JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
R23 B.TECH - CSD COURSE STRUCTURE & SYLLABUS

B. Tech– II Year I Semester

S.No.	Category	Title	L	T	P	Credits
1	BS&H	Discrete Mathematics & Graph Theory	3	0	0	3
2	BS&H	Universal human values – understanding harmony and Ethical human conduct	2	1	0	3
3	Engineering Science	Digital Logic &Computer Organization	3	0	0	3
4	Professional Core	Advanced Data Structures & Algorithms Analysis	3	0	0	3
5	Professional Core	Object-Oriented Programming Through JAVA	3	0	0	3
6	Professional Core	Advanced Data Structures and Algorithms Analysis Lab	0	0	3	1.5
7	Professional Core	Object-Oriented Programming Through JAVA Lab	0	0	3	1.5
8	Skill Enhancement course	Python programming	0	1	2	2
9	Audit Course	Environmental Science	2	0	0	-
Total			**15**	**2**	**10**	**20**

B. Tech– II Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Management Course- I	MEFA	2	0	0	2
2	Engineering Science/ Basic Science	Mathematical Modeling and Simulation	3	0	0	3
3	Professional Core	Operating Systems	3	0	0	3
4	Professional Core	Database Management Systems	3	0	0	3
5	Professional Core	Human Computer Interaction	3	0	0	3
6	Professional Core	Human Computer Interaction Lab	0	0	3	1.5
7	Professional Core	Database Management Systems Lab	0	0	3	1.5
8	Skill Enhancement course	Full Stack development-1	0	1	2	2
9	BS&H	Design Thinking &Innovation	1	0	2	2
Total			**15**	**1**	**12**	**21**
Mandatory Community Service Project Internship of 08weeks duration during summer vacation						

II Year I Semester

L	T	P	C
3	0	0	3

DISCRETE MATHEMATICS AND GRAPH THEORY

Course Objectives:

- To introduce the students to the topics and techniques of discrete methods and combinatorial reasoning.
- To introduce a wide variety of applications. The algorithmic approach to the solution of problems is fundamental in discrete mathematics, and this approach reinforces the close ties between this discipline and the area of computer science.

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

1. Build skills in solving mathematical problems (L3)
2. Comprehend mathematical principles and logic (L4)
3. Demonstrate knowledge of mathematical modeling and proficiency in using mathematical software (L6)
4. Manipulate and analyze data numerically and/or graphicallysing appropriate Software (L3)
5. How to communicate effectively mathematical ideas/results verbally or in writing (L1)

UNIT–I: Mathematical Logic:

Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises, Indirect Method of Proof, Predicate Calculus: Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.

UNIT-II: Set Theory:
Sets: Operations on Sets, Principle of Inclusion-Exclusion, Relations: Properties, Operations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering, Hasse Diagrams, Functions: Bijective, Composition, Inverse, Permutation, and Recursive Functions, Lattice and its Properties.

UNIT-III: Combinatorics and Recurrence Relations:
Basis of Counting, Permutations, Permutations with Repetitions, Circular and Restricted Permutations, Combinations, Restricted Combinations, Binomial and Multinomial Coefficients and Theorems.

Recurrence Relations:
Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic

Roots, Solving Inhomogeneous Recurrence Relations

UNIT-IV: Graph Theory:

Basic Concepts, Graph Theory and its Applications, Subgraphs, Graph Representations: Adjacency and Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs,

Unit-V: Multi Graphs

Multigraphs, Bipartite and Planar Graphs, Euler's Theorem, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Prim's and Kruskal's Algorithms, BFS and DFS Spanning Trees.

TEXT BOOKS:

1. Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and P. Manohar, Tata McGraw Hill.
2. Elements of Discrete Mathematics-A Computer Oriented Approach, C. L.Liu and D. P. Mohapatra, 3rd Edition, Tata McGraw Hill.
3. Theory and Problems of Discrete Mathematics, Schaum's Outline Series, Seymour Lipschutz and Marc Lars Lipson, 3rd Edition, McGraw Hill.

REFERENCE BOOKS:

1. Discrete Mathematics for Computer Scientists and Mathematicians, J. L.Mott, A. Kandel and T. P. Baker, 2nd Edition, Prentice Hall of India.
2. Discrete Mathematical Structures, Bernand Kolman, Robert C. Busby andSharon Cutler Ross, PHI.
3. Discrete Mathematics, S. K. Chakraborthy and B.K. Sarkar, Oxford, 2011.
4. Discrete Mathematics and its Applications with Combinatorics and GraphTheory, K. H. Rosen, 7th Edition, Tata McGraw Hill.

II Year I Semester

L	T	P	C
2	1	0	3

UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT

Course Objectives:

- To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Outcomes:

- Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2)
- Identify one's self, and one's surroundings (family, society nature) (L1, L2)
- Apply what they have learnt to their own self in different day-to-day settings in real life (L3)
- Relate human values with human relationship and human society. (L4)
- Justify the need for universal human values and harmonious existence (L5)
- Develop as socially and ecologically responsible engineers (L3, L6)

Course Topics

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1-hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.

The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

UNIT I Introduction to Value Education (6 lectures and 3 tutorials for practice session)

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture 2: Understanding Value Education
Tutorial 1: Practice Session PS1 Sharing about Oneself
Lecture 3: self-exploration as the Process for Value Education
Lecture4: Continuous Happiness and Prosperity – the Basic Human Aspirations
Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario

Lecture 6: Method to Fulfill the Basic Human Aspirations
Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

UNIT II Harmony in the Human Being (6 lectures and 3 tutorials for practice session)
Lecture 7: Understanding Human being as the Co-existence of the self and the body.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.
Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

UNIT III Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)
Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust
Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT IV Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)
Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence.

UNIT V Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)
Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and Profession

Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education
PS1 Sharing about Oneself
PS2 Exploring Human Consciousness
PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being
PS4 Exploring the difference of Needs of self and body
PS5 Exploring Sources of Imagination in the self
PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – Harmony in the Family and Society
PS7 Exploring the Feeling of Trust
PS8 Exploring the Feeling of Respect
PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV – Harmony in the Nature (Existence)
PS10 Exploring the Four Orders of Nature
PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics
PS12 Exploring Ethical Human Conduct
PS13 Exploring Humanistic Models in Education
PS14 Exploring Steps of Transition towards Universal Human Order

READINGS:

Textbook and Teachers Manual

a. The Textbook

R R Gaur, R Asthana, G P Bagaria, *A Foundation Course in Human Values and Professional Ethics*, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

b. The Teacher's Manual

R R Gaur, R Asthana, G P Bagaria,*Teachers' Manual for A Foundation Course in Human Values and Professional Ethics,* 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. *JeevanVidya: EkParichaya*, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. *Human Values*, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. *The Story of Stuff* (Book).
4. *The Story of My Experiments with Truth* - by Mohandas Karamchand Gandhi
5. *Small is Beautiful* - E. F Schumacher.
6. *Slow is Beautiful* - Cecile Andrews
7. *Economy of Permanence* - J C Kumarappa
8. *Bharat Mein Angreji Raj* – PanditSunderlal
9. *Rediscovering India* - by Dharampal
10. *Hind Swaraj or Indian Home Rule* - by Mohandas K. Gandhi
11. *India Wins Freedom* - Maulana Abdul Kalam Azad

12. *Vivekananda* - Romain Rolland (English)
13. *Gandhi* - Romain Rolland (English)

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.
Tutorial hours are to be used for practice sessions.
While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.
In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.
It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.
Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

Online Resources:

1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf
4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf

7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

II Year I Semester

L	T	P	C
3	0	0	3

DIGITAL LOGIC & COMPUTER ORGANIZATION

Course Objectives:

The main objectives of the course is to

- provide students with a comprehensive understanding of digital logic design principles and computer organization fundamentals
- Describe memory hierarchy concepts
- Explain input/output (I/O) systems and their interaction with the CPU, memory, and peripheral devices

UNIT – I:

Data Representation: Binary Numbers, Fixed Point Representation. Floating Point Representation. Number base conversions, Octal and Hexadecimal Numbers, components, Signed binary numbers, Binary codes

Digital Logic Circuits-I: Basic Logic Functions, Logic gates, universal logic gates, Minimization of Logic expressions. K-Map Simplification, Combinational Circuits, Decoders, Multiplexers

UNIT – II:

Digital Logic Circuits-II: Sequential Circuits, Flip-Flops, Binary counters, Registers, Shift Registers, Ripple counters

Basic Structure of Computers: Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers, Computer Generations, Von- Neumann Architecture

UNIT – III:

Computer Arithmetic : Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations

Processor Organization: Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control and Multi programmed Control

UNIT – IV:

The Memory Organization: Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage

UNIT – V:

Input/Output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces

Textbooks:

1. Computer Organization, Carl Hamacher, ZvonkoVranesic, SafwatZaky, 6th edition, McGraw Hill, 2023.
2. Digital Design, 6th Edition, M. Morris Mano, Pearson Education, 2018.
3. Computer Organization and Architecture, William Stallings, 11thEdition, Pearson, 2022.

Reference Books:

1. Computer Systems Architecture, M.Moris Mano, 3rdEdition, Pearson, 2017.
2. Computer Organization and Design, David A. Paterson, John L. Hennessy, Elsevier, 2004.
3. Fundamentals of Logic Design, Roth, 5thEdition, Thomson, 2003.

Online Learning Resources:

https://nptel.ac.in/courses/106/103/106103068/

II Year I Semester

L	T	P	C
3	0	0	3

ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS

Course Objectives:

The main objectives of the course is to

- provide knowledge on advance data structures frequently used in Computer Science domain
- Develop skills in algorithm design techniques popularly used
- Understand the use of various data structures in the algorithm design

UNIT – I:

Introduction to Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations.

AVL Trees – Creation, Insertion, Deletion operations and Applications

B-Trees – Creation, Insertion, Deletion operations and Applications

UNIT – II:

Heap Trees (Priority Queues) – Min and Max Heaps, Operations and Applications

Graphs – Terminology, Representations, Basic Search and Traversals, Connected Components and Biconnected Components, applications

Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen's matrix multiplication, Convex Hull

UNIT – III:

Greedy Method: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths

Dynamic Programming: General Method, All pairs shortest paths, Single Source Shortest Paths – General Weights (Bellman Ford Algorithm), Optimal Binary Search Trees, 0/1 Knapsack, String Editing, Travelling Salesperson problem

UNIT – IV:

Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, 0/1 Knapsack Problem

Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem

UNIT – V:

NP Hard and NP Complete Problems: Basic Concepts, Cook's theorem

NP Hard Graph Problems: Clique Decision Problem (CDP), Chromatic Number Decision Problem (CNDP), Traveling Salesperson Decision Problem (TSP)

NP Hard Scheduling Problems: Scheduling Identical Processors, Job Shop Scheduling

Textbooks:

1. Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh 2nd Edition Universities Press
2. Computer Algorithms/C++ Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran 2nd Edition University Press

Reference Books:

1. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
2. An introduction to Data Structures with applications, Trembley & Sorenson, McGraw Hill
3. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison-Wesley, 1997.
4. Data Structures using C & C++: Langsam, Augenstein & Tanenbaum, Pearson, 1995
5. Algorithms + Data Structures & Programs:, N.Wirth, PHI
6. Fundamentals of Data Structures in C++: Horowitz Sahni & Mehta, Galgottia Pub.
7. Data structures in Java:, Thomas Standish, Pearson Education Asia

Online Learning Resources:

1. https://www.tutorialspoint.com/advanced_data_structures/index.asp
2. http://peterindia.net/Algorithms.html
3. Abdul Bari, 1. Introduction to Algorithms (youtube.com)

II Year I Semester

L	T	P	C
3	0	0	3

OBJECT-ORIENTED PROGRAMMING THROUGH JAVA

Course Objectives:

The learning objectives of this course are to:

- identify Java language components and how they work together in applications
- learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
- understand how to design applications with threads in Java
- understand how to use Java APIs for program development

UNIT I: Object Oriented Programming: Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, **Introduction to Operators**, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

UNIT II: Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

UNIT III: Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for

Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT IV: Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.

Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java(Text Book 2)

UNIT V: String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread-Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

Java Database Connectivity: Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, Result Set Interface

Java FX GUI: Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events (Text Book 3)

Text Books:

1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, DebasisSamanta, MonalisaSarma, Cambridge, 2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

References Books:

1. The complete Reference Java, 11th edition, Herbert Schildt,TMH
2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

Online Resources:

1. https://nptel.ac.in/courses/106/105/106105191/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview

II Year I Semester

L	T	P	C
0	0	3	1.5

ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS LAB

Course Objectives:

The objectives of the course is to

- acquire practical skills in constructing and managing Data structures
- apply the popular algorithm design methods in problem-solving scenarios

Experiments covering the Topics:

- Operations on AVL trees, B-Trees, Heap Trees
- Graph Traversals
- Sorting techniques
- Minimum cost spanning trees
- Shortest path algorithms
- 0/1 Knapsack Problem
- Travelling Salesperson problem
- Optimal Binary Search Trees
- N-Queens Problem
- Job Sequencing

Sample Programs:

1. Construct an AVL tree for a given set of elements which are stored in a file. And implement insert and delete operation on the constructed tree. Write contents of tree into a new file using in-order.
2. Construct B-Tree an order of 5 with a set of 100 random elements stored in array. Implement searching, insertion and deletion operations.
3. Construct Min and Max Heap using arrays, delete any element and display the content of the Heap.
4. Implement BFT and DFT for given graph, when graph is represented by
   a) Adjacency Matrix b) Adjacency Lists
5. Write a program for finding the bi-connected components in a given graph.
6. Implement Quick sort and Merge sort and observe the execution time for various input sizes (Average, Worst and Best cases).
7. Compare the performance of Single Source Shortest Paths using Greedy method when the graph is represented by adjacency matrix and adjacency lists.
8. Implement Job sequencing with deadlines using Greedy strategy.
9. Write a program to solve 0/1 Knapsack problem Using Dynamic Programming.
10. Implement N-Queens Problem Using Backtracking.
11. Use Backtracking strategy to solve 0/1 Knapsack problem.
12. Implement Travelling Sales Person problem using Branch and Bound approach.

Reference Books:

1. Fundamentals of Data Structures in C++, Horowitz Ellis, SahniSartaj, Mehta, Dinesh, 2nd Edition, Universities Press
2. Computer Algorithms/C++ Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, 2nd Edition, University Press
3. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
4. An introduction to Data Structures with applications, Trembley& Sorenson, McGraw Hill

Online Learning Resources:

1. http://cse01-iiith.vlabs.ac.in/
2. http://peterindia.net/Algorithms.html

II Year I Semester

L	T	P	C
0	0	3	1.5

OBJECT-ORIENTED PROGRAMMING THROUGH JAVA LAB

Course Objectives:

The aim of this course is to

- Practice object oriented programming in the Java programming language
- implement Classes, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism
- Illustrate inheritance, Exception handling mechanism, JDBC connectivity
- Construct Threads, Event Handling, implement packages, Java FX GUI

Experiments covering the Topics:

- Object Oriented Programming fundamentals- data types, control structures
- Classes, methods, objects, Inheritance, polymorphism,
- Exception handling, Threads, Packages, Interfaces
- Files, I/O streams, JavaFX GUI

Sample Experiments:

Exercise – 1:

a) Write a JAVA program to display default value of all primitive data type of JAVA

b) Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root.

Exercise - 2

a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism.

b) Write a JAVA program to sort for an element in a given list of elements using bubble sort

c) Write a JAVA program using String Buffer to delete, remove character.

Exercise - 3

a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.

b) Write a JAVA program implement method overloading.

c) Write a JAVA program to implement constructor.

d) Write a JAVA program to implement constructor overloading.

Exercise - 4

a) Write a JAVA program to implement Single Inheritance

b) Write a JAVA program to implement multi level Inheritance

c) Write a JAVA program for abstract class to find areas of different shapes

Exercise - 5

a) Write a JAVA program give example for "super" keyword.
b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?
c) Write a JAVA program that implements Runtime polymorphism

Exercise - 6

a) Write a JAVA program that describes exception handling mechanism
b) Write a JAVA program Illustrating Multiple catch clauses

- Write a JAVA program for creation of Java Built-in Exceptions
- Write a JAVA program for creation of User Defined Exception

Exercise - 7

a) Write a JAVA program that creates threads by extending Thread class. First thread display "Good Morning "every 1 sec, the second thread displays "Hello "every 2 seconds and the third display "Welcome" every 3 seconds, (Repeat the same by implementing Runnable)
b) Write a program illustrating **is Alive** and **join ()**
c) Write a Program illustrating Daemon Threads.
d) Write a JAVA program Producer Consumer Problem

Exercise – 8

1. Write a JAVA program that import and use the user defined packages
2. Without writing any code, build a GUI that display text in label and image in an ImageView (use JavaFX)
3. Build a Tip Calculator app using several JavaFX components and learn how to respond to user interactions with the GUI

Exercise – 9

1. Write a java program that connects to a database using JDBC

b)Write a java program to connect to a database using JDBC and insert values into it.
c) Write a java program to connect to a database using JDBC and delete values from it

II Year I Semester

L	T	P	C
0	1	2	2

PYTHON PROGRAMMING
(SKILL ENHANCEMENT COURSE)

Course Objectives:

The main objectives of the course are to

- Introduce core programming concepts of Python programming language.
- Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
- Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these

UNTI-I: History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.
Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.
Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.

i) Arithmetic Operators ii) Relational Operators iii) Assignment Operatorsiv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators

5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number.

UNIT-II: Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.
Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.
Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Sample Experiments:

1. Write a program to define a function with multiple return values.
2. Write a program to define a function using default arguments.
3. Write a program to find the length of the string without using any library functions.
4. Write a program to check if the substring is present in a given string or not.
5. Write a program to perform the given operations on a list:
   i. Addition ii. Insertion iii. slicing
6. Write a program to perform any 5 built-in functions by taking any list.

UNIT-III: Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.
Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

Sample Experiments:

1. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
2. Write a program to count the number of vowels in a string (No control flow allowed).
3. Write a program to check if a given key exists in a dictionary or not.
4. Write a program to add a new key-value pair to an existing dictionary.
5. Write a program to sum all the items in a given dictionary.

UNIT-IV: Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.
Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

Sample Experiments:

1. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
2. Python program to print each line of a file in reverse order.
3. Python program to compute the number of characters, words and lines in a file.
4. Write a program to create, display, append, insert and reverse the order of the items in the array.
5. Write a program to add, transpose and multiply two matrices.

6. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

UNIT-V: Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

Sample Experiments:

1. Python program to check whether a JSON string contains complex object or not.
2. Python Program to demonstrate NumPy arrays creation using array () function.
3. Python program to demonstrate use of ndim, shape, size, dtype.
4. Python program to demonstrate basic slicing, integer and Boolean indexing.
5. Python program to find min, max, sum, cumulative sum of array
6. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
    a) Apply head () function to the pandas data frame
    b) Perform various data selection operations on Data Frame
7. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

Reference Books:

1. Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

Online Learning Resources/Virtual Labs:

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.coursera.org/learn/python?specialization=python#syllabus

II Year I Semester

L	T	P	C
2	0	0	--

ENVIRONMENTAL SCIENCE

Course Objectives:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
- To save earth from the inventions by the engineers.

UNIT – I

Multidisciplinary Nature of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT – II

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and Its Conservation : Introduction and Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III

Environmental Pollution: Definition, Cause, effects and control measures of:

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT – IV

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT – V

Human Population And The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Textbooks:

1. Erach Bharucha,Text book of Environmental Studies for Undergraduate Courses,Universities Press (India) Private Limited, 2019.
2. Palaniswamy, Environmental Studies, 2/e, Pearson education, 2014.
3. S.Azeem Unnisa, Environmental Studies, Academic Publishing Company, 2021.
4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, SciTech Publications (India), Pvt. Ltd, 2010.

Reference Books:

1. Deeksha Dave and E.Sai Baba Reddy, Textbook of Environmental Science, 2/e, Cengage Publications, 2012.
2. M.Anji Reddy, "Textbook of Environmental Sciences and Technology", BS Publication, 2014.
3. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications, 2006.
4. J. Glynn Henry and Gary W. Heinke, Environmental Sciences and Engineering, Prentice Hall of India Private limited, 1988.
5. G.R. Chatwal, A Text Book of Environmental Studies, Himalaya Publishing House, 2018.
6. Gilbert M. Masters and Wendell P. Ela, Introduction to Environmental Engineering and Science, 1/e, Prentice Hall of India Private limited, 1991.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc23_hs155/preview
- https://www.edx.org/learn/environmental-science/rice-university-ap-r-environmental-science-part-3-pollution-and-resources?index=product&objectID=course-3a6da9f2-d84c-4773-8388-1b2f8f6a75f2&webview=false&campaign=AP%C2%AE+Environmental+Science++Part+3%3A+Pollution+and+Resources&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fenvironmental-science
- http://ecoursesonline.iasri.res.in/Courses/Environmental%20Science-I/Data%20Files/pdf/lec07.pdf
- https://www.youtube.com/watch?v=5QxxaVfgQ3k

Course Outcomes:

COs	Statements	Blooms Level
CO1	asp multi disciplinary nature of environmental studies and various renewable and non-renewable resources.	L2
CO2	derstand flow and bio-geo- chemical cycles and ecological pyramids.	L2
CO3	derstand various causes of pollution and solid waste management and related preventive measures.	L2
CO4	derstand the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.	L2
CO5	strate the causes of population explosion, value education and welfare programmes.	L3

II Year II Semester

L	T	P	C
2	0	0	2

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Course Objectives:

- To inculcate the basic knowledge of microeconomics and financial accounting
- To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost
- To Know the Various types of market structure and pricing methods and strategy
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

Course Outcomes:

- Define the concepts related to Managerial Economics, financial accounting and management(L2)
- Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets (L2)
- Apply the Concept of Production cost and revenues for effective Business decision (L3)
- Analyze how to invest their capital and maximize returns (L4)
- Evaluate the capital budgeting techniques. (L5)
- Develop the accounting statements and evaluate the financial performance of business entity (L5)

UNIT - I Managerial Economics

Introduction – Nature, meaning, significance, functions, and advantages. Demand-Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting-Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.

