.5
2	ITUCLT2	OBJECT ORIENTED PROGRAMMING WITH C++ LAB	0	0	3	25	25	50	1.5
TOTAL CREDITS									**22**
IA- INTERNAL ASSESSMENT, ESE-END SEMESTER EXAMINATION, L-LECTURE, T-TUTORIAL, P-PRACTICAL									

LIST OF DEPARTMENT ELECTIVE-I

1	ITUCTK1	COMPUTER ORGANIZATION & ARCHITECTURE
2	ITUCTK2	SOFTWARE ENGINEERING
3.	ITUCTK3	MULTIMEDIA SYSTEM DESIGN

LIST OF INSTITUTE CORE-I

1	ITUCTO1	COMPUTER ORGANIZATION & ARCHITECTURE (Not for IT)
2	CSUCTO1	DATA STRUCTURE WITH C++
3	ECUCTO1	DATA COMMUNICATION
4	CEUCTO1	GREEN BUILDINGS
5	CHUCTO1	ENGINEERING MATERIALS
6	MEUCTO1	INTRODUCTION TO THERMODYNAMICS
7	IPUCTO1	I.C. ENGINE

SUB CODE	L	T	P	DURATION/WEEK	IA	ESE	CREDITS
ITUCLT1	0	0	3	3 HOURS	25	25	1.5

DATA STURCTURE LAB

Course Objective

1. Understand and remember algorithms and its analysis procedure.
2. Introduce the concept of data structures through ADT including List, Stack, Queues.
3. To design and implement various data structure algorithms.
4. To develop application using data structure algorithms.
5. Compute the complexity of various algorithms.

List of Practical's

1. Write a C program for declaration, assignment, and accessing the arrays elements.
2. Write a C Program to Find Average Marks obtained by a class of 30 Students in a Test.
3. Write a C program to perform Array Insertion Operation.
4. Write a C program to perform Array Deletion Operation.
5. Write a C program to implement Linear Search.
6. Write a C program to implement Binary Search.
7. Write a C program to implement Bubble Sort.
8. Write a C program to implement Merging operation.
9. Write a program in C to create and display Singly Linked List.
10. Write a program in C to create a singly linked list of n nodes and count the number of nodes.
11. Write a program in C to insert a new node at the beginning of a Singly Linked List.
12. Write a program in C to insert a new node at the end of a Singly Linked List.
13. Write a program in C to insert a new node after a given location of Singly Linked List.
14. Write a program in C to delete first node of Singly Linked List.
15. Write a program in C to delete the last node of Singly Linked List.
16. Write a program in C to delete a node from the middle of Singly Linked List.
17. Write a program in C to search an existing element in a singly linked list.
18. Write C programs to implement the stack push operation using an array.
19. Write C programs to implement the stack pop operation using an array.

References books:

1. Lipschutz, "Data Structures with C" Schaum's Outline Series, TMH.
2. Horowitz and Sahani, "Fundamentals of data Structures", Galgotia Publication Pvt. Ltd.
3. R. Kruse etal, "Data Structures and Program Design in C", Pearson Education Asia.
4. A. M. Tenenbaum, "Data Structures using C & C++", Prentice-Hall of India Pvt. Ltd.
5. K Loudon, "Mastering Algorithms with C", Shroff Publisher & Distributors Pvt. Ltd.
6. Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with applications", McGraw Hill.
7. G A V Pai, "Data Structures and Algorithms", TMH.
8. G.S.Baluja, "Data Structures through C", Dhanpat Rai & Co.
9. Yashavant Kanetkar, "Data Structure Through C", BPB Publication.

Course Outcome

At the end of this lab session, the student will

1. Design programs using a variety of data structures such as Stacks, Queues, Array, Binary Trees, and Linked List.
2. Analyze and implement various kinds of searching and sorting techniques.

3. Have practical knowledge on the applications of data structures.
4. Design and analyze complexity of different algorithms.
5. Design advance data structure using non linear data structure.

SUB CODE	L	T	P	DURATION	IA	ESE	CREDITS
ITUCTT3	3	0	0	3 HOURS	40	60	3

DIGITAL ELECTRONICS

Course Objectives:

1. To understand the basic knowledge of digital logic and components.
2. To simplify the Boolean expressions or Combinational circuits for compact circuits.
3. Design of combinational circuits and sequential circuits.
4. Application of knowledge to understand digital electronics circuits.
5. To impart how to design Digital Circuits.

UNIT 1 - Fundamentals of Digital systems and logic families

Digital signals, digital circuits, AND,OR, NOT, NAND, NOR and Exclusive OR operations, Boolean algebra, examples of IC gates, number systems- binary, signed binary, octal, Hexadecimal number, binary arithmetic, Once's and two's complements, arithmetic codes, error detecting, and correcting codes, characteristics of digital ICs, digital logic families, TTL, schottky TTL and CMOS logic , interfacing CMOS and TTL, Tri-state logic.

UNIT 2 - Combinational Digital Circuits

Standard representation for logic function, K map representation, simplification of logic functions, using K map, minimization of logical functions. Don't care conditions, Multiplexes, De- Multiplexes, / Decoders, Adders, Sub tractors, BCD arithmetic, carry look ahead, serial adders , ALU , elementary ALU design, popular MSI chips , digital comparator , parity checker, / generator, code converters, priority encoders, decoders/ drivers, for display devices, Q-M method of function realization.

UNIT 3 - Sequential circuits and systems

A 1 bit memory, the circuits properties, of Bi-stable latch, the clocked SR flip flop, JK flip flops, T flip flops, D flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counter's design using flip flops, special counter IC's, Asynchronous sequential counters, applications of counters.

UNIT 4 - A/D and D/A converters

Digital to analog converters: weighted registers/ converters, R-2R Ladder, D/A converters , specifications for D /A converters, examples of D /A converter ICs, sample and hold circuits, Analog to digital converters: quantization and encoding, parallel comparator , A/D converter, successive approximation A/D converter, counting A/D converter, dual slop A / D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs.

UNIT 5 - Semiconductor memories and Programmable logic devices

Memory organization and operation, expanding memory size, classification and characteristics of memories, Sequential memories, read-only memory(ROM), read and write memory (RAM), content addressable memory (CAM) , charge coupled device memory (CCD) , commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS) , Field Programmable Gate Array (GPGA).

Text / References:

1. M.M Mano, "Digital logic and Computer design", Pearson Education India.
2. R.P. Jain, " Modern Digital Electronics" , McGraw Hill Education.
3. A kumar, "Fundamentals of Digital Circuits ", Prentice Hall India.
4. S Salivahanan and S Arivazhagan " Digital Circuits and Design" OXFORD University Press.

Course Outcome (COs):

At the end of this course, students will demonstrate the ability to

1. Employ the codes and number systems converting circuits and Compare different types of logic families which are the basic unit of different types of logic gates in the domain of economy, performance and efficiency.
2. Analyze different types of digital electronic circuit using various mapping and logical tools and know the techniques to prepare the most simplified circuit using various mapping and mathematical methods.
3. Design different types of with and without memory element digital electronic circuits for particular operation, within the realm of economic, performance, efficiency, user friendly and environmental constraints.
4. Apply the fundamental knowledge of analog and digital electronics to get different types analog to digitalized signal and vice-versa converters in real world with different changing circumstances.
5. Assess the nomenclature and technology in the area of memory devices and apply the memory devices in different types of digital circuits for real world application.

SUB CODE	L	T	P	DURATION/WEEK	IA	ESE	CREDITS
ITUCTE1	3	0	0	3 HOURS	40	60	3

MATHEMATICS III

Course Objective:

1. The primary objective of the course is to develop the basic understanding of numerical algorithms and skills to implement algorithms to solve mathematical problems on the computer.
2. Adequate exposure to learn alternative methods and analyze mathematical problems to determine the suitable numerical techniques.
3. Grasp the basic elements of numerical methods and error analysis.
4. The main objective of this course is to provide students with an introduction to the field of numerical analysis. Aside from developing competency in the topics and emphases listed above, the course aims to: further develop.
5. To apply problem solving skills through the introduction of numerical methods; provide a ground for applying knowledge acquired in previous mathematics courses; and give students an opportunity to develop and present an independent project.

UNIT-I Introduction of Errors and their Analysis, types of errors, numerical problems on error analysis, curve fitting: method of least squares, fitting of exponential curves $y=ae^{bx}$ fitting of the curve $y = ab^x$ fitting of the curve $y = ax^b$ at Method or moments

UNIT-II Numerical Solution of Algebraic and Transcendental Equations: Graphical method bisection Method, Secant Method, Regula-falsi Method, Newton Raphson Method, Solution of a system of a simultaneous linear algebraic Equations Direct methods: Gauss elimination Method, Gauss Jordan method, Iterative methods, Jacobi Iterative Method. Gauss Seidel Iterative method.

UNIT-III The Calculus of Finite Differences: Finite differences. Difference formula operators and Relation between operators. Inverse Operator, Interpolation with equal intervals: -Newton's forward and backward interpolation formula, Interpolation with Unequal intervals: - Lagrange's interpolation Newton's difference formula, inverse interpolation.

UNIT- IV Numerical Differentiation and Integration: - Numerical Differentiation Newton's forward and Backward difference interpolation formula, Maxima and Minima of a Tabulated function, Numerical Integration :- Trapezoidal rule, simpson's $(1/3)^{rd}$ and $(3/8)^{th}$ rule, Boole's Rule, weddle rule.

Difference Equations: Definition, order and degree of a difference equation. Linear difference Equations, Difference equations reducible to linear form, simultaneous difference equations with Constant coefficients.

UNIT- V Numerical solution of ordinary differential equation: Taylor series method, Euler's Method, Modified Euler method Runge's method, Runge-Kutta method, Numerical method for solution of partial differential equations, General linear partial differential equation, Laplace equation and Poisson equation.

Text Books:

1. JAIN & IYNGAR Numerical Methods for Scientific and Engineering Computations.
2. RAO G.S. Numerical Analysis
3. Grewal B S Numerical Methods In Engineering and Science
4. Das K K Advance Engineering Methods

Reference Books:

1. Rajaraman V Computer Oriented Numerical Methods

2. P. Kandasamy K. Thilagavathy. K Gumavathi, Numerical Methods & Chand & Company, 2nd Edition, Reprint 2012
3. S.S. Sastry, Introduction methods of Numerical Analysis, PHI, 4th Edition, 2005.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Son 2006.

Course Outcomes:

After completion of this course students will be able to:

1. Find Numerical solution of various equations, which may be arising due to mathematical modelling based on engineering problems.
2. Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to intractable mathematical problems.
3. Apply numerical methods to obtain approximate solutions to mathematical problems.
4. Analyse and evaluate the accuracy of common numerical methods.
5. Implement numerical methods in Matlab and Write efficient, well-documented Matlab code and present numerical results in an informative way.

SUB CODE	L	T	P	DURATION	IA	ESE	CREDITS
ITUCLT2	0	0	3	3 HOURS	25	25	1.5

OBJECT ORIENTED PROGRAMMING WITH C++ LAB

Course Objectives:

1. To understand and Practice Programming Construct: Variable, Operators, Control Structures, Loop, Functions, learn the concept of class and object and develop classes for simple applications with C++.
2. To learn how to implement Constructors, copy constructors and destructor functions.
3. To learn how to overload functions and operators in C++.
4. To learn how to design C++ classes for code reuse and perform inheritance.
5. To learn working with files and handle exceptions in program.