UNIT - II Production and Cost Analysis

Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least- cost combination– Short run and long run Production Function- Isoquants and Is costs, Cost & Break-Even Analysis - Cost concepts and Cost behaviour- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems).

UNIT - III Business Organizations and Markets

Introduction – Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition– Oligopoly-Price-Output Determination - Pricing Methods and Strategies

UNIT - IV Capital Budgeting

Introduction – Nature, meaning, significance. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals, Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems)

UNIT - V Financial Accounting and Analysis

Introduction – Concepts and Conventions- Double-Entry Bookkeeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Introduction to Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

Textbooks:

1. Varshney & Maheswari: Managerial Economics, Sultan Chand.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH.

Reference Books:

1. Ahuja Hl Managerial economics Schand.
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage.

Online Learning Resources:

https://www.slideshare.net/123ps/managerial-economics-ppt
https://www.slideshare.net/rossanz/production-and-cost-45827016
https://www.slideshare.net/darkyla/business-organizations-19917607
https://www.slideshare.net/balarajbl/market-and-classification-of-market
https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396
https://www.slideshare.net/ashu1983/financial-accounting

II Year II Semester

L	T	P	C
3	0	0	3

MATHEMATICAL MODELLING & SIMULATION

Course Objectives:

This course focuses on what is needed to build simulation software environments, and not just building simulations using preexisting packages.

Course Outcomes:

1. Understand basic Model Forms.
2. Understand Model fitting
3. Understand basic Simulation Approaches.
4. Examine reliability systems.
5. Analyse graph models.

UNIT – I: Principles of Mathematical Modelling:

Systems, Models, Simulations, Mathematics as a Natural Modelling Language, Definition of Mathematical Models, Examples and Some More Definitions, Classification of Mathematical Models. (Section 1.2-1.5 andSection-1.7 of Chapter-1 from Text Book-1).

UNIT – II: Model Fitting:

Fitting models to data graphically, analytic methods of model fitting, least-square criterion (Chapter- 3 of Text Book -2)

UNIT – III: Simulation modelling:

Simulating deterministic behaviour, Generating random numbers, Simulating probabilistic behaviour, Inventory model: Gasoline and consumer demand, Queuing models (Chapter-5 of Text Book-2)

UNIT – IV: Discrete probabilistic modelling:

Probabilistic modelling with discrete systems, Modelling component and system reliability, Linear regression**.** (Chapter-6 of Text Book-2)

UNIT – V: Modelling using Graph theory:

Graphs as models, Describing Graphs, Graph models. Using graph models to solve problems, connections to mathematical programming(Chapter-8 of Text Book-2)

Textbooks:

1. Mathematical Modelling and Simulation: Introduction for Scientists and Engineersby Kai Velten, Wiley Publishers
2. A first course in Mathematical modelling – Frank R. Giordano, William P.Fox, Steven B.Horton, cengage

Reference Books:

1. Introduction to Mathematical Modeling and Computer Simulations By Vladimir Mityushev,WojciechNawalaniecNataliaRylko Published by Chapman and Hall/CRC.

II Year II Semester

L	T	P	C
3	0	0	3

OPERATING SYSTEMS

Course Objectives:

The main objectives of the course is to make student

- Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
- Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- Illustrate different conditions for deadlock and their possible solutions.

UNIT – I: Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Free and Open-Source Operating Systems

System Structures: Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Building and Booting an Operating System, Operating system debugging

UNIT – II: Processes: Process Concept, Process scheduling, Operations on processes, Inter-process communication.

Threads and Concurrency: Multithreading models, Thread libraries, Threading issues.

CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling.

UNIT – III: Synchronization Tools: The Critical Section Problem, Peterson's Solution, Mutex Locks, Semaphores, Monitors, Classic problems of Synchronization.

Deadlocks: system Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock.

UNIT – IV: Memory-Management Strategies: Introduction, Contiguous memory allocation, Paging, Structure of the Page Table, Swapping.

Virtual Memory Management: Introduction, Demand paging, Copy-on-write, Page replacement, Allocation of frames, Thrashing

Storage Management: Overview of Mass Storage Structure, HDD Scheduling.

UNIT – V: File System: File System Interface: File concept, Access methods, Directory Structure; File system Implementation: File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management; File-System Internals: File-System Mounting, **Partitions and Mounting, File Sharing.**

Protection: Goals of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix.

Text Books:

1. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10th Edition, Wiley, 2018.
2. Modern Operating Systems, Tanenbaum A S, 4th Edition, Pearson , 2016

Reference Books:

1. Operating Systems -Internals and Design Principles, Stallings W, 9th edition, Pearson, 2018
2. Operating Systems: A Concept Based Approach, D.M Dhamdhere, 3rd Edition, McGraw- Hill, 2013

Online Learning Resources:

1. https://nptel.ac.in/courses/106/106/106106144/
2. http://peterindia.net/OperatingSystems.html

II Year II Semester

L	T	P	C
3	0	0	3

DATABASE MANAGEMENT SYSTEMS

Course Objectives:

The main objectives of the course is to

- Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra
- Introduce the concepts of basic SQL as a universal Database language
- Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
- Provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques

UNIT I: Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.
Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

Unit II: Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

UNIT III: SQL: Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions (Date and Time, Numeric, String conversion).Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational set operations.

UNIT IV: Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form(BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF).

UNIT V: Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for

Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.

Introduction to Indexing Techniques: B+ Trees, operations on B+Trees, Hash Based Indexing:

Text Books:

1. Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)
2. Database System Concepts,5th edition, Silberschatz, Korth, Sudarsan,TMH (For Chapter 1 and Chapter 5)

Reference Books:

1. Introduction to Database Systems, 8thedition, C J Date, Pearson.
2. Database Management System, 6th edition, RamezElmasri, Shamkant B. Navathe, Pearson
3. Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

Web-Resources:

1. https://nptel.ac.in/courses/106/105/106105175/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview

II Year II Semester

L	T	P	C
3	0	0	3

HUMAN COMPUTER INTERACTION

Course Objectives:

The objectives of the course is to

- facilitate communication between students of psychology, design, and computer science on user interface development projects,
- provide the future user interface designer with concepts and strategies for making design decisions,
- expose the future user interface designer to tools, techniques, and ideas for interface design,
- introduce the student to the literature of human-computer interaction and to stress the importance of good user interface design.

UNIT I: Introduction - Good and Poor Design, Interaction design, User experience, Understanding users, Accessibility and Inclusiveness, Usability and user Experience goals Conceptualization Interaction - Conceptual models, Interface metaphors, Interaction types, Paradigms, Visions, Theories, Models and Frameworks

UNIT II: Cognitive Aspects- Introduction, Cognition, Cognitive Frameworks
Social Interaction - Being social, Face to Face Conversations, Remote Conversations, Co-Presence, Social Engagement

UNIT III: Emotional Interaction- Introduction, Emotions and the user Experience, Expressive Interfaces and Emotional designs, Annoying Interfaces, Affective computing and Emotional AI, Persuasive Technologies and Behavioral Change, Anthropomorphism
Interfaces - Interface types, Natural User Interface and beyond.

UNIT IV: Data Analysis, Interpretation and Presentation- Introduction, Quantitative and Qualitative Analysis, Data at Scale- Introduction, Approaches to collecting and Analyzing data, Visualizing and Exploring data, Ethical design concerns

UNITV: Interactive Design Process- Introduction, Prototyping, Conceptual design, Concrete design, generating prototypes.
Evaluation- Introduction, Types of evaluation, Evaluation Case studies, Usability studies, Conducting Experiments.

Text Books:

1. Helen Sharp, Yvonne Rogers, Jennifer Preece, Interaction Design: Beyond Human Computer Interaction, 2019, 5th Edition, Wiley.

Reference Books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, Human Computer Interaction, Third Edition, Pearson Education, 2004.
2. Brian Fling, Mobile Design and Development, First Edition , O'Reilly Media, 2009
3. Bill Scott and Theresa Neil, Designing Web Interfaces, First Edition, O'Reilly, 2009.

Online Learning Resources:

1. https://nptel.ac.in/courses/106103115

II Year II Semester

L	T	P	C
0	0	3	1.5

HUMAN COMPUTER INTERACTION LAB

Course Objectives:

1. To study the field of human-computer-interaction.
2. To gain an understanding of the human part of human-computer-interactions.
3. To learn to do design and evaluate effective human-computer-interactions.

List of Activities/Experiments:

1. **Identify and observe bad designs**
   Students are expected to submit minimum of 3 to 5 photographs of bad designs in their surrounding or home or any product or neighborhood and create a report mentioning why is it bad? They can submit word/pdf file having photos and description, source of photos and place and mention why is it bad and discuss the outcome during lab session.
2. **"The Jugad":**
   Humans are very creative and often use it to get work done with available set up and resources. Students are expected to identify Jugad (things used creatively but not meant for that) things and submit minimum of 3 to 5 photographs of Jugad in their surrounding or home or neighborhood. Prepare a report mentioning the Jugad and source of photos. Discuss the outcome during lab session.
3. **Feedback and Constraint:**
   Products or interfaces should offer useful feedback to understand the state and have constraints to avoid mistakes while using them. Students are expected to identify and analyze minimum of 5 interfaces or products offering feedback and constraint. Prepare a report clearly showcasing feedback and constraint and support it with minimum of 5 photographs taken in their surrounding or home or neighborhood. Discuss the outcome during lab session.
4. **Prototype and Wire frame:**
   Consider a virtual reality device which can be used by teachers and students for more realistic and immersive Online Classroom. Use wireframes for performing the following:
   a. Information and architecture design, b. Layout Design, and c. Functional Design.
   Do the tasks: static wireframe design and Dynamic wireframe design using tool of your choice.
5. Do all the tasks mentioned in the above experiment for design of a device which supports GPS and also Simultaneous localization and mapping.

6. **CSS:**
   Students are expected to design minimum of 5 web pages using CSS for the problem statement chosen in assignment no. 4. Apply CSS properties Border, margins, Padding, Navigation, dropdown list to page.
7. **CMS tool:**
   Develop website using any CMS tool which falls into one of the categories blog, social networking, News updates, Wikipedia, E-commerce store. Website must include home page, and at least 5 forms. Use WordPress/ Joomla/ Drupal /PHP/ CSS/Bootstrap/ JavaScript.
8. **Evaluation of Interface:**
   Students are expected to evaluate minimum of two products / software interface against known HCI evaluation.
9. Do one of the following projects using all you have studied
   a. Gram Panchayat
   b. E-shopping
   c. E-Arogyasree
   d. E-voter system.

References:

1. AlanDix (2008).Human Computer Interaction. Pearson Education.
2. Ben Schneiderman; Catherine Plaisant; Maxine Cohen; Steven Jacobs (29 August 2013). Designing the User Interface: Strategies for Effective Human-Computer Interaction. Pearson Education Limited.

Online Learning Resources:

1. https://www.coursera.org/specializations/interaction-design
2. https://iitg.ac.in/cseweb/vlab/creative-design-prototyping/index.html

L	T	P	C
0	0	3	1.5

II Year II Semester

DATABASE MANAGEMENT SYSTEMS LAB

Course Objectives:

This Course will enable students to

- Populate and query a database using SQL DDL/DML Commands
- Declare and enforce integrity constraints on a database
- Writing Queries using advanced concepts of SQL
- Programming PL/SQL including procedures, functions, cursors and triggers,

Experiments covering the topics:

- DDL, DML, DCL commands
- Queries, nested queries, built-in functions,
- PL/SQL programming- control structures
- Procedures, Functions, Cursors, Triggers,
- Database connectivity- ODBC/JDBC

Sample Experiments:

1. Creation, altering and droping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.
2. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints. Example:- Select the roll number and name of the student who secured fourth rank in the class.
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)
5.
   i. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)
   ii. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.
6. Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.

7. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE-APPLICATION ERROR.
8. Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.
9. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.
10. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.
11. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers
12. Create a table and perform the search operation on table using indexing and non-indexing techniques.
13. Write a Java program that connects to a database using JDBC
14. Write a Java program to connect to a database using JDBC and insert values into it
15. Write a Java program to connect to a database using JDBC and delete values from it

Text Books/Suggested Reading:

1. Oracle: The Complete Reference by Oracle Press
2. Nilesh Shah, "Database Systems Using Oracle", PHI, 2007
3. Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007

II Year II Semester

L	T	P	C
0	1	2	2

FULL STACK DEVELOPMENT – 1
(SKILL ENHANCEMENT COURSE)

Course Objectives:

The main objectives of the course are to

1. Make use of HTML elements and their attributes for designing static web pages
2. Build a web page by applying appropriate CSS styles to HTML elements
3. Experiment with JavaScript to develop dynamic web pages and validate forms

Experiments covering the Topics:

- Lists, Links and Images
- HTML Tables, Forms and Frames
- HTML 5 and Cascading Style Sheets, Types of CSS
- Selector forms
- CSS with Color, Background, Font, Text and CSS Box Model
- Applying JavaScript - internal and external, I/O, Type Conversion
- JavaScript Conditional Statements and Loops, Pre-defined and User-defined Objects
- JavaScript Functions and Events
- Node.js

Sample Experiments:

1. Lists, Links and Images

a. Write a HTML program, to explain the working of lists.
   Note: It should have an ordered list, unordered list, nested lists and ordered list in an unordered list and definition lists.
b. Write a HTML program, to explain the working of hyperlinks using <a> tag and href, target Attributes.
c. Create a HTML document that has your image and your friend's image with a specific height and width. Also when clicked on the images it should navigate to their respective profiles.
d. Write a HTML program, in such a way that, rather than placing large images on a page, the preferred technique is to use thumbnails by setting the height and width parameters to something like to 100*100 pixels. Each thumbnail image is also a link to a full sized version of the image. Create an image gallery using this technique

2. HTML Tables, Forms and Frames

- Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>, <td> and attributes: border, rowspan, colspan)

- Write a HTML program, to explain the working of tables by preparing a timetable. (Note: Use <caption> tag to set the caption to the table & also use cell spacing, cell padding, border, rowspan, colspan etc.).
- Write a HTML program, to explain the working of forms by designing Registration form. (Note: Include text field, password field, number field, date of birth field, checkboxes, radio buttons, list boxes using <select>&<option> tags, <text area> and two buttons ie: submit and reset. Use tables to provide a better view).
- Write a HTML program, to explain the working of frames, such that page is to be divided into 3 parts on either direction. (Note: first frame image, second frame paragraph, third frame hyperlink. And also make sure of using "no frame" attribute such that frames to be fixed).

3. HTML 5 and Cascading Style Sheets, Types of CSS

a. Write a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>, <footer>, <header>, <main>, <nav>, <section>, , tags.
b. Write a HTML program, to embed audio and video into HTML web page.
c. Write a program to apply different types (or levels of styles or style specification formats) - inline, internal, external styles to HTML elements. (identify selector, property and value).

4. Selector forms

a. Write a program to apply different types of selector forms
   - Simple selector (element, id, class, group, universal)
   - Combinator selector (descendant, child, adjacent sibling, general sibling)
   - Pseudo-class selector
   - Pseudo-element selector
   - Attribute selector

5. CSS with Color, Background, Font, Text and CSS Box Model

a. Write a program to demonstrate the various ways you can reference a color in CSS.
b. Write a CSS rule that places a background image halfway down the page, tilting it horizontally. The image should remain in place when the user scrolls up or down.
c. Write a program using the following terms related to CSS font and text:
   i. font-size ii. font-weight iii. font-style
   iv. text-decoration v. text-transformation vi. text-alignment
d. Write a program, to explain the importance of CSS Box model using
   i. Content ii. Border iii. Margin iv. padding

6. Applying JavaScript - internal and external, I/O, Type Conversion

a. Write a program to embed internal and external JavaScript in a web page.
b. Write a program to explain the different ways for displaying output.
c. Write a program to explain the different ways for taking input.

d. Create a webpage which uses prompt dialogue box to ask a voter for his name and age. Display the information in table format along with either the voter can vote or not

7. JavaScript Pre-defined and User-defined Objects

a. Write a program using document object properties and methods.
b. Write a program using window object properties and methods.
c. Write a program using array object properties and methods.
d. Write a program using math object properties and methods.
e. Write a program using string object properties and methods.
f. Write a program using regex object properties and methods.
g. Write a program using date object properties and methods.
h. Write a program to explain user-defined object by using properties, methods, accessors, constructors and display.

8. JavaScript Conditional Statements and Loops

a. Write a program which asks the user to enter three integers, obtains the numbers from the user and outputs HTML text that displays the larger number followed by the words "LARGER NUMBER" in an information message dialog. If the numbers are equal, output HTML text as "EQUAL NUMBERS".
b. Write a program to display week days using switch case.
c. Write a program to print 1 to 10 numbers using for, while and do-while loops.
d. Write aprogram to print data in object using for-in, for-each and for-of loops
e. Develop a program to determine whether a given number is an 'ARMSTRONG NUMBER' or not. [Eg: 153 is an Armstrong number, since sum of the cube of the digits is equal to the number i.e.,13 + 53+ 33 = 153]
f. Write a program to display the denomination of the amount deposited in the bank in terms of 100's, 50's, 20's, 10's, 5's, 2's & 1's. (Eg: If deposited amount is Rs.163, the output should be 1-100's, 1-50's, 1- 10's, 1-2's & 1-1's)

9. Javascript Functions and Events

a. Design a appropriate function should be called to display
   - Factorial of that number
   - Fibonacci series up to that number
   - Prime numbers up to that number
   - Is it palindrome or not

b. Design a HTML having a text box and four buttons named Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate function should be called to display
   4. Factorial of that number
   5. Fibonacci series up to that number
   6. Prime numbers up to that number
   7. Is it palindrome or not

c. Write a program to validate the following fields in a registration page
   i. Name (start with alphabet and followed by alphanumeric and the length should not be less than 6 characters)
   ii. Mobile (only numbers and length 10 digits)
   iii. E-mail (should contain format like xxxxxxx@xxxxxx.xxx)

Text Books:

1. Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013.
2. Web Programming with HTML5, CSS and JavaScript, John Dean, Jones & Bartlett Learning, 2019 (Chapters 1-11).
3. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, APress, O'Reilly.

Web Links:

1. https://www.w3schools.com/html
2. https://www.w3schools.com/css
3. https://www.w3schools.com/js/
4. https://www.w3schools.com/nodejs
5. https://www.w3schools.com/typescript

II Year II Semester

L	T	P	C
1	0	2	2

DESIGN THINKING & INNOVATION

Course Objectives: The objectives of the course are to

- Bring awareness on innovative design and new product development.
- Explain the basics of design thinking.
- Familiarize the role of reverse engineering in product development.
- Train how to identify the needs of society and convert into demand.
- Introduce product planning and product development process.

UNIT – I Introduction to Design Thinking

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT - II Design Thinking Process

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT - III Innovation

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT - IV Product Design

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.

Activity: Importance of modeling, how to set specifications, Explaining their own product design.

UNIT – V Design Thinking in Business Processes

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.

Activity: How to market our own product, about maintenance, Reliability and plan for startup.

Textbooks:

1. Tim Brown, Change by design, 1/e, Harper Bollins, 2009.
2. Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press, 2018.
2. Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018.
3. William lidwell, Kritinaholden, &Jill butter, Universal principles of design, 2/e, Rockport Publishers, 2010.
4. Chesbrough.H, The era of open innovation, 2003.

Online Learning Resources:

- https://nptel.ac.in/courses/110/106/110106124/
- https://nptel.ac.in/courses/109/104/109104109/
- https://swayam.gov.in/nd1_noc19_mg60/preview
- https://onlinecourses.nptel.ac.in/noc22_de16/preview

Course Outcomes:

COs	Statements	Blooms Level
CO1	Define the concepts related to design thinking.	L1
CO2	Explain the fundamentals of Design Thinking and innovation.	L2
CO3	Apply the design thinking techniques for solving problems in various sectors.	L3
CO4	Analyse to work in a multidisciplinary environment.	L4
CO5	Evaluate the value of creativity.	L5

B. Tech – III Year I Semester

S.No.	Category	Title	L	T	P	C
1	Professional Core	Visual Design and Communication	3	0	0	3
2	Professional Core	Computer Networks	3	0	0	3
3	Professional Core	Data Mining and Data Warehousing	3	0	0	3
4	Professional Elective-I	1. Software Engineering 2. Cyber Security 3. Internet of Things 4. Human Computer Interaction 5. Artificial Intelligence	3	0	0	3
5	Open Elective- I	OR Entrepreneurship Development & Venture Creation OR NPTEL - Usability Engineering	3	0	0	3
6	Professional Core	Visual Design and Communication Lab	0	0	3	1.5
7	Professional Core	Data Mining and Data Warehousing Lab	0	0	3	1.5
8	Skill Enhancement Course	Full Stack development-2 / SWAYAM Plus – Data Engineer / AI Engineer /	0	1	2	2
9	ES	Tinkering Lab (*User Interface Design using Flutter*) / SWAYAM Plus - Android Application Development (with Flutter)	0	0	2	1
	Evaluation of Community Service Internship		-	-	-	2
Total			**15**	**01**	**10**	**23**

MC	Student may select from the same Minor Pool	3	0	3	4.5
MC	Minor Course through SWAYAM / NPTEL (Minimum 12 Week, 3 credit course)	3	0	0	3
HC	Student may select from the same Honors Pool	3	0	0	3
HC	Student may select from the same Honors Pool	3	0	0	3

B. Tech– III Year II Semester

S.No	Category	Title	L	T	P	C
1	Professional Core	Automata Theory & Compiler Design	3	0	0	3
2	Professional Core	Multimedia Applications & Development	3	0	0	3
3	Professional Core	Design of Interactive systems	3	0	0	3
4	Professional Elective-II	1. Software Testing Methodologies 2. Cryptography & Network Security 3. Cloud Computing 4. Principles of Video Editing and 3D Animation	3	0	0	3
5	Professional Elective-III	1. Object Oriented Analysis and Design 2. Mobile Adhoc Networks 3. Augmented Reality and Virtual Reality 4. Computer Graphics & Animation	3	0	0	3
6	Open Elective – II		3	0	0	3
7	Professional Core	Multimedia Applications & Development Lab	0	0	3	1.5
8	Professional Core	Design of Interactive Systems Lab	0	0	3	1.5
9	Skill Enhancement course	Soft skills / SWAYAM Plus - 21st Century Employability Skills	0	1	2	2
10	Audit Course	Technical Paper Writing & IPR	2	0	0	-
Total			**20**	**1**	**08**	**23**
Mandatory Industry Internship / Mini Project of 08 weeks duration during summer vacation						
MC	Student may select from the same minor's pool		3	0	3	4.5
MC	Minor Course (Student may select from the same specialized minors pool)		3	0	0	3
HC	Student may select from the same honors pool		3	0	0	3
HC	Honors Course (Student may select from the honors pool)		3	0	0	3

**** Under Industry Internship interested students can pursue SWAYAM Plus courses viz., Hands-on Masterclass on Data Analytics OR Artificial Intelligence for Real-World Application***

Note: Student need to do at least ONE MOOC Course (3 credits out of 160 credits) to meet the mandatory requirement (11th criteria, as per R23 Regulations)

Open Electives, offered to other department students:

Open Elective I: Principles of Operating Systems/ Computer Organization and Architecture
Open Elective II: Principles of Database Management Systems
Open Elective III: Object Oriented Programming Through Java
Open Elective IV: Principles of Software Engineering /Computer Networks

B. Tech III Year – I Semester

III Year I Semester	VISUAL DESIGN AND COMMUNICATION	L	T	P	C
		3	0	0	3

Objectives:

- To understand the principles of the visual language and their semantic use. A multi-disciplinary domain, design consists of, aesthetics, architecture, products, communication, processes, systems, technology, business/commerce, ramification on environment and society and demands
- To communicate more concisely and in a visually appropriate manner, it is necessary to use commonly understood principles, perspective and design layout standards.
- To understand the fundamentals of Typography and Photography.

Course Outcomes: On completion of the course students will be able to

- Develop the ability to create visual compositions using basic elements and by applying appropriate principles of visual composition to communicate
- Develop the ability to perceive, visualize, and communicate visual elements as visual narratives.
- Develop the ability to apply the dynamics of visual design in Typography and Photography.
- Develop the ability to address simple communication problems through a visualization process and construct mental imageries
- Demonstrate the ability to plan, develop, design and execute communication products

Syllabus:

UNIT-I:

Introduction to Visual Design: Importance of understanding visual language-its relation in context to nature and environment-Exploring and understanding Dots, Lines, Forms, Space, Pattern, Texture and Colour as an elements of visual language

UNIT-II:

Introduction to the Principles of Visual Language: Visual explorations and experiments with Form, Colour, and Space, Texture, in relation to the context and environments – Concepts of harmony, balance, contrast, proportion, order, symmetry, asymmetry, rhythm, tension, juxtaposition, proximity, size, scale, proportion, orientation, alignment, variety, gradation, dominance, subordination, transition etc.

UNIT-III:

Introduction to Fundamentals of Typography: Introduction to Type and its History-Type as a form and means of communication in our environment-Introduction to Indian type: Vernacular letter-forms-Classification of types: Typefaces, type families and type designers-

Anatomy of the type: x-height, ascenders, descenders, counter, cap-height, baseline, etc-Typographic variables: Kerning, tracking, leading, spacing etc.-Semantics of type: Legibility & readability issues in type and meaning attributed to type. 4h. Expressive Typography-Introduction to printing techniques

UNIT-IV:

Introduction to Photography: Introduction and Orientation: Art and Science of Photography. Drawing out parallels / differences between the EYE and the CAMERA-Camera: Understanding the various controls on a Digital SLR Camera Features and Details. Shooting Modes. Aperture and Depth of Field. Shutter Speed. Critical Shutter Speeds and Effects- Exposure: Exposure as function of Quantity of Light and Time. Getting used to shoot in Manual Mode and learning to measure light using the camera's built-in exposure meter-Film Speed/Sensor Sensitivity: Understanding the role of sensitivity in Exposure. ISO/ASA and Digital Noise-Lenses: Different Types of Lenses. Classification of Lenses by Focal Lengths. Angle of View. Fixed Focal Length and Zoom Lenses. Close up and Macro Lenses-Light and Color Temperature- Digital Post-Production: Introduction to File-Formats. RAW vs.JPG. Understanding resolution, resizing and basic image post processing using Photoshop. Exploring the software to visualize and create digital mosaics.

UNIT-V:

Introduction to Videography: Concept development Storyboarding-Video Shooting - Framing, Camera movement etc. Video Editing- Defining communication-Sender, Channel and Receiver-Semiotics - Study of sign process (semiosis), meaning making and meaningful communication. Sign, Signifier, Signified-Denotation and Connotation. Story, narrative and see different perspectives-Identifying problems, opportunities and improvements. Differentiating problem, need and conflict-Persona study-Scenario study

Text Book(s):

1. Wallschlaeger, Charles, &Busic-Synder, Cynthia, Basic Visual Concepts and Principles for Artists, Architects and Designers, McGraw-Hill, (1992).

Reference Books(s):

1. Buxton, Bill, Sketching User Experience: Getting the Design Right and the Right Design (Interactive Technologies), Morgan Kaufmann, (2007).
2. Caplin, Steve; Banks, Adam,The Complete Guide to Digital Illustration, Publisher: Watson - Guptill Publications, (2003).

III Year I Semester	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives:

- To provide insight about networks, topologies, and the key concepts.
- To gain comprehensive knowledge about the layered communication architectures (OSI and TCP/IP) and its functionalities.
- To understand the principles, key protocols, design issues, and significance of each layers in ISO and TCP/IP.
- To know the basic concepts of network services and various network applications.

UNIT I: Introduction: Network Types, LAN, MAN, WAN, Network Topologies Reference models- The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models, OSI Vs TCP/IP.
Physical Layer –Introduction to Guided Media- Twisted-pair cable, Coaxial cable and Fiber optic cable and introduction about unguided media.

UNIT II: Data link layer: Design issues, **Framing**: fixed size framing, variable size framing, flow control, error control, error detection and correction codes, CRC, Checksum: idea, one's complement internet checksum, services provided to Network Layer, **Elementary Data Link Layer protocols**: simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel.
Sliding window protocol: One bit, Go back N, Selective repeat-Stop and wait protocol, Data link layer in HDLC, Point to point protocol (PPP)

UNIT – III: Media Access Control: Random Access: ALOHA, Carrier sense multiple access (CSMA), CSMA with Collision Detection, CSMA with Collision Avoidance, **Controlled Access:** Reservation, Polling, Token Passing, **Channelization:** frequency division multiple Access(FDMA), time division multiple access(TDMA), code division multiple access(CDMA).
Wired LANs: Ethernet, Ethernet Protocol, Standard Ethernet, Fast Ethernet(100 Mbps), Gigabit Ethernet, 10 Gigabit Ethernet.

UNIT – IV: The Network Layer Design Issues – Store and Forward Packet Switching- Services Provided to the Transport layer- Implementation of Connectionless Service- Implementation of Connection Oriented Service- Comparison of Virtual Circuit and Datagram Networks,
Routing Algorithms-The Optimality principle-Shortest path, Flooding, Distance vector, Link state, Hierarchical, Congestion Control algorithms-General principles of congestion control, Congestion prevention polices, Approaches to Congestion Control-Traffic Aware Routing-Admission Control-Traffic Throttling-Load Shedding. Traffic Control Algorithm-Leaky bucket & Token bucket.

Internet Working: How networks differ- How networks can be connected- Tunnelling, internetwork routing-, Fragmentation, network layer in the internet – IP protocols-IP Version 4 protocol-IPV4 Header Format, IP addresses, Class full Addressing, CIDR, Subnets-IP Version 6-The main IPV6 header, Transition from IPV4 to IPV6, Comparison of IPV4 & IPV6.

UNIT –V: The Transport Layer: Transport layer protocols: Introduction-services- port number-User data gram protocol-User datagram-UDP services-UDP applications-Transmission control protocol: TCP services- TCP features- Segment- A TCP connection-windows in TCP- flow control-Error control, Congestion control in TCP.
Application Layer –- World Wide Web: HTTP, Electronic mail-Architecture- web based mail- email security- TELENET-local versus remote Logging-Domain Name System.

Text Books:

1. Computer Networksm, Andrew S Tanenbaum, Fifth Edition. Pearson Education/PHI
2. Data Communications and Networks, Behrouz A. Forouzan, Fifth Edition TMH.

References Books:

1. Data Communications and Networks- Achut S Godbole, AtulKahate
2. Computer Networks, Mayank Dave, CENGAGE

III Year I Semester	DATA MINING AND DATA WAREHOUSING	L	T	P	C
		3	0	0	3

Pre-requisites: Data Structures, Algorithms, Probability & Statistics, Data Base Management Systems

Course Objectives: The main objective of the course is to

- Introduce basic concepts and techniques of data warehousing and data mining
- Examine the types of the data to be mined and apply pre-processing methods on raw data
- Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.

UNIT–I:

Data Warehousing and Online Analytical Processing: Basic concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Cloud Data Warehouse, Data Mining and Patten Mining, Technologies, Applications, Major issues, Data Objects & Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity. (Text Book- 1)

UNIT II:

Data Preprocessing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization. (Text Book- 1)

UNIT–III:

Classification: Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Attribute Selection Measures, Tree Pruning, Scalability and Decision Tree Induction, Visual Mining for Decision Tree Induction, Bayesian Classification Methods: Bayes Theorem, Naïve Bayes Classification, Rule-Based Classification, Model Evaluation and Selection. (Text Book- 2)

UNIT–IV:

Association Analysis: Problem Definition, Frequent Itemset Generation, Rule Generation: Confident Based Pruning, Rule Generation in Apriori Algorithm, Compact Representation of frequent item sets, FP-Growth Algorithm. (Text Book- 2)

UNIT–V:

Cluster Analysis: Overview, Basics and Importance of Cluster Analysis, Clustering techniques, Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means Additional Issues, Bi-secting K Means, Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm DBSCAN: Traditional Density Center-Based Approach, DBSCAN Algorithm, Strengths and Weaknesses. (Text Book- 2)

Text Books:

1. Data Mining concepts and Techniques, 3rd edition, Jiawei Han, Michel Kamber, Elsevier, 2011.
2. Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson, 2012.

Reference Books:

1. Data Mining: VikramPudi and P. Radha Krishna, Oxford Publisher.
2. Data Mining Techniques, Arun K Pujari, 3rd edition, Universities Press,2013.
3. (NPTEL course by Prof.PabitraMitra)
http://onlinecourses.nptel.ac.in/noc17_mg24/preview
4. http://www.saedsayad.com/data_mining_map.htm

III Year I Semester	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

The objectives of this course are to introduce

- Software life cycle models, Software requirements and SRS document.
- Project Planning, quality control and ensuring good quality software.
- Software Testing strategies, use of CASE tools, Implementation issues, validation &verification procedures.

UNIT-I:

Introduction: Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering.

Software Life Cycle Models: Basic concepts, Waterfall model and its extensions, Rapid application development, Agile development model, Spiral model.

UNIT-II:

Software Project Management: Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, Halstead's software science, risk management.

Requirements Analysis and Specification: Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, Algebraic specification, Executable specification and 4GL.

UNIT-III:

Software Design: Overview of the design process, how to characterize a good software design? Layered arrangement of modules, Cohesion and Coupling. approaches to software design.

Agility: Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, Tool Set for the Agile Process (Text Book 2)

Function-Oriented Software Design: Overview of SA/SD methodology, Structured analysis, Developing the DFD model of a system, Structured design, Detailed design, and Design Review.

User Interface Design: Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology.

UNIT-IV:

Coding And Testing: Coding, Code review, Software documentation, Testing, Black-box testing, White-Box testing, Debugging, Program analysis tools, Integration testing**,** testing

object-oriented programs, Smoke testing, and some general issues associated with testing.

Software Reliability and Quality Management: Software reliability. Statistical testing, Software quality, Software quality management system ISO 9000. SEI Capability maturity model. Few other important quality standards, and Six Sigma**.**

UNIT-V:

Computer-Aided Software Engineering (Case): CASE and its scope, CASE environment, CASE support in the software life cycle, other characteristics of CASE tools, Towards second generation CASE Tool, and Architecture of a CASE Environment.

Software Maintenance: Characteristics of software maintenance, Software reverse engineering, Software maintenance process models and Estimation of maintenance cost.

Software Reuse: Reuse-definition, introduction, reason behind no reuse so far, Basic is suesin any reuse program, A reuse approach, and Reuse at organization level.

Text Books:

1. Fundamentals of Software Engineering, RajibMall,5th Edition, PHI.
2. Software Engineering A practitioner's Approach, Roger S. Pressman, 9th Edition, McGraw Hill International Edition.

Resources Books:

1. Software Engineering, Ian Sommerville,10th Edition,Pearson.
2. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

E- Resources:

1. https://nptel.ac.in/courses/106/105/106105182/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0126058950638714882 7_shared/overview
3. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0133826904110039047 35_shared/overview

III Year I Semester	CYBER SECURITY	L	T	P	C
		3	0	0	3

Course Objectives:

- To learn threats and risks with in context of the cyber security architecture.
- Student should learn and identify security tools and hardening techniques.
- To learn types of incidents including categories, responses and timelines for response.

Course Outcomes: At the end of the course, student will be able to

Course Outcomes		Knowledge Level(K)#
CO1	Apply cyber security architecture principles.	**K3**
CO2	Demonstrate the risk management processes and practices.	**K2**
CO3	Appraise cyber security incidents to apply appropriate response	**K5**
CO4	Distinguish system and application security threats and vulnerabilities.	**K4**
CO5	Identify security tools and hardening techniques	**K3**

#Based on suggested Revised BTL

UNIT–I:
Introduction to Cyber Security-Cyber security objectives, roles, differences between information security and cyber security, Cyber security principles- confidentiality, integrity, availability, authentication and non-repudiation

UNIT–II:
InformationSecuritywithinLifecycleManagement-Lifecyclemanagement landscape, Security architecture processes, Security architecture tools, Intermediate lifecycle management concepts, Risks& Vulnerabilities-Basics of risk management, Operational threat environments, Classes of attacks.

UNIT–III:
Incident Response-Incident categories, Incident response, Incident recovery, Operational security protection-Digital and data assets, ports and protocols, Protection technologies, Identity and access Management, configuration management

UNIT–IV:
Threat Detection and Evaluation Monitoring-Vulnerability management, Security logs and alerts, Monitoring tools and appliances, Analysis-Network traffic analysis, packet capture and analysis

UNIT–V:

Introduction to backdoor System and security-Introduction to metasploit, backdoor, demilitarized zone (DMZ), Digital signature, Brief study on Harding of operating system.

Text Books:

1. NASSCOM: Security Analyst Student Hand Book, Dec2015
2. Information Security Management Principles, Updated Edition, David Alexander, Amanda Finch, David Sutton, BCSpublishers,June2013

Reference Books:

1. Cyber Security Fundamentals-Cyber Security, Network Security and Data Governance Security, 2nd Edition, ISACA Publishers, 2019

III Year I Semester	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

Course Objectives:

- Vision and Introduction to Internet of Things(IoT).
- Understand IoT Market perspective.
- Data and Knowledge Management and use of Devices in IoT Technology.
- Understand State of the Art – IoT Architecture.
- Understand Real World IoT Design Constraints, Industrial Automation and Commercial.

Course Outcomes (COs): At the end of the course, student will be able to

- Explain in a concise manner how the general Internet as well as Internet of Things work.
- Understand constraints and opportunities of wireless and mobile networks for Internet of Things.
- Use basic sensing and measurement and tools to determine the real-time performance of network of devices.
- Develop prototype models for various applications using IoT technology.

UNIT-I:

The Internet of Things: An Overview of Internet of things, Internet of Things Technology, behind IoTs Sources of the IoTs, M2M Communication, Examples of IoTs, Design Principles for Connected Devices Internet Connectivity Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet.

UNIT-II:

Business Models for Business Processes in the Internet of Things, IoT/M2M systems LAYERS AND designs standardizations, Modified OSI Stack for the IoT/M2M Systems, ETSI M2M domains and High- level capabilities, Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability

UNIT -III:

Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.

UNIT IV:

Data Acquiring, Organizing and Analytics in IoT/M2M, Applications /Services /Business Processes, IOT/M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.

UNIT V:

Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform

Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology, Sensors Technology, Sensing the World.

Text Book:

1. Internet of Things: Architecture, Design Principles and Applications, Rajkamal, McGraw Hill Higher Education
2. Internet of Things, A. Bahgya and V. Madisetti, Univesity Press, 2015

Reference Books:

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley
Getting Started with the Internet of Things, Cuno Pfister, Oreilly

III Year I Semester	HUMAN COMPUTER INTERACTION	L	T	P	C
		3	0	0	3

Course Objectives:

- To facilitate communication between students of psychology, design, and computer science on user interface development projects.
- To provide the future user interface designer with concepts and strategies for making design decisions.
- To expose the future user interface designer to tools, techniques, and ideas for interface design.
- To introduce the student to the literature of human-computer interaction.
- To stress the importance of good user interface design.

UNIT - I

Introduction: Importance of user Interface, definition, importance of good design. Benefits of good design. A brief history of Screen design, The graphical user interface, popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user, Interface popularity, characteristics- Principles of user interface.

UNIT – II

Design process: Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, and understanding business junctions.

UNIT – III

Screen Designing: Design goals, Screen planning and purpose, organizing screen elements, ordering of screen data and content, screen navigation and flow, visually pleasing composition, amount of information, focus and emphasis, presentation information simply and meaningfully, information retrieval on web, statistical graphics, Technological consideration in interface design.

UNIT – IV

Windows: New and Navigation schemes selection of window, selection of devices based and screen-based controls, Components, text and messages, Icons and increases, Multimedia, colors, uses problems, choosing colors.

UNIT – V

Software tools: Specification methods, interface Building Tools, Interaction Devices, Keyboard and function keys, pointing devices, speech recognition digitization and generation, image and video displays, drivers.

Text Books:

1. The essential guide to user interface design, Wilbert O Galitz, Wiley DreamaTech.
2. Designing the user interface. 3rd Edition Ben Shneidermann , Pearson Education Asia.

Reference Books:

1. Human – Computer Interaction. Alan Dix, Janet Fincay, Gre Goryd,Abowd, Russell Bealg, Pearson.
2. Interaction Design Prece, Rogers, Sharps. Wiley Dreamtech,
3. User Interface Design, Soren Lauesen, Pearson Education.

III Year I Semester	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

Course Objectives:

- Gain a historical perspective of Artificial Intelligence (AI) and its foundations.
- Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
- Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
- Experience AI development tools such as an 'AI language', expert system shell, and/or data mining tool. Experiment with a machine learning model for simulation and analysis.
- Explore the current scope, potential, limitations, and implications of intelligent systems.

Course Outcomes (COs): At the end of the course, student will be able to

- Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents.
- Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game-based techniques to solve them.
- Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing.
- Attain the capability to represent various real life problem domains using logic-based techniques and use this to perform inference or planning.
- Solve problems with uncertain information using Bayesian approaches.