List of Experiments:-

1. Write a program to display message using cout statement.
2. Write a program to calculate average of five numbers given by user.
3. Write a program to calculate compound interest given P, R and T.
4. Write a program to calculate factorial of a given number.
5. Write a program to generate n numbers of fibonacii series. Value of n should be provided by user.
6. Write a function to calculate the power of a number raised to another number using function. Write appropriate main() function to read and display the result.
7. Write a function factorial to calculate the factorial of a number, write appropriate main function also.
8. Write a function swap to swap the value of two integer variables. Write appropriate main function for the program.
9. Write a function to perform sorting using bubble sort algorithm. Use arrays to store the list of numbers. Also write main() function to read contents and display output.
10. Write a program to perform overloading of area function.
11. Write a program with overloaded volume function. Use volume function to calculate the volume of a cube, cone, sphere etc.
12. Write a program to calculate simple interest. Use default argument for rate. Write main function to exhibit the use of default argument.
13. Write a program to show the use of return by reference.
14. Write a program with at least one function made as inline.
15. Create a structure data type with data items roll number, name, and total marks.Write main function to read data for two students and also display the stored data.
16. Create a class named 'Student' with a string variable 'name' and an integer variable 'roll no'. Assign the value of roll no as '2' and that of name as "John" by creating an object of the class Student.
17. Write a program to print the area of a rectangle by creating a class named 'Area' having two functions.First function named as ‘readData' takes the length and breadth of the rectangle as parameters and the second function named as ‘calculateArea' returns the area of the rectangle. Length and breadth of the rectangle are entered through keyboard.
18. Write a program that would print the information (name, year of joining, salary, address) of three employees by creating a class named 'Employee'. The output should be as follows:

Name	Year of joining	Address
Ramesh	1994	64-C New Delhi
Sam	2000	68-D Bilaspur
John	1999	26-B-Banglore

19. Define a class to represent a bank account. Include the following members:
    Data members:
    1. Name of the depositor.
    2. Account number.
    3. Type of account.
    4. Balance amount in the account.

Member functions:

1. To assign initial values.
2. To deposit an amount.
3. To withdraw an amount after checking the balance.
4. To display the name and balance.

Write a main program to test the program.

20. Define a class to represent a bank account (FOR 100 CUSTOMERS). Include the following members:
    Data members:
    1. Name of the depositor.
    2. Account number.
    3. Type of account.
    4. Balance amount in the account.

    Member functions:
    1. To assign initial values.
    2. To deposit an amount.
    3. To withdraw an amount after checking the balance.
    4. To display the name and balance.

    Write a main program to test the program.
21. Create two classes DM and DB which store the value of distances. DM stores distances in meters and centimeters and DB in feet and inches. Write a program that can read values for the class objects and add one object of DM with another object of DB. Use friend function to carry out the addition operation. The object that stores result may be a DM object or DB object depending on the units in which result is required.
22. Create a class time to store time in hours and minutes. Write a program that can read values for the class objects and add one object with another object storing the result in third object. Use object as arguments to sum() function and object return type from sum() function to assign the sum to the third object.
23. Write a program to demonstrate the use of Static Keyword. Write a program to print the names of students by creating a Student class. If no name is passed while creating an object of the Student class, then the name should be "Unknown", otherwise the name should be equal to the String value passed while creating the object of the Student class. Use “new” operator to create an instance of “name” member of class.
24. Write a program to add two complex number using a friend function. Use appropriate constructor function to initialize the object.
25. Write a program to initialize an object with another using copy constructor.
26. Write a program to show the highest scorer in a test out of three students who appeared in a exam. Use this pointer to refer to objects.
27. Write a program to show the highest scorer in a test out of three students who appeared in a exam. Use this pointer to refer to objects. (USER INPUT)
28. Write a program to illustrate the creation and destruction of objects.
29. Write a program to illustrate pointer to member and pointer to object concepts of 00P.
30. Create two objects of a class with two integer type members. Compare the two operators have same member values. Using overloaded = operator for comparison.
31. Create a class FLOAT that contains one float data member. Overload all the four arithmetic operators so that they operate on the objects of FLOAT.
32. Write a program to overload << and >> operators to display time object.
33. Write a program to overload <=, >== and == operator to compare time objects.
34. Write a program to perform overloading of function call operator.
35. Write a program to perform overloading of subscripting operator.
36. Write a Program to Concatenate two Strings Using Operator Overloading(+).
37. Write a program to convert time type object to an Integer value and integer type value to object of time type. Use appropriate data type conversion functions to perform the required conversion.
38. Write a program for an inventory of product in store. Use appropriate data type conversion functions to perform the required conversion.

39. Define a class Student with data members as rollno and name. Derive a class Fees from student that has a data member fees and functions to submit fees and generate receipt.. Derive another class Result from Student and display the marks and grade obtained by the student.

Reference Books:

1. Object Oriented Programming with C++ by M. P. Bhave, S. A. Patekar, Pearson Education
2. Object Oriented Programming With C++ by E. Balaguruswamy.
3. Object Oriented Programming in turbo C++ by Robert Lafore.
4. Programming with C++ by D. Ravichandan.
5. Programming with C++ (SOS) by Hubbard.

Course Outcomes:-

1. Understand the C++ language features. Use the control structure and data types in C++. Write simple programs using classes and objects.
2. Understand the concepts of arrays, pointers, references and use of dynamic allocation operators. Write simple programs to implement Constructor & destructor concepts.
3. Understand the concept of Operator overloading and type conversion. Write simple programs using overloaded operators.
4. Understand the concepts of inheritance and virtual functions. Write simple programs to implement inheritance and virtual functions.
5. Understand file handling concepts, generic class and I/O exception handling. Write small programs to implement file handling concepts and exception handling.

SUB CODE	L	T	P	DURATION	IA	ESE	CREDITS
ITUCTT2	3	1	0	4 HOURS	40	60	4

OBJECT ORIENTED PROGRAMMING

Course Objectives:

1. To understand and Practice Programming Construct: Variable, Operators, Control Structures, Loop, Functions, learn the concept of class and object and develop classes for simple applications with C++.
2. To learn how to implement Constructors, copy constructors and destructor functions.
3. To learn how to overload functions and operators in C++.
4. To learn how to design C++ classes for code reuse and perform inheritance.
5. To learn working with files and handle exceptions in program.

UNIT I

Overview of C++: Object oriented programming, Concepts, Advantages, Usage. C++ Environment: Program development environment, the language and the C++ language standards. Introduction to various C++ compilers, C++ standard libraries, Prototype of main() function, Data types. C++ as a superset of C, New style comments, main function in C++, meaning of empty argument list, function prototyping, default arguments and argument matching.

User defined data types: enumerated types, use of tag names, anonymous unions, scope of tag names Classes & Objects : Classes, Structure & Classes, Inline Function, Scope Resolution operator, Static Class Members: Static Data Member, Static Member Function, Passing Objects to Function, Returning Objects, Object Assignment. Friend Function, Friend Classes

UNIT II

Array, Pointers References & The Dynamic Allocation Operators: Array of Objects, Pointers to Object, Type Checking C++ Pointers, The This Pointer, Pointer to Derived Types, Pointer to Class Members, References: Reference Parameter, call by reference and return by reference Passing References to Objects, Returning Reference, Independent Reference, C++'S Dynamic Allocation Operators, Initializing Allocated Memory, Allocating Array, Allocating Objects.

Constructor & Destructor: Introduction, Constructor, access specifies for constructors, and instantiation, Parameterized Constructor, Multiple Constructor in A Class, Constructor with Default Argument, Copy Constructor, Destructor.

UNIT III

Overloading as polymorphism: Function & Operator Overloading : Function Overloading, Overloading Constructor Function Finding the Address of an Overloaded Function, Operator Overloading: Creating A Member Operator Function, Creating Prefix & Postfix Forms of the Increment & Decrement Operation, Overloading The Shorthand Operation (i.e., +=, -= etc), Operator Overloading Restrictions, Operator Overloading Using Friend Function, Overloading Some Special Operators like [ ], ( ), -, Comma Operator, Overloading << etc.

UNIT IV

Inheritance : Base Class Access Control, Inheritance & Protected Members, Protected Base Class Inheritance, Inheriting Multiple Base Classes, Constructors, Destructors & Inheritance, When Constructor & Destructor Function are Executed, Passing Parameters to Base Class Constructors, Granting Access, Virtual Base Classes .

Virtual Functions & Polymorphism: Virtual Function, Pure Virtual Functions, Early Vs. Late Binding.

UNIT V

Working with files: File & stream, Opening and closing a file, read ( ) and write ( ) functions, detecting end of file.

Templates and Exception Handling: Exception handling in C++, try, throw, catch sequence, multiple catch blocks, uncaught exceptions, catch-all exception handler

Reference Books:

1. Object Oriented Programming with C++ by M. P. Bhave, S. A. Patekar, Pearson Education
2. Object Oriented Programming With C++ by E. Balaguruswamy.
3. Object Oriented Programming in turbo C++ by Robert Lafore.
4. Programming with C++ by D. Ravichandan.
5. Programming with C++ (SOS) by Hubbard.

Course Outcomes:-

1. Understand the C++ language features. Use the control structure and data types in C++. Write simple programs using classes and objects.
2. Understand the concepts of arrays, pointers, references and use of dynamic allocation operators. Write simple programs to implement Constructor & destructor concepts.
3. Understand the concept of Operator overloading and type conversion.
4. Understand the concepts of inheritance and virtual functions.
5. Understand file handling concepts, generic class and I/O exception handling.

SUB CODE	L	T	P	DURATION/WEEK	IA	ESE	CREDITS
ITUCTT1	3	0	0	3 HOURS	40	60	3

DATA STURCTURE & ALGORITHMS

Course Objective

1. To impart the basic concepts of data structures and algorithms and understand concepts about searching and sorting techniques.
2. To understand basic concepts about Linked lists and master the implementation of linked data structures.
3. To understand basic concepts about stacks and queues.
4. To understand basic concepts about Tree.
5. To understand basic concepts about Graph and be familiar with some graph algorithms such as shortest path and minimum spanning tree.

UNIT- I

Introduction: Basic Terminology, Definition of Data Structure, Types of Data Structure, Operation on Data Structure, **Arrays:** Array Definition, Representation of Arrays: Row Major Order, and Column Major Order.

Searching and Sorting: Selection Sort, Insertion Sort, Bubble Sort, Quick Sort, Merge Sort, Binary Search, Linear Search.

UNIT II

Linked lists: Definition, Representation and Implementation of Singly Linked Lists, Traversing and Searching of Linked List, Insertion and deletion to/from Linked Lists, Insertion and deletion Algorithms, Doubly Linked List, Circularly Linked List.

UNIT III

Stacks: Array Representation and Implementation of stack, Operations on Stacks: Push & Pop, Array Representation of Stack, Linked Representation of Stack, Operations Associated with Stacks, Application of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack.,

Queue: Array and linked representation of queues, Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, Deques.

UNIT IV

Trees: Basic Technology , Binary Tree , Binary tree representation , Algebraic Expressions , Complete Binary Tree, Extended Binary Tree, Full Binary Tree, Array and linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees, Binary search trees (BST), Insertion and deletion in BST, AVL trees, Heap and heap sort.