UNIT-I:

Introduction to artificial intelligence: Introduction, history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of AI languages, current trends in AI, **Problem solving: state-space search and control strategies:** Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative-deepening a*, constraint satisfaction

UNIT-II:

Problem reduction and game playing: Introduction, problem reduction, game playing, alpha-beta pruning, two-player perfect information games, **Logic concepts:** Introduction, propositional calculus, proportional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic

UNIT-III:

Knowledge representation: Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR,

knowledge representation using frames, **advanced knowledge representation techniques:** Introduction, conceptual dependency theory, script structure, cyc theory, case grammars, semantic web.

UNIT-IV:

Uncertainty measure: probability theory: Introduction, probability theory, Bayesian belief networks, certainty factor theory, dempster-shafer theory

UNIT-V:

Fuzzy sets and fuzzy logic: Introduction, fuzzy sets, fuzzy set operations, types of membership functions, multi valued logic, fuzzy logic, linguistic variables and hedges, fuzzy propositions, inference rules for fuzzy propositions, fuzzy systems.

Text Books:

1. Artificial intelligence, A modern Approach, 2nded, Stuart Russel, Peter Norvig, Prentice Hall
2. Artificial Intelligence, Saroj Kaushik, 1st Edition, CENGAGE Learning, 2011.

Reference Books:

1. Artificial intelligence, structures and Strategies for Complex problem solving, 5th Edition, George F Lugar, PEA
2. Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer, 2017
3. Artificial Intelligence, A new Synthesis, 1st Edition, Nils J Nilsson, Elsevier, 1998
4. Artificial Intelligence- 3rd Edition, Rich, Kevin Knight, Shiv Shankar B Nair, TMH
5. Introduction To Artificial Intelligence and Expert Systems, 1st Edition, Patterson, Pearson India, 2015

III Year I Semester	VISUAL DESIGN AND COMMUNICATION LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To understand the elements and principles of visual design in the context of communication.
- To explore and experiment with typography, photography, and videography.
- To develop skills in using visual design tools and software for creative projects.
- To create effective visual communication through hands-on activities.

Course Outcomes:

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

- Analyze and apply visual design principles like harmony, contrast, and rhythm.
- Design compositions and layouts using dots, lines, forms, and textures.
- Create expressive typographic compositions and understand type anatomy.
- Capture and edit photographs using digital tools.
- Develop short videos and understand videography concepts, including framing and storyboarding.

Software/Tools Required:

- Adobe Creative Suite: Photoshop, Illustrator, InDesign, Premiere Pro
- Open-source tools: GIMP, DaVinci Resolve (optional)
- DSLR Cameras and accessories (tripods, lenses, lights, etc.)

List of Experiments:

Unit I: Introduction to Visual Design

1. **Experiment 1:** Explore visual elements like dots, lines, and shapes. Create abstract compositions inspired by nature.
2. **Experiment 2:** Develop patterns and textures using both physical media and digital tools.
3. **Experiment 3:** Create a basic color palette and apply it to a simple visual design.

Unit II: Introduction to the Principles of Visual Language

4. **Experiment 4:** Design compositions to explore harmony, contrast, and balance using forms and colors.
5. **Experiment 5:** Create symmetric and asymmetric layouts using geometric shapes.
6. **Experiment 6:** Develop a poster or brochure showcasing principles like rhythm, gradation, and alignment.

Unit III: Fundamentals of Typography

7. **Experiment 7:** Analyze and sketch vernacular letterforms and typefaces.
8. **Experiment 8:** Create a typographic composition to express emotions or ideas.
9. **Experiment 9:** Experiment with kerning, tracking, and leading in digital layouts.
10. **Experiment 10:** Design a typographic poster using a mix of type families and expressive typography.

Unit IV: Introduction to Photography

11. **Experiment 11:** Practice capturing images in manual mode using a DSLR camera. Focus on aperture, shutter speed, and ISO settings.
12. **Experiment 12:** Experiment with different lenses to capture varied perspectives.
13. **Experiment 13:** Edit images for color correction and cropping using Photoshop. Create a digital mosaic as a project.

Unit V: Introduction to Videography

14. **Experiment 14:** Develop a concept and storyboard for a short video.
15. **Experiment 15:** Record video sequences focusing on framing, angles, and camera movement.
16. **Experiment 16:** Edit the video using Premiere Pro or DaVinci Resolve. Add transitions, effects, and sound.

III Year I Semester	DATA MINING AND DATA WAREHOUSING LAB	L	T	P	C
		0	0	3	1.5

Pre-requisites: Data Base Management Systems, Python Programming

Course Objectives: The main objective of the course is to

- Inculcate Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment
- Design a data warehouse or data mart to present information needed by management in a form that is usable
- Emphasize hands-on experience working with all real data sets.
- Test real data sets using popular data mining tools such as WEKA, Python Libraries
- Develop ability to design various algorithms based on data mining tools.

Software Requirements: WEKA Tool/Python/R-Tool/Rapid Tool/Oracle Data mining

List of Experiments:

1. Creation of a Data Warehouse.
   - Build Data Warehouse/Data Mart (using open-source tools like Pentaho Data Integration Tool, Pentaho Business Analytics; or other data warehouse tools like Microsoft-SSIS, Informatica, Business Objects,etc.,)
   - Design multi-dimensional data models namely Star, Snowflake and Fact Constellation schemas for any one enterprise (ex. Banking, Insurance, Finance, Healthcare, manufacturing, Automobiles, sales etc.).
   - Write ETL scripts and implement using data warehouse tools.
   - Perform Various OLAP operations such slice, dice, roll up, drill up and pivot

2. Explore machine learning tool "WEKA"
   - Explore WEKA Data Mining/Machine Learning Toolkit.
   - Downloading and/or installation of WEKA data mining toolkit.
   - Understand the features of WEKA toolkit such as Explorer, Knowledge Flow interface, Experimenter, command-line interface.
   - Navigate the options available in the WEKA (ex. Select attributes panel, Preprocess panel, Classify panel, Cluster panel, Associate panel and Visualize panel)
   - Study the arff file format Explore the available data sets in WEKA. Load a data set (ex. Weather dataset, Iris dataset, etc.)
   - Load each dataset and observe the following:
     1. List the attribute names and they type
     2. Number of records in each dataset
     3. Identify the class attribute (if any)
     4. Plot Histogram
     5. Determine the number of records for each class.
     6. Visualize the data in various dimensions

3. Perform data preprocessing tasks and demonstrate performing association rule mining on data sets
   - Explore various options available in Weka for preprocessing data and apply Unsupervised filters like Discretization, Resample filter, etc. on each dataset
   - Load weather. nominal, Iris, Glass datasets into Weka and run Apriori Algorithm with different support and confidence values.

- Study the rules generated. Apply different discretization filters on numerical attributes and run the Apriori association rule algorithm. Study the rules generated.
- Derive interesting insights and observe the effect of discretization in the rule generation process.

4. Demonstrate performing classification on data sets Weka/R
   - Load each dataset and run 1d3, J48 classification algorithm. Study the classifier output. Compute entropy values, Kappa statistic.
   - Extract if-then rules from the decision tree generated by the classifier, Observe the confusion matrix.
   - Load each dataset into Weka/R and perform Naïve-bayes classification and k-Nearest Neighbour classification. Interpret the results obtained.
   - Plot RoC Curves
   - Compare classification results of ID3, J48, Naïve-Bayes and k-NN classifiers for each dataset, and deduce which classifier is performing best and poor for each dataset and justify.

5. Demonstrate performing clustering of data sets
   - Load each dataset into Weka/R and run simple k-means clustering algorithm with different values of k (number of desired clusters).
   - Study the clusters formed. Observe the sum of squared errors and centroids, and derive insights.
   - Explore other clustering techniques available in Weka/R.
   - Explore visualization features of Weka/R to visualize the clusters. Derive interesting insights and explain.
6. Demonstrate knowledge flow application on data sets into Weka/R
   - Develop a knowledge flow layout for finding strong association rules by using Apriori, FP Growth algorithms
   - Set up the knowledge flow to load an ARFF (batch mode) and perform a cross validation using J48 algorithm
   - Demonstrate plotting multiple ROC curves in the same plot window by using j48 and Random Forest tree
7. Demonstrate ZeroR technique on Iris dataset (by using necessary preprocessing technique(s)) and share your observations
8. Write a java program to prepare a simulated data set with unique instances.
9. Write a Python program to generate frequent item sets / association rules using Apriori algorithm
10. Write a program to calculate chi-square value using Python/R. Report your observation.
11. Write a program of Naive Bayesian classification using Python/R programming language.
12. Implement a Java/R program to perform Apriori algorithm
13. Write a R program to cluster your choice of data using simple k-means algorithm using JDK
14. Write a program of cluster analysis using simple k-means algorithm Python/R programming language.
15. Write a program to compute/display dissimilarity matrix (for your own dataset containing at least four instances with two attributes) using Python
16. Visualize the datasets using matplotlib in python/R.(Histogram, Box plot, Bar chart, Pie chart etc

III Year I Semester	FULL STACK DEVELOPMENT – II	L	T	P	C
		0	1	2	2

Course Objectives:

The main objectives of the course are to

- Make use of router, template engine and authentication using sessions to develop application in ExpressJS.
- Build a single page application using RESTful APIs in ExpressJS
- Apply router and hooks in designing ReactJS application
- Make use of MongoDB queries to perform CRUD operations on document database

Experiments covering the Topics:

- ExpressJS – Routing, HTTP Methods, Middleware, Templating, Form Data
- ExpressJS – Cookies, Sessions, Authentication, Database, RESTful APIs
- ReactJS – Render HTML, JSX, Components – function & Class, Props and States, Styles, Respond to Events
- ReactJS – Conditional Rendering, Rendering Lists, React Forms, React Router, Updating the Screen
- ReactJS – Hooks, Sharing data between Components, Applications – To-do list and Quiz
- MongoDB – Installation, Configuration, CRUD operations, Databases, Collections and Records

Sample Experiments:

1. ExpressJS – Routing, HTTP Methods, Middleware.

a. Write a program to define a route, Handling Routes, Route Parameters, Query Parameters and URL building.
b. Write a program to accept data, retrieve data and delete a specified resource using http methods.
c. Write a program to show the working of middleware.

2. ExpressJS – Templating, Form Data

a. Write a program using templating engine.
b. Write a program to work with form data.

3. ExpressJS – Cookies, Sessions, Authentication

a. Write a program for session management using cookies and sessions.
b. Write a program for user authentication.

4. ExpressJS – Database, RESTful APIs

a. Write a program to connect MongoDB database using Mangoose and perform CRUD operations.
b. Write a program to develop a single page application using RESTful APIs.

5. ReactJS – Render HTML, JSX, Components – function & Class

a. Write a program to render HTML to a web page.
b. Write a program for writing markup with JSX.
c. Write a program for creating and nesting components (function and class).

6. ReactJS – Props and States, Styles, Respond to Events

a. Write a program to work with props and states.
b. Write a program to add styles (CSS & Sass Styling) and display data.

c. Write a program for responding to events.

7. ReactJS – Conditional Rendering, Rendering Lists, React Forms

a. Write a program for conditional rendering.
b. Write a program for rendering lists.
c. Write a program for working with different form fields using react forms.

8. ReactJS – React Router, Updating the Screen

a. Write a program for routing to different pages using react router.
b. Write a program for updating the screen.

9. ReactJS – Hooks, Sharing data between Components

a. Write a program to understand the importance of using hooks.
b. Write a program for sharing data between components.

10. MongoDB – Installation, Configuration, CRUD operations

a. Install MongoDB and configure ATLAS
b. Write MongoDB queries to perform CRUD operations on document using insert(), find(), update(), remove()

11. MongoDB – Databases, Collections and Records

a. Write MongoDB queries to Create and drop databases and collections.
b. Write MongoDB queries to work with records using find(), limit(), sort(), createIndex(), aggregate().

12. Augmented Programs: (Any 2 must be completed)

a. Design a to-do list application using NodeJS and ExpressJS.
b. Design a Quiz app using ReactJS.
c. Complete the MongoDB certification from MongoDB University website.

Text Books:

1. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, APress, O'Reilly.
2. Node.Js in Action, Mike Cantelon, Mark Harter, T.J. Holowaychuk, Nathan Rajlich, Manning Publications. (Chapters 1-11)
3. React Quickly, AzatMardan,Manning Publications(Chapters 1-8,12-14)

Web Links:

1. ExpressJS - https://www.tutorialspoint.com/expressjs
2. ReactJS - https://www.w3schools.com/REACT (and) https://react.dev/learn#
3. MongoDB - https://learn.mongodb.com/learning-paths/introduction-to-mongodb

III Year I Semester	TINKERING LAB (UI DESIGN USING FLUTTER)	L	T	P	C
		0	0	2	1

Course Objectives:

- Learns to Implement Flutter Widgets and Layouts
- Understands Responsive UI Design and with Navigation in Flutter
- Knowledge on Widges and customize widgets for specific UI elements, Themes
- Understand to include animation apart from fetching data

List of Experiments: Students need to implement the following experiments

1. a) Install Flutter and Dart SDK.
   b) Write a simple Dart program to understand the language basics.

2. a) Explore various Flutter widgets (Text, Image, Container, etc.).
   b) Implement different layout structures using Row, Column, and Stack widgets.

3. a) Design a responsive UI that adapts to different screen sizes.
   b) Implement media queries and breakpoints for responsiveness.

4. a) Set up navigation between different screens using Navigator.
   b) Implement navigation with named routes.

5. a) Learn about stateful and stateless widgets.
   b) Implement state management using set State and Provider.

6. a) Create custom widgets for specific UI elements.
   b) Apply styling using themes and custom styles.

7. a) Design a form with various input fields.
   b) Implement form validation and error handling.

8. a) Add animations to UI elements using Flutter's animation framework.
   b) Experiment with different types of animations (fade, slide, etc.).

9. a) Fetch data from a REST API.
   b) Display the fetched data in a meaningful way in the UI.

10. a) Write unit tests for UI components.
    b) Use Flutter's debugging tools to identify and fix issues.

Text Book:

1. Marco L. Napoli, Beginning Flutter: A Hands-on Guide to App Development.
2. Rap Payne, Beginning App Development with Flutter: Create Cross-Platform Mobile Apps 1st Edition, Apres

B. TECH III Year II Semester

III Year II Semester	AUTOMATA THEORY AND COMPILER DESIGN	L	T	P	C
		3	0	0	3

COURSE OUTCOMES: After completion of this course

- Understand and apply formal language theory.
- Design and implement parsers.
- Understand the phases of a compiler.
- Apply semantic analysis and error handling.
- Optimize intermediate and target code.

UNIT – I:

Introduction to Finite Automata: Structural Representations, Automata and Complexity, the Central Concepts of Automata Theory – Alphabets, Strings, Languages, Problems. Nondeterministic Finite Automata: Formal Definition, an application, Text Search, Finite Automata with Epsilon-Transitions. Deterministic Finite Automata: Definition of DFA, How A DFA Process Strings, The language of DFA, Conversion of NFA with €-transitions to NFA without €-transitions. Conversion of NFA to DFA

UNIT – II:

Regular Expressions: Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Conversion of Finite Automata to Regular Expressions. Pumping Lemma for Regular Languages: Statement of the pumping lemma, Applications of the Pumping Lemma. Context-Free Grammars: Definition of Context-Free Grammars, Derivations Using a Grammar, Leftmost and Rightmost Derivations, the Language of a Grammar, Parse Trees, Ambiguity in Grammars and Languages.

UNIT – III:

Push Down Automata: Definition of the Pushdown Automaton, the Languages of a PDA, Equivalence of PDA's and CFG's, Acceptance by final state Turing Machines: Introduction to Turing Machine, Formal Description, Instantaneous description, The language of a Turing machine Undecidability: Undecidability, A Language that is Not Recursively Enumerable, An Undecidable Problem That is RE, Undecidable Problems about Turing Machines

UNIT - IV Introduction: The structure of a compiler, Lexical Analysis: The Role of the Lexical Analyzer, Input Buffering, Recognition of Tokens, The Lexical- Analyzer Generator Lex, Syntax Analysis: Introduction, Context-Free Grammars, Writing a Grammar, Top-Down Parsing, Bottom- Up Parsing, Introduction to LR Parsing: Simple LR, More Powerful LR Parsers R18 B.Tech. CS&D Syllabus JNTU Hyderabad

UNIT - V Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Syntax Directed Translation Schemes, Implementing L-Attributed SDD's. Intermediate-Code Generation: Variants of Syntax Trees, Three-Address Code Run-Time Environments: Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management

TEXT BOOKS:

1. Introduction to Automata Theory, Languages, and Computation, 3nd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
2. Compilers: Principles, Techniques and Tools, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman, 2nd Edition, Pearson.
3. Theory of Computer Science – Automata languages and computation, Mishra and Chandrashekaran, 2nd Edition, PHI.

REFERENCE BOOKS:

1. Introduction to Formal languages Automata Theory and Computation, Kamala Krithivasan, Rama R, Pearson.
2. Introduction to Languages and The Theory of Computation, John C Martin, TMH.
3. lex &yacc – John R. Levine, Tony Mason, Doug Brown, O'reilly
4. Compiler Construction, Kenneth C. Louden, Thomson. Course Technology.

III Year II Semester	MULTIMEDIA APPLICATION & DEVELOPMENT	L	T	P	C
		3	0	0	3

Course Objectives:

- To analyze and explain various technologies involved in supporting multimedia

application development.

- To understand multimedia authoring and the constraints on multimedia systems, as well as the range of technologies available to multimedia systems designers and integrators.
- To demonstrate how the quality of multimedia systems is perceived and how this relates to the design of multimedia input, output, and editing systems.
- To distinguish compression principles and different compression techniques, and to understand the mathematics involved in the digital and analog conversion of multimedia components.
- To design and develop multimedia systems according to the requirements of multimedia applications and to understand the specific issues related to virtual reality.

UNIT-I:

Multimedia Authoring, Graphics and Image and Data Representation: Whatis Multimedia, Multimedia and Hypermedia, World Wide Web, Overview of Multimedia SoftwareTools,Graphics/ImageDataTypes,FileFormats,Colorin Image and Video:Color Science, Color Models in Images, Color Models in Video.

UNIT-II:

Fundamental Concepts in Video and Digital Audio: Types of Video Signals, Analog Video, and Digital Video, Digitization of Sound, MIDI, Quantization and Transmission of Audio.

UNIT-III:

Action Script I: Action Script Features, Object-Oriented Action Script, Data types and Type Checking, Classes, Authoring an Action Script Class, **Action Script II:**Inheritance, Authoring an Action Script 2.0 Subclass, Interfaces, Packages,Exceptions,ApplicationDevelopment:AnOOPApplicationFrame work, Using Components with Action Script Movie Clip Subclasses.

UNIT-IV:

Multimedia Data Compression: Lossless Compression Algorithms: Run-Length Coding, Variable Length Coding, Dictionary Based Coding, Arithmetic Coding, Lossless Image Compression, Lossy Compression Algorithm: Quantization, Transform Coding, Wavelet-Based Coding, Embedded Zero tree of Wavelet Coefficients, Set Partitioning in Hierarchical Trees (SPIHT),Basic Video Compression Techniques: Introduction to Video Compression, Video Compression Based on Motion Compensation, Search for Motion Vectors, MPEG:MPEG–1,2,4and7,BasicAudioCompressionTechniques:ADPCM,G.726ADPCM,Vocoders.

UNIT-V:

Multimedia Networks: Basics of Multimedia Networks, Multimedia Network Communications and Applications: Quality of Multimedia Data Transmission, Multimedia over IP, Multimedia over ATM Networks, Transport of MPEG- 4, Media-on- Demand (MOD).

Text Books:

1. Fundamentals of Multimedia, Ze-NianLi,MarkS.Drew,PHI/PEA,2004
2. EssentialsActionScript2.0, Colin Moock, SPDO, Reilly, 2004

Reference Books:

1. Multimedia Applications,Steinmetz,Nahrstedt,Springer,2004
2. Multimedia Systems, Parag Havaldar, Gerard Medioni, cengage, 2006
3. Digital Multimedia, Nigel Chapman, Jenny Chapman, Wiley-Dream tech, 2009

Web References:

1. https://onlinecourses.swayam2.ac.in/nou20_cs05/preview

III Year II Semester	DESIGN OF INTERACTIVE SYSTEMS	L	T	P	C
		3	0	0	3

Pre-requisites:

- BasicUnderstandingofHuman-ComputerInteractionmethodologyandGUIstyles

Course Objectives:

- To focus on creating interfaces, systems and analyze the devices revolving around user behavior,
- Explore theinteractiondesignprocessandthetoolsusedforprinciplesofinteractive systems.

Course Outcomes:

- Understand the devices revolving around user behaviour
- List the interaction of design process and the devices
- Understand the creation of interfaces and system
- Recognize the designers' work and the tools they use for interaction design

UNIT-I

Usability of Interactive Systems: Introduction, Usability Requirements, Usability Measures, Universal Usability, Goals for our Profession

Guidelines, Principles and Theories: Introduction, Guidelines, Principles, Theories, Object-Action Interface Model

UNIT- II

Managing Design Processes: Introduction, Organizational Design to Support Usability, The Three Pillars of Design, Development Methodologies, Ethnographic Observation, Participatory Design, Scenario Development, Social Impact Statement for Early Design Review, Legal Issues

Evaluating Interface Designs: Introduction, Expert Reviews, Usability Testing and Laboratories, Survey Instruments, Acceptance Tests, Evaluation During Active Use, Controlled Psychologically Oriented Experiments

Software Tools: Introduction, Specification Methods, Interface-Building Tools, Evaluation and Critiquing Tools

UNIT- III

Direct Manipulation and Virtual Environments: Introduction, Examples of Direct Manipulation, Discussion of Direct Manipulation, 3D interfaces, Tele-operation, Virtual and Augmented Reality **Menu Selection, Form Filling, and Dialog Boxes:** Introduction, Task-Related Menu Organization, Single Menus, Combinations of Multiple Menus, Content Organization, Fast Movement Through Menus, Data Entry with Menus, Audio Menus and Menus for Small Displays

Command and Natural Languages: Introduction, Functionality to Support Users 'Tasks, Command- Organization Strategies, The Benefits of Structure, Naming and Abbreviations, Natural Language in Computing

UNIT-IV

Interaction Devices: Introduction, Keyboards and Keypads, Pointing Devices, Speech and Auditory Interfaces, Displays-Small and Large, Printers

Collaboration: Introduction, Goals of Collaboration, A synchronous Distributed Interfaces, Synchronous Distributed Interfaces, Face-to-Face Interfaces

Quality of Service: Introduction, Models of Response Time Impacts, Expectations and Attitudes, User Productivity, Variability in Response Time, Frustrating Experiences

UNIT-V

Balancing Function and Fashion: Introduction, Error Messages, Non-anthropomorphic Design, Display Design, Window Design, Color

User Manuals, Online Help, and Tutorials: Introduction ,Paper versus Online Manuals, Reading rom Paper Versus from Displays, Shaping the Content of the Manuals, Online Manuals and Help, Online Tutorials, Demonstrations, and Guides, Online Communities for User Assistance, The Development Process

Information Search and Visualization: Introduction, Search in Textual Documents and Database Querying, Multimedia Document Searches, Advanced Filtering and Search Interfaces, Information Visualization

TEXTBOOK:

1. Ben Shneiderman, "Designing the User Interface", Fourth Edition,Addison-Wesley,2010.

REFERENCE BOOKS:

2. Barfied, Lon,"The User Interface:ConceptsandDesign",Addison–Wesley.
3. WilbertO.Galiz,"TheEssentialguidetoUserInterfaceDesign", WileyDreamtech.
4. JacobNielsen,"UsabilityEngineering",AcademicPress.
5. AlanDixetal,"Human-ComputerInteraction",PrenticeHall,2012.

III Year II Semester	SOFTWARE TESTING METHODOLOGIES (Common to CSE, CS, IT, CSD, CSE(AI), CSE (AI&ML), CSE (AI&DS))	L	T	P	C
		3	0	0	3

Course Objectives

- To provide knowledge of the concepts in software testing such as testing process, criteria, strategies, and methodologies.
- To develop skills in software test automation and management using the latest tools.

UNIT - I

Introduction: Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs Flow graphs and Path testing: Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT - II

Transaction Flow Testing: transaction flows, transaction flow testing techniques.
Data Flow testing: Basics of data flow testing, strategies in data flow testing, application of data flow testing.
Domain Testing: domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domain and interface testing, domains and testability.

UNIT - III

Paths, Path products and Regular expressions: path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.
Logic Based Testing: overview, decision tables, path expressions, kv charts, specifications.

UNIT - IV

State, State Graphs and Transition testing: state graphs, good & bad state graphs, state testing, Testability tips.

UNIT - V

Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools. (Student should be given an exposure to a tool like Jmeter/selenium/soapUI/Catalon).

Text Books:

1. Software Testing techniques - BarisBeizer, Dreamtech, second edition.
2. Software Testing Tools – Dr. K. V. K. K. Prasad, Dreamtech.

Reference Books:

1. The craft of software testing - Brian Marick, Pearson Education.
2. Software Testing Techniques – SPD(Oreille)
3. Software Testing in the Real World – Edward Kit, Pearson.
4. Effective methods of Software Testing, Perry, John Wiley.
5. Art of Software Testing – Meyers, John Wiley.

III Year II Semester	CRYPTOGRAPHY & NETWORK SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Explain the objectives of information security
- Explain the importance and application of each of confidentiality, integrity, authentication and availability
- Understand the basic categories of threats to computers and networks
- Discusses the Mathematics of Cryptography
- Discuss the fundamental ideas of Symmetric and Asymmetric cryptographic Algorithms
- Discusses the Network layer, Transport Layer and Application layer Protocols Enhanced security mechanisms

Course Outcomes: At the end of the course, student will be able to

CO	Course Outcomes	Knowledge Level (K)#
CO1	Student will be able to understand security issues related to computer networks and learn different symmetric key techniques	**K2**
CO2	Students will be able learn mathematic of cryptography for symmetric and Asymmetric algorithms and apply this knowledge to understand the Cryptographic algorithms	**K3**
CO3	Students will be able learn different types of symmetric and Asymmetric algorithms	**K3**
CO4	Students will be able learn different algorithms of Hash functions, message authentication and digital signature and their importance to the security	**K4**
CO5	Students will be able learn different Enhanced security protocols of Application Layer, Transport Layer and Network layer	**K4**

#Based on suggested Revised BTL

SYLLABUS:

UNIT – I: Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography. Classical Encryption Techniques-symmetric cipher model, Substitution techniques, Transposition techniques, Rotor Machines, Steganography.

UNIT – II: Introduction to Symmetric Cryptography: Algebraic Structures-Groups, Rings, Fields, GF(2^n) fields, Polynomials.**Mathematics of Asymmetric cryptography:** Primes, Checking For Primness, Eulers phi-functions, Fermat's Little Theorem, Euler's Theorem, Generating Primes, Primality Testing, Factorization, Chinese Remainder Theorem, Quadratic Congruence, Exponentiation And Logarithm.

UNIT – III: Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, IDEA, Block cipher operation, Stream ciphers: RC4, RC5
Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman Key Exchange, Elgamal Cryptographic system, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.

UNIT – IV: Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithms (SHA)

Message Authentication Codes: Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MAC'S, MAC'S Based on Hash Functions: HMAC, MAC'S Based on Block Ciphers: DAA And CMAC

Digital Signatures: Digital Signatures, Elgamal Digital Signature Scheme, Elliptic Curve Digital Signature Algorithm, RSA-PSS Digital Signature Algorithm.

UNIT – V: Network and Internet Security: Transport-Level Security: Web Security Considerations, Transport Level Security, HTTPS, SSH.

IP Security: IP Security Overview, IP Security Policy, Encapsulating Security Payload, Authentication Header Protocol.

Electronic-Mail Security: Internet-mail Security, Email Format, Email Threats and Comprehensive Email Security, S/MIME, PGP.

TEXT BOOKS:

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 7th Edition, 2017
2. Cryptography and Network Security: Behrouz A. Forouzan Debdeep, Mc Graw Hill, 3rd Edition, 2015

REFERENCE BOOKS:

1. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition
2. Introduction to Cryptography with Coding Theory: Wade Trappe, Lawrence C. Washington, Pearson.
3. Modern Cryptography: Theory and Practice ByWenbo Mao. Pearson

III Year – II Semester	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives:

- To explain the evolving utility computing model called cloud computing.
- To introduce the various levels of services offered by cloud.
- To discuss the fundamentals of cloud enabling technologies such as distributed computing, service-oriented architecture and virtualization.
- To emphasize the security and other challenges in cloud computing.
- To introduce the advanced concepts such as containers, serverless computing and cloud-centric Internet of Things.

UNIT -I:

Introduction to Cloud Computing Fundamentals Cloud computing at a glance, defining a cloud, cloud computing reference model, types of services (IaaS, PaaS, SaaS), cloud deployment models (public, private, hybrid), utility computing, cloud computing characteristics and benefits, cloud service providers (Amazon Web Services, Microsoft Azure, Google App Engine).

UNIT-II:

Cloud Enabling Technologies: Ubiquitous Internet, parallel and distributed computing, elements of parallel computing, hardware architectures for parallel computing (SISD, SIMD, MISD, MIMD), elements of distributed computing, Inter-process communication, technologies for distributed computing, remote procedure calls (RPC), service-oriented architecture (SOA), Web services, virtualization.

UNIT-III:

Virtualization and Containers: Characteristics of virtualized environments, taxonomy of virtualization techniques, virtualization and cloud Computing, pros and cons of virtualization, technology examples (XEN, VMware),building blocks of containers, container platforms (LXC, Docker), container orchestration, Docker Swarm and Kubernetes,public cloud VM (e.g. Amazon EC2) and container (e.g. Amazon Elastic Container Service) offerings.

UNIT-IV:

Cloud computing challenges: Economics of the cloud, cloud interoperability and standards, scalability and fault tolerance, energy efficiency in clouds, federated clouds, cloud computing security, fundamentals of computer security, cloud security architecture, cloud shared responsibility model, security in cloud deployment models.

UNIT -V:

Advanced concepts in cloud computing: Serverless computing, Function-as-a-Service, serverless computing architecture, public cloud (e.g. AWS Lambda) and open-source (e.g.

OpenFaaS)serverless platforms, Internet of Things (IoT), applications, cloud-centric IoT and layers, edge and fog computing, DevOps, infrastructure-as-code, quantum cloud computing.

Text Books:

1. Mastering Cloud Computing, 2nd edition, Rajkumar Buyya, Christian Vecchiola, Thamarai Selvi, Shivananda Poojara, Satish N. Srirama, Mc Graw Hill, 2024.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.

Reference Books:

1. Cloud Computing, Theory and Practice, Dan C Marinescu, 2nd edition, MK Elsevier, 2018.
2. Essentials of cloud Computing, K. Chandrasekhran, CRC press, 2014.
3. Online documentation and tutorials from cloud service providers (e.g., AWS, Azure, GCP)

III Year I Semester	PRINCIPLES OF VIDEO EDITING AND 3D ANIMATION	L	T	P	C
		3	0	0	3

Course Objectives

This comprehensive course introduces students to the fundamental principles and techniques of video editing and 3D animation. Students will learn industry-standard software tools, storytelling through visual media, and technical aspects of both disciplines.

Course Outcomes:

By the end of this course, students will be able to:

- Master fundamental video editing techniques and workflows
- Understand 3D modelling, texturing, and animation principles
- Create compelling visual narratives through edited content
- Develop professional-grade animation sequences
- Apply industry-standard post-production techniques

UNIT -I: Fundamentals of Video Editing

Introduction to Video Editing: History and evolution of video editing, Different types of edits and their psychological impact, File formats and video codecs

Basic Editing Techniques: Cutting and trimming, Timeline management, Transitions and effects, Audio editing basics

UNIT-II: Advanced Editing Concepts:

Color correction and grading, Motion graphics integration, green screen and compositing, multi-camera editing, Narrative Structure in Editing, Storytelling through editing, Pacing and rhythm, Montage theory, Contemporary editing styles

Sound Design: Audio cleanup and enhancement, music editing, sound effects, mix level and audio workflow.

UNIT-III: 3D Animation Foundations:

Introduction to 3D Animation, History of animation**,** Principles of animation**,** 3D coordinate systems**,** Interface familiarization**,** 3D Modelling Basics: Primitive modelling**,** Polygon modelling**,** Edge flow and topology**,** UV mapping basics

Materials and Texturing: Material types and properties, Texture mapping, PBR materials, Shader networks

Lighting and Rendering: Basic lighting setups, Global illumination, Render settings, Output formats

UNIT-IV: Advanced Animation:

Character Animation: Character rigging, Weight and balance, Walk cycles, Facial animation

Dynamics and Effects: Particle systems, Cloth simulation, Rigid body dynamics, Fluid simulation

Advanced Rendering: Render layers, Pass rendering, Compositing, Post-production effects

Motion Graphics: Typography in motion, Logo animation, Kinetic typography, Integration with video

UNIT – V: Professional Practice

Project Planning: Pre-production workflows, Asset management, Team collaboration, Version control
Industry Standards: File organization, Naming conventions, Render farm management, Delivery specifications
Portfolio Development: Demo reel creation, Project documentation, Online presence, Industry networking

Required Software:

- Adobe Premiere Pro or DaVinci Resolve
- Autodesk Maya or Blender
- Adobe After Effects
- Substance Painter (optional)

Text Books:

1. The Technique of Film and Video Editing by Ken Dancyger (Focal Press), 6th Edition,2018.
   - Primary text covering editing theory and practice
   - Includes historical context and modern techniques
2. In the Blink of an Eye by Walter Murch (Silman-James Press), 2nd Edition, 2001.
   - Essential perspective on editing philosophy and decision-making
   - Written by Academy Award-winning editor
3. 3D Animation Essentials by Andy Beane ISBN: 978-1118147481, 2012.

Required Textbooks

1. "The Filmmaker's Eye: Learning (and Breaking) the Rules of Cinematic Composition" by Gustavo Mercado ISBN: 978-0240812175
2. "The Animator's Survival Kit" by Richard Williams ISBN: 978-0571238347
3. Digital Cinematography: Fundamentals, Tools, Techniques, and Workflows by David Stump ISBN: 978-0240817915

Recommended Reading

1. Color Correction Handbook by Alexis Van Hurkman ISBN: 978-0321929662

III Year II Semester	OBJECT ORIENTED ANALYSIS AND DESIGN	L	T	P	C
		3	0	0	3

Course Objectives: The main objective is the students to

- Become familiar withal phases of OOAD.
- Master the main features of the UML.
- Master the main concepts of Object Technologies and how to apply the matwork and develop the ability to analyze and solve challenging problem in various domains.
- Learn the Object design Principles and understand how to apply them towards Implementation.

UNIT-I:

Introduction: The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems .**Case Study:** System Architecture: Satellite-Based Navigation

UNIT-II:

Introduction to UML: Importance of modeling, principles of modeling, object-oriented modeling, conceptual model of the UML, Architecture, and Software Development Life Cycle. **Basic Structural Modeling:** Classes, Relationships, common Mechanisms, and diagrams. **Case Study:** Control System: Traffic Management.

UNIT-III:

Class & Object Diagrams: Terms, concepts, modelling techniques for Class &Object Diagrams. **Advanced Structural Modeling:** Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages. **Case Study:** AI:Cryptanalysis.

UNIT IV:

Basic Behavioral Modeling-I: Interactions, Interaction diagrams Use cases, Use case Diagrams, Activity Diagrams.**Case Study:** Web Application:Vacation Tracking System

UNIT V:

Advanced Behavioral Modelling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams. **Architectural Modelling:** Component, Deployment, Component diagrams and Deployment diagrams **Case Study:** Weather Forecasting.

Text Books:

1. Grady BOOCH, Robert A.Maksimchuk, Michael W.ENGLE, BobbiJ.Young, Jim Conallen, Kellia Houston, "Object- Oriented Analysis and Design with Applications", 3rd edition,2013,PEARSON.
2. Grady Booch, James Rumbaugh, IvarJacobson: The Unified Modeling Language User Guide, Pearson Education.

Reference Books:

1. Meilir Page-Jones: Fundamentals of Object-Oriented Design in UML, Pearson Education.
2. Pascal Roques: Modeling Software Systems Using UML2, WILEY- Dreamtech India Pvt.Ltd.
3. AtulKahate: Object Oriented Analysis &Design, The McGraw-Hill Companies. Appling UMLand Patterns:An introduction to Object–Oriented Analysis and Design and Unified Process,Craig Larman,Pearson Education.

III Year II Semester	MOBILE ADHOC NETWORKS (Common to CSE, CS, IT, CSE (AI), CSE (AI &ML, CSD)	L	T	P	C
		3	0	0	3

Course Objectives:
From the course the student will learn

- Architect sensor networks for various application setups.
- Devise appropriate data dissemination protocols and model links cost.
- Understanding of the fundamental concepts of wireless sensor networks and has a basic knowledge of the various protocols at various layers.
- Evaluate the performance of sensor networks and identify bottlenecks.

UNIT I:
Introduction to Ad Hoc Wireless Networks- Cellular and Ad Hoc Wireless Networks, Characteristics of MANETs, Applications of MANETs, Issues and Challenges of MANETs, Ad Hoc Wireless Internet, MAC protocols for Ad hoc Wireless Networks-Issues, Design Goals and Classifications of the MAC Protocols.

UNIT II:
Routing Protocols for Ad Hoc Wireless Networks- Issues in Designing a Routing Protocol, Classifications of Routing Protocols, Topology-based versus Position-based Approaches, Issues and design goals of a Transport layer protocol, Classification of Transport layer solutions, TCP over Ad hoc Wireless Networks, Solutions for TCP over Ad Hoc Wireless Networks, Other Transport layer protocols.

UNIT III:
Security protocols for Ad hoc Wireless Networks- Security in Ad hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad hoc Wireless Networks, Cooperation in MANETs, Intrusion Detection Systems.

UNIT IV:
Basics of Wireless Sensors and Applications- The Mica Mote, Sensing and Communication Range, Design Issues, Energy Consumption, Clustering of Sensors, Applications, Data Retrieval in Sensor Networks-Classification of WSNs, MAC layer, Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs.

UNIT V:
Security in WSNs- Security in WSNs, Key Management in WSNs, Secure Data Aggregation in WSNs, Sensor Network Hardware-Components of Sensor Mote, Sensor Network Operating Systems–TinyOS, LA-TinyOS, SOS, RETOS, Imperative Language-nesC, **Dataflow Style Language**-TinyGALS, Node-Level Simulators, NS-2 and its sensor network extension, TOSSIM.

Text Books:

1. Ad Hoc Wireless Networks – Architectures and Protocols, 1st edition, C. Siva Ram Murthy, B. S. Murthy, Pearson Education, 2004
2. Ad Hoc and Sensor Networks – Theory and Applications, 2nd edition *Carlos Corderio Dharma P.Aggarwal*, World Scientific Publications / Cambridge University Press, March 2006

Reference Books:

1. Wireless Sensor Networks: An Information Processing Approach, 1st edition, *Feng Zhao, Leonidas Guibas*, Elsevier Science imprint, Morgan Kauffman Publishers, 2005, rp2009
2. Wireless Ad hoc Mobile Wireless Networks – Principles, Protocols and Applications, 1st edition, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2008
3. Ad hoc Networking, 1st edition,*Charles E.Perkins*, Pearson Education, 2001
4. Wireless Ad hoc Networking, 1st edition, *Shih-Lin Wu, Yu-Chee Tseng*, Auerbach Publications, Taylor & Francis Group, 2007
5. Wireless Sensor Networks – Principles and Practice, 1st edition, Fei Hu, Xiaojun Cao, An Auerbach book, CRC Press, Taylor & Francis Group, 2010

III Year II Semester	AUGMENTED REALITY & VIRTUAL REALITY	L	T	P	C
		3	0	0	3

Objectives:

- Provide a foundation to the fast-growing field of AR and make the students aware of the various AR concepts.
- To give historical and modern overviews and perspectives on virtual reality. It describes the fundamentals of sensation, perception, technical and engineering aspects of virtual reality systems.

UNIT - I

Introduction to Augmented Reality: Augmented Reality - Defining augmented reality, history of augmented reality, Examples, Related fields

Displays: Multimodal Displays, Visual Perception, Requirements and Characteristics, Spatial Display Model, Visual Displays

Tracking: Tracking, Calibration, and Registration, Coordinate Systems, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors

UNIT - II

Computer Vision for Augmented Reality: Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Outdoor Tracking.

Interaction: Output Modalities, Input Modalities, Tangible Interfaces, Virtual User Interfaces on Real Surfaces, Augmented Paper, Multi-view Interfaces, Haptic Interaction

Software Architectures: AR Application Requirements, Software Engineering Requirements, Distributed Object Systems, Dataflow, Scene Graphs

UNIT - III

Introduction to Virtual Reality: Defining Virtual Reality, History of VR, Human Physiology and Perception

The Geometry of Virtual Worlds: Geometric Models, Axis-Angle Representations of Rotation, Viewing Transformations

Light and Optics: Basic Behaviour of Light, Lenses, Optical Aberrations, The Human Eye, Cameras, Displays

UNIT - IV

The Physiology of Human Vision: From the Cornea to Photoreceptors, From Photoreceptors to the Visual Cortex, Eye Movements, Implications for VR

Visual Perception: Visual Perception - Perception of Depth, Perception of Motion, **Perception of ColorVisual Rendering:** Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates, Immersive Photos and Videos

UNIT - V

Motion in Real and Virtual Worlds: Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection

Interaction: Motor Programs and Remapping, Locomotion, Social Interaction

Audio: The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering

Text Books:

1. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India;First edition (12 October 2016),ISBN-10: 9332578494
2. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016

Reference Books:

1. Allan Fowler-AR Game Development‖, 1st Edition, A press Publications, 2018, ISBN 978-1484236178
2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002
3. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009
4. Designing for Mixed Reality, Kharis O'Connell Published by O'Reilly Media, Inc., 2016, ISBN:9781491962381
5. SanniSiltanen- Theory and applications of marker-based augmented reality. Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0
6. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005

III Year II Semester	COMPUTER GRAPHICS & ANIMATION	L	T	P	C
		3	0	0	3

Course Objectives:

- To enable animation as a medium for observing, representing, conceptualizing, visualizing and communicating design ideas.
- To develop an understanding of spatial concepts and the critical ability to think and visualize in three dimensions through the graphics
- To develop observational skills through the study of the environment and as a tool for visual representation, ideation/ conceptualization, visualization and communication or presentation of designed as through animation and graphics.