UNIT V

Graph: Terminology & Representations, Graphs & Multi-graphs, Directed Graphs, Weighted Graph, Sequential Representations of Graphs, Adjacency Matrices, Adjacency List, Path Matrices, Linked Representations of Graphs, Graph Traversal - DFS, BFS, Shortest Path algorithm: Warshal Algorithm and Dijikstra Algorithm, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal algorithm.

References books:

1. Lipschutz, “Data Structures with C” Schaum’s Outline Series, TMH.
2. Horowitz and Sahani, “Fundamentals of data Structures”, Galgotia Publication Pvt. Ltd.

3. R. Kruse etal, “Data Structures and Program Design in C”, Pearson Education Asia.
4. A. M. Tenenbaum, “Data Structures using C & C++”, Prentice-Hall of India Pvt. Ltd.
5. K Loudon, “Mastering Algorithms with C”, Shroff Publisher & Distributors Pvt. Ltd.
6. Jean Paul Trembley and Paul G. Sorenson, “An Introduction to Data Structures with applications”, McGraw Hill.
7. G A V Pai, “Data Structures and Algorithms”, TMH.
8. G.S.Baluja, “Data Structures through C”, Dhanpat Rai & Co.
9. Yashavant Kanetkar, “Data Structure Through C”, BPB Publication.

Course Outcome

Upon completion of this course, the students will be able to

1. Student will be able to choose appropriate data structure as applied to specified problem definition.
2. Student will be able to handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.
3. Students will be able to apply concepts learned in various domains like DBMS, compiler construction etc.
4. Students will be able to use linear and non-linear data structures like stacks, queues, linked list etc.
5. Students will be able to know about different types of graphs and their applications.

SUB CODE	L	T	P	DURATION/WEEK	IA	ESE	CREDITS
ITUCTK1	3	0	0	3 HOURS	40	60	3

COMPUTER ORGANIZATION & ARCHITECTURE

Course Objectives:

1. Conceptualize the basics of organizational and architectural,
2. Learn about various basic arithmetic operation
3. Learn about various control unit design and Input-output subsystems
4. Understand the basics pipeline.
5. Understand the basics Memory organization and their basic working.

UNIT 1

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU – registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

UNIT 2

Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.

UNIT 3

Introduction to x86 architecture. CPU control unit design: hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU. Memory system design: semiconductor memory technologies, memory organization. Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers – program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces – SCII, USB

UNIT 4

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards. Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

UNIT 5

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

Suggested books:

1. “Computer Organization and Design: The Hardware/Software Interface”, 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
2. “Computer Organization and Embedded Systems”, 6th Edition by Carl Hamacher, McGraw Hill Higher Education.

Suggested reference books:

1. “Computer Architecture and Organization”, 3rd Edition by John P. Hayes, WCB/McGraw-Hill
2. “Computer Organization and Architecture: Designing for Performance”, 10th Edition by William Stallings, Pearson Education.
3. “Computer System Design and Architecture”, 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

Course Outcomes:

After the course the students are expected to be able to

1. Demonstrate computer organization and architecture concepts of a computer system
2. Describe the Computer arithmetic operation algorithm and hardware
3. Understand the basics of hardwired and micro-programmed control of the CPU, Memory, I/O system
4. Describe fundamentals concepts of pipeline and issues
5. Describe the memory hierarchy and related function.

SUB CODE	L	T	P	DURATION	IA	ESE	CREDITS
ITUCTK3	3	0	0	3 HOURS	40	60	3

MULTIMEDIA SYSTEM DESIGN

Course Objectives:

The major goals of this course are:

1. Learn how learning theories influence the development of multimedia product.
2. Develop competencies in designing and creating interactive multimedia applications by explaining how elements of these applications reflect a theory of how learning will occur.
3. Work with all aspects of text, audio, images and video;
4. Learn the phases involved in multimedia planning, design and production.
5. Be able to use various multimedia authoring tools.
6. Be able to design and create interactive multimedia products.

UNIT 1: Introduction to Multimedia System: An overview of multimedia system and media streams architecture and components, synchronization & quality of service (QOS).

UNIT 2: Audio and Speech: Data acquisition, sampling and quantization, human speech, digital model of speech production, analysis and synthesis, psychoacoustics, low bit rate speech compression, MPEG audio compression.

UNIT 3: Images and Video: Image acquisition and representation, bi-level image compression standards: ITU (formerly CCITT) Group III and IV standards, JPEG image compression standards, MPEG, H.264/AVC video compression standards, Transcoding.

UNIT 4: Multimedia Communication: Fundamentals of data communication and networking, Bandwidth requirements of different media, Real time constraints: latency, video data rate, multimedia over LAN and WAN, Multimedia conferencing, video-on-demand broadcasting issues.

UNIT 5: Hypermedia Presentation: Authoring and publishing, Linear and non-linear presentation, Structuring Information, Different approaches of authoring hypermedia documents, Hyper-media data models and standards.

Text Books:

1. Jerry D. Gibson, Toby Berger, Tom Lookabaugh, Dave Lindergh and Richard L. Baker Digital Compression for Multimedia: Principles and Standards Elsevier, 2006.
2. Ralf Steinmetz and Klara Nahrstedt, Multimedia: Computing, Communications, and Application, Prentice Hall, 1995.
3. Khalid Sayood Introduction to Data Compression 3rd Edition, Elsevier, 2006.
4. Asit Dan and Dinkar Sitaram Multimedia Servers Elsevier, 2006.

Course Outcomes :

Upon successful completion of the course, students should be able to: Knowledge and understanding:

1. Understand the concepts and processes which underpin the design and development of multimedia products.
2. Understand the techniques and technologies used in the development of multimedia solutions. Intellectual / cognitive skills.
3. Plan the development of an idea into the realization of a product.
4. Design and implement multimedia solutions. Practical, research and independent learning skills.
5. Use appropriate tools for the design, development and creation of digital media arte facts.
6. Learn how to be proactive and reflective Transferable / key skills.

SUB CODE	L	T	P	DURATION	IA	ESE	CREDITS
ITUCTK2	3	0	0	3 HOURS	40	60	3

SOFTWARE ENGINEERING

Course Objective

1. To provide the idea of decomposing the given problem into Analysis, Desing, Implementation, Testing and Maintenance phases.
2. To provide an idea of using various process models in the software industry according to given circumstances.
3. To gain the knowledge of how Analysis, Design, Implementation, Testing and Maintenance processes are conducted in a software project.

UNIT I Software Engineering – What is software, Characteristics of software, Application of software, Software Development Life Cycle, Software Process Models - Linear Sequential model, Prototype model, RAD model, Incremental model, Component Based Development Model, Fourth Generation Techniques.

UNIT II . Software Requirement Specification-Problem Analysis, Requirement Specification, Validation, metrics, monitoring and control.

UNIT III System Design - Problem portioning, abstraction, top-down and bottom-up design, Structured approach, Coupling and Cohesion,Functional versus Object oriented approach, design specification and verification, metrics.

UNIT IV Coding: Top–down and bottom-up structured programming, information hiding, programming style, internal documentation,verification. Metrics, Monitoring and Control.

UNIT V Software testing – Software Testing fundamentals, Black Box Testing, White box testing, Basics path testing, A strategic Issues, Types of Testing-Unit testing, Integration testing, validation testing, System Testingsoftware metrics, software evaluation, software maintenance & reliability.

List of Books:

1. Software Engg, Pressmen
2. Software Engg, Pankaj Jalote
3. Software Engg, Shaum's Outline Series
4. Fundamentals of Software Engineering, Rajib Mal.

Course Outcome

1. Students will be able to decompose the given project in various phases of a lifecycle.
2. Students will be able to choose appropriate process model depending on the user requirements.
3. Students will be able perform various life cycle activities like Analysis, Design, Implementation, Testing and Maintenance.
4. Students will be able to know various processes used in all the phases of the product.
5. Students can apply the knowledge, techniques, and skills in the development of a software product.

SUB CODE	L	T	P	DURATION	IA	ESE	CREDITS
	3	0	0	3 HOURS	40	60	3

DATA COMMUNICATION

Course Objective

To provide a solid conceptual understanding of the fundamentals of data communications. More specifically –

1. To learn the basic concepts of data communications.
2. To learn the layered architecture of communication protocols.
3. To learn digital signal transmission and encoding techniques.
4. To learn multiplexing techniques.
5. To learn the concepts and techniques in error detection and correction.

Unit I

Data and Signal - Analog and digital signals, Time and frequency domain, Composite signals, Bandwidth, bit rate, bit length, Baseband and broadband transmission. Attenuation, distortion, noise, Nyquist bit rate Shannon capacity.

Unit II

Data communication concepts - Data transmission, Parallel and serial transmission, synchronous and Asynchronous transmission, Simplex, half-duplex and full-duplex, unipolar and polar line codes, Non return to zero codes, return to zero codes, bipolar line codes.

Unit III

Telephone Network, Network topology, Multiplexing, Frequency division multiplexing, time division multiplexing and wavelength division multiplexing, pulse code modulation.

Unit IV

Switching techniques - Circuit, packet and hybrid switching, Types of error - single bit error, burst error, Error detection, Vertical redundancy check, Longitudinal redundancy check, cyclic redundancy check, error correction, Integrated services digital network.

Unit V

Transmission media - Guided and unguided media, twisted pair, Unshielded twisted pair and Shielded twisted pair, coaxial cable and fiber optic cable, radio waves, microwaves and infrared transmission RJ-45, Network interface card, rack, cable standard - Category 5, 6 and 7, cross connection, straight connection, cable coding standards.

BOOKS & REFERENCES:

1. "Data communication and networking", Forouzan, TMH.
2. Data communication and Computer Networks, Prakash C Gupta, PHI Learning.
3. "Computer Networks", Tanenbaum, PHI Learning.
4. "Communication Networks - Fundamental concepts and key Architectures", Leon-Garcia, Widjaja, TMH.
5. "Computer Communications & Networking Technologies", Michael A. Gallo & William M. Hancock - Cengage pearsen publications.
6. "Network for computer scientists & engineers", Youlu zheng & shakil akhtar, Oxford pubcation.

Course Outcomes

On completion of the course, students will be able to attain the following COs –

1. Understand the basics of data communication, networking, internet and their importance.

2. Interpret the components, tools and techniques of communication systems.
3. Explain how information can be sent via communication interfaces and links.
4. Determine the various modulation and error detection and correction techniques and their application in communication systems.
5. Identify the basic security threats of a network.

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
			L	T	P	CIA				SEA		
						CT–1	CT–2	Assignments, surprise test, quiz test etc	Attendance			
B. Tech III Sem.	IP23TIC301	Automobile Engineering	3	-	-	15	15	5	5	60	100	3

COURSE OBJECTIVES:

1. To provide the knowledge of basic structure of an automobile.
2. To provide the knowledge of transmission system and its various elements.
3. To provide the knowledge of clutches and suspension system
4. To provide the knowledge of braking system.
5. To provide the knowledge of steering system and engine emissions.

COURSE CONTENT:

Module - I

Introduction of an automobile: Component and basis structure of automobile, classification, difference between automobile and automotive, the chassis construction & classification, defect in frames, frameless construction & specifications. Wheel and tyres: Types of wheel, wheel dimension, desirable tyres properties, types of tyres, tyre material, tyre dimension, factors affecting tyre life.