Course Outcomes:

On completion of the course students will be able to

- Enable students to understand a sound knowledge of colour, typography, images, and layout. They will be trained in the art of visual communication involving various digital formats.
- To implement the design principle and practices by using different digital design tools.
- Will get an understanding of basic concept of animation, different types /style and their work flow.
- Able to create a complete promotional campaign using Animation and Graphics technique.
- Develop the ability to analyses complex images and in turn develop the ability to create mental imageries and visualize concepts.

UNIT -I:

Introductionto3D: Introduction to MAY A Interface, Software and Hardware Requirement Understanding about View Ports, Tool bar & Menu bar **Layers**, Shortcut Keys, Understanding Primitive objects Channel Box & Hot Box Channel Attributes &Outline Editor.

UNIT-II:

Tools and techniques in Modeling & Texturing: Introduction to modeling with Primitive objects NURBS & polygon tools, Organic and Industrial designs, Editing Nurbs &Polygons, Learning Menusin Surfaces and Polygons Tabs &Shortcut. Introduction to Materials & Understanding Materials & Behavior, Understanding UV Texture Editor & Applying Single Color to object. Hyper shade Understanding different types of Maps, Understanding, UV mapping &UV manipulation, Editing texture in Photoshop UV snap shot. Applying materials and textures to models and props Shortcuts .

UNIT-III:

Lighting & **Rendering:** Understanding Color Theory & Introduction to lighting, Importance of light in Animation Basic Lighting Concepts types of lights, Change the color of the light attributes rendering, Introduction to rendering & Knowing Renderers, Software Rendering & Hardware Rendering Vector Rendering & Mental Ray Rendering Selecting a Render Type & Interactive Photorealistic Rendering (IPR) Batch Rendering, Working with the Options in Render setting.

UNIT-IV:

Animation & Rigging: Introduction to Animation in MAYA & Time Codes Principles of animation (squash and stretch, timing etc.) Doing Object animation &Understanding the Behavior of Shapes of Objects Making play blasts Working with Animation Curves Graph Editor, Time Line Shortcuts, Camera Animation & Setting Resolution Gates. Knowing Deformers and their functionality (Linear & Non-Linear Deformers) Knowing Constraints (Point,or nt ,Scale, Parent, Pole Vector, Aim) introduction to Joints difference between Local Axis and World Axis for Joints.

UNIT-V:

Graphic Designing Tools-Photoshop & Illustrator: Changing blending modes and opacity, Using and editing an opacity mask, Using layers to keep your art project organized, Creating clipping masks, Tracing a scanned image with Live Trace, Applying warp effects and the envelope feature, Understanding the Appearance panel, real ting effects and styles, Using multiple strokes and fills, Creating and manipulating type ,Creating symbols and using the symbol tools, Understanding and creating the four kinds of custom brushes, Using the mesh tool for complex gradients, Applying 3D
effects.

Text Book(s):

1. Tereza Flaxman**. Maya 2015 Character Modeling and Animation.** Focal Press. (unit-I,unit-II)
2. Richard Williams “The Animator's Survival Kit”, Faber & Faber,2010 (unit-III, unit-IV)
3. Chris Meyer, Trish Meyer “Creating Motion Graphics with Aft er Effects, Essential and Advanced Techniques”, Taylor & Francis, 2013. (unit-v)

Reference Books(s):

1. Michael Betancourt, “The History of Motion Graphics From Avant-garde to Industry in the UnitedStates”, Wildside Press.2013
2. EdHooks “Acting for Animators 4”, Routledge,2017
3. TomSito “Timing for Animation, 40th Anniversary Edition”, CRCPress,2021.
4. A Dariush Derakhshani. **Introducing Autodesk Maya2016.**Paperback
5. Paperback.**TheArtofMayaAnIntroductionto3DComputerGraphics.**Autodesk

III Year I Semester	MULTIMEDIA APPLICATION DEVELOPMENT LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

1. To understand simple photo editing tasks in GIMP
2. To design objects using Blender3D
3. To perform operations on audio files using Audacity
4. To write some actions using Action Script
5. To Create visiting cards, brochures using image editor

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

1. Apply simple photo editing tasks in GIMP
2. Design objects using Blender3D
3. Perform operations on audio files using Audacity
4. Write some actions using Action Script
5. Create visiting cards, brochures using image editor

Software's Required:

1. **GIMP/Blender/Audacity/Adobe Animate/Adobe Photoshop/canva**

List of Experiments:

1. Create a Drip Portrait Effect in GIMP
2. Create a Double Exposure Effect in GIMP
3. Turn Any Photo into a Cartoon in GIMP
4. Quick and Easy Color Match Technique in GIMP (Photo Compositing)
5. Remove objects from a Photo in GIMP
6. Design a simple Toy Train using Blender 3D
7. Design a simple bird on an inscribed base using Blender 3D
8. Design a Realistic Wooden chair using Blender 3D
9. Perform the following tasks using Audacity
    i. Recording and Playback
    ii. Importing audio tracks
    iii. Selecting audio
10. Perform the following tasks using Audacity
    i. Editing the tempo of the audio
    ii. Editing the pitch of the audio
    iii. Splitting audio tracks
    iv. Exporting audio
11. Perform the following tasks using Action script
    i. Assigning actions to an object and button
    ii. Tinting a movie clip's color and controlling colors with sliders
    iii. Crete a text field and password input field
12. Perform the following tasks using any editor

i. Create your visiting card
ii. Design a poster for technical poster presentation
iii. Create a brochure for an event

Web References:

1. https://daviesmediadesign.com/20-gimp-photo-manipulation-tutorials-for-2020/
2. https://www.skillshare.com/en/blog/10-blender-projects-for-beginners/
3. https://www.instructables.com/Basic-recording-and-editing-with-Audacity/

III Year I Semester	DESIGN OF INTERACTIVE SYSTEMS LAB	L	T	P	C
		0	0	3	1.5

Objective:

The objective of these lab sessions is to provide students with practical experience in designing interactive systems. Students will explore various interaction design concepts and techniques, applying them to real-world systems.

List of Main Experiments:

Experiment 1: Evaluate the usability of an existing software system using usability guidelines and measures.
Experiment 2: Design an interactive interface applying key usability principles such as visibility, feedback, and user control.
Experiment 3: Design a low-fidelity prototype (using paper or sketches) for a simple interactive system.
Experiment 4: Conduct usability testing on a prototype using a small group of users.
Experiment 5: Design an interactive system that uses direct manipulation (e.g., drag-and-drop).
Experiment 6: Design an efficient menu system with easy navigation and data entry (e.g., form filling).
Experiment 7: Develop a simple command-line or voice-based interface for a task.
Experiment 8: Design an interface that caters to users with disabilities or diverse needs.
Experiment 9: Test and compare different interaction devices (e.g., keyboard, mouse, touchscreen).
Experiment 10: Analyze how different response times affect user productivity and satisfaction.
Required Tools:

1. **Prototyping Tools:**
   - Figma, Adobe XD, Balsamiq, InVision
2. **Usability Testing Tools:**
   - Maze, Lookback.io, Tobii (Eye Tracking), WAVE, Axe (Accessibility Testing)
3. **Survey and Research Tools:**
   - Google Forms, Typeform
4. **Speech Recognition and Command Tools:**
   - Google Speech API, Arduino, Raspberry Pi

Outcome:
By completing these 10 experiments, students will gain hands-on experience with interactive system design and usability testing, building foundational skills to design and evaluate user interfaces effectively. Students will also explore the impact of different interaction devices and response times on user experience.

III Year II Semester	SOFT SKILLS (SKILL ENHANCEMENT COURSE)	L	T	P	C
		0	1	2	2

Course Objectives:

- To equip the students with the skills to effectively communicate in English
- To train the students in interview skills, group discussions and presentation skills
- To motivate the students to develop confidence
- To enhance the students' interpersonal skills
- To improve the students' writing skills

UNIT – I

Analytical Thinking & Listening Skills: Self-Introduction, Shaping Young Minds - A Talk by Azim Premji (Listening Activity), Self – Analysis, Developing Positive Attitude, Perception.

Communication Skills: Verbal Communication; Non-Verbal Communication (Body Language)

UNIT – II

Self-Management Skills: Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities

Etiquette: Social Etiquette, Business Etiquette, Telephone Etiquette, Dining Etiquette

UNIT – III

Standard Operation Methods: Basic Grammars, Tenses, Prepositions, Pronunciation, Letter Writing; Note Making, Note Taking, Minutes Preparation, Email & Letter Writing

UNIT-IV

Job-Oriented Skills: Group Discussion, Mock Group Discussions, Resume Preparation, Interview Skills, Mock Interviews

UNIT-V

Interpersonal relationships: Introduction, Importance, Types, Uses, Factors affecting interpersonal relationships, Accommodating different styles, Consequences of interpersonal relationships

Text books:

1. Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011.
2. S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010.

Reference books:

1. R.S.Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S.Chand& Company Ltd., 2018.
2. Raman, Meenakshi& Sharma, Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2011.

E-resources:

1. https://swayam-plus.swayam2.ac.in/courses/course-details?id=P_CAMBR_01

III Year II Semester	TECHNICAL PAPER WRITING & IPR	L	T	P	C
		2	0	0	-

Course Objective: The course will explain the basic related to writing the technical reports and understanding the concepts related to formatting and structuring the report. This will help students to comprehend the concept of proofreading, proposals and practice

Unit I:

Introduction: An introduction to writing technical reports, technical sentences formation, using transitions to join sentences, Using tenses for technical writing.

Planning and Structuring: Planning the report, identifying reader(s), Voice, Formatting and structuring the report, Sections of a technical report, Minutes of meeting writing.

Unit II:

Drafting report and design issues: The use of drafts, Illustrations and graphics.

Final edits: Grammar, spelling, readability and writing in plain English: Writing in plain English, Jargon and final layout issues, Spelling, punctuation and Grammar, Padding, Paragraphs, Ambiguity.

Unit III:

Proofreading and summaries: Proofreading, summaries, Activities on summaries. **Presenting final reports:** Printed presentation, Verbal presentation skills, Introduction to proposals and practice.

Unit IV:

Using word processor: Adding a Table of Contents, Updating the Table of Contents, Deleting the Table of Contents, Adding an Index, Creating an Outline, Adding Comments, Tracking Changes, Viewing Changes, Additions, and Comments, Accepting and Rejecting Changes , Working with Footnotes and Endnotes, Inserting citations and Bibliography, Comparing Documents, Combining Documents, Mark documents final and make them read only., Password protect Microsoft Word documents., Using Macros,

Unit V:

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of **Patenting and Development:** technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property

Text Books:

1. Kompal Bansal & Parshit Bansal, “Fundamentals of IPR for Beginner’s”, 1st Ed., BS Publications, 2016.
2. William S. Pfeiffer and Kaye A. Adkins, “Technical Communication: A Practical

Approach", Pearson.
3. Ramappa,T., "Intellectual Property Rights Under WTO", 2nd Ed., S Chand, 2015.

Reference Books:

1. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.
2. Day R, How to Write and Publish a Scientific Paper, Cambridge University Press(2006)

E-resources:

1. https://www.udemy.com/course/reportwriting/
2. https://www.udemy.com/course/professional-business-english-and-technical-report-writing/
3. https://www.udemy.com/course/betterbusinesswriting/

Syllabus

for

Open Electives

	PRINCIPLES OF OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course is to make student

- Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
- Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- Illustrate different conditions for deadlock and their possible solutions.

UNIT - I

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Free and Open-Source Operating Systems

System Structures: Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Building and Booting an Operating System, Operating system debugging

UNIT - II

Processes: Process Concept, Process scheduling, Operations on processes, Inter-process communication.

Threads and Concurrency: Multithreading models, Thread libraries, Threading issues.

CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling.

UNIT – III

Synchronization Tools: The Critical Section Problem, Peterson's Solution, Mutex Locks, Semaphores, Monitors, Classic problems of Synchronization.

Deadlocks: system Model, Deadlock characterization, Methods for handling Deadlocks.

UNIT - IV

Memory-Management Strategies: Introduction, Contiguous memory allocation, Paging, Structure of the Page Table, Swapping.

Virtual Memory Management: Introduction, Demand paging, Copy-on-write, Page replacement, Allocation of frames, Thrashing

Storage Management: Overview of Mass Storage Structure, HDD Scheduling.

UNIT - V

File System: File System Interface: File concept, Access methods, Directory Structure; File system Implementation: File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management; File-System Internals: File-System Mounting, Partitions and Mounting, File Sharing.

Text Books:

1. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10th Edition, Wiley, 2018.
2. Modern Operating Systems, Tanenbaum A S, 4th Edition, Pearson , 2016

Reference Books:

1. Operating Systems: A Concept Based Approach, D.M Dhamdhere, 3rd Edition, McGraw- Hill, 2013

Online Learning Resources:

1. https://nptel.ac.in/courses/106/106/106106144/
2. http://peterindia.net/OperatingSystems.html

	COMPUTER ORGANIZATION AND ARCHITECTURE	L	T	P	C
		3	0	0	3

Course Objectives:
The purpose of the course is to introduce principles of computer organization and the basic architectural concepts. It provides an in depth understanding of basic organization, design, programming of a simple digital computer, computer arithmetic, instruction set design, micro programmed control unit, pipelining and vector processing, memory organization and I/O systems

UNIT I:
Basic Structure Of Computers: Computer Types, Functional unit, Basic Operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers.
Logic gates: Digital Logic gates,Two-level realizations using gates - AND-OR, OR-AND, NAND-NAND and NOR-NOR

UNIT II:
Sequential circuits I: Classification of sequential circuits (synchronous and asynchronous): basic flip-flops, truth tables and excitation tables (NAND RS latch, NOR RS latch, RS flip-flop. JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals).Conversion of flip-flop to flip-flop, Race around condition, Master J-K flipflop
Register Transfer Language And Micro-operations: Register Transfer language. Register Transfer Bus and memory transfers, Arithmetic Micro-operations, Logic micro operations, shift micro operations, Arithmetic logic shift unit. Instruction codes. Computer Registers, Computer instructions, Instruction cycle.

UNIT III:
Micro Programmed Control: Control memory, Address sequencing, micro program example, design of control unit.
Central Processing Unit: General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control.

UNIT IV:
Microprocessors: Evaluation of Microprocessors, CISC and RISC, Characteristics of Microprocessors
Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory, Cache memories performance considerations, Virtual memories Introduction to Shift registers and RAID

UNIT V:
Input – Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupts, DMA, Input Output Processor, Serial Communication.

Text Books:
1. Digital Logic and Computer Design, Moriss Mano, 11th Edition, Pearson Education.
2. Computer Organization, 5thed.,Hamacher, Vranesicand Zaky,TMH,2002
3. Computer System Architecture, 3/e, MorisMano, Pearson/PHI.

Reference Books:

1. Computer System Organization &Architecture, John D.Carpinelli, Pearson,2008
2. Computer System Organization, NareshJotwani, TMH, 2009
3. Computer Organization & Architecture: Designing for Performance, 7th ed., William Stallings, PHI, 2006
4. Structured Computer Organization, Andrew S. Tanenbaum, 4th Edition, PHI/Pearson.

	PRINCIPLES OF DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:
The main objectives of the course is to

- Introduce database management systems and to give a good formal foundation on the relational model of data
- Introduce the concepts of SQL
- Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
- Provide an overview of physical design of a database system, by discussing database storage techniques

UNIT I:
Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

UNIT II:
Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.
Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance.

UNIT III:
BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).
SQL: Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions (Date and Time, Numeric, String conversion).Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational set operations.

UNIT IV:
Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form (BCNF).

UNIT V:
Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock

based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.

Text Books:

1) Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)
2) Database System Concepts,5th edition, Silberschatz, Korth, Sudarsan, TMH (For Chapter 1 and Chapter 5)

Reference Books:

1) Introduction to Database Systems, 8thedition, C J Date, Pearson.
2) Database Management System, 6th edition, Ramez Elmasri, Shamkant B. Navathe, Pearson
3) Database Principles Fundamentals of Design Implementation and Management, 10th edition, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning, 2022

Web-Resources:

1) https://nptel.ac.in/courses/106/105/106105175/
2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012758066728202245 6_shared/overview

	OBJECT ORIENTED PROGRAMMING THROUGH JAVA	L	T	P	C
		3	0	0	3

Course Objectives:
The learning objectives of this course are to:

- identify Java language components and how they work together in applications
- Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
- understand how to design applications with threads in Java
- understand how to use Java APIs for program development

UNIT I:
Object Oriented Programming: Basic concepts, Principles,
Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.
Data Types, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (--) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.
Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

UNIT II:
Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.
Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static

UNIT III:
Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three dimensional Arrays, Arrays as Vectors.
Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and

Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.
Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT IV:
Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Autoboxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.
Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.
Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java(Text Book 2)

UNIT V:
String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings,Comparison, Modifying, Searching; Class String Buffer.
Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread-Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.
Java Database Connectivity: Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, Result Set Interface
Java FX GUI: Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events (Text Book 3)

Text Books:
1) JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2) Joy with JAVA, Fundamentals of Object Oriented Programming, Debasis Samanta, Monalisa Sarma, Cambridge, 2023.
3) JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

References Books:
1) The complete Reference Java, 11thedition, Herbert Schildt,TMH
2) Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

Online Resources:
1) https://nptel.ac.in/courses/106/105/106105191/
2)
https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview

	PRINCIPLES OF SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:
The objectives of this course are to introduce

- Software life cycle models, Software requirements and SRS document.
- Project Planning, quality control and ensuring good quality software.
- Software Testing strategies, use of CASE tools, Implementation issues, validation & verification procedures.

UNIT I:
Introduction: Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering.
Software Life Cycle Models: Basic concepts, Waterfall model and its extensions, Rapid application development, Agile development model, Spiral model.

UNIT II:
Software Project Management: Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, risk management.
Requirements Analysis and Specification: Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, Algebraic specification, Executable specification and 4GL.

UNIT III:
Software Design: Overview of the design process, How to characterize a good software design? Layered arrangement of modules, Cohesion and Coupling. approaches to software design.
Agility: Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, Tool Set for the Agile Process (Text Book 2)
Function-Oriented Software Design: Overview of SA/SD methodology, Structured analysis, Developing the DFD model of a system, Structured design, Detailed design, and Design Review.
User Interface Design: Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology.

UNIT IV:
Coding and Testing: Coding, Code review, Software documentation, Testing, Black-box testing, White-Box testing, Debugging, Program analysis tools, Integration testing**,** Testing object-oriented programs, Smoke testing, and Some general issues associated with testing.
Software Reliability and Quality Management: Software reliability. Statistical testing, Software quality, Software quality management system, ISO 9000. SEI Capability maturity model. Few other important quality standards, and Six Sigma**.**

UNIT V:
Software Maintenance: Characteristics of software maintenance, Software reverse engineering, Software maintenance process models and Estimation of maintenance cost.

Software Reuse: reuse- definition, introduction, reason behind no reuse so far, Basic issues in any reuse program, A reuse approach, and Reuse at organization level.

Text Books:

1. Fundamentals of Software Engineering, Rajib Mall, 5th Edition, PHI.
2. Software Engineering: A Practitioner's Approach, Roger S. Pressman, 9th Edition, Mc-Graw Hill International Edition.

Reference Books:

1. Software Engineering, Ian Sommerville,10th Edition, Pearson.
2. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

e-Resources:

1) https://nptel.ac.in/courses/106/105/106105182/
2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012605895063871 48827_shared/overview
3) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003 904735_shared/overview

	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives:

- To provide insight about networks, topologies, and the key concepts.
- To gain comprehensive knowledge about the layered communication architectures (OSI and TCP/IP) and its functionalities.
- To understand the principles, key protocols, design issues, and significance of each layers in ISO and TCP/IP.
- To know the basic concepts of network services and various network applications.

UNIT I: Introduction: Network Types, LAN, MAN, WAN, Network Topologies Reference models- The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models, OSI Vs TCP/IP.
Physical Layer –Introduction to Guided Media- Twisted-pair cable, Coaxial cable and Fiber optic cable and introduction about unguided media.

UNIT II: Data link layer: Design issues, **Framing**: fixed size framing, variable size framing, flow control, error control, error detection and correction codes, CRC, Checksum: idea, one's complement internet checksum, services provided to Network Layer, **Elementary Data Link Layer protocols**: simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel.
Sliding window protocol: One bit, Go back N, Selective repeat-Stop and wait protocol, Data link layer in HDLC, Point to point protocol (PPP)

UNIT – III: Media Access Control: Random Access: ALOHA, Carrier sense multiple access (CSMA), CSMA with Collision Detection, CSMA with Collision Avoidance, **Controlled Access:** Reservation, Polling, Token Passing, **Channelization:** frequency division multiple Access(FDMA), time division multiple access(TDMA), code division multiple access(CDMA).
Wired LANs: Ethernet, Ethernet Protocol, Standard Ethernet, Fast Ethernet(100 Mbps), Gigabit Ethernet, 10 Gigabit Ethernet.