Module - II

Transmission system: Function of transmission types, sliding mesh gear box, constant mesh gear box, synchro mesh gear box, torque converter, propeller shaft, universal joint, hook joint, final drive, differential, performance of gear box.

Module - III

Clutches: Requirement, function & type of clutch, dry friction clutch, wet friction clutch, clutch plate, single plate & multiple plate clutch, centrifugal clutch and fluid fly wheel.

Suspension system function and requirement, leaf spring, torsion bar, telescopic shock absorber.

Module - IV

Brakes: Function and requirement, brake efficiency, wheel skidding, types of brake, electrical, mechanical and hydraulic & pneumatic brakes, master cylinder, wheel cylinder, self-actualizing brakes, brake drum, brake liners, brake shoe, trouble shooting.

Module - V

Front axle and suspension wheel alignment purpose: Factor of front wheel alignment, steering geometry, correct steering angle, steering mechanism, under steer and over steer, steering gear, power steering, reversibility of steering gears, steering gear ratio, calculation of turning radius.

Engine emission: Emission standard of vehicle in India, Euro norms, emission, testing. Principle of multipoint fuel injection (MPFI), component of MPFI, different sensors of MPFI system, vehicle air conditioning.

TEXT & REFERENCE BOOKS:

1. Automobile Engineering - Kripal Singh Vol. I, II.
2. Automobile Mechanics - Joseph Heitner.
3. Automobile Engineering - N.K Giri
4. Automobile Engineering - Shrinivasan T.M.H.
5. Automobile Engineering - K.K. Jain, R.B. Asthana T.M.H.
6. Automobile Engineering - R.B. Gupta Tech India Publication Series.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Graduates will gain a strong foundation in core automobile engineering, both in theoretical and applied concepts.

CO2: Acquire knowledge and hands-on competence in the design and development of automobile.

CO3: Graduates will develop an ability to identify and solve automobile engineering maintenance problems.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs1	PSOs2	PSOs3
CO1	3	1	1	1	-	-	-	-	-	-	-	1	3	1	1
CO2	3	3	3	3	2	1	-	-	-	-	-	2	3	1	1
CO3	3	3	2	1	-	-	-	-	-	-	-	1	3	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SUB CODE	L	T	P	DURATION/WEEK	IA	ESE	CREDITS
ITUCTO1	3	0	0	3 HOURS	40	60	3

COMPUTER ORGANIZATION & ARCHITECTURE (Not for IT)

COURSE OBJECTIVE:

1. Conceptualize the basics of organizational and architectural issues of a digital computer.
2. Analyze processor performance improvement using instruction level parallelism.
3. Learn the function of each element of a memory hierarchy.
4. Study various data transfer techniques in digital computer.
5. Articulate design issues in the development of processor or other components that satisfy design requirements and objectives.

UNIT No	Syllabus Content	No of Hours
1	**Basic of Computer Organization & Architecture:** Introduction, Computer Organization vs. Computer architecture, Von Neumann Architecture vs. Harvard Architecture. **Input & Output Organization:** Introduction, Simple Bus Architecture, TypesofBuses,I/OCommunicationMethodologies:ProgrammedI/O(Polling),Interrupt-drivenI/O&DirectMemoryAccess(DMA),I/Ochannel&I/OProcessor,AccessingI/Odevice:MemoryMappedI/O,IsolatedorI/OMapped.	10
2	**Computer Arithmetic:** Introduction, Addition & Subtraction: Addition & Subtraction with Signed – Magnitude Data, Hardware Implementation & Algorithm, Addition & Subtraction with Signed - 2's Complement Data, Multiplication Algorithm: Hardware Implementation for Signed – Magnitude Data, Hardware Algorithm, Booth Multiplication Algorithm, Array Multiplier, Division Algorithms: Hardware Implementation for Signed-Magnitude Data & Algorithm, Carry Look Ahead Adder.	10
3	**Memory Organization:** Introduction, Types of Memory, Memory Hierarchy, Main Memory, Cache Memory, Virtual Memory, Associative Memory. Processor Organization: Introduction, Control Unit: Hardwired Control Unit, Micro programmed Control Unit, Instruction Set Computer: Reduced Instruction Set Computer (RISC) vs. Complex Instruction Set Computer (CISC).	10
4	**Pipelining:** Introduction, Concept of Instruction Pipeline, Design Problems with Pipeline: Structural Hazard, Data Hazard & Control Hazard, Extension in Pipeline Designed: Super Pipelining, Superscalar Processor, Very Long Instruction Width (VLIW) Architecture.	8
5	**Multiprocessor System:** Introduction, Shared Memory Multiprocessor, Distributed Memory Multiprocessor, Flynn's Classification: Single Instruction Single Data (SISD), Single Instruction Multiple Data (SIMD), Multiple Instruction Single Data (MISD), Multiple Instruction Multiple Data (MIMD), Cache Coherence, Message Passing Model, Cluster Computing, Distributed Computing.	7

Text Books:

1. Computer System Architecture, M.Morris Mano, Pearson Education India.
2. Computer Organization & Architecture, W. Stalling, Pearson Education India.

Reference Books:

1. Computer Architecture & Organization, J. P. Hayes, McGraw-Hill India.
2. Computer System Organization, Naresh Jotwani, Mc Graw Hill, India.
3. Computer System Architecture, P. V. S. Rao, PHI India.
4. Advanced Computer Architecture, Rajiv Chopra, S. Chand India.
5. Computer Organization & Architecture, Lalit K. Arora, Anjali Arora, S.K.Kataria & Sons, India.
6. Computer Fundamentals Architecture & Organization, B Ram, Sanjay Kumar, New Age International, India.

COURSE OUTCOMES:

The students would have learnt -

1. Understand the computer architecture concepts.
2. Understand and apply different number systems and codes.
3. Understand memory hierarchy and its impact on computer cost/performance.
4. Designapipelineforconsistentexecutionofinstructionswithminimumhazards.
5. Understand the concepts of multiprocessor.

CH23TIC301 Engineering Materials [L:3, T:0, P:0]

Objectives

1. To provide the understanding of material selections for construction to execute a task for a particular application, its properties and behaviour at different circumstances.
2. Properties, behaviour and maintenance of various engineering materials.

Contents:

Unit-I: Crystalline and Non-Crystalline Materials: Crystalline state, Atomic bonding, Bravias lattices, Miller indices, Structure of some common inorganic compounds, Structural imperfections. Economic, environmental and social issues of material usage.

Unit-II: Mechanical properties of materials and their variation with temperature, importance and limitations of these properties on material selection for a particular application. Failure of materials: Failure of materials under service conditions.

Unit-III: Corrosion: Mechanism of corrosion, Types of corrosion, Factors influencing corrosion, Methods of corrosion control, Inhibition and other precautionary measures.

Unit-IV: Non-Ferrous Metals: Copper, Brasses, Bronze, Aluminium, their mechanical properties, Workability and applications, Corrosion resistance. Non-metallic materials of construction.

Unit-V: Phase diagram: Phase rules, Equilibrium phase diagram, cooling curves and their relations to properties of metals and alloys, Iron-carbon equilibrium diagram. Response of materials to chemical environment.

Suggested Text Books :

1. Introduction to Materials Science for Engineers by James F. Shackelford, Pearson.
2. Elements of Materials Science and Engineering by L.H.Van Vlack, Pearson.
3. Materials Science and Engineering by V. Raghavan, PHI Learning Private Limited.
4. Materials Science for Engineers by L. H. VanVlack, Addison-Wesley Publishing Co.
5. Chemistry of Engineering Materials by A. M. Sikkander and T. N. Balu, Raj Publications.
6. Corrosion, Prevention and Control by K.S. Rajagopalan, Scientific Surveys Limited.
7. Corrosion Engineering by M. G. Fontana, McGraw Hill Education.

Reference Book:

1. Perry's Chemical Engineers' Handbook by D. W. Green and R. H. Perry, McGraw Hill Publication.

Course Outcome:

Students would be able to

1. Explain different types of materials and their mechanical properties and limitations.
2. Explain types of corrosion and various methods to control them.
3. Describe phase diagram and its significance.

CO-PO Mapping															
CO	**PO**												**PSO**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1		2			1						1	1	
CO2	2	1		2			1						1	1	
CO3	2	1		2			1						1	1	
Weightage: weak-01, moderate-02, strong-03															

Course Code	Subjects	Periods			Evaluation Scheme				Credits
		L	T	P	TA	IA	ESE	Total	
CE23TIC301	Green Buildings	3	0	0	10	30	60	100	3

Course Learning Objectives:

- To understand the basics of Green Buildings.
- To learn the concept of site selection and water conservation.
- To study the use of efficient energies.
- To learn about maintenance of Indoor environmental quality.
- To study various green building rating systems including their mandatory requirements and credit points.

Course Content:

UNIT-I

Green Buildings: Introduction, history and evolution, objectives, benefits, typical features of green buildings, sustainability and green buildings, global trends in green buildings, Examples of green buildings in India and the world (case studies to be presented by students).

UNIT-II

Site selection and building planning: Criteria for site selection, preservation of landscape, soil erosion control, understanding and minimizing urban heat island effect. Water conservation and efficiency: Rainwater harvesting methods for roof & non-roof, water demand, water efficient plumbing systems, water metering, waste water disposal, recycle and reuse systems.

UNIT-III

Energy Efficiency: Concepts of embodied energy, operational energy, demolition energy and life cycle energy. Methods to reduce operational energy: Energy efficient building envelopes, efficient lighting technologies, energy efficient appliances for heating and air conditioning systems in buildings, wind and solar energy harvesting, energy metering and monitoring, concept of net zero buildings.

UNIT-IV

Indoor Environmental Quality for Occupant Comfort: Daylighting, air ventilation, exhaust systems, materials, adhesives, building acoustics. **Environment Quality and Occupational Health:** Air conditioning, air quality, Sick building syndrome, minimum fresh air
requirement, improved fresh air ventilation, Measure of Indoor air quality (IAQ), Reasons for poor IAQ, Measures to achieve Acceptable IAQ levels.

UNIT- V

Green Building Rating Systems: Introduction to various rating systems (LEED, GRIHA, IGBC etc.), mandatory requirements and credit points of various rating systems, study of green building rating criteria of IGBC, Understanding the green building measures in the areas of site preservation, energy efficiency, materials, water conservation and indoor air quality.

Text Books

1) IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.
2) GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.
3) Alternative building materials and technologies by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao.
4) Non-Conventional Energy Resources by G. D. Rai, Khanna Publishers.
5) Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi 2004.
6) Mike Montoya, Green Building Fundamentals, Pearson, USA, 2010.
7) Charles J. Kibert, Sustainable Construction Green Building Design and Delivery, John Wiley & Sons, New York, 2008.
8) Regina Leffers, Sustainable Construction and Design, Pearson / Prentice Hall, USA, 2009.

Course Outcomes- At the end of the course students will be able to:

CO1: Apply the concept and knowledge of Green Building in handling any physical projects.

CO2: Conduct a site selection process and apply water conservation techniques for green buildings.

CO3: Make use of technologies with efficient energies.

CO4: Apply the knowledge in maintaining the indoor environmental quality.

CO5: Revise essential parameters of green building rating system.