UNIT – IV: The Network Layer Design Issues – Store and Forward Packet Switching- Services Provided to the Transport layer- Implementation of Connectionless Service- Implementation of Connection Oriented Service- Comparison of Virtual Circuit and Datagram Networks,
Routing Algorithms-The Optimality principle-Shortest path, Flooding, Distance vector, Link state, Hierarchical, Congestion Control algorithms-General principles of congestion control, Congestion prevention polices, Approaches to Congestion Control-Traffic Aware Routing-Admission Control-Traffic Throttling-Load Shedding. Traffic Control Algorithm-Leaky bucket & Token bucket.
Internet Working: How networks differ- How networks can be connected- Tunnelling, internetwork routing-, Fragmentation, network layer in the internet – IP protocols-IP Version 4 protocol-IPV4 Header Format, IP addresses, Class full Addressing, CIDR, Subnets-IP Version 6-The main IPV6 header, Transition from IPV4 to IPV6, Comparison of IPV4 & IPV6.

UNIT –V: The Transport Layer: Transport layer protocols: Introduction-services- port number-User data gram protocol-User datagram-UDP services-UDP applications-Transmission control protocol: TCP services- TCP features- Segment- A TCP connection-windows in TCP- flow control-Error control, Congestion control in TCP.
Application Layer –- World Wide Web: HTTP, Electronic mail-Architecture- web based mail- email security- TELENET-local versus remote Logging-Domain Name System.

Text Books:

3. Computer Networksm, Andrew S Tanenbaum, Fifth Edition. Pearson Education/PHI
4. Data Communications and Networks, Behrouz A. Forouzan, Fifth Edition TMH.

References Books:

3. Data Communications and Networks- Achut S Godbole, AtulKahate
4. Computer Networks, Mayank Dave, CENGAGE

B. Tech – IV Year I Semester

S. No.	Category	Title	L	T	P	Credits
1	Professional Core	Game Design and Development	3	0	0	3
2	Management Course- II	Human Resource & Project Management	2	0	0	2
3	Professional Elective-IV	1. Software Architecture & Design Patterns 2. Blockchain Technology 3. Machine Learning 4. Computer Vision 5. Animation Principles and Design 6. 12 week MOOC offered by NPTEL/SWAYAM recommended by the BoS	3	0	0	3
4	Professional Elective-V	1. Agile Methodologies 2. Metaverse 3. Cyber Physical Systems 4. Digital Audio Design & Synthesis 5. Big Data Analytics 6. 12 week MOOC offered by NPTEL/SWAYAM recommended by the BoS	3	0	0	3
5	Open Elective-III		3	0	0	3
6	Open Elective-IV		3	0	0	3
7	Skill Enhancement Course	Prompt Engineering / NPTEL : 8 Week 2 Credit course - *User-centric Computing For Human-Computer Interaction*	0	1	2	2
8	Audit Course	Constitution of India	2	0	0	-
9	Evaluation of Industry Internship / Mini Project		-	-	-	2
		Total	**19**	**1**	**02**	**21**
MC	Student may select from the minor's pool		3	0	0	3
HC	Student may select from the honors pool		3	0	0	3
HC	Student may select from the honors pool		3	0	0	3

B. Tech– IV Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Internship / Project Work	Full semester Internship & Project Work	0	0	24	12

Note: Student need to do at least ONE MOOC Course (3 credits out of 160 credits) to meet the mandatory requirement (11th criteria, as per R23 Regulations)

Open Electives, offered to other department students:

Open Elective I: Operating Systems / Computer Organization and Architecture
Open Elective II: Database Management Systems
Open Elective III: Object Oriented Programming Through Java
Open Elective IV: Computer Networks / Software Engineering / IOT Based Smart Systems

IV Year I Semester	GAME DESIGN AND DEVELOPMENT (Professional Core)	L	T	P	C
		3	0	0	3

Course Objective:

- The primary objective of this course is to introduce students to the fundamental concepts and practices involved in the design and development of games, with a particular focus on video games.
- The course aims to explore game genres, player psychology, storytelling techniques, character development, level design, and the challenges of online gaming. It also emphasizes both entertainment and serious games, while equipping students with the tools needed to conceptualize, design, and document original game ideas within a team-based development environment.

Course Outcomes:

Upon successful completion of this course, students will be able to:

- Differentiate between conventional games and video games and explain the key components and structure involved in game development.
- Evaluate different platforms for gaming including consoles, PCs, and portable devices, and assess their impact on game design and user experience.
- Develop and refine game concepts from initial ideas into fully-formed game designs with creative game worlds and expressive mechanics.
- Design compelling characters and avatars, focusing on their visual, narrative, and audio elements to enhance player engagement.
- Apply storytelling techniques within game narratives, balancing linear and nonlinear story elements, and using appropriate tools such as dialogue trees.

UNIT- I: Games and Video Games: Game, Conventional Games Versus Video Games, Games for
Entertainment, Serious Games, Designing and Developing Games: An Approach to the Task, Key Components of Video Games, The Structure of a Video Game, Stages of the Design Process, Game Design Team Roles, Game Design Documents, The Anatomy of a Game Designer

UNIT- II: The Major Genres: Genre. The Classic Game Genres. Understanding Your Player: Vanden Berghe‘s Five Domains of Play, Demographic Categories, Gamer Dedication, The Dangers of Binary Thinking Understanding Your Machine: Home Game Consoles, Personal Computers, Portable Devices Other Devices

UNIT- III: Game Concepts: Getting an Idea, From Idea to Game Concept Game Worlds: What Is a Game World? The Purposes of a Game World, The Dimensions of a Game Creative and Expressive Play: Self-Defining Play, Creative Play, Other Forms of Expression, Game Modifications. **Character Development: The** Goals of Character Design, The

Relationship Between Player and Avatar, Visual Appearances, Character Depth, Audio Design

UNIT- IV: Storytelling: Why Put Stories in Games? Key Concepts, The Storytelling Engine, Linear Stories, Nonlinear Stories, Granularity, Mechanisms for Advancing the Plot, Emotional Limits of Interactive Stories, Scripted Conversations and Dialogue Trees, When to Write the Story, Other Considerations

UNIT- V: General Principles of Level Design: What Is Level Design? Key Design Principles, Layouts, Expanding on the Principles of Level Design, The Level Design Process, Pitfalls of Level Design
Design Issues for Online Gaming: What Are Online Games? Advantages of Online Games, Disadvantages of Online Games, Design Issues, Technical Security, Persistent Worlds, Social Problems

Textbooks:

1. Fundamentals of Game Design, Third Edition, by Ernest Adams, Released December 2013,Publisher(s): New Riders, ISBN: 9780133435726

Reference Books:

1. Designing Games, A Guide to Engineering Experiences by Tynan Sylvester.
2. Game Design Essentials by Briar Lee Mitchell.

IV Year I Semester	HUMAN RESOURCE AND PROJECT MANAGEMENT (Management Course-II)	L	T	P	C
		2	0	0	2

Course Objectives: The main objectives of the course are to

- Provide knowledge about HR planning, recruitment, selection, and job design.
- Develop skills in managing HR functions such as performance appraisal, compensation, and employee relations.
- Emphasize the importance of ethical practices and HR audits in maintaining organizational health.
- Understand the HRD framework and its impact on organizational success.
- **Improve group interaction and team dynamics** for better collaboration and performance.

UNIT –I: HRM: Nature, Scope, Concept of HRM, Functions of HRM, Role of HR manager, emerging trends in HRM, E-HRM, HR audit models, ethical aspects of HRM. HR Planning, Demand and Supply forecasting of HR, Job Design, Recruitment, Sources of recruitment, Selection- Selection Procedure.

UNIT –II: HRD, HR accounting, Models, Concept of Training and Development, Methods of Training. Performance Appraisal: Importance Methods of performance appraisal, Career Development and Counseling, group interaction.

UNIT –III: Basics of Project Management, Concept, resource management, Project environment, Types of Projects, project networks-DPR, Project life cycle, Project proposals, Monitoring project progress, Project appraisal and Project selection, 80-20 rules, production technology, communication matrix

UNIT-IV: Identify various project types and their unique management challenges and apply appropriate management strategies for each. Project Implementation and Review: Forms of project organization, project planning, project control, human aspects of project management, prerequisites for successful project implementation, project review, performance evaluation, abandonment analysis

UNIT-V: Project Implementation and Review: Forms of project organization, project planning, project control, human aspects of project management, prerequisites for successful project implementation, project review, performance evaluation, abandonment analysis

Text Books:

1. Robert L. Mathis, John H. Jackson, Manas Ranjan Tripathy, Human Resource Management, Cengage Learning 2016.
2. Sharon Pande and Swapnalekha Basak, Human Resource Management, Text and Cases, Vikas Publishing, 2e, 2016.

3. Stewart R. Clegg, Torgeir Skyttermoen, Anne Live Vaagaasar, Project Management, Sage

Publications, 1e, 2021.
4. K. Nagarajan, Project Management, New Age International Publishers, 8e, 2017.

Reference Books :

1. Subba Rao P, "Personnel and Human Resource Management-Text and Cases", Himalaya Publications, Mumbai, 2013.
2. K Aswathappa, "Human Resource and Personnel Management", Tata McGraw Hill, New Delhi, 2013.
3. Prasanna Chandra, "Projects, Planning, Analysis, Selection, Financing, Implementation and Review", Tata McGraw Hill Company Pvt. Ltd., New Delhi, 1998.
4. Vasanth Desai, "Project Management", 4th edition, Himalaya Publications, 2018.
5. Lalitha Balakrishnan, Gowri, "Project Management", Himalaya publishing house, New Delhi, 2022.

IV Year I Semester	SOFTWARE ARCHITECTURE & DESIGN PATTERNS (Professional Elective-IV)	L	T	P	C
		3	0	0	3

Course Outcomes

- Understand the basic concepts to identify state behavior of real world objects
- Apply Object Oriented Analysis and Design concepts to solve complex problems
- Construct various UML models using the appropriate notation for specific problem context
- Design models to Show the importance of systems analysis and design in solving complex problems using case studies
- Study of Pattern Oriented approach for real world problems

UNIT – I: Introduction: Define Design Pattern, describing design patterns, the catalog of design pattern, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern What is object oriented development? key concepts of object oriented design other related concepts, benefits and drawbacks of the paradigm

UNIT – II: Analysis a System: Overview of the analysis phase, stage 1 gathering the requirements functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain Design and Implementation, discussions and further reading

UNIT – III: Design Pattern Catalog: Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy.

UNIT – IV: Interactive systems and the MVC architecture: Introduction The MVC architectural pattern, analyzing a simple drawing program designing the system, designing of the subsystems, getting into implementation, implementing undo operation drawing incomplete items, adding a new feature pattern based solutions

UNIT – V: Designing with Distributed Objects: Client server system, java remote method invocation, implementing an object oriented system on the web, Web services (SOAP, Restful), Enterprise Service Bus

Text Books:

1. Object oriented analysis, design and implementation, brahma dathan, sarnath rammath , universities press,2013
2. Design patterns, Erich Gamma, Richard helan , Ralph johman , john vlissides, PEARSON Publication,2013

Reference Books:

1. Frank Bachmann, Regine Meunier , Hans Rohnert “Pattern Oriented Software Architecture” Volume 1, 1996.
2. William J Brown et al., "Anti Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998.

IV Year I Semester	BLOCK CHAIN TECHNOLOGY (Professional Elective-IV)	L	T	P	C
		3	0	0	3

Course Outcomes: At the end of the Course student will be able to:

CO1: Discuss the Cryptographic primitives used in Blockchain (K2)
CO2: Discuss about various technologies borrowed in blockchain (K2)
CO3: Illustrate various models for blockchain (K2)
CO4: Discuss about Ethereum (K2)
CO5: Discuss about Hyperledger Fabric (K2)

UNIT- I: INTRODUCTION TO BLOCKCHAIN: Introduction, history of Bitcoin and origins of Blockchain, Fundamentals of Blockchain and key components (Chapter 1-book1), Permission and Permission-less platforms(Chapter 1-book2), Introduction to Cryptography, SHA256 and ECDSA, Hashing and Encryption, Symmetric/ Asymmetric keys, Private and Public Keys(Chapter 3-book2).

UNIT –II: TECHNOLOGIES BORROWED IN BLOCKCHAIN: Technologies Borrowed in Blockchain –hash pointers- - Digital cash etc.- Bitcoin blockchain - Wallet – Blocks Merkley Tree - hardness of mining - Transaction verifiability - Anonymity - forks - Double spending - Mathematical analysis of properties of Bitcoin - Bitcoin- the challenges and solutions. (Chapter 3-book2).

UNIT- III: CONSENSUS MECHANISMS: Consensus Algorithms: Proof of Work (PoW) as random oracle - Formal treatment of consistency- Liveness and Fairness - Proof of Stake (PoS) based Chains -Hybrid models (PoW + PoS), Byzantine Models of fault tolerance. ((Chapter 1-book2))

UNIT-IV: ETHEREUM: Ethereum -Ethereum Virtual Machine (EVM) -Wallets for Ethereum -Solidity - Smart Contracts **(Chapter 5-book1),** - The Turing Completeness of Smart Contract Languages and verification challenges- Using smart contracts to enforce legal contracts- Comparing Bitcoin scripting vs. Ethereum Smart Contracts-Some attacks on smart contracts (**Chapter 6 and Chapter 7-book2)**

UNIT- V: HYPERLEDGER FABRIC : Hyperledger fabric- the plug and play platform and mechanisms in permissioned blockchain - Beyond Cryptocurrency – applications of blockchain in cyber security- integrity of information- E-Governance and other contract enforcement mechanisms - Limitations of blockchain as a technology and myths vs reality of blockchain technology **(Chapter 16-book1),** (**Chapter 9 -book2)**

TEXT BOOKS:

1. Blockchain Technology Chandramouli Subramanian, Asha A George, Abhilash K A and Meena Karthikeyan, University Press, 2020.

2. Mastering Blockchain - Distributed ledger technology, decentralization, and smart contracts explained, Imran Bashir,2nd ed. Edition,2018, pakct publication

REFERENCES:

1. S.Shukla, M.Dhawan, S.Sharma,S. Venkatesan "Blockchain Technology: Cryptocurrency and Applications" ,Oxford University Press 2019 .
2. Cryptography and network security principles and practice, William Stallings, Pearson, 8th edition,

WEB REFERENCES:

1. https://drive.google.com/file/d/1PtYaDmWYaqPVGjKDnMYGWO5eoI5wMPtJ/view
2. https://archive.nptel.ac.in/courses/106/104/106104220/
3. https://www.tutorialspoint.com/blockchain/index.htm

IV Year I Semester	MACHINE LEARNING (Professional Elective-IV)	L	T	P	C
		3	0	0	3

Course Objectives: The objectives of the course is to

- Define machine learning and its different types (supervised and unsupervised) and understand their applications.
- Apply supervised learning algorithms including decision trees and k-nearest neighbours (k-NN).
- Implement unsupervised learning techniques, such as K-means clustering.

,

Course Outcomes: At the end of the course, student will be able to

- Enumerate the Fundamentals of Machine Learning
- Build Nearest neighbour based models
- Apply Models based on decision trees and Bayes rule
- Make use of Linear discriminants for machine Learning
- Choose appropriate clustering technique

UNIT-I: Introduction to Machine Learning: Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Selection, Model Learning, Model Evaluation, Model Prediction, Search and Learning, Data Sets.

UNIT-II: Nearest Neighbor-Based Models: Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures ,K-Nearest Neighbor Classifier, Radius Distance Nearest Neighbor Algorithm, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.

UNIT-III: Models Based on Decision Trees: Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression.

The Bayes Classifier: Introduction to the Bayes Classifier, Bayes' Rule and Inference, The Bayes Classifier and its Optimality, Multi-Class Classification | Class Conditional Independence and Naive Bayes Classifier (NBC)

UNIT-IV: Linear Discriminants for Machine Learning: Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Perceptrons (MLPs), Back propagation for Training an MLP.

UNIT-V: Clustering : Introduction to Clustering, Partitioning of Data, Matrix Factorization | Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering, Rough Clustering, Rough K-Means Clustering Algorithm, Expectation Maximization-Based Clustering, Spectral Clustering.

Text Books:

1. "Machine Learning Theory and Practice", M N Murthy, V S Ananthanarayana, Universities Press (India), 2024

Reference Books:

1. "Machine Learning", Tom M. Mitchell, McGraw-Hill Publication, 2017
2. "Machine Learning in Action",Peter Harrington, DreamTech
3. "Introduction to Data Mining", Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th Edition, 2019.

IV Year I Semester	COMPUTER VISION (Professional Elective-IV)	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the Fundamental Concepts related to sources, shadows and shading
- To understand the Geometry of Multiple Views

Course Outcomes:

1. Implement fundamental image processing techniques required for computer vision
2. Implement boundary tracking techniques
3. Apply chain codes and other region descriptors, Hough Transform for line, circle, and ellipse detections.
4. Apply 3D vision techniques and Implement motion related techniques.
5. Develop applications using computer vision techniques.

UNIT–I: Cameras: Pinhole Cameras Radiometry–Measuring Light: Lighting Space, Light Surfaces, Important Special Cases Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Inter reflections: Global Shading Models Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

UNIT-II: Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges Texture0: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.

UNIT-III: The Geometry of Multiple Views: Two Views Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras Segmentation by Clustering: What Is Segmentation? Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,

UNIT-IV: Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, kalman filtering, data association, applications and examples

UNIT-V: Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry,

Case study: Mobile Robot Localization Model- Based Vision: Initial Assumptions, Obtaining

Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Case study: Registration In Medical Imaging Systems, Curved Surfaces and Alignment.

TEXT BOOKS:

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.

REFERENCE BOOKS:

1. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.
2. R. C. Gonzalez and R. E. Woods "Digital Image Processing" Addison Wesley 2008.
3. Richard Szeliski "Computer Vision: Algorithms and Applications" Springer-Verlag London Limited 2011.

IV Year I Semester	ANIMATION PRINCIPLES AND DESIGN (Professional Elective-IV)	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the concept of 2D animation, cycles, and scenes.
- To understand basic concepts of animation, different types/ style and their workflow.
- To explain tools and techniques for 2D animation.
- To examine various processes of animation techniques that are developed with various equipment.

Course Outcomes: After completion of the course, students will be able to

- Identify and apply various Animation Principles.
- Relate knowledge of various animation history and techniques.
- Determine various animation techniques with basic principles of animation.
- Create a 2D animation short movie.
- Create a complete promotional campaign using Animation and Graphics technique.
- Demonstrate skills in the use of industry standard tools.

UNIT –I: Drawing Techniques: What is Animation, History of Animation – Starting from Early approaches to motion in art, Animation before film, Traditional Animation – The silent era, Walt Disney & Warner Bros., Snow White & the seven dwarfs, The Television era, Stop-motion, CGI Animation - till date. Different Types of Animation, Basic Drawing Concepts of Visualization Illustration and Sketching Basic Shapes and Sketching Techniques

UNIT –II: Script Writing and Character Enhancement: Basic Script and Story Board, Concepts of 2D, Cel Animation, Character Design and Development, Traditional animation, key frame animation, key poses and time stretch, character design development, facial expressions and walk cycles.

UNIT –III: Animation Tools Processing: Scripting & Storyboarding with Toon Boom Pro, Animation Process Development, Usage of tools for Digital Painting and vector drawings, How to develop a character and background creation, Usage of timeline and its purpose.

UNIT-IV: Principles, Storytelling & Editing : Animation Concept Acting and Direction for Animation Timing for Animation Storytelling Techniques Script Writing Concept Design and Development Storyboarding and Animatics, Audio and Video Streaming and Editing, Previsualization

UNIT-V: Advanced Techniques of Production, Digital Animation : Advanced 2D Production and Post Production, Digital Animation Scene Planning, Digital Animation Ink and Paint, and Digital Animation Composting and Effects

Textbooks:

1. Edoux, Trish, Ranney, “Complete Anime Guide: Japanese Animation Film Directory and Resource Guide”, ‘Tiger Mountain Press, 1997.
2. Kevin Hedgpeth (Author), Stephen Missal, “Exploring Drawing for Animation ,Design
Concepts,1st Edition, march 15, 2004.
3. The Illusion of Life: Disney Animation - Frank Thomas and Ollie Johnston

Reference Books:

1. Pakhira Malay K, "Computer Graphics, Multimedia and Animation”, Second Edition, 2010.
2. Preston Blair, "Cartooning: Animation 1 with Preston Blair: Learn to animate cartoons step by step (How to Draw & Paint)", Walter Foster Publishing, 2003

Online Learning Resources:

1. https://onlinecourses.swayam2.ac.in/cec20_cs08/preview

IV Year I Semester	AGILE METHODOLOFGIES (Professional Elective-V)	L	T	P	C
		3	0	0	3

Course Outcomes: At the end of the course the student will be able to:
CO1 Apply agile methodology and agile process to create high quality software.
CO2 Use Agile methodology for knowledge management.
CO3 Apply Agile development and testing techniques to manage risks.
CO4 Analyze the pros and cons of working in Agile Team.
CO5 Apply Feature Driven Development on large size projects.

UNIT –I: Agile Methodology: Theories for Agile Management, Agile Software Development – Traditional Model vs. Agile Model, Classification of Agile Methods, Agile Manifesto and Principles, Agile Project Management, Agile Team Interactions, Ethics in Agile Teams, Agility in Design, Testing, Agile Documentations, Agile Drivers, Capabilities and Values.

UNIT-II: Agile Process: Lean Production - SCRUM, Crystal, Feature Driven Development- Adaptive Software Development - Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.

UNIT-III: Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM).

UNIT-IV: Agility and Requirements Engineering: Impact of Agile Processes in RE, Current Agile Practices, Variance, Overview of RE Using Agile, Managing Unstable Requirements, Requirements Elicitation, Agile Requirements Abstraction Model, Requirements Management in Agile Environment, Agile Requirements Prioritization, Agile Requirements Modelling, Generation – Concurrency in Agile Requirements Generation.

UNIT-V: Agility and Quality Assurance: Agile Product Development, Agile Metrics, Feature Driven Development (FDD), Financial and Production Metrics in FDD, Agile Approach to Quality Assurance, Test Driven Development, Agile Approach in Global Software Development.

TEXT BOOKS:

1. David J. Anderson and Eli Schragenheim, Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Pearson, 2003.
2. Hazza and Dubinsky, Agile Software Engineering, Springer, 2009th edition, 2008.

REFERENCE BOOKS:

1. Craig Larman, ―Agile and Iterative Development, Addison-Wesley, First Edition, 2003

IV Year I Semester	METAVERSE (Professional Elective-V)	L	T	P	C
		3	0	0	3

Course Objectives (COs)

- To **introduce** the fundamental concepts, definitions, and historical evolution of the Metaverse, along with the technologies that contribute to its structure, such as AR/VR, Blockchain, AI, IoT, and Web 3.0.
- To **familiarize** students with the core enabling technologies of the Metaverse, including development tools for VR/AR, blockchain infrastructure, NFTs, digital ownership models, and spatial computing.
- To **develop** a comprehensive understanding of the infrastructure and system architecture of the Metaverse, covering networking, decentralization, identity management, security, and development platforms like Unity and Unreal Engine.

Course Outcomes:

1. **Explain** the key concepts, historical evolution, and foundational components of the Metaverse, including digital avatars, AR/VR, Blockchain, and Web 3.0 technologies. (K2)
2. **Apply** development tools and technologies such as VR/AR SDKs, blockchain-based ownership models, and spatial computing to simulate Metaverse environments. (K3)
3. **Analyze** the architectural design, infrastructure, and platform-specific considerations of the Metaverse, focusing on networking, decentralization, identity, and XR development platforms.(K4)
4. **Evaluate** real-world Metaverse applications, ethical concerns, and emerging trends to assess their societal, legal, and environmental implications. (K4)

UNIT I: Introduction to Metaverse: Definition and History of the Metaverse, Key Concepts: Digital Avatars, Virtual Worlds, Interoperability, Components: AR/VR, AI, Blockchain, IoT, Web Evolution: Web 1.0 to Web 3.0 and Beyond, Current Metaverse Platforms (e.g., Decentraland, Roblox, Meta Horizon)

UNIT II: Technologies Enabling the Metaverse: Virtual Reality (VR): Hardware and Software, Augmented Reality (AR): SDKs and Development Tools, Blockchain & NFTs in Metaverse (Digital Ownership, Smart Contracts), 3D Modeling and Simulation Tools, Spatial Computing and Digital Twin Concepts

UNIT III: Infrastructure & Architecture of the Metaverse: Networking in the Metaverse (5G, Edge Computing, Cloud Services), Decentralized Systems vs Centralized Platforms, Identity, Security, and Privacy; Avatar Systems, Digital Assets, and Economy; XR SDKs and Development Platforms (Unity, Unreal Engine, WebXR)

UNIT IV: Applications and Use Cases of the Metaverse : Education, Healthcare, Gaming, Retail, and Industrial Applications; Enterprise Metaverse: Remote Work, Digital Twins; Real-World Use Case Analysis: Meta, Microsoft Mesh, Nvidia Omniverse; Design and Usability Challenges; Cross-platform and Interoperability Issues

UNIT V: Ethics, Law, and Future Trends in Metaverse: Ethical and Legal Considerations (Privacy, Consent, IP Rights); Social Impacts: Addiction, Digital Divide, Inclusivity; Governance and Policy Challenges; Environmental Impact of Metaverse Infrastructure; Future Scope: Metaverse in AI, Robotics, and Quantum Computing

Textbooks

1. **"The Metaverse: And How It Will Revolutionize Everything"** Matthew Ball, Liveright, 2022, **Relevance**: Unit I (History and Foundation) and Unit V (Future Trends)
2. **"Augmented Human: How Technology Is Shaping the New Reality",** Helen Papagiannis, O'Reilly Media, 2017, **Relevance**: Unit II (AR/VR, Spatial Computing) and Unit III (Infrastructure)
3. **"Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile",** Tony Parisi, O'Reilly Media, 2015, **Relevance**: Practical foundation for Unit II and Unit III
4. **"Blockchain Basics: A Non-Technical Introduction in 25 Steps",** Daniel Drescher, Apress, 2017, **Relevance**: Essential for understanding blockchain and NFTs in Unit II & IV

Suggested E-Content and Online Resources

1. **Coursera – "Introduction to XR: VR, AR, and Mixed Reality"**
   Provider: University of London
   Link: https://www.coursera.org/learn/introduction-extended-reality
   Relevant Units: II, III
2. **Coursera – "Metaverse Technologies"**
   Provider: Yonsei University
   Link: https://www.coursera.org/learn/metaverse-technologies
   Relevant Units: I, II, IV, V
3. **edX – "Blockchain Fundamentals"**
   Provider: UC Berkeley
   Link: https://www.edx.org/course/blockchain-fundamentals
   Relevant Units: II, IV
4. **YouTube Playlist – "Metaverse Explained"**
   Creator: Simplilearn or MIT Media Lab Lectures
   Link: Search "Metaverse Simplilearn" or "Metaverse MIT lectures"
   Relevant Units: I, V

IV Year I Semester	CYBER PHYSICAL SYSTEMS (Professional Elective-V)	L	T	P	C
		3	0	0	3

COURSE OUTCOMES: the Students would be able to:

1. Understand the core principles behind CPS
2. Identify Security mechanisms of Cyber physical systems
3. Understand Synchronization in Distributed Cyber-Physical Systems

UNIT – I: Symbolic Synthesis for Cyber-Physical Systems: Symbolic Synthesis for Cyber-Physical Systems Introduction and Motivation, Basic Techniques - Preliminaries, Problem Definition, Solving the Synthesis Problem, Construction of Symbolic Models, Advanced Techniques: Construction of Symbolic Models, Continuous-Time Controllers, Software Tools

UNIT – II: Security of Cyber-Physical Systems: Security of Cyber-Physical Systems Introduction and Motivation, Basic Techniques - Cyber Security Requirements, Attack Model, Countermeasures, Advanced Techniques: System Theoretic Approaches

UNIT – III: Synchronization in Distributed Cyber-Physical Systems: Synchronization in Distributed Cyber-Physical Systems: Challenges in Cyber-Physical Systems, A Complexity-Reducing Technique for Synchronization, Formal Software Engineering, Distributed Consensus Algorithms, Synchronous Lockstep Executions, Time-Triggered Architecture, Related Technology, Advanced Techniques

UNIT – IV: Real-Time Scheduling for Cyber-Physical Systems: Real-Time Scheduling for Cyber-Physical Systems Introduction and Motivation, Basic Techniques - Scheduling with Fixed Timing Parameters, Memory Effects, Multiprocessor/Multicore Scheduling, Accommodating Variability and Uncertainty

UNIT – V: Model Integration in Cyber-Physical Systems: Model Integration in Cyber-Physical Systems Introduction and Motivation, Causality, Semantic Domains for Time, Interaction Models for Computational Processes, Semantics of CPS DSMLs, Advanced Techniques, ForSpec, The Syntax of CyPhyML, Formalization of Semantics, Formalization of Language Integration.

TEXT BOOKS:

1. Raj Rajkumar, Dionisio De Niz, and Mark Klein, Cyber-Physical Systems, Addison-Wesley Professional.
2. Rajeev Alur, Principles of Cyber-Physical Systems, MIT Press, 2015

IV Year I Semester	DIGITAL AUDIO DESIGN & SYNTHESIS (Professional Elective-V)	L	T	P	C
		3	0	0	3

Course Objectives:

- To learn about discrete time sampling, quantization, and signal processing.
- To understand and utilize general digital audio processing theory.
- Describe and demonstrate an understanding of the digital to analog and analog to digital conversion process (using PCM), and how digital audio files are created, stored, and processed.

Course Outcomes: After completion of the course, students will be able to

1. Examine the role of and the creative expectations of the sound designer. • Learn the typical workflow for audio post production.
2. Apply physical properties of sound in future projects.
3. Articulate strengths and weaknesses of film, video, and web based sound design.
4. Demonstrate technical proficiency in basic sound recording and live studio set-ups.

UNIT-I: Sound and Numbers: Physics of Sound, Digital Basics, Binary Codes, Boolean Algebra, Analog versus Digital.
Fundamentals of Digital Audio: Discrete Time Sampling, The Sampling Theorem, Aliasing,
Quantization, Dither. Digital Audio Recording: Pulse-Code Modulation, Dither Generator, Input Lowpass Filter, Sample and-Hold Circuit, Analog-to-Digital Converter, Record Processing, Channel Codes.

UNIT-II: Digital Audio Reproduction: Reproduction Processing, Digital-to-Analog Converter, Output Sample and-Hold Circuit, Output Low pass Filter, Impulse Response, Digital Filters, Noise Shaping, Output Processing, Alternate Coding Architectures, Time base Correction.

UNIT- III: Error Correction: Sources of Errors, Quantifying Errors, Objectives of Error Correction, Error Detection, Error-Correction Codes, Reed-Solomon Codes, CIRC, Product Codes, Error Concealment.

UNIT-IV: Digital Sound Synthesis: Introduction to Digital Sound Synthesis, Sampling and Additive Synthesis, Multiple Wavetable, Wave Terrain, Granular, and Subtractive Synthesis.

UNIT-V: Digital Sound Synthesis: Modulation Synthesis, Physical Modelling and Format Synthesis, Waveform Segment, Graphic, and Stochastic Synthesis.

Textbooks:

1. Ken C. Pohlmann, Principles of Digital Audio, Sixth Edition, O'Reilly.
2. The Computer Music Tutorial by Curtis Roads.

Reference Books:

1. On Sonic Art by Trever Wishart Andy Farnell, Designing Sound, 2010, ISBN: 9780262014410

Online Learning Resources: https://www.my-mooc.com/en/mooc/digitalsounddesign/

IV Year I Semester	BIG DATA ANALYTICS (Professional Elective-V)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Optimize business decisions and create competitive advantage with Big Data analytics
- Introducing Java concepts required for developing map reduce programs
- Derive business benefit from unstructured data
- Imparting the architectural concepts of Hadoop and introducing map reduce paradigm
- To introduce programming tools PIG & HIVE in Hadoop echo system.

UNIT-I: Data structures in Java: Linked List, Stacks, Queues, Sets, Maps; Generics: Generic classes and Type parameters, Implementing Generic Types, Generic Methods, Wrapper Classes, Concept of Serialization

UNIT-II: Working with Big Data: Google File System, Hadoop Distributed File System (HDFS) Building blocks of Hadoop (Namenode, Datanode, Secondary Namenode, Job Tracker, Task Tracker), Introducing and Configuring Hadoop cluster (Local, Pseudo-distributed mode, Fully Distributed mode), Configuring XML files.

UNIT-III: Writing Map Reduce Programs: A Weather Dataset, Understanding Hadoop API for Map Reduce Framework (Old and New), Basic programs of Hadoop Map Reduce: Driver code, Mapper code, Reducer code, Record Reader, Combiner, Practitioner

UNIT-IV: Stream Memory and Spark: Introduction to Streams Concepts– Stream Data Model and Architecture, Stream computing, Sampling Data in a Stream , Filtering Streams ,Counting Distinct Elements in a Stream , Introduction to Spark Concept , Spark Architecture and components , Spark installation , Spark RDD(Resilient Distributed Dataset) – Spark RDD operations.

UNIT-V: **Pig:** Hadoop Programming Made Easier Admiring the Pig Architecture, Going with the Pig Latin Application Flow, Working through the ABCs of Pig Latin, Evaluating Local and Distributed Modes of Running Pig Scripts, Checking out the Pig Script Interfaces, Scripting with Pig Latin.

Applying Structure to Hadoop Data with Hive: Saying Hello to Hive, Seeing How the Hive is Put Together, Getting Started with Apache Hive, Examining the Hive Clients, Working with Hive Data Types, Creating and Managing Databases and Tables, Seeing How the Hive Data Manipulation Language Works, Querying and Analysing data

TEXT BOOKS:

1. Wiley & Big Java 4th Edition, Cay Horstmann, Wiley John Sons, INC
2. Hadoop: The Definitive Guide by Tom White, 3rd. Edition, O'reilly

REFERENCE BOOKS:

1. Hadoop in Action by Chuck Lam, MANNING Publ.
2. Hadoop for Dummies by Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk,Bruce Brown, Rafael Coss
3. Hadoop in Practice by Alex Holmes, MANNING Publ.
4. Big Data Analytics by Dr. A.Krishna Mohan and Dr.E.Laxmi Lydia
5. Hadoop Map Reduce Cookbook, SrinathPerera, Thilina Gunarathne

Software Links:

1. Hadoop:http://hadoop.apache.org/
2. Hive: https://cwiki.apache.org/confluence/display/Hive/Home
3. Piglatin: http://pig.apache.org/docs/r0.7.0/tutorial.html

IV Year I Semester	PROMPT ENGINEERING (Skill Enhancement Course)	L	T	P	C
		0	1	2	2

Course Objectives:

The main objectives of the course are to

- Apply iterative prompting for clarity and context.
- Create varied prompts to steer model outputs.
- Construct chain-of-thought and structured prompts.
- Develop retrieval-augmented pipelines to ground outputs.
- Evaluate LLM agents and multimodal apps for ethics and robustness.

Unit I: Foundations of Prompt Engineering: Definition of prompt engineering, Distinction between prompt engineering and model fine-tuning, Motivation and benefits of prompt engineering, Core principles of effective prompt design**,** Anatomy of a prompt, Setting up the Python environment for LLM interaction, Iterative prompting lifecycle, Common prompt pitfalls and remediation

Lab Experiments:

1. Environment & Connectivity: Install required packages (e.g., transformers, openai); securely configure the API key; run a simple "Hello, world" prompt to verify model access.
2. Baseline vs. Enhanced Prompts: Execute a naïve prompt ("Write a one-paragraph bio of Ada Lovelace.") and an enhanced prompt that adds role framing, specificity, and explicit format instructions; compare both outputs for relevance, completeness, and style.
3. Iterative Refinement on a Simple Task: Summarize the plot of the Shakespearean play Romeo and Juliet in two sentences through three rounds of prompt tweaking:
    a. Minimal instruction.
    b. Addition of length and style constraints
    c. Specification of key content elements (setting and theme)

    Document how each iteration changes and improves the result.
4. Diagnosing Prompt Failures & Edge Cases: Craft a vague or contradictory prompt; analyze the failure mode (ambiguity, missing context, or format errors); refine the prompt by adding examples or clarifying instructions.

Unit II: Advanced Prompt Patterns & Techniques: Enhanced prompt anatomy: contextual detail and explicit output specifications, Few-shot in-context prompting, Prompt structuring and template design, Role-based prompting to establish personas or system behavior, Negative prompting to filter or suppress undesired content, Constraint specification and instruction enforcement (e.g., length, format), Iterative prompt refinement and optimization

Lab Experiments:

1. Few-Shot vs. Zero-Shot Comparison: Design and execute a zero-shot prompt and a few-shot prompt (with 2–3 exemplar input-output pairs) for a chosen text task (e.g., sentiment
2. classification or translation); compare outputs for accuracy, consistency, and adherence to examples.
3. Role-Based & Negative Prompting: Craft a role-based prompt to establish a specific persona (e.g., "You are a financial advisor…"); then create a negative prompt to suppress undesired content (e.g., "Do not mention any brand names"); evaluate how each influences the model's response.
4. Constraint Specification & Iterative Refinement: Select an open-ended task (e.g., summarizing a technical article); issue a basic prompt; identify failures in length or format; refine the prompt by adding explicit constraints (word count, bullet format, etc.); document improvements over two refinement cycles.

Unit III: Structured Output & Reasoning Techniques: Importance of structured outputs for real-world applications, Prompting for specific formats (lists, tables, Markdown), Generating valid JSON and YAML via explicit instructions, Eliciting chain-of-thought reasoning in zero-shot prompts, Decomposing complex tasks into manageable sub-tasks

Lab Experiments:

1. Structured Format Prompting: Instruct the model to output information as bullet lists and Markdown tables (e.g., "List three benefits of daily exercise in a Markdown table with columns 'Benefit' and 'Description.'"); verify the output matches the requested structure.
2. JSON/YAML Generation: Provide a brief dataset description (e.g., three books with title, author, publication year) and prompt the model to produce valid JSON or YAML; use a parser to validate syntax and refine the prompt if errors occur.
3. Chain-of-Thought & Task Decomposition: Present a multi-step problem (e.g., a logic puzzle) and apply zero-shot CoT prompting (e.g., "Let's think step by step. Explain your reasoning before the final answer."); separately, decompose the problem into sequential sub-questions, collect partial answers, combine them, and compare accuracy against a direct-answer baseline.

Unit IV: Retrieval-Augmented Generation & LangChain Workflows: Limitations of LLM internal knowledge, Need for external data sources, Introduction to Retrieval-Augmented Generation (RAG), Overview of RAG architecture (indexing vs. retrieval + generation), Getting started with LangChain for LLM applications, Basics of LangChain Expression Language (LCEL), Simplified indexing pipeline: document loading & text splitting, Fundamentals of embeddings and vector stores, Building a basic retrieval-generation pipeline with an LCEL chain

Lab Experiments:

1. Building a Simple LCEL Chain: Create a minimal LCEL script that accepts a fixed instruction (e.g., "Summarize this text: …"), passes it to an LLM, and prints the result; verify end-to-end execution.
2. Basic Data Indexing for RAG: Load a small collection of documents; split into uniform chunks (e.g., 200 tokens); generate embeddings for each chunk; store them in an in-memory vector store; inspect for consistency.
3. Constructing & Running a Basic RAG Chain: Build a pipeline that:
    a. Receives a user query
    b. Retrieves the top-k relevant chunks
    c. Constructs a combined prompt with context + query
    d. Send it to the LLM
    e. Returns the answer

Test with sample queries and compare factual accuracy against a prompt without retrieval.

Unit V: Agents, Multimodal AI & Ethical Evaluation: Introduction to LLM agents and their basic architecture, Overview of multimodal AI models (VLMs), Prompting for text-to-image generation and image understanding, Importance of prompt evaluation beyond subjective judgment, Manual evaluation techniques (heuristic checks for accuracy, relevance, format), Introduction to "LLM-as-Judge" for automated evaluation, Security considerations (prompt injection, sensitive-information risks), Prompt-based mitigation strategies for safety and robustness, Ethical concerns (bias, misinformation, data privacy), Brief exploration of UI frameworks (Streamlit/Gradio) for deploying prompt-driven apps, Adapting to the evolving nature of prompt engineering through continuous learning

Lab Experiments:

1. Building a Simple LLM Agent: Register a tool (e.g., a calculator function) and craft prompts that instruct the agent to invoke it when required; implement using Lang Chain or a function-calling API; test on queries requiring tool execution.
2. Multimodal Prompting Exploration: Generate images from detailed text prompts; feed one generated image into an image-understanding model or API with an appropriate prompt; compare the returned caption to the original prompt to evaluate alignment.
3. Prompt Evaluation & Ethics Workshop:
    a. Select two existing prompts and generate multiple outputs; apply manual heuristic checks for accuracy, relevance, and format compliance.
    b. Use an "LLM-as-Judge" prompt (e.g., "Rate these outputs on a scale of 1–5 for clarity and correctness.") to automate evaluation.
    c. Design a prompt- injection test (e.g., "Ignore previous instructions…"), observe the response, then refine system prompts to mitigate the vulnerability.

IV Year I Semester	CONSTITUTION OF INDIA (Audit Course)	L	T	P	C
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Course Objectives:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT–I: History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution- Preamble, Salient, Features

UNIT–II: Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT–III: Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive- President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

UNIT–IV: Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: ZilaPachayat, Elected officials and their roles, CEO ZilaPachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT–V: Election Commission: Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

Text Books:

1. The Constitution of India, 1st Edition, (Bare Act), Government Publication, 1950
2. Framing of Indian Constitution, 1st Edition, Dr. S. N. Busi, Dr. B. R. Ambedkar 2015

Reference Books:

1. Indian Constitution Law, 7th Edition, M. P. Jain, Lexis Nexis, 2014.