Course Outcomes and their mapping with Programme Outcomes: Green Buildings (CE23IC301)

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1		3	3					2	2	1	2
CO2	3	2	1	2		3	3					1	2	2	3
CO3	3	2	1	2		3	3					2	2	2	3
CO4	3	2	2	2		3	3					2	2	2	2
CO5	3	2	1	1		2	2					1	2	1	2

Weight age: 1-Sightly; 2-Moderately; 3-Strongly

Subject: DATA STRUCTURE WITH C++

SUB CODE	L	T	P	DURATION	IA	ESE	CREDITS
CS23TIC301	3	0	0	3 HOURS	40	60	3

DATA STRUCTURE USING C++

COURSEOBJECTIVE:

1. Introduce the concept of data structures through Array, Stack, and Queues.
2. To design and implement various data structure algorithms.
3. To introduce various techniques for representation of the data in the real world.
4. To develop application using data structure algorithms.

Syllabus Content

UNIT-I: INTRODUCTION: Functions and parameter, Dynamic memory allocation, Recursion.

LINEAR LISTS: Data objects and structures, Linear list data structures, Array Representation, Vector Representation, Singly Linked lists and chains. L1, L2

UNIT-II: ARRAYS AND MATRICS: Arrays, Matrices, Special matrices, Sparse matrices.

STACKS: The abstract data types, Array Representation, Linked Representation, Applications-Parenthesis Matching & Towers of Hanoi. L1, L2, L3

UNIT-III: QUEUES: The abstract data types, Array Representation, Linked Representation, Applications-Railroad car arrangement.

HASHING: Dictionaries, Linear representation, Hash table representation. L1, L2, L3

UNIT-IV: BINARY AND OTHER TREES: Trees, Binary trees, Properties and representation of binary trees, Common binary tree operations, Binary tree traversal the ADT binary tree, ADT binary tree and the class linked binary tree. L1, L2, L3

UNIT-V: PRIORITY QUEUES: Linear lists, Heaps, Applications-Heap Sorting.

SEARCH TREES: Binary search trees operations and implementation, Binary Search trees with duplicates.

L1, L2, L3

Text Books:

1. Data structures, Algorithms, and applications in C++, Sartaj Sahni, Universities Press, 2nd Edition, 2005.

SCHEME FOR EXAMINATION
B.TECH (FOUR YEAR) DEGREE COURSE
SECOND YEAR, INFORMATION TECHNOLOGY
SEMESTER IV
EFFECTIVE FROM SESSION 2023-24 (NEP)

SL. NO.	SUBJECT CODE	SUBJECTS	PERIODS/ WEEK			EVALUATION SCHEME			CREDITS
			L	T	P	IA	ESE	TOTAL	
THEORY									
1	ITUDTT1	PYTHON FOR DATA SCIENCE	3	1	0	40	60	100	4
2	ITUDTT2	OPERATING SYSTEMS	3	0	0	40	60	100	3
3	ITUDTT3	DISCRETE MATHEMATICS	3	0	0	40	60	100	3
4	ITUDTKX	DEPARTMENT ELECTIVE-II	3	0	0	40	60	100	3
5		INSTITUTE CORE-II	3	0	0	40	60	100	3
PRACTICAL									
1	ITUDLT1	PYTHON FOR DATA SCIENCE LAB	0	0	3	25	25	50	1.5
2	ITUDLT2	OPERATING SYSTEMS LAB	0	0	3	25	25	50	1.5
3	ITUDPV1	MINI PROJECT	0	0	4	50	50	100	2
TOTAL CREDITS									**21**
IA- INTERNAL ASSESSMENT, ESE-END SEMESTER EXAMINATION, L-LECTURE, T-TUTORIAL, P-PRACTICAL									

LIST OF DEPARTMENT ELECTIVE-II

1	ITUDTK1	DESIGN & ANALYSIS OF ALGORITHMS
2	ITUDTK2	DIGITAL SIGNAL PROCESSING
3	ITUDTK3	COMPUTER APPLICATION IN SOCIAL SCIENCES

LIST OF INSTITUTE CORE-II

1	ITUDTO1	COMPUTER NETWORK (Not for IT)
2	ITUDTO2	FUNDAMENTALS OF PYTHON PROGRAMMING (Not for IT)
3	CSUDTO1	INTRODUCTION TO INFORMATION SCIENCE
4	ECUDTO1	ELECTRONICS DEVICES AND CIRCUITS
5	CEUDTO1	REMOTE SENSING & GIS
6	CHUDTO1	ENERGY AND ENVIRONMENT ENGINEERING
7	ESUDTO1	EFFECTIVE TECHNICAL COMMUNICATION
8	MEUDTO1	INTRODUCTION TO FLUID MECHANICS
9	IPUDTO1	AUTOMOBILE ENGINEERING

SUB CODE	L	T	P	DURATION/WEEK	IA	ESE	CREDITS
ITUDTT3	3	0	0	3 HOURS	40	60	3

DISCRETE MATHEMATICS

Course Objective:

1. To introduce a number of discrete mathematical structures found to be serving as tools in the Development of theoretical computer science.
2. Course focuses on how discrete structures actually helped computer engineers to solve problems Occurred in the development of programming languages
3. Course highlights the importance of discrete structures towards simulation of a problem in computer science engineering.
4. To apply logical reasoning to solve a variety of problems.
5. Model and analyze computational processes using analytic and combinatorial methods.

Unit 1:

Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's Diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem.

Unit 2:

Basic counting technique s-inclusion and exclusion, pigeon-hole principle, Permutation and combination, Principle of Mathematical Induction, The Well Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor, Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

Unit 3:

Propositional Logic: Basic Connectives and Truth Tables, Logical Equivalence the Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers.

Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Prof by Contraposition, Proof of Necessity and Sufficiency.

Unit 4:

Algebraic Structures and Morphism: Algebraic Structures with one binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields, Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form.

Unit 5:

Graphs and Trees: Graphic and their properties, Degree. Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Four colour conjecture, trees and rooted trees, binary trees.

Test books:

1. Kenneth II. Rosen, Discrete Mathematics and its Applications, Tau McGraw-Hill.
2. Susanna S. Epp, Discrete Mathematics with Applications, 4th edition. Wadsworth Publishing Co. Inc. J.
3. C L. Liu and D P Mahapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw-Hill.

Reference Book:

1. J. P. Tremblay and R Manor, Discrete Mathematical Structure and its Application to Computer science, TMG Edition, Tata McGraw-Hill.

2. Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press, Schaum's Outlines Series, Seymour lipschutz, Mare Lipson.

Course Outcomes

After completion of this course students will be:

1. Able to apply mathematical logic and Boolean algebra in switching circuits & logic circuits.
2. Familiar with set theory, relation and functions.
3. Familiar with algebraic structures, graph theory and combinatorics.
4. Able to solve problems in various fields in computer science, specially networking.
5. Model problems in Computer Science using graphs and trees.

SUB CODE	L	T	P	DURATION/WEEK	IA	ESE	CREDITS
ITUDLT2	0	0	3	3 HOURS	25	25	1.5

OPERATING SYSTEMS LAB

Course Objectives

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

List of Experiments

1. Simulate the following CPU scheduling algorithms-
   a) FCFS b) SJF c) Round Robin d) Priority.
2. Write a C program to simulate producer-consumer problem using Semaphores.
3. Write a C program to simulate the concept of Dining-philosophers problem.
4. Write a C program to simulate the following contiguous memory allocation Techniques-
   a) Worst fit b) Best fit c) First fit.
5. Simulate all page replacement algorithms a)
   a) FIFO b) LRU c) OPTIMAL
6. Simulate all File Organization Techniques
   a) Single level directory b) Two level directory
7. Simulate Bankers Algorithm for Dead Lock Avoidance and dead lock prevention.
8. Write a program to simulate disk scheduling algorithms.
   a) FCFS b) SCAN c) C-SCAN

Reference Books

1. Milenkovic M. , “Operating System concepts”, MGH
2. Tanenbaubm A. S. “Operating System design and implementation” , PHI
3. Silberschartz A.and Patterson J.I. , “ Operating system concepts”, Wisley.
4. Stilling William “ Operating System “, Maxwell McMillan International Edition 1992.
5. Dectel H.N. , “An introduction to operating system “, Addision Wisley.

Course Outcomes

1. Create processes and threads.
2. Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, and Response Time.
3. Specification of memory organization develops the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.
4. Design and implement file management system.
5. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

SUB CODE	L	T	P	DURATION/WEEK	IA	ESE	CREDITS
ITUDTT2	3	0	0	3 HOURS	40	60	3

OPERATING SYSTEMS

Objectives of the course

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

UNIT I - INTRODUCTION TO OPERATING SYSTEM:

Objective and function of operating system. The evaluation of the operating system, system components operating system services, system structure, batch interactive, time sharing and real time operating system, Protection. File system: File concepts, file organization and access mechanism.

UNIT II - CONCURRENT PROCESS:

Process concepts, principal of concurrency. The producer consumer problem, the critical section problem, semaphore, classical problem in concurrency , inter process communication , process generation, process scheduling.

UNIT III - CPU SCHEDULING:

Scheduling concepts, performance criteria scheduling algorithms. Algorithm evaluation, multiprocessor scheduling. I/O management and Disk scheduling I/O devices and organization of the I/O functions. I/O buffering disk I/O operating system design issues.

UNIT IV - DEAD LOCKS:

System models, deadlock characterization, prevention, avoidance and detection recovery from deadlock, combined approach.

UNIT V - MEMORY MANAGEMENT:

Base machine , Residence monitor , multiprogramming with fixed partition , multiprogramming with variable partitions, multiple base register, paging, segmentation, paging segmentation, virtual memory concepts , demand paging performance , page replacement algorithms, allocation of frames, thrashing, cache memory organization impact on performance.

Reference Books

1. Milenkovic M. , “Operating System concepts”, MGH
2. Tanenbaubm A. S. “Operating System design and implementation” , PHI
3. Silberschartz A.and Patterson J.I. , “ Operating system concepts”, Wisley.
4. Stilling William “ Operating System “, Maxwell McMillan International Edition 1992.
5. Dectel H.N. , “An introduction to operating system “, Addision Wisley.

Course Outcomes

1. Create processes and threads.
2. Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, and Response Time.
3. Specification of memory organization develops the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.
4. Design and implement file management system.
5. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

SUB CODE	L	T	P	DURATION	IA	ESE	CREDITS
ITUDLT1	0	0	3	3 HOURS	25	25	1.5

PYTHON FOR DATA SCIENCE LAB

Course Objectives:

This course is designed to enable the students to:

1. To be able to introduce core programming basics and program design with functions using Python programming language.
2. To understand a range of Object-Oriented Programming, as well as in-depth data and information processing techniques.
3. To understand the high-performance programs designed to strengthen the practical expertise.

S.No.	Experiments
1	Write a program to demonstrate different number data types in Python.
2	Write a program to perform different Arithmetic Operations on numbers in Python.
3	Write a program to create, concatenate and print a string and accessing sub-string from a given string.
4	Write a python script to print the current date in the following format “Sun May 29 02:26:23 IST 2017”.
5	Write a program to create, append, and remove lists in python.
6	Write a program to demonstrate working with tuples in python.
7	Write a program to demonstrate working with dictionaries in python.
8	Write a python program to find largest of three numbers.
9	Write a Python program to convert temperatures to and from Celsius, Fahrenheit. [Formula : c/5 = f-32/9]
10	Write a Python script that prints prime numbers less than 20.
11	Write a python program to find factorial of a number using Recursion.
12	Write a program that accepts the lengths of three sides of a triangle as inputs. The program output should indicate whether or not the triangle is a right triangle (Recall from the Pythagorean Theorem that in a right triangle, the square of one side equals the sum of the squares of the other two sides).
13	Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.
14	Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
15	Write a python program to define a module and import a specific function in that module to another program.
16	Write a Python class to convert an integer to a roman numeral.
17	Write a Python class to implement pow(x, n).
18	Write a Python class to reverse a string word by word.

TEXT BOOKS:

1. Core Python Programming, Wesley J. Chun, Second Edition, Pearson.

REFERENCES BOOKS:

1. Think Python, Allen Downey, Green Tea Press.
2. Introduction to Python, Kenneth A. Lambert, Cengage.

3. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.
4. Learning Python, Mark Lutz, O'Really.

Course Outcomes:

At the end of this course the student can answer how to:

1. Student should be able to understand the basic concepts scripting and the contributions of scripting language.
2. Ability to explore python especially the object-oriented concepts, and the built in objects of Python.
3. Ability to create practical and contemporary applications such as TCP/IP network programming, Web applications, discrete event simulations.

SUB CODE	L	T	P	DURATION	IA	ESE	CREDITS
ITUDTT1	3	1	0	4 HOURS	40	60	4

PYTHON FOR DATA SCIENCE

Course Objectives:

1. To read and write simple Python programs.
2. To develop Python programs with conditions, loops and functions.
3. To create and work with files in python.
4. To develop OOP programs in python.
5. To create and work on Numpy arrays.
6. To handle data in python using pandas.

UNIT 1: INTRODUCTION TO DATA SCIENCE AND PYTHON PROGRAMMING

Introduction to Data Science - Why Python? - Essential Python libraries - Python Introduction- Features, Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List, Tuples, Dictionary, Set - Type Conversion- Operators.

Decision Making- Looping- Loop Control statement- Math and Random number functions. User defined functions - function arguments & its types.

UNIT 2: FILE, EXCEPTION HANDLING AND OOP

User defined Modules and Packages in Python- Files: File manipulations, File and Directory related methods- Python Exception Handling.

OOPs Concepts -Class and Objects, Constructors – Data hiding- Data Abstraction- Inheritance.

UNIT 3: INTRODUCTION TO NUMPY

NumPy Basics: Arrays and Vectorized Computation - The NumPy nd array- Creating ndarrays- Data Types for ndarrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing - Boolean Indexing- Transposing Arrays and Swapping Axes.

Universal Functions: Fast Element-Wise Array Functions- Mathematical and Statistical Methods - Sorting-Unique and Other Set Logic.

UNIT 4: DATA MANIPULATION WITH PANDAS

Introduction to pandas Data Structures: Series, Data Frame, Essential Functionality: Dropping Entries- Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking. Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership. Reading and Writing Data in Text Format.

UNIT 5: DATA CLEANING, PREPARATION AND VISUALIZATION

Data Cleaning and Preparation: Handling Missing Data - Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers- String Manipulation: Vectorized String Functions in pandas.

Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots.

TEXT BOOKS

1. Y. Daniel Liang, “Introduction to Programming using Python”, Pearson, 2012.
2. Wes McKinney, “Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython”,O’Reilly, 2nd Edition,2018.
3. Jake VanderPlas, “Python Data Science Handbook: Essential Tools for Working with Data”, O’Reilly,2017.

4. Miller, Bradley, and David Ranum. Problem Solving with Algorithms and Data Structures Using Python. 2nd ed. Franklin, Beedle & Associates, 2011. ISBN: 9781590282571.

REFERENCES BOOKS

1. Wesley J. Chun, "Core Python Programming", Prentice Hall,2006.
2. Mark Lutz, "Learning Python", O'Reilly, 4th Edition, 2009.

E BOOKS

1. https://www.programmer-books.com/introducing-data-science-pdf/
2. https://www.cs.uky.edu/~keen/115/Haltermanpythonbook.pdf
3. http://math.ecnu.edu.cn/~lfzhou/seminar/[Joel_Grus]_Data_Science_from_Scratch_First_Princ.pdf

MOOC

1. https://www.edx.org/course/python-basics-for-data-science
2. https://www.edx.org/course/analyzing-data-with-python
3. https://www.coursera.org/learn/python-plotting?specialization=data-science-python

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Introduce students to Python's history, installation, and basic usage, enabling them to write and execute simple Python programs.
2. Familiarize students with Python syntax, data types, variables, and fundamental operators to build a solid programming foundation.
3. Teach students how to make decisions and control program flow using conditional statements and loops in Python.
4. Equip students with essential skills for file handling, and exception handling, and introduce them to modules and libraries in Python for more advanced programming tasks.
5. Teach students data structures and data manipulation techniques for data analysis
6. Familiarize students for data preparation and visualization tasks

SUB CODE	L	T	P	DURATION/WEEK	IA	ESE	CREDITS
ITUDTK3	3	0	0	3 HOURS	40	60	3

COMPUTER APPLICATION IN SOCIAL SCIENCES

Course Objective

1. To understand basic concepts about Architecture of Computers Input output Devices.
2. To understand basic concepts about Central Processing Unit, hardware and software.
3. To understand basic concepts about Applications of computers, E-governance, E-commerce.
4. To understand basic concepts about Computer Operating System.
5. To understand basic concepts about Classification of computer languages.

Unit I: Information technology - definition, need, qualities, values freedom of information, information management, right to information - information society, globalization of communication, new frontiers of information technology Computer - Fundamentals of Computer Importance of Computer, Architecture of Computers Input output Devices, Central Processing Unit, hardware and software, applications of computers, classification of computer, classification of computer languages.
Unit – II: Computer Operating System: MS-DOS, Windows up to the latest versions, MS-Word, MS-Excel.
Unit-III: System Analysis : Preliminary survey, analysis of problems and laying down specifications, design development, testing and debugging, system analysis methods, data flow diagrams, structure chart, programme/system development process Internet - understanding internet, internet management, uses of internet - website, e-mail, information retrieval, security of data on internet.
Unit –IV: E-governance - meaning, growth, scope, problems, E-commerce - meaning, nature, processes, scope, problems and barriers, cyber crimes, satellite communication, video conferencing.
Unit V: MIS - meaning, nature, process - office automation: means and Uses - uses of information technology in public administration – planning and monitoring, improving services, transparency, empowering citizens by access to information, grievance redressal, training through computers.

Texts/references

1. E. Garrison Walters, The Essential Guide to Computing: The Story of Information Technology, Indian Edition (New Delhi: Prentice Hall, 2000).
2. Brian Williams and Stacy Sawyer, Using Information Technology, 9th Edition (New York: Career Edition, 2010).
3. Lawrence Snyder, Fluency with Information Technology: Skills, Concepts and Capabilities, 4th Indian Edition (New Delhi: Prentice Hall, 2010).
4. Jon Piot and Nicholas Carr, The Executive's Guide to Information Technology (New York: Wiley, 2007).
5. Carl V. Brown and others, Managing Information Technology, 7th Indian Edition (New Delhi: Prentice Hall, 2011).

Course Outcomes

Upon completion of this course, the students will be able to

1. Learn about Architecture of Computers Input output Devices.
2. Learn about Central Processing Unit, hardware and software.
3. Learn about Applications of computers, E-governance, E-commerce.
4. Learn about Computer Operating System.
5. Learn about Classification of computer languages.

SUB CODE	L	T	P	DURATION/WEEK	IA	ESE	CREDITS
ITUDTK1	3	0	0	3 HOURS	40	60	3

DESIGN & ANALYSIS OF ALGORITHMS

Course Objectives

1. To develop proficiency in problem solving and programming.
2. To be able to carry out the Analysis of various Algorithms for mainly Time and Space Complexity.
3. To get a good understanding of applications of Data Structures.
4. To develop a base for advanced study in Computer Science.
5. To teach various advanced design and analysis techniques such as greedy algorithms, dynamic programming & Know the concepts of tractable and intractable problems and the classes P, NP and NP-complete problems.

Unit 1:

Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

Unit 2:

Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Branchand-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving , Bin Packing, Knap Sack TSP. Heuristics – characteristics and their application domains.

Unit 3:

Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

Unit 4:

Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.

Unit 5:

Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE

Suggested books:

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.

2. Fundamentals of Algorithms – E. Horowitz et al.

Suggested reference books

1. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
2. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
3. Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA.

Course Outcomes

1. For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.

2. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.
3. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.
4. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming.
5. To understand an analyses approximation algorithms, Randomized algorithms, NP and P SPACE.

SUB CODE	L	T	P	DURATION/WEEK	IA	ESE	CREDITS
ITUDTK2	3	0	0	3 HOURS	40	60	3

DIGITAL SIGNAL PROCESSING

Course Objective

1. Formulate engineering problems in terms of DSP tasks.
2. Analyze digital and analog signals and systems.
3. Analyze discrete time signals in frequency domain.
4. Design digital filters and Change sampling rate of the signal.
5. Conceptualize the need of adaptive filters in communication applications.

UNIT I

Analysis of Discrete Time Signals and Systems: Discrete Fourier analysis, Classification, Discrete Time Fourier Transform (DTFT) & its properties, Inverse DTFT. Discrete Fourier Transform (DFT) & its Properties, Inverse DFT. Fast Fourier Transform, Properties, Types of FFT, N-point Radix-2 FFT, Inverse FFT. Discrete Linear Convolution, Circular Convolution, Fast Convolution, Frequency Response of LTI system using Discrete Fourier Analysis. Discrete Cosine Transform.

UNIT II

Implementation of Discrete-time Systems: Structures for the Realization of discrete-time systems, Structures for FIR systems: Direct, Cascade, Frequency Sampling & Lattice structures. Structures for IIR systems: Direct, Signal Flow Graphs & Transposed, Cascade, Parallel, Lattice & Lattice-Ladder structures. State space system analysis and structures.

UNIT III

FIR Filter Design: Symmetric and Anti-symmetric FIR filters, FIR Filter design by window method (Rectangular, Bartlett, Hamming, Hanning, Blackman and Kaiser window), Frequency Sampling method, Optimum approximation of FIR filters, Design of FIR differentiators, Design of Hilbert transformers.

UNIT IV

IIR Filter Design: Design of Discrete-time IIR filters from Continuous-time Filters: Filter design by Impulse invariant and bilinear transformation method: Butterworth, Chebyshev& Elliptic approximation Filter, Frequency transformation.

UNIT V

Multirate Digital Signal Processing: Introduction, Decimation, Interpolation, Sampling rate conversion by rational factor, Filter design and implementation for sampling rate conversion: Direct form FIR digital filter structure, Polyphase filter structure, Time varying digital filter structure, Sampling rate conversion by an arbitrary factor.

Text Books:

1. Discrete Time Signal Processing by A.V. Oppenheim, R. W. Schafer, & John R. Buck, , 2nd Edition, Prentice Hall, 1999. (Unit I, Unit II, Unit III, Unit IV)
2. Digital Signal Processing: Principles, Algorithms and Applications by John G. Proakis& D.G. Manolakis, Prentice Hall, 1997. (Unit II, Unit III, Unit IV, Unit V)
3. Digital Signal Processing by S. K. Mitra, 3rd edition, McGraw-Hill, 2007. (Unit V)

Reference Books:

1. Signals and Systems by A. V. Oppenheim, A. S. Willsky& S. H. NAWAB, 2nd edition, Prentice Hall, 1996.
2. Digital Signal Processing by S. Salivahanan, A. Vallavaraj, C. Gnanapriya, Tata McGraw-Hill, 2000.
3. Digital Signal Processing by A. Anand Kumar, PHI Learning Pvt. Ltd, 2012.

Course Outcome

After the completion of the course the student will be able to

1. Illustrate digital signals, systems and their significance.
2. Analyse the digital signals using various digital transforms DFT, FFT etc.
3. Design and develop the basic digital system.
4. Interpret the finite word length effects on functioning of digital filters.

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
						CIA						
			L	T	P	CT–1	CT–2	Assignments, surprise test, quiz test etc	Attendance	SEA		
B. Tech IV Sem.	IP23TIC401	Business Communication And Presentation Skill	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- Understand necessary skills for technical communication and its role in a technical organization.
- Develop outer and inner personality traits to enrich the business capabilities and to meet the challenges associated with different job levels in a market.
- Rule out development in style, personality, presentation, speaking, reading and writing skills
- Estimate the psychological aspects of communication via gaining technical knowledge and to understand the importance of cultural factors in communication.
- Demonstrate body language, use of voice during presentation in relation to the audience during presentation.

COURSE CONTENT:

Module – I

Business communication: Role of communication in information age, concept and meaning of communication, skills necessary for technical communication, communications in a technical organization, barriers to the process of communication and sola.

Module – II

Style and organization in technical communication: Listening, speaking, reading and writing as skills, objectivity, clarity, precision as defining features of technical communication, various types of business writing: letters, reports, notes, memos, language and format of various types of business letters, language and style of reports, report writing strategies, analysis of a sample report.

Module – III

Communication and personality development: Psychological aspects of communication, cognition as a part of communication, emotional intelligence, politeness and etiquette in communication, cultural factors that influence communication, mannerisms to be avoided in communication, language and persuasion, language and conflict resolution.

Module – IV

Language laboratory: Emphasizing listening and comprehension skills, reading skills, sound structure of English and intonation patterns.

Module – V

Oral presentation and professional speaking: Basics of English pronunciation, elements of effective presentation, body language and use of voice during presentation, connecting with the audience during presentation, projecting a positive image while speaking, planning and preparing a model presentation, organizing the presentation to suit the audience and context, basics of public speaking, preparing for a speech.

TEXT & REFERENCE BOOKS:

1. Organizational Behaviour – Fred Luthans, McGraw Hill.
2. Report writing for Business – Lesikar and Petit.
3. Effective Technical Communication – M. Ashraf Rizvi, McGraw Hill.
4. Personal Development for Life and Work – Wallace and Masters, Thomson Learning.

COURSE OUTCOMES:

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

- Present himself under the different domain of markets.
- Project a positive image of the associated organization, while speaking, planning and preparing a presentation.
- Develop leadership style, listening & interacting skills to handle conflict situations based on personality and communication.
- Adapt attitudinal changes, cultural speaking and technical communication.
- Utilize decision–making qualities, emotional intelligence, politeness and etiquette in communication.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	-	-	1	-	-	-	-	1	1	2	-
CO2	3	1	1	-	-	-	-	-	1	-	-	1	2	2	2
CO3	3	2	2	2	-	-	-	-	-	-	-	-	3	-	2
CO4	3	2	1	2	-	-	-	-	-	-	-	-	1	2	-
CO5	3	1	2	2	-	-	-	-	-	-	-	-	2	2	1

Weightage: 1-Sightly, 2-Moderately, 3-Strongly

SUB CODE	L	T	P	DURATION/WEEK	IA	ESE	CREDITS
ITUDTO1	3	0	0	3 HOURS	40	60	3

COMPUTER NETWORK (Not for IT)

Course Objective

1. Discuss the basic taxonomy and terminology of the computer networking.
2. Discuss the functionality of different layers of OSI Model.
3. Discuss different protocols of TCP/IP protocol suite.
4. Discuss the process of IP addressing and working of routing protocols.
5. Discuss the different challenges of Internetworking, Congestion control and Quality of services.

Unit No.	Syllabus Content	No. of Hours
1	**Introduction:** **Data communications:** Components, Data representation, Direction of data flow (simplex, half duplex, full duplex). **Networks:** Distributed processing, Network criteria, Physical structure (type of connection, topology), categories of network (LAN, MAN,WAN); Internet: brief history, internet today, Protocols and standard. **Reference models:** OSI reference model, TCP/IP reference model, their comparative study. **Physical Layer:** Transmission technology.	10
2	**Data Link Layer:** Types of errors, Error detection & correction methods, Framing (character and bit stuffing), Flow control, Protocols: Stop & wait ARQ Go – Back – N ARQ, Selective repeat ARQ **Medium access sub layer:** Point to point protocol, Multiple Access Protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, Token ring, Reservation, Polling, FDMA, TDMA, CDMA.	10
3	**Network Layer:** **Internetworking devices**: Repeaters, Hubs, Bridges, Switches, Router, Gateway. **Addressing**: IP addressing, classful addressing, subnetting. **Routing**: Techniques, Static vs. Dynamic routing, Routing table for classful address, Flooding, Shortest path algorithm, Distance vector routing, Link state routing. **Protocols:** ARP, RARP, IP, ICMP, IPV6.	10
4	**Transport Layer:** Process to process delivery, UDP: Services and applications, TCP: Stream Oriented Service, Segment, Timers, Congestion control techniques: Avoidance and Detection.	8
5	**Application Layer:** DNS, SMTP, FTP, HTTP & WWW. **Security:** Cryptography, User authentication, Security protocols in internet, Firewalls. Recent research topic on networking.	7

Text Books:

1. Data Communications and Networking by B.A.Forouzan – TMH Publication.
2. Computer Networks by S. Tanenbaum – Pearson Education / PHI Publication.

Reference Books:

1. Internetworking with TCP/IP by Comer - Pearson Education/PHI by Publication.
2. Data and Computer Communications by W.Stallings – PHI Publication.

Course Outcome

1. Upon completion of this course, the students will be able to
2. Understand the working of different internetworking devices.
3. Understand the working of Internet.
4. Understand the difference between OSI and TCP/IP.
5. Understand the security mechanism in Networking.
6. Understand core concept of IP addressing and routing.

SUB CODE	L	T	P	DURATION	IA	ESE	CREDITS
ITUDTO2	3	0	0	3 HOURS	40	60	3

FUNDAMENTALS OF PYTHON PROGRAMMING (Not for IT)

Course Objectives:

1. To read and write simple Python programs.
2. To develop Python programs with conditionals and loops.
3. To define Python functions and call them.
4. To use Python data structures –- lists, tuples, dictionaries.
5. To do input/output with files in Python.

UNIT-I

Introduction to Python: Introduction to Python and its historical background, Applications, Installation of Python, and development environments (IDLE, Jupyter), Writing and running Python programs, Understanding Python's syntax and code structure, Basic input and output operations.

UNIT II:

Data Types and Variables: Data types: integers, floats, strings, and Booleans, Variables and variable naming conventions, Type conversion, and typecasting, Python Operators: Arithmetic, comparison, logical, and assignment operators.

UNIT III:

Python Control Flow and Loops: Python decision-making with if, elif, and else statements, Python loops: while and for loops, Break and continue statements, Python control statements (pass, assert), String operations: concatenation, replication, slicing, and indexing.

UNIT IV:

Python Data Structures and Functions: Python sequences, lists, tuples, and range, Python collections, sets, dictionaries, Functions in Python: defining, calling, parameters, return. Work with various data structures and create functions for different tasks.

UNITV:

Advanced Topics and Modules: File handling in Python, Exception handling, Introduction to modules and libraries, Built-in modules in Python, Overview of Python libraries (e.g., math, random), Explore packages.

TEXT BOOKS / REFERENCES BOOKS:

1. Core Python Programming, Wesley J. Chun, Second Edition, Pearson.
2. Think Python, Allen Downey, Green Tea Press.
3. Introduction to Python, Kenneth A. Lambert, Cengage.
4. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.
5. Learning Python, Mark Lutz, O'Really.

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Introduce students to Python's history, installation, and basic usage, enabling them to write and execute simple Python programs.
2. Familiarize students with Python syntax, data types, variables, and fundamental operators to build a solid programming foundation.
3. Teach students how to make decisions and control program flow using conditional statements and loops in Python.
4. Enable students to work with various data structures like lists, tuples, sets, dictionaries, and functions to manipulate data effectively.
5. Equip students with essential skills for file handling, and exception handling, and introduce them to modules and libraries in Python for more advanced programming tasks.

CH23TIC402 Fluidization Engineering [L:3, T:0, P:0]

Objectives To impart the fundamental knowledge of Fluidization and understand the different aspects of fluidized bed systems applied in various industries.

Contents:

Unit-I: Phenomenon of Fluidization, Advantages and disadvantages of fluidization compared to conventional processes, Classification of various industrial beds, Industrial applications of fluidized beds in mineral processing, coal and biomass gasification & combustion FCC petroleum refining, pharmaceuticals, cement and other solid handling systems, Fluidized Bed Drying.

Unit-II: Gross behavior of fluidized beds-Minimum fluidizing velocity and pressure drops; Voidage, Design of distributors, Effect of temperature and pressure on fluidized bed, Elutriation and entrainment Transport disengaging height.

Unit-III: Bubbles in dense beds-Davidson Model, stream of bubbles, Bubbling bed models, Geldart classification, Different regimes of Fluidization, Davidson's model, Variation of Bubbling bed and Circulating Fluidized beds.

Unit-IV: Emulsion phase, Turn-over rate of solids, Residence Time Distribution of Solids, Diffusion model of solids movement, Interchange coefficient of solid into and out of wake.

Unit-V: Flow Pattern of Gas through fluidized beds, diffusion model for gas flow; two region models, evaluation of interchange coefficients, Heat and Mass transfer in Fluidized Beds.

Suggested Text Books :

1. Fluidization Engineering by D. Kunii and O. Levenpiel, Butterworth-Heinemann, Elsevier.

Reference Book:

1. Fluidization by J. F. Davidson and D. Harrison, Academic Press.
2. Fluidization and Fluid Particles Systems by F.A. Zenz and D. F. Othmer, Reinhold Publishing.
3. Handbook of Fluidization and Fluid-Particle Systems, by W. C. Yang, CRC Press. Course **Outcome:** Students would be able to

1. Describe fluidization and its recommendation in various industries exploiting its various advantages evaluating the heat and mass transfer aspects.
2. Apply model equations for fluidized beds for application in various industries.
3. Able to understand various fluidization characteristics like minimum fluidization velocity, complete fluidization velocity and transport disengage height.

CO-PO Mapping

CO	**PO**												**PSO**		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	--	--	--	--	--	--	--	3	3	--
CO2	3	3	3	3	3	--	--	--	--	--	--	--	3	3	--
CO3	3	3	3	3	3	--	--	--	--	--	--	--	3	3	--
Weightage: weak-01, moderate-02, strong-03															

Course Code	Subjects	Periods			Evaluation Scheme				Credits
		L	T	P	TA	IA	ESE	Total	
CE23TIC401	Remote Sensing & GIS	3	0	0	10	30	60	100	3

Course Objectives:

- Apply the concepts of Photogrametry and its applications such as determination of heights of objects on terrain.
- Understand the basic concept of Remote Sensing and know about different types of satellite and sensors.
- Illustrate Energy interactions with atmosphere and with earth surface features, Interpretation of satellite and top sheet maps.
- Understand different components of GIS and Learning about map projection and coordinate system.
- Develop knowledge on conversion of data from analogue to digital and working with GIS software.

SYLLABUS:

UNIT – I: INTRODUCTION TO PHOTOGRAMMETRY Principles and types of aerial photographs, geometry of vertical and aerial photograph, Scale and Height measurement on single and vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of Stereoscopy, fiducial points, parallax measurement using fiducial line.

UNIT – II: REMOTE SENSING Basic concepts and foundation of Remote Sensing elements, Data information, Remote sensing data collection, Remote sensing advantages and Limitations, Remote sensing process. Electromagnetic spectrum, Energy interaction with atmosphere and with earth surface features (soil, water, and vegetation) Indian Satellites and Sensors characteristics, Map and Image false color composite, introduction to digital data, elements of visual interpretations techniques.

UNIT – III: GEOGRAPHIC INFORMATION SYSTEMS Introduction to GIS, Components of GIS, Geospatial data: Spatial Data – Attribute Data- Joining Spatial and Attribute Data, GIS Operations: Spatial Data input- Attribute Data Management-Data Display-Data Exploration-Data Analysis. **COORDINATE SYSTEMS:** Geographic Coordinate system; Approximation of Earth, Datum: Map Projections; Types of Map Projections-Map Projection Parameters-Commonly used Map Projections – Projected Coordinate Systems.

UNIT – IV: VECTOR DATA MODEL Representation of simple features- Topology and its importance: coverage and its data structure, shape file:, data models for composite features Object Based Vector Data Model; Classes and their Relationships: The geo-based data model: Geometric representation of Spatial feature and data structure: Topology rules.

UNIT – V: RASTER DATA MODEL Elements of Raster data model: Types of Raster data: Raster data structure: Data conversion, Integration of Raster and Vector data. Data Input: Metadata: Conversion of Existing data, Creating new data, Remote sensing data, Field data, Digitizing, Scanning, on screen digitizing, importance of source map, Data Editing.

TEXT BOOKS:

1. Bhatta B (2008), Remote sensing and GIS‟, Oxford University Press
2. Lillesand, T.M, R.W. Kiefer and J.W. Chipman (2013) Remote Sensing and Image Interpretation‟, Wiley India Pvt. Ltd., New Delhi
3. Schowenger, R. A (2006) Remote Sensing, Elsevier publishers.

4. Parkinson,B. W., Spilker, J. J. (Jr.) (1996). Global Positioning System: Theory & Applications (Volume-I). AIAA, USA
5. Remote Sensing of the environment- An earth resource perspective- 2nd edition- by John R. Jensen, Pearson Education.
6. Introduction to geographic information system- kang – Tsung Chang, Tata McGraw- Hill Education Private Limited.
7. Concepts & Techniques of GIS by C.P.Lo Albert, K.W. Yonng, Prentice Hall (India) Publications. Remote Sensing and Geographical Information systems by M.Anji Reddy JNTU Hyderabad 2001, B.S. Publications.
8. Principals of Geo physical Information System- Peter A Burragh and Rachael A. Mc Donnell, Oxford Publishers 2004
9. Basics of Remote Sensing and GIS by S. Kumar, laxmi Publications.

REFERENCE BOOKS:

1. Fundamentals of Remote Sensing by George Joseph, Universities Press, 2013.
2. Fundamentals of Geographic Information Systems‟ by Demers, M.N, Wiley India Pvt.Ltd, 2013. 3. Jensen John R. Introduction to Digital Image Processing: A Remote Sensing Perspective Prentice hall, New Jersey
4. Paul Wolf, Elements of Photogrammetry, McGraw Hill.
5. Leick Alfred, 1995: GPS Satellite Surveying, Wiley Interscience
6. Burrough, P. P. &McDonnel, R. A. (1998). Principles of GIS. Oxford University Press

Course Outcomes:

After completing this course the student will have acquired the ability on the following. 1. Understand the concepts of Photogrametry and compute the heights of objects.

CO1 Understand the principles of aerial and satellite remote sensing, Able to comprehend the energy interactions with earth surface features, spectral properties of water bodies.

CO2 Understand the basic concept of GIS and its applications, know different types of data representation in GIS.

CO3 Understand and Develop models for GIS spatial Analysis and will be able to know what the questions that GIS can answer are.

CO4 Apply knowledge of GIS software and able to work with GIS software in various application fields.

CO5 Illustrate spatial and non spatial data features in GIS and understand the map projections and coordinates systems.

CO6 Apply knowledge of GIS and understand the integration of Remote Sensing and GIS.

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3											3		2
CO2	3	2											3	2	
CO3				3			2						3	2	
CO4											2		2	3	
CO5			3	2						2			2	3	2

SUB CODE	L	T	P	DURATION	IA	ESE	CREDITS
CS23TIC401	3	0	0	3 HOURS	40	60	3

INTRODUCTION TO INFORMATION SCIENCE

Course Objective

1. To understand basic concepts about Coding Theorem.
2. To understand basic concepts about error detection and correction methods.
3. To understand basic concepts about compression techniques.
4. To understand basic concepts about video image compression techniques.
5. To understand basic concepts about cryptography.

UNIT-I

Uncertainty, Information and Entropy Information Measures: Characteristics on information measure, Shannon's concept of information, Shannon's measure of information, Model for source coding theorem, Communication system, Source coding and line/channel coding, channel models, channel mutual information capacity (Bandwidth).

UNIT-II

Channel coding, Theorem for discrete memory less channel, Information capacity theorem, Error detecting and error correcting codes, Types of codes, Block codes, Tree codes, Hamming codes, Description of linear block codes by matrices, Description of linear tree code by matrices, Parity check codes, Parity check polynomials.

UNIT-III

Compression: Lossless and lossy, Huffman codes, Binary Image compression schemes, Runlength Encoding, CCITT group-3 1D compression, CCITT group-3 2D compression, CCITT group-42D compression.

UNIT-IV

Video Image Compression: Requirement of full motion video compression, CCITT H 261video coding algorithm, MPEG compression methodology: MPEG-2 compression, Audio (Speech)compression.

UNIT-V

Cryptography: Encryption, Decryption, Cryptogram (cipher text), Concept of cipher, Cryptanalysis, Keys: Single key (Secret key), Cryptography, two-key (Public key) cryptography, Single key cryptography, Ciphers, Block Cipher code, Stream ciphers, Requirements for secrecy, The data Encryption Standard, Public Key Cryptography, Diffie-Hellmann public key distribution, The Rivest-Shamin Adelman (R-S-A) system for public key cryptography, Digital Signature.

Text Books:

1. Digital Communication by Das, Mullick & Chatterjee, New Age Pub.
2. Digital Communication by Proakis, TMH.
3. Digital Image Processing by Gonzales & Woods, Pearson.
4. Local Area Network by G. Keiser, TMH.

Course Outcomes

Upon completion of this course, the students will be able to

1. Student will be able to know about Coding Theorems.
2. Student will be able to know about error detection and correction methods.
3. Student will be able to know about compression techniques.

4. Student will be able to know about video image compression techniques.
5. Student will be able to know about cryptography.

SEMESTER IV

SYLLABUS	(SEMESTER-IV)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	ES23TIC401	L	T	P	TA	IA	Total	60	100	3
Subject:	Effective Technical Communication	3	0	0	10	30	40			

Course Objectives:

Effective Technical communication is critical in today's world. Most problems in an organization arise as a result of poor communication. Effective communication ensures a smooth flow of ideas, facts, decisions, and advice. This way, employees eliminate hindrances in achieving the organization's target.

Course Content:

Unit-1 Fundamentals of Communication Technical Communication: features: Distinction between General and Technical communication; Language as a tool of communication; Levels of communication: Interpersonal, Organizational, Mass communications; the flow of Communication: Downward, Upward, Lateral of Horizontal (Peer group): Importance of technical communication; Barriers to Communication.

Unit-2 Constituents of Technical Written Communication Words and Phrases: Word formation. Synonyms and Antonyms; Homophones; Select vocabulary of about 500-1000 New words; Correct Usage: all Parts of Speech; Modals; Concord; Articles; Infinitives; Requisites of Sentence Construction: Paragraph Development: Techniques and Methods- Inductive, Deductive, Spatial, Linear, Chronological etc; The Art of Condensation-various steps.

Unit-3 Business Communication Principles, Sales & Credit letters; Claim and Adjustment Letters; Job application and Resumes. Reports: Types; Significance; Structure, Style & Writing of Reports. Technical Proposal; Parts; Types; Writing of Proposal; Significance. Negotiation & Business Presentation skills.

Unit-4 Presentation Strategies and Listening Skills. Defining Purpose; Audience & Local; Organizing Contents; Preparing Outline; Audio-visual Aids; Nuances of Delivery; Body Language; Dimensions of Speech: Syllable; Accent; Pitch; Rhythm; Intonation; Paralinguistic features of voice; Listening Skills: Active Listening, Passive Listening. methods for improving Listening Skills.

Unit-5 Value-Based Text Readings Following essays form the suggested text book with emphasis on Mechanics of writing. (i) Humanistic and Scientific Approaches to Human Activity by Moody E. Prior
(ii) The Language of Literature and Science by A. Huxley (iii) Man and Nature by J.Bronowski (iv) The Social Function of Literature by Ian Watt (v) Science and Survival by Barry Commoner (vi) The Mother of the Sciences by A.J.Bahm (vii) The Effect of Scientific Temper on Man by BertrandRussell.

Text Book :

1. Improve Your Writing ed. V.N.Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi..
2. Technical Communication: A Practical Approach: Madhu Rani and Seema Verma- Acme Learning, NewDelhi-2011
3. Technical Communication- Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press,2007, New Delhi.

Reference Books:

1. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt.Ltd,2011, New Delhi.

2. Business Correspondence and Report Writing by Prof. R.C.Sharma& Krishna Mohan, Tata McGraw Hill &Co.Ltd.,2001, New Delhi.
3. Word Power Made Easy by Norman Lewis, W.R.Goyal Pub. &Distributors, 2009,Delhi.
4. Developing Communication Skills by Krishna Mohan, Mecra Bannerji- Macmillan India Ltd. 1990, Delhi.
5. Manual of Practical Communication by L.U.B.Pandey: A.I.T.B.S. Publications India Ltd.; Krishan Nagar,2013, Delhi.
6. English Grammar and Usage by R.P.Sinha,

Course Outcomes:

CO1 At the end of the semester, employability skills of the students will develop.
CO2 Students will improve their Vocabulary and their Accent.
CO3 Enable students with the confidence to use written communication in professional and personal work.
CO4 Students will use correct and appropriate language in oral and written communication

Course Outcomes and their mapping with Programme Outcomes: Effective Technical Communication(CE23IC401)

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	2	3	1	2	3	2	2	2	2	1
CO2	2	3	2	2	1	3	2	1	2	3	2	2	2	2	2
CO3	3	3	2	2	2	2	2	2	2	3	2	2	2	1	2
CO4	3	3	2	2	2	3	3	2	1	3	2	2	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly