



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**  
**KAKINADA – 533 003, Andhra Pradesh, India**  
**R23 B.Tech CSBS 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 & Algorithm 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 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	Fundamental of Economics	2	0	0	0
<b>Total</b>			<b>16</b>	<b>2</b>	<b>8</b>	<b>20</b>



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**B.Tech.– II Year II Semester**

S.No.	Category	Title	L	T	P	Credits
1	Management Course- I	Financial Management	2	0	0	2
2	Engineering Science/ Basic Science	Probability & Statistics	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	Software Engineering	3	0	0	3
6	Professional Core	Operating Systems & Software Engineering 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
<b>Total</b>			<b>15</b>	<b>1</b>	<b>10</b>	<b>21</b>
Mandatory Community Service Project Internship of 08 weeks duration during summer Vacation						



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**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 graphically using 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 and Sharon Cutler Ross, PHI.
3. Discrete Mathematics, S. K. Chakraborty and B.K. Sarkar, Oxford, 2011.
4. Discrete Mathematics and its Applications with Combinatorics and GraphTheory, K. H. Rosen, 7th Edition, Tata McGraw Hill.



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**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
- Lecture 4: 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** session)

Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice

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. *Jeevan Vidya: Ek Parichaya*, A Nagaraj, Jeevan Vidya Prakashan, 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* – Pandit Sunderlal
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%202023.pdf>



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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](https://onlinecourses.swayam2.ac.in/aic22_ge23/preview)



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**II Year I Semester**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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

**Text books:**

1. Computer Organization, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 6th edition, McGraw Hill
2. Digital Design, 6th Edition, M. Morris Mano, Pearson Education.
3. Computer Organization and Architecture, William Stallings, 11thEdition, Pearson.

**Reference Books:**

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

**Online Learning Resources:**

1. <https://nptel.ac.in/courses/106/103/106103068/>



**II Year I Semester**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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:**



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### **B.Tech CSBS (R23-COURSE STRUCTURE & SYLLABUS)**

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, Sahni, Sartaj; Mehta, Dinesh, 2<sup>nd</sup> Edition Universities Press
2. Computer Algorithms in C++, Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, 2<sup>nd</sup> 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:**

[https://www.tutorialspoint.com/advanced\\_data\\_structures/index.asp](https://www.tutorialspoint.com/advanced_data_structures/index.asp)

<http://peterindia.net/Algorithms.html>



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II Year I Semester

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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,



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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



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Connections, ResultSet 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, 4<sup>th</sup> Edition, Pearson.

**References Books:**

- 1) The complete Reference Java, 11<sup>th</sup> edition, Herbert Schildt, TMH
- 2) Introduction to Java programming, 7<sup>th</sup> 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](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview)



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**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

**Experiments:**

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 biconnected 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.



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**Reference Books:**

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

**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

#### **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 discriminant 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 StringBuffer 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.



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**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
- c) Write a JAVA program for creation of Java Built-in Exceptions
- d) 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**

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



## 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

#### **UNIT-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.

#### **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 Operators iv) 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.



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**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.

**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.

**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,



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Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

**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.

**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. Gowri shankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2<sup>nd</sup> 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	0

**FUNDAMENTAL OF ECONOMICS**

**Objectives:**

- To gain basic knowledge in Economics and understand the concept of management at the macro and micro level.
- Understand the basic concepts of economics at the macro and micro level.
- Conceptualize the basic principles of management.

**UNIT I :**

**Periods Fundamentals of Economics:** Wealth, Welfare and Scarce Definitions of Economics; Micro and Macro Economics; Demand- Law of Demand, Elasticity of Demand, Types of Elasticity and Factors determining price elasticity of Demand - Law of Diminishing Marginal Utility.

**UNIT II**

**Periods Forms of Business Organizations:** Features, merits and demerits of Sole Proprietorship, Partnership and Joint Stock Company- Public Enterprises and their types.

**UNIT III**

**Periods Introduction to Management:** Functions of Management- Taylor's Scientific Management; Henry Fayol's Principles of Management; Human Resource Management – Basic functions of Human Resource Management (in brief). Production Management: Production Planning and Control, Plant Location, Break-Even Analysis- Assumptions, limitations and applications.

**UNIT IV**

**Periods Financial Management:** Types of Capital: Fixed and Working Capital and Methods of Raising Finance; Final Accounts- Trading Account, Statement of Profit and Loss and Balance Sheet (simple problems)

**UNIT V**

**Periods Marketing Management and Entrepreneurship:** Marketing Management: Functions of marketing and Distribution Channels. Entrepreneurship: Definition, Characteristics and Functions of an Entrepreneurship

**TEXT BOOKS**

1. .S.N.Maheswari, SK Maheswari, Financial Accounting Fifth Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2012
2. S.C. Sharma and Banga T. R., Industrial Organization & Engineering Economics, khanna Publications, Delhi-6, 2006
3. .A.R.AryaSri, Managerial Economics and Financial Analysis, TMH Publications, new Delhi, 2014



**II Year II Semester**

L	T	P	C
2	0	0	2

**FINANCIAL MANAGEMENT**

**Course Outcomes:**

Students will be able to

- Understand the fundamental concepts of financial management
- Appreciate basic concepts such as time value of money, cost of capital, risk and return, working capital management, capital budgeting etc.
- Leverage the concept for deciding financial angle of IT projects

**UNIT - I**

**Introduction** : Introduction to Financial Management - Goals of the firm - Financial Environments. **Time Value of Money** : Simple and Compound Interest Rates, Amortization, Computing more than once a year, Annuity Factor.

**UNIT - II**

**Valuation of Securities** : Bond Valuation, Preferred Stock Valuation, Common Stock Valuation, Concept of Yield and YTM. **Risk & Return**: Defining Risk and Return, Using Probability Distributions to Measure Risk, Attitudes Toward Risk, Risk and Return in a Portfolio Context, Diversification, The Capital Asset Pricing Model (CAPM)

**UNIT - III**

**Operating & Financial Leverage**: Operating Leverage, Financial Leverage, Total Leverage, Indifference Analysis in leverage study. **Cost of Capital** : Concept, Computation of Specific Cost of Capital for Equity - Preference – Debt, Weighted Average Cost of Capital – Factors affecting Cost of Capital 4L.

**UNIT-IV**

**Capital Budgeting** : The Capital Budgeting Concept & Process - An Overview, Generating Investment Project Proposals, Estimating Project, After Tax Incremental Operating Cash Flows, Capital Budgeting Techniques, Project Evaluation and Selection – Alternative Methods **Working Capital Management**: Overview, Working Capital Issues, Financing Current Assets (Short Term and Long Term-Mix), Combining Liability Structures and Current Asset Decisions, Estimation of Working Capital.



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**UNIT – V**

**Cash Management:** Motives for Holding cash, Speeding Up Cash Receipts, Slowing Down Cash Payouts, Electronic Commerce, Outsourcing, Cash Balances to maintain, Factoring. **Accounts Receivable Management:** Credit & Collection Policies, Analyzing the Credit Applicant, Credit References, Selecting optimum Credit period. 4L

**Text Book**

1. Chandra, Prasanna - Financial Management - Theory & Practice, Tata McGraw Hill.

**References Books :**

1. Srivastava, Misra: Financial Management, OUP
2. Van Horne and Wachowicz : Fundamentals of Financial Management, Prentice Hall/Pearson Education.



**II Year II Semester**

L	T	P	C
3	0	0	3

**PROBABILITY AND STATISTICS**

**Course Objectives:**

- To familiarize the students with the foundations of probability and statistical methods
- To impart probability concepts and statistical methods in various applications Engineering

**Course Outcomes:** Upon successful completion of this course, the student should be able to

1. Classify the concepts of data science and its importance (L2)
2. Interpret the association of characteristics and through correlation and regression tools (L4)
3. Apply discrete and continuous probability distributions (L3)
4. Design the components of a classical hypothesis test (L6)
5. Infer the statistical inferential methods based on small and large sampling tests (L4)

**Unit – I: Descriptive statistics and methods for data science:**

Data science – Statistics Introduction – Population vs Sample –Collection of data – primary and secondary data – Type of variable: dependent and independent Categorical and Continuous variables – Data visualization – Measures of Central tendency – Measures of Variability – Skewness – Kurtosis.

**UNIT – II: Correlation and Regression:**

Correlation – Correlation coefficient – Rank correlation.

Linear Regression: Straight line – Multiple Linear Regression - Regression coefficients and properties – Curvilinear Regression: Parabola – Exponential – Power curves.

**UNIT – III: Probability and Distributions:**

Probability– Conditional probability and Baye’s theorem – Random variables – Discrete and Continuous random variables – Distribution functions – Probability mass function, Probability density function and Cumulative distribution functions – Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Normal distributions.

**UNIT – IV: Sampling Theory:**

Introduction – Population and Samples – Sampling distribution of Means and Variance (definition only) – Point and Interval estimations – Maximum error of estimate – Central limit theorem (without proof) – Estimation using t,  $\chi^2$  and F-distributions.

**UNIT – V: Tests of Hypothesis:**

Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance – One tail and two-tail tests – Test of significance for large samples and Small Samples: Single and difference means – Single and two proportions – Student’s t- test,



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F-test,  $\chi^2$ -test.

**Text Books:**

- **Miller and Freund's**, Probability and Statistics for Engineers,7/e, Pearson, 2008.
- **S. C. Gupta and V.K. Kapoor**, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.

**Reference Books:**

- **Shron L. Myers, Keying Ye, Ronald E Walpole**, Probability and Statistics Engineers and the Scientists,8<sup>th</sup> Edition, Pearson 2007.
- **Jay I. Devore**, Probability and Statistics for Engineering and the Sciences, 8<sup>th</sup> Edition, Cengage.
- **Sheldon M. Ross**, Introduction to probability and statistics Engineers and the Scientists, 4<sup>th</sup> Edition, Academic Foundation, 2011.
- **Johannes Ledolter and Robert V. Hogg**, Applied statistics for Engineers and Physical Scientists, 3<sup>rd</sup> Edition, Pearson, 2010.



## II Year II Semester

### 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 processmanagement, memory management, file systems, and Protection
- Make use of process scheduling algorithms and synchronization techniques to achievebetter 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.



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**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, 10<sup>th</sup> Edition, Wiley,2018.
2. Modern Operating Systems, Tanenbaum A S, 4<sup>th</sup> Edition, Pearson , 2016

**Reference Books:**

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

**Online Learning Resources:**

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



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**II Year II Semester**

**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 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



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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, 3<sup>rd</sup> edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)
- 2) Database System Concepts, 5<sup>th</sup> edition, Silberschatz, Korth, Sudarsan, TMH (For Chapter 1 and Chapter 5)

**Reference Books:**

- 1) Introduction to Database Systems, 8<sup>th</sup> edition, C J Date, Pearson.
- 2) Database Management System, 6<sup>th</sup> edition, Ramez Elmasri, Shamkant B. Navathe, Pearson
- 3) Database Principles Fundamentals of Design Implementation and Management, Carlos 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](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

**SOFTWARE ENGINEERING**

**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 characterise 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



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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 issues in any reuse program, A reuse approach, and Reuse at organisation level.

Text Books:

Fundamentals of Software Engineering, Rajib Mall, 5<sup>th</sup> Edition, PHI.

Software Engineering A practitioner's Approach, Roger S. Pressman, 9<sup>th</sup> Edition, Mc-Graw Hill International Edition.

Reference Books:

Software Engineering, Ian Sommerville, 10<sup>th</sup> Edition, Pearson.

Software Engineering, Principles and Practices, DeepakJain, OxfordUniversity 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](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](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003_904735_shared/overview)



## II Year II Semester

L	T	P	C
0	0	3	1.5

### **OPERATING SYSTEMS & SOFTWAREENGINEERING LAB**

#### **Course Objectives:**

The main objectives of the course are to

- Provide insights into system calls, file systems, semaphores,
- Develop and debug CPU Scheduling algorithms, page replacement algorithms, threadimplementation
- Implement Bankers Algorithms to Avoid the Dead Lock
- acquire the generic software development skill through various stages of software lifecycle
- generate test cases for software testing

#### **Experiments covering the Topics:**

- UNIX fundamentals, commands & system calls
- CPU Scheduling algorithms, thread processing
- IPC, semaphores, monitors, deadlocks
- Page replacement algorithms, file allocation strategies
- Memory allocation strategies
- Software Requirement Specification, DFD, CFD
- Software estimation, UML diagrams, test case design

#### **Sample Experiments in Operating Systems:**

1. Practicing of Basic UNIX Commands.
2. Write programs using the following UNIX operating system callsfork, exec, getpid, exit, wait, close, stat, opendir and readdir
3. Simulate UNIX commands like cp, ls, grep, etc.,
4. Simulate the following CPU scheduling algorithms  
a) FCFS b) SJF c) Priority d) Round Robin
5. Control the number of ports opened by the operating system with  
a) Semaphore b) Monitors.
6. Write a program to illustrate concurrent execution of threads using pthreads library.
7. Write a program to solve producer-consumer problem using Semaphores.
8. Implement the following memory allocation methods for fixed partition  
a) First fit b) Worst fit c) Best fit
9. Simulate the following page replacement algorithms  
a) FIFO b) LRU c) LFU
10. Simulate Paging Technique of memory management.



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11. Implement Bankers Algorithm for Dead Lock avoidance and prevention
12. Simulate the following file allocation strategies
  - a) Sequential b) Indexed c) Linked

**Sample Experiments in Software Engineering:**

- 1) Perform the following, for the following experiments:
  - i. Do the Requirement Analysis and Prepare SRS
  - ii. Draw E-R diagrams, DFD, CFD and structured charts for the project.
    - a. Course Registration System
    - b. Students Marks Analyzing System
    - c. Online Ticket Reservation System
    - d. Stock Maintenance
- 2) Consider any application, using COCOMO model, estimate the effort.
- 3) Consider any application, Calculate effort using FP oriented estimation model.
- 4) Draw the UML Diagrams for the problem a, b, c, d.
- 5) Design the test cases for e-Commerce application (Flipcart, Amazon)
- 6) Design the test cases for a Mobile Application (Consider any example from Appstore)
- 7) Design and Implement ATM system through UML Diagrams.



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**II Year II Semester**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

**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 dropping 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, NOT EXISTS, 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



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- 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



# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

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## R23 B.Tech CSBS COURSE STRUCTURE & SYLLABUS

### 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

- Make use of HTML elements and their attributes for designing static web pages
- Build a web page by applying appropriate CSS styles to HTML elements
- 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

- a. Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>,



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<td> and attributes: border, rowspan, colspan)

- b. 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.).
- c. 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).
- d. 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>, <div>, <span> 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
  - i. Simple selector (element, id, class, group, universal)
  - ii. Combinator selector (descendant, child, adjacent sibling, general sibling)
  - iii. Pseudo-class selector
  - iv. Pseudo-element selector
  - v. 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



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- i. Content      ii. Border      iii. Margin      iv. padding

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

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

- Write a program using document object properties and methods.
- Write a program using window object properties and methods.
- Write a program using array object properties and methods.
- Write a program using math object properties and methods.
- Write a program using string object properties and methods.
- Write a program using regex object properties and methods.
- Write a program using date object properties and methods.
- Write a program to explain user-defined object by using properties, methods, accessors, constructors and display.

**8. JavaScript Conditional Statements and Loops**

- 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”.
- Write a program to display week days using switch case.
- Write a program to print 1 to 10 numbers using for, while and do-while loops.
- Write a program to print data in object using for-in, for-each and for-of loops
- 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.,  $13 + 53 + 33 = 153$ ]
- 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. Java script Functions and Events**

- Design a appropriate function should be called to display
  - Factorial of that number



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### R23 B.Tech CSBS COURSE STRUCTURE & SYLLABUS

- ii. Fibonacci series up to that number
  - iii. Prime numbers up to that number
  - iv. 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
- i. Factorial of that number
  - ii. Fibonacci series up to that number
  - iii. Prime numbers up to that number
  - iv. 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](mailto:xxxxxxx@xxxxxx.xxx))

#### 10. Node.js

- a. Write a program to show the workflow of JavaScript code executable by creating webserver in Node.js.
- b. Write a program to transfer data over http protocol using http module.
- c. Create a text file src.txt and add the following content to it. (HTML, CSS, Javascript, Typescript, MongoDB, Express.js, React.js, Node.js)
- d. Write a program to parse an URL using URL module.
- e. Write a program to create an user-defined module and show the workflow of Modularization of application using Node.js

#### Text Books:

1. Programming the World Wide Web, 7th Edition, Robert W. Sebesta, Pearson, 2013.
2. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2<sup>nd</sup> edition, APress, O'Reilly.

#### Web Links:

- <https://www.w3schools.com/html>  
<https://www.w3schools.com/css>  
<https://www.w3schools.com/js/>  
<https://www.w3schools.com/nodejs>  
<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, customer, 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.



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### R23 B.Tech CSBS COURSE STRUCTURE & SYLLABUS

#### 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://swayam.gov.in/nd1_noc19_mg60/preview)
- [https://onlinecourses.nptel.ac.in/noc22\\_de16/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



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**R23 B.TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

**B.Tech – III Year I Semester**

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	Data Analytics	3	0	0	3
2	Professional Core	Computer Networks	3	0	0	3
3	Professional Core	Automata Theory & Compiler Design	3	0	0	3
4	Professional Elective-I	1. Object-Oriented Analysis And Design 2. Cryptography & Network Security 3. Artificial Intelligence 4. Business Intelligence 5. 12week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
5	Open Elective-I/ Minor-1	OR Entrepreneurship Development & Venture Creation	3	0	0	3
6	Professional Core	Data Analytics Lab	0	0	3	1.5
7	Professional Core	Computer Networks Lab	0	0	3	1.5
8	Skill Enhancement course	FULL STACK DEVELOPMENT-2	0	1	2	2
9	Engineering Sciences	Using Interface Design Using Flutter	0	0	2	1
10	Evaluation of Community Service Internship		0	0	0	2
<b>Total</b>			<b>15</b>	<b>1</b>	<b>10</b>	<b>23</b>
MC	Minor Course (Student may select from the same specialized minors pool)		3	0	3	4.5
MC	Minor Course through SWAYAM / NPTEL (Minimum 12 Week, 3 credit course)		3	0	0	3
HC	Honors Course (Student may select from the same Honors pool)		3	0	0	3
HC	Honors Course (Student may select from the same Honors Pool)		3	0	0	3



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**R23 B.TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

**B.Tech.–III Year II Semester**

S.No.	Category	Title	L	T	P	C
1	Professional Core	Marketing Research and Marketing Management	3	0	0	3
2	Professional Core	Financial And Cost Accounting	3	0	0	3
3	Professional Core	Machine Learning	3	0	0	3
4	Professional Elective-II	1. Software Testing Methodologies 2. Principles of Cybersecurity 3. Cloud Computing 4. DevOps 5. 12-week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
5	Professional Elective-III	1. Software Project Management 2. Mobile Adhoc Networks 3. Natural Language Processing 4. Distributed Operating System 5. 12-week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
6	Open Elective-II/ Minor-II		3	0	0	3
7	Professional Core	Business communication and value science lab-II	0	0	3	1.5
8	Professional Core	Python for Machine Learning Lab	0	0	3	1.5
9	Skill Enhancement Course	Soft Skills or IELTS	0	1	2	2
10	Audit Course	Technical Paper Writing & IPR	2	0	0	0
<b>Total</b>			<b>20</b>	<b>1</b>	<b>8</b>	<b>23</b>
Mandatory Industry Internship of 08 weeks duration during summer vacation						
MC	Student may select from the same minors pool		3	0	3	4.5
MC	Minor Course (Student may select from the same specialized minors pool)		3	0	0	3



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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

Open Electives & Minor

**Note: To obtain Minor Engineering, student needs to obtain 18 credits by successfully completing any of the following courses in the concern stream.**

**For Minor in CSBS:**

**L-T-P-C**

1. Operating Systems	3-0-0-3
2. Software Engineering	3-0-0-3
3. Data Analytics	3-0-0-3
4. Financial and cost Accounting	3-0-0-3
5. Marketing Research and Marketing Management	3-0-0-3
6. Business Communication and Value Sciences Lab	0-0-3-1.5
7. Data Analytics Lab	0-0-3-1.5

**Open Electives, offered to other department students:**

- Open Elective I : Java Programming
- Open Elective II : Operating Systems
- Open Elective III : Database Management Systems
- Open Elective IV : Computer Networks

**COURSES OFFERED FOR HONOURS DEGREE IN CSBS**

S.No.	Code	Course Name	Contact Hours per week		Credits
			L	T	
1		Operations on Research	3	0	3
2		No SQL Databases	3	0	3
3		Services science & Service operational Management	3	0	3
4		IT project Management	3	0	3
5		Social Network Analysis	3	0	3
6		Operations on Research lab		3	1.5
7		Services science & Service operational Management lab		3	1.5
					<b>18</b>



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## R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)

III Year I Semester	DATA ANALYTICS	L	T	P	C
		3	0	0	3

### Course Outcomes:

After completion of this course students will be able to

- Understand the impact of data analytics for business decisions and strategy
- Carry out data analysis/statistical analysis
- To carry out standard data visualization and formal inference procedures
- Design Data Architecture
- Understand various Data Sources

### UNIT-I

**Data Management:** Design Data Architecture and manage the data for analysis, understand various sources of Data like Sensors/Signals/GPS etc. Data Management, Data Quality(noise, outliers, missing values, duplicate data) and Data Processing & Processing.

### UNIT-II

**Data Analytics:** Introduction to Analytics, Introduction to Tools and Environment, Application of Modeling in Business, Databases & Types of Data and variables, Data Modeling Techniques, Missing Imputations etc. Need for Business Modeling.

### UNIT-III

**Regression** – Concepts, Blue property assumptions, Least Square Estimation, Variable Rationalization, and Model Building etc. Logistic Regression: Model Theory, Model fit Statistics, Model Construction, Analytics applications to various Business Domains etc.

### UNIT-IV

**Object Segmentation:** Regression Vs Segmentation – Supervised and Unsupervised Learning, Tree Building – Regression, Classification, Overfitting, Pruning and Complexity, Multiple Decision Trees etc. Time Series Methods: Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height, Average Energy etc and Analyse for prediction.

### UNIT-V

**Data Visualization:** Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations.



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**R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

**TEXT BOOKS:**

1. Student's Handbook for Associate Analytics – II, III.
2. Data Mining Concepts and Techniques, Han, Kamber, 3<sup>rd</sup> Edition, Morgan Kaufmann Publishers.

**Reference Books:**

1. Introduction to Data Mining, Tan, Steinbach and Kumar, Addison Wesley, 2006.
2. Data Mining Analysis and Concepts, M. Zaki and W. Meira
3. Mining of Massive Datasets, Jure Leskovec Stanford Univ. AnandRajaramanMilliway Labs Jeffrey D Ullman Stanford Univ.



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## R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)

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.



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**KAKINADA–533003, Andhra Pradesh, India**

### **R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

**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 Networks, 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



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## R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)

III Year I Semester	<b>AUTOMATA THEORY &amp; COMPILER DESIGN</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### Course Objectives:

- Introduce the notion of formal languages and grammars
- Design of Grammars, FAs and PDAs
- To become familiar with the underlying theory and methods used in compiler design
- To Introduce the parsing techniques, code optimization techniques and generate code

### UNIT – I: Regular Expressions, Languages and Finite Automata

Formal Languages and the Chomsky Hierarchy, Regular Expressions and Regular Languages, Algebraic Laws for Regular Expressions, Applications of Regular Expressions, Abstract model of Finite Automaton, Transition Tables and Transition Graphs, Deterministic Finite Automata (DFA), Nondeterministic Finite Automata (NFA), Converting NFA to DFA, Finite Automata with  $\epsilon$  transitions (NFA- $\epsilon$ ), Converting NFA- $\epsilon$  to NFA/DFA, Minimization of Finite Automata, Equivalence of FA and Regular Expressions

### UNIT-II: Context Free Grammars and Push Down Automata:

Context Free Grammars (CFG) and Context Free Languages (CFL), Design of CFGs, Leftmost and Rightmost Derivations, Parse Trees, Applications of CFGs, Ambiguity in Grammars and Languages, Push Down Automata (PDA), The Language of a PDA, Equivalence of PDAs and CFGs

### UNIT-III: Lexical Analysis and Top-Down Parsing

The structure of a compiler, Role of lexical analyzer, Input Buffering, Specification of tokens, Recognition of tokens, The Lexical Analyser Generator –LEX

Introduction to Syntax Analysis, Eliminating ambiguity and left recursion from a CFG, Recursive Decent Parsing, LL(1) Grammars, Nonrecursive Predictive Parsing

### UNIT-IV: Bottom-Up Parsing and Syntax Directed Translation

Shift-Reduce Parsing, Simple LR parsing, Canonical LR(1) Parsing, LALR Parsing, Parser Generators

Syntax Directed Definitions, Evaluation Orders for SDDs, Syntax Directed Translation Schemes

### UNIT-V: Intermediate Code Generation, Code Generation and Optimization:

Three address code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow, Issues in the design of a Code Generator, The Target Language, A simple Code Generator Basic Blocks and Flow

### Textbooks:

1. Introduction to Automata Theory, Languages and Computation, J.E.Hopcroft, R.Motwani and J.D.Ullman, 3<sup>rd</sup> Edition, Pearson, 2008.
2. Compilers Principles, Techniques and Tools, 2<sup>nd</sup> Edition, Alfred V.Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Pearson

### Reference Books:

1. Introduction to Languages and The Theory of Computation, John C. Martin, McGraw Hill.
2. Theory of Computer Science-Automata, Languages and Computation, K.L.P.Mishra and N.Chandrasekaran, 3<sup>rd</sup> Edition, PHI, 2007
3. Compiler Construction, K.V.N. Sunitha, Pearson, 2013
4. Compiler Design, SandeepSaxena, Rajkumar Singh Rathore, S.Chand publication



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## R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)

III Year I 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 with all phases of OOAD.
- Master the main features of the UML.
- Master the main concepts of Object Technologies and how to apply them at work 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.

### Course Outcomes:

- Ability to find solutions to the complex problems using object oriented
- Represent classes, responsibilities and states using UML notation
- Identify classes and responsibilities of the problem domain.
- develop robust object-based models for Systems
- Inculcate necessary skills to handle complexity in software design

### 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 Modelling:** Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages. **Case Study:** AI: Cryptanalysis.

### UNIT-IV

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



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#### **UNIT-V**

**Advanced Behavioural 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, Bobbi J. Young, Jim Conallen, Kellia Houston, “Object- Oriented Analysis and Design with Applications”, 3rd edition, 2013, PEARSON.
2. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide,
3. 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.
4. Applying UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.



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**R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

<b>III Year I Semester</b>	<b>CRYPTOGRAPHY &amp; NETWORK SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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

**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, Stenography.

**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.



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#### **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 By Wenbo Mao. Pearson



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**R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

<b>III Year I Semester</b>	<b>ARTIFICIAL INTELLIGENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objective:**

- The student should be made to study the concepts of Artificial Intelligence.
- The student should be made to learn the methods of solving problems using Artificial Intelligence.
- To understand the applications of AI, namely game playing, theorem proving, and machine learning.
- To learn different knowledge representation techniques

**Course Outcomes:**

- Apply difficult real life problems in a state space representation so as to solve them using AI techniques like searching and game playing.
- Describe important search techniques and their suitable problem domains.
- Apply the AI principles and techniques to solve problems.
- Define knowledge representation and deduction methods.
- Analyse the problems and suggest a suitable problem solving method.

**UNIT-I**

**Introduction, Overview of Artificial intelligence:** Problems of AI, AI technique, Tic - Tac - Toe problem. Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal-based agents, utility-based agents, learning agents. **Problem Solving, Problem Space & search:** Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.

**UNIT-II**

**Search techniques:** Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best-first search, A\* search, AO\* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search

**UNIT-III**

**Constraint satisfaction problems:** Local search for constraint satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.



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### **R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

#### **UNIT – IV**

**Knowledge & reasoning:** Knowledge representation issues, representation & mapping, approaches to knowledge representation. Using predicate logic, representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. Representing knowledge using rules, Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

#### **UNIT – V**

**Probabilistic reasoning:** Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Planning Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques. **Expert Systems:** Representing and using domain knowledge, expert system shells, and knowledge acquisition.

#### **Home Assignments:**

Assignments should include problems related to the topics covered in lectures, like heuristics, optimal search, and graph heuristics. Constraint satisfaction problems, k-nearest neighbors, decision trees, etc. can be included in home assignments.

#### **Text Books:**

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach
2. Artificial Intelligence, Russel, Pearson

#### **Reference Books:**

1. Artificial Intelligence, Ritch & Knight, TMH
2. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
3. Logic & Prolog Programming, Saroj Kaushik, New Age International
4. Expert Systems, Giarranto, VIKAS



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KAKINADA-533003, Andhra Pradesh, India

## R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)

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

### Course Objectives:

- To appreciate e-Business as a significant business segment of the future
- To develop capacity to initiate/lead an e-business venture/ business segment
- To understand principles of BI and Analytics at conceptual level
- To develop skills to design BI and Analytics projects

### Course Outcomes:

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

- Understand the basic concepts of business intelligence and its application.
- Elucidate the role of business intelligence and its value chain analysis.
- Describe the use of Online Analytical Processing to analyze and interpret data
- Ability to perform the preprocessing of data and apply mining techniques on it
- identify the needs and patterns for business domains by applying various Classification and clustering techniques.

### UNIT-I

**Business Intelligence an Introduction:** Introduction - Definition - History and Evolution - Business Intelligence Segments - Difference between Information and Intelligence - Defining Business Intelligence Value Chain - Factors of Business Intelligence System - Real time Business Intelligence - Business Intelligence Applications.

### UNIT-II

**Essentials of Business Intelligence:** Introduction - Creating Business Intelligence Environment - Business Intelligence Landscape - Types of Business Intelligence - Business Intelligence Platform -Applications in Business Analytics -Dynamic roles in Business Intelligence - Challenges - Business Intelligence Tools - Modern Business Intelligence - Enterprise Business Intelligence - Information Workers.

### UNIT-III

**Business Intelligence User Model:** Introduction - Business Intelligence Opportunity Analysis Overview - Content Management System - End User Segmentation - Basic Reporting and Querying - Online Analytical Processing - OLAP Techniques - OLAP Applications - Applying OLAP to Data Warehousing - Benefits of using OLAP – Dashboard -Key Performance Indicators -Advanced/Emerging BI Technologies - Future of Business Intelligence- Critical Challenges for Business Intelligence success.



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### **R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

#### **UNIT-IV**

**Data mining:** Definition of data mining, Models and methods for data mining, Data mining, classical statistics and OLAP, Applications of data mining, Representation of input data, Data mining process, Analysis methodologies, **Data preparation:** Data validation, Incomplete data, Data affected by noise, Data transformation, Standardization, Feature extraction, Data reduction, Sampling, Feature selection, Principal component analysis, Data discretization.

#### **UNIT-V**

Mining Frequent Patterns: Basic Concept – Frequent Item Set Mining Methods – Mining Association Rules – Association to Correlation Analysis. Classification and Predication: Issues – Decision Tree Induction – Bayesian Classification – Rule Based Classification – kNearest mining Classification. Prediction –Accuracy and Error measures. Clustering: Overview of Clustering – Types of Data in Cluster Analysis – Major Clustering Methods.

#### **Text Books:**

1. Cindi Howson; Successful Business Intelligence McGraw-Hill & Osborne Media
2. Larissa T. Moss, Shaku Atre Business Intelligence Roadmap 9th 2007 Addison Wesley 2003
3. Rajiv Sabherwal, Irma Becerra Fernandez Business Intelligence: Practices, Technologies, and Management 2nd Wiley & Sons 2011
4. Business Intelligence: Data Mining and Optimization for Decision Making Carlo Vercellis 2009 John Wiley & Sons, Ltd. ISBN: 978-0-470-51138-1

#### **Reference Books:**

1. Efraim Turban, Ramesh Sharda, Jay E. Aronson, David King Business Intelligence: A Managerial Approach 9th Prentice Hall Year 2013
2. Graham, Benjamin The Intelligent Investor Revised Harper Business 2013.
3. Jiawei Han, MichelineKamber and Jian Pei, “Data Mining Concepts and Techniques”, Third Edition, Elsevier Publisher, 2006.



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## R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)

III Year I Semester	DATA ANALYTICS LAB	L	T	P	C
		0	0	3	1.5

### Course Objectives:

- To explore the fundamental concepts of data analytics.
- To learn the principles and methods of statistical analysis
- Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.
- To understand the various search methods and visualization techniques.

### Course Outcomes:

- Understand linear regression and logistic regression.
- Understand the functionality of different classifiers.
- Implement visualization techniques using different graphs.
- Apply descriptive and predictive analytics for different types of data.

### List of Experiments:

1. Data Preprocessing
  - a. Handling missing values
  - b. Noise detection removal
  - c. Identifying data redundancy and elimination
2. Implement any one imputation model
3. Implement Linear Regression
4. Implement Logistic Regression
5. Implement Decision Tree Induction for classification
6. Implement Random Forest Classifier
7. Implement ARIMA on Time Series data
8. Object segmentation using hierarchical based methods
9. Perform Visualization techniques (types of maps- Bar, Colum, Line, Scatter, 3DCubes)
10. Perform Descriptive analytics on Health care data
11. Perform Predictive analytics on Product Sales data
12. Apply Predictive analytics for Weather fore casting.



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**R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

**Text Books:**

1. Student's Handbook for Associate Analytics–II, III.
2. Data Mining Concepts and Techniques, Han, Kamber, 3rdEdition, Morgan Kaufmann Publishers.

**Reference Books:**

1. Introduction to Data Mining, Tan, Steinbach and Kumar, Addison Wesley, 2006.
2. Data Mining Analysis and Concepts, M.Zakiand W.Meira
3. Mining of Massive Datasets, Jure Leskovec Stanford Univ.Anand Rajaraman Millilway Labs Jeffrey DULLman Stanford Univ.



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## R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)

III Year I Semester	COMPUTER NETWORKS LAB	L	T	P	C
		0	0	3	1.5

### Course Objectives:

Learn basic concepts of computer networking and acquire practical notions of protocols with the emphasis on TCP/IP. A lab provides a practical approach to Ethernet/Internet networking: networks are assembled, and experiments are made to understand the layered architecture and how do some important protocols work

### List of Experiments:

1. Study of Network devices in detail and connect the computers in Local Area Network.
2. Write a Program to implement the data link layer framing methods such as
  - i) Character stuffing
  - ii) bit stuffing.
3. Write a Program to implement data link layer framing method checksum.
4. Write a program for Hamming Code generation for error detection and correction.
5. Write a Program to implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP.
6. Write a Program to implement Sliding window protocol for Goback N.
7. Write a Program to implement Sliding window protocol for Selective repeat.
8. Write a Program to implement Stop and Wait Protocol.
9. Write a program for congestion control using leaky bucket algorithm
10. Write a Program to implement Dijkstra's algorithm to compute the Shortest path through a graph.
11. Write a Program to implement Distance vector routing algorithm by obtaining routing table at each node (Take an example subnet graph with weights indicating delay between nodes).
12. Write a Program to implement Broadcast tree by taking subnet of hosts.
13. Wireshark
  - i. Packet Capture Using Wire shark
  - ii. Starting Wire shark
  - iii. Viewing Captured Traffic
  - iv. Analysis and Statistics & Filters.
14. How to run Nmap scan
15. Operating System Detection using Nmap
16. Do the following using NS2 Simulator
  - i. NS2 Simulator-Introduction
  - ii. Simulate to Find the Number of Packets Dropped
  - iii. Simulate to Find the Number of Packets Dropped by TCP/UDP
  - iv. Simulate to Find the Number of Packets Dropped due to Congestion
  - v. Simulate to Compare Data Rate& Throughput.



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## R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)

III Year I Semester	FULL STACK DEVELOPMENT - 2	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 Express JS.
- Build a single page application using RESTful APIs in Express JS
- Apply router and hooks in designing React JS application
- Make use of MongoDB queries to perform CRUD operations on document database

### Experiments covering the Topics:

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

### Sample Experiments:

#### 1. Express JS – 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. Express JS – Templating, Form Data

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

#### 3. Express JS – Cookies, Sessions, Authentication

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



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### **4. Express JS – Database, RESTful APIs**

- a. Write a program to connect MongoDB database using Mongoose 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).
- d.

### **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().



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#### **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, Vasam Subramanian, 2<sup>nd</sup> 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#>
- MongoDB - <https://learn.mongodb.com/learning-paths/introduction-to-mongodb>



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KAKINADA–533003, Andhra Pradesh, India

## R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)

III Year I Semester	USER INTERFACE 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 Widgets 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.



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**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 1<sup>st</sup> Edition, Apres



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## R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)

III Year II Semester	MARKETING RESEARCH AND MARKETING MANAGEMENT	L	T	P	C
		3	0	0	3

### Course Outcome(s):

Students will be able to

- Understand basic marketing concepts
- Comprehend the dynamics of marketing and analyze how its various components interact with each other in the real world
- Leverage marketing concepts for effective decision making
- Understand basic concepts and application of statistical tools in Marketing research

### UNIT-I

**Marketing Concepts and Applications:** Introduction to Marketing & Core Concepts, Marketing of Services, Importance of marketing in service sector. **Marketing Planning & Environment:** Elements of Marketing Mix, Analyzing needs & trends in Environment - Macro, Economic, Political, Technical & Social. **Understanding the consumer:** Determinants of consumer behavior, Factors influencing consumer behavior

### UNIT-II

**Market Segmentation:** Meaning & Concept, Basis of segmentation, selection of segments, Market Segmentation strategies, Target Marketing, Product Positioning. **Product Management:** Product Life cycle concept, New Product development & strategy, Stages in New Product development, Product decision and strategies, Branding & packaging

### UNIT-III

**Pricing, Promotion and Distribution Strategy:** Policies & Practices – Pricing Methods & Price determination Policies. Marketing Communication – The promotion mix, Advertising & Publicity, 5 M's of Advertising Management. Marketing Channels, Retailing, Marketing Communication, Advertising

### UNIT-IV

**Marketing Research:** Introduction, Type of Market Research, Scope, Objectives & Limitations

Marketing Research Techniques, Survey Questionnaire design & drafting, Pricing Research, Media Research, Qualitative Research. **Data Analysis:** Use of various statistical tools – Descriptive & Inference Statistics, Statistical Hypothesis Testing, Multivariate Analysis - Discriminant Analysis, Cluster Analysis, Segmenting and Positioning, Factor Analysis



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### **R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

#### **UNIT-V**

**Internet Marketing:** Introduction to Internet Marketing. Mapping fundamental concepts of Marketing (7Ps, STP); Strategy and Planning for Internet Marketing. **Business to Business Marketing:** Fundamental of business markets. Organizational buying process. Business buyer needs. Market and sales potential. Product in business markets. Price in business markets. Place in business markets. Promotion in business markets. Relationship, networks and customer relationship management. Business to Business marketing strategy

#### **Home Assignments:**

1. **Written Analyses of Cases** – Students are expected to report on their analysis and recommendations of what to do in specific business situations by applying concepts and principles learned in class (Case Studies to be shared by Faculty) e.g. “Marketing Myopia”
2. Field visit & live project covering steps involved in formulating Market Research Project
3. Measuring Internet Marketing Effectiveness: Metrics and Website Analytics

#### **Text Books:**

1. Marketing Management (Analysis, Planning, Implementation & Control) – Philip Kotler
2. Fundamentals of Marketing – William J. Stanton & Others
3. Marketing Management – V.S. Ramaswamy and S. Namakumari
4. Marketing Research – Rajendra Nargundkar
5. Market Research – G.C. Beri
6. Market Research, Concepts, & Cases – Cooper Schindler

#### **Reference Books:**

1. Marketing Management – RajanSaxena
2. Marketing Management – S.A. Sherlekar
3. Service Marketing – S.M. Zha
4. Journals – The IUP Journal of Marketing Management, Harvard Business Review
5. Research for Marketing Decisions by Paul Green, Donald, Tull
6. Business Statistics, A First Course, David M Levine at al, Pearson Publication



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**KAKINADA–533003, Andhra Pradesh, India**

**R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

<b>III Year II Semester</b>	<b>FINANCIAL AND COST ACCOUNTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Outcome(s):**

This course will help students

- To create an awareness about the importance and usefulness of the accounting concepts and their managerial implications
- To develop an understanding of the financial statements and the underlying principles and learn to interpret financial statements
- To create an awareness about cost accounting, different types of costing and cost management

**UNIT-I**

**Accounting Concept:** Introduction, Techniques and Conventions, Financial Statements- Understanding & Interpreting Financial Statements

**UNIT-II**

**Accounting Process:** Book Keeping and Record Maintenance, Fundamental Principles and Double Entry, Journal, Ledger, Trial Balance, Balance Sheet, Final Accounts, Cash Book and Subsidiary Books, Rectification of Errors

**UNIT-III**

**Financial Statements:** Form and Contents of Financial Statements, Analysing and Interpreting Financial Statements, Accounting Standards.

*Class Discussion: Corporate Accounting Fraud- A Case Study of Satyam*

**Cash Flow and Fund Flow Techniques:** Introduction, how to prepare, Difference between them

**UNIT-IV**

**Costing Systems:** Elements of Cost, Cost Behavior, Cost Allocation, OH Allocation, Unit Costing, Process Costing, Job Costing, Absorption Costing, Marginal Costing, Cost Volume Profit Analysis, Budgets, ABC Analysis

*Class Discussion: Application of costing concepts in the Service Sector*

**UNIT-V**

**Company Accounts and Annual Reports:** Audit Reports and Statutory Requirements, Directors Report, Notes to Accounts, Pitfalls.



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#### **Home Assignment:**

Case study materials book will be given to students. Students are required to meet in groups before coming to class and prepare on the case for the day. Instructor may ask the student groups to present their analysis and findings to the class. Further, the topic for class discussion will be mentioned beforehand and students should be prepared to discuss these topics in class. Few topics are mentioned below as examples. Instructor can add or change any topic as per requirement.

1. Topic: Corporate Accounting Fraud: A Case Study of Satyam
2. Topic: Application of costing concepts in the Service Sector

#### **Text Books:**

1. Robert N Anthony, David Hawkins, Kenneth Marchant, *Accounting: Texts and Cases*, McGraw-Hill
2. Case Study Materials: To be distributed for class discussion



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**R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

<b>III Year II Semester</b>	<b>MACHINE LEARNING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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 neighbor-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)



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**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), Backpropagation 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.



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**R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

<b>III Year II Semester</b>	<b>SOFTWARE TESTING METHODOLOGIES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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.

**Course Outcomes:**

- List a range of different software testing techniques and strategies and be able to apply specific(automated) unit testing method to the projects.
- Distinguish characteristics of structural testing methods.
- Demonstrate the integration testing which aims to uncover interaction and compatibility problems as early as possible.
- Discuss about the functional and system testing methods
- Demonstrate various issues for object oriented testing

**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.



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### **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.



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**R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

<b>III Year II Semester</b>	<b>PRINCIPLES OF CYBER SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objectives:**

- To learn threats and risks within 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.

**UNIT-I**

**Introduction to Cyber security-** Cyber security objectives, Cyber security roles, Differences between Information Security & Cyber security. **Cyber security Principles-** Confidentiality, integrity, availability Authentication and non-repudiation.

**UNIT-II**

**Information Security (IS) within Lifecycle Management-**Lifecycle management 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 (DE):** 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.



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**Text Books:**

1. NASSCOM: Security Analyst Student Hand Book Dec 2015.
2. Information Security Management Principles Updated Edition by David Alexander, Amanda Finch, David Sutton ,Published by BCS, June 2013.

**Reference Books:**

1. CSX- cyber security fundamentals 2nd edition, Published by ISACA, Cyber security, Network Security, Data Governance Security.



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KAKINADA-533003, Andhra Pradesh, India

## R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)

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, server less 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.



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### **R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

#### **UNIT -V: Advanced concepts in cloud computing**

Server less computing, Function-as-a-Service, server less computing architecture, public cloud (e.g. AWS Lambda) and open-source (e.g. Open FaaS) server less 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, 2<sup>nd</sup> edition, Rajkumar Buyya, Christian Vecchiola, ThamaraiSelvi, ShivanandaPoojara, 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, 2<sup>nd</sup> 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)



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## R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)

III Year II Semester	DevOps	L	T	P	C
		3	0	0	3

### Course Objectives:

The main objectives of this course are to:

- Describe the agile relationship between development and IT operations.
- Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.
- Implement automated system update and DevOps lifecycle.

### Course Outcomes:

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

- Identify components of Devops environment.
- Describe Software development models and architectures of DevOps.
- Apply different project management, integration, testing and code deployment tool.
- Investigate different DevOps Software development models.
- Assess, Collaborate and adopt various Devops in real-time projects.

### UNIT-I

**Introduction to DevOps:** Introduction to SDLC, Agile Model. Introduction to DevOps. DevOps Features, DevOps Architecture, DevOps Lifecycle, Understanding Workflow and principles, Introduction to DevOps tools, Build Automation, Delivery Automation, Understanding Code Quality, Automation of CI/ CD. Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples

### UNIT-II

**Source Code Management (GIT):**The need for source code control, The history of source code management, Roles and code, source code management system and migrations. What is Version Control and GIT, GIT Installation, GIT features, GIT workflow, working with remote repository, GIT commands, GIT branching, GIT staging and collaboration. **UNIT TESTING - CODE COVERAGE:** Junit, n Unit& Code Coverage with Sonar Qube, SonarQube - Code Quality Analysis.

### UNIT-III

**Build Automation - Continuous Integration (CI):** Build Automation, What is CI Why CI is Required, CI tools, Introduction to Jenkins (With Architecture), jenkins workflow, jenkins master slave architecture, Jenkins Pipelines, PIPELINE BASICS - Jenkins Master, Node, Agent, and Executor Freestyle Projects & Pipelines, Jenkins for Continuous Integration, Create and Manage Builds, User Management in Jenkins Schedule Builds, Launch Builds on Slave Nodes.



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#### **UNIT-IV**

**Continuous Delivery (CD):** Importance of Continuous Delivery, CONTINUOUS DEPLOYMENT CD Flow, Containerization with Docker: Introduction to Docker, Docker installation, Docker commands, Images & Containers, DockerFile, Running containers, Working with containers and publish to Docker Hub. **Testing Tools:** Introduction to Selenium and its features, JavaScript testing.

#### **UNIT-V**

**Configuration Management - ANSIBLE:** Introduction to Ansible, Ansible tasks, Roles, Jinjatemplating, Vaults, Deployments using Ansible. **CONTAINERIZATION USING KUBERNETES(OPENSIFT):** Introduction to Kubernetes Namespace & Resources, CI/CD - On OCP, BC, DC & ConfigMaps, Deploying Apps on Openshift Container Pods. Introduction to Puppet master and Chef.

#### **Text Books:**

1. Joyner, Joseph., Devops for Beginners: Devops Software Development Method Guide for Software Developers and It Professionals, 1<sup>st</sup> Edition MihailsKonoplows, 2015.
2. Alisson Machado de Menezes., Hands-on DevOps with Linux, 1<sup>st</sup> Edition, BPB Publications, India, 2021.

#### **Reference Books:**

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-10
2. Gene Kim Je Humble, Patrick Debois, John Willis. The DevOps Handbook, 1st Edition, IT Revolution Press, 2016.
3. Verona, Joakim Practical DevOps, 1<sup>st</sup> Edition, Packt Publishing, 2016.
4. Joakim Verona. Practical Devops, Ingram short title; 2<sup>nd</sup> edition (2018). ISBN10: 1788392574
5. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952



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**R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

<b>III Year II Semester</b>	<b>SOFTWARE PROJECT MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objectives:**

At the end of the course, the student shall be able to:

- To describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project
- To compare and differentiate organization structures and project structures
- To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools

**Course Outcomes:**

- Identify the different project contexts and suggest an appropriate management strategy.
- Practice the role of professional ethics unsuccessful software development.
- Identify and describe the key phases of project management.
- Determine an appropriate project management approach through an evaluation of the business context and scope of the project.
- Investigate different DevOps Software development models.

**UNIT-I**

**Conventional Software Management:** The waterfall model, conventional software Management performance. **Evolution of Software Economics:** Software Economics, pragmatic software cost estimation. **Improving Software Economics:** Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections. **The old way and the new:** The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

**UNIT-II**

**Life cycle phases:** Engineering and production stages, inception, Elaboration, construction, transition phases. **Artifacts of the process:** The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

**UNIT-III**

**Model based software architectures:** A Management perspective and technical perspective. **Work Flows of the process:** Software process workflows, Iteration workflows. **Check points of the process:** Major mile stones, Minor Milestones, Periodic status assessments. **Iterative Process Planning:** Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.



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### **R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

#### **UNIT-IV**

**Project Organizations and Responsibilities:** Line-of-Business Organizations, Project Organizations, evolution of Organizations. **Process Automation:** Automation Building blocks, The Project Environment. **Project Control and Process instrumentation:** The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation.

#### **UNIT-V**

Agile Methodology, ADAPTING to Scrum, Patterns for Adopting Scrum, Iterating towards Agility. **Fundamentals of DevOps:** Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system. DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes

#### **Text Books:**

1. Software Project Management, Walker Royce, PEA, 2005.
2. Succeeding with Agile: Software Development Using Scrum, Mike Cohn, Addison Wesley.
3. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim, John Willis, Patrick Debois, Jez Humble, 1st Edition, O'Reilly publications, 2016

#### **Reference Books:**

1. Software Project Management, Bob Hughes, 3/e, Mike Cotterell, TMH
2. Software Project Management, Joel Henry, PEA
3. Software Project Management in practice, Pankaj Jalote, PEA, 2005,
4. Effective Software Project Management, Robert K. Wysocki, Wiley, 2006.
5. Project Management in IT, Kathy Schwalbe, Cengage



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**KAKINADA-533003, Andhra Pradesh, India**

**R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

<b>III Year II Semester</b>	<b>MOBILE ADHOC NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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.

**Course Outcomes:**

- Discuss various multicast routing protocols and energy management in MANET
- Identify the different types of mobile ad hoc networks and their challenges
- Differentiate the media access control protocols for ad hoc networks
- Identify the different functionalities and protocol to enhance Security in WSNs
- Trace the issues & challenges in providing security in wireless network.

**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.



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### **R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

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

#### **Reference Books:**

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



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**KAKINADA-533003, Andhra Pradesh, India**

**R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

<b>III Year II Semester</b>	<b>NATURAL LANGUAGE PROCESSING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objectives:**

This course introduces the fundamental concepts and techniques of natural language processing (NLP).

- Students will gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
- The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.
- Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

**Course Outcomes:**

After completion of this course

- Demonstrate a given text with basic Language features
- To design an innovative application using NLP components
- Explain a rule based system to tackle morphology/syntax of a language
- To design a tag set to be used for statistical processing for real-time applications
- To compare and contrast the use of different statistical approaches for different types of NLP applications.

**UNIT-I**

**INTRODUCTION:** Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.

**UNIT-II**

**WORD LEVEL ANALYSIS:** Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part- of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.



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#### **UNIT-III**

**SYNTACTIC ANALYSIS:** Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures

#### **UNIT-IV**

**SEMANTICS AND PRAGMATICS:** Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

#### **UNIT-V**

**DISCOURSE ANALYSIS AND LEXICAL RESOURCES:** Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

#### **Text Books:**

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, 2<sup>nd</sup> Edition, Daniel Jurafsky, James H. Martin - Pearson Publication,2014.
2. Natural Language Processing with Python, First Edition, Steven Bird, Ewan Klein and Edward Loper, OReilly Media,2009.

#### **Reference Books:**

1. Language Processing with Java and Ling Pipe Cookbook, 1<sup>st</sup> Edition, Breck Baldwin, Atlantic Publisher, 2015.
2. Natural Language Processing with Java, 2<sup>nd</sup> Edition, Richard M Reese, OReilly Media,2015.
3. Handbook of Natural Language Processing, Second, Nitin Indurkhya and Fred J. Damerau, Chapman and Hall/CRC Press, 2010.Edition
4. Natural Language Processing and Information Retrieval, 3<sup>rd</sup> Edition, Tanveer Siddiqui, U.S. Tiwary, Oxford University Press,2008.



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KAKINADA-533003, Andhra Pradesh, India

## R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)

III Year II Semester	<b>DISTRIBUTED OPERATING SYSTEM</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### Course Objectives:

The main objective of the course is to

- introduce design issues and different message passing techniques in DOS, distributed systems
- RPC implementation and its performance in DOS
- Distributed shared memory and resource management
- Distributed file systems and evaluate the performance in terms of fault tolerance, file replication as major factors

Course Outcomes:

- Illustrate principles and importance of distributed operating system
- Implement distributed client server applications using remote method invocation
- Gain knowledge of distributed operating system architecture
- Distinguish between centralized systems and distributed systems to manage resource
- Understand how to perform file handling in distributed environment

### UNIT-I

#### Fundamentals:

What is Distributed Computing Systems? Evolution of Distributed Computing System; Distributed Computing System Models; What is Distributed Operating System? Issues in Designing a Distributed Operating System; Introduction to Distributed Computing Environment (DCE). **Message Passing:** Introduction, Desirable features of a Good Message Passing System, Issues in PC by Message Passing, Synchronization, Buffering, Multi-datagram Messages, Encoding and Decoding of Message Data, Process Addressing, Failure Handling, Group Communication, Case Study: 4.3 BSD UNIX IPC Mechanism.

### UNIT-II

**Remote Procedure Calls:** Introduction, The RPC Model, Transparency of RPC, Implementing RPC Mechanism, Stub Generation, RPC Messages, Marshaling Arguments and Results, Server Management, Parameter-Passing Semantics, Call Semantics, Communication Protocols for RPCs, Complicated RPCs, Client-Server Binding, Exception Handling, Security, Some Special Types of RPCs, RPC in Heterogeneous Environments, Lightweight RPC, Optimization for Better Performance, Case Studies: Sun RPC



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#### **UNIT-III**

**Distributed Shared Memory:** Introduction, General Architecture of DSM systems, Design and Implementation Issues of DSM, Granularity, Structure of Shared Memory Space, Consistency Models, Replacement Strategy, Thrashing, Other approaches to DSM, Heterogeneous DSM, Advantages of DSM. Synchronization: Introduction, Clock Synchronization, Event Ordering, Mutual Exclusion, Dead Lock, Election Algorithms

#### **UNIT-IV**

**Resource Management:** Introduction, Desirable Features of a Good Global Scheduling Algorithm, Task Assignment Approach, Load – Balancing Approach, Load – Sharing Approach Process Management: Introduction, Process Migration, Threads.

#### **UNIT-V**

**Distributed File Systems:** Introduction, Desirable Features of a Good Distributed File System, File models, File–Accessing Models, File – Sharing Semantics, File – Caching Schemes, File Replication, Fault Tolerance, Atomic Transactions and Design Principles.

#### **Text books**

1. Pradeep. K. Sinha: Distributed Operating Systems: Concepts and Design, PHI, 2007.

#### **Reference Books:**

1. Andrew S. Tanenbaum: Distributed Operating Systems, Pearson Education, 2013.
2. Ajay D. Kshemkalyani and Mukesh Singhal, Distributed Computing: Principles, Algorithms and Systems, Cambridge University Press, 2008
3. Sunita Mahajan, Seema Shan, “ Distributed Computing”, Oxford University Press, 2015



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**R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

<b>III Year II Semester</b>	<b>BUSINESS COMMUNICATION AND VALUE SCIENCE LAB - II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

**Course Objectives:**

- To augment students overall communication and thus aid in helping them
- To improve their interpersonal skills by engaging them in group activities
- To emerge as professionals.

**Course Outcomes:**

- Speak fluently in English without errors in the sentence construction and hence present themselves as effective English communicators.
- Differentiate between vocabularies used as adjectives, verbs.
- Deliver a public speech according to the need of the audience and also be aware of positive body language to be manifested during a speech.
- Deal with the deeper parameters of working in teams like team motivation, multicultural team activity and team conflict resolution.
- Set realistic goals in terms of personal and professional growth.

**List of Experiments:**

1. Introducing Oneself and Sharing Information
2. Writing letters and creating mails
3. Construction of paragraphs and essays
4. Speaking skills and methods of speech
5. Leadership, Communication and Interpersonal skills
6. Being a motivator and role model
7. Presentation on the persona of any well-known person & Role-Play
8. Corporate Etiquettes
9. Professionalism in the workplace
10. Engineering ethics, rights and responsibilities
11. Managing cultural diversities and global diversities
12. Right use of social media
13. Create a podcast on a topic
14. Maintaining the image and pride of the organization
15. Winning formula for a successful manager/leader



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16. Listening to TED

**List of Equipment's:(30 Students Per Batch)**

1. Systems with Rosetta stone and Globarena

**Text Books:**

1. Bovee, Thill and Raina, Business Communication Today , Pearson Education, 2017.
2. APAART: Speak Well 1 (English Language and Communication)
3. APAART: Speak Well 2 (Soft Skills)

**Reference Books:**

1. Charles Marsh , Strategic Communication, New International Edition, 2013.
2. Alan Mccarthy and Odell, English Vocabulary in Use, Cambridge University Press, 4th edition, 2017.
3. Dr. SarojHiremath , Business Communication, NiraliPrakashan, 2018.



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**R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

<b>III Year II Semester</b>	<b>PYTHON FOR MACHINE LEARNING LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

Course Objectives:

- To learn about computing central tendency measures and Data preprocessing techniques
- To learn about classification and regression algorithms
- To apply different clustering algorithms for a problem.

**Software Required: Python/R/Weka**

Lab should cover the concepts studied in the course work, sample list of Experiments:

1. Compute Central Tendency Measures: Mean, Median, Mode Measure of Dispersion: Variance, Standard Deviation.
2. Apply the following Pre-processing techniques for a given dataset.
  - a. Attribute selection
  - b. Handling Missing Values
  - c. Discretization
  - d. Elimination of Outliers
3. Apply KNN algorithm for classification and regression
4. Demonstrate decision tree algorithm for a classification problem and perform parameter tuning for better results
5. Demonstrate decision tree algorithm for a regression problem
6. Apply Random Forest algorithm for classification and regression
7. Demonstrate Naïve Bayes Classification algorithm.
8. Apply Support Vector algorithm for classification
9. Demonstrate simple linear regression algorithm for a regression problem
10. Apply Logistic regression algorithm for a classification problem
11. Demonstrate Multi-layer Perceptron algorithm for a classification problem
12. Implement the K-means algorithm and apply it to the data you selected. Evaluate performance by measuring the sum of the Euclidean distance of each example from its class center. Test the performance of the algorithm as a function of the parameters K
13. Demonstrate the use of Fuzzy C-Means Clustering
14. Demonstrate the use of Expectation Maximization based clustering algorithm



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<b>III Year II Semester</b>	<b>SOFT SKILLS or IELTS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>1</b>	<b>2</b>	<b>2</b>

### 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



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**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.swyam2.ac.in/courses/course-details?id=P\\_CAMBR\\_01](https://swayam-plus.swyam2.ac.in/courses/course-details?id=P_CAMBR_01)



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## R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)

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



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#### **Text Books:**

1. Kompal Bansal & Parshit Bansal, “Fundamentals of IPR for Beginner’s”, 1<sup>st</sup> 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”, 2<sup>nd</sup> 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/>



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## R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)

	<b>JAVA PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### 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,DataTypes,TypeCasting,ScopeofVariableIdentifier,LiteralConstants,Symbolic Constants, Formatted Output with print f() 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 byValue 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.



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#### UNITIII

**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.

#### UNITIV

**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/Oand File:** JavaI/OAPI,standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java (Text Book 2)

#### UNITYV

**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)



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### **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) JAVA9forProgrammers, Paul Deitel, Harvey Deitel,4<sup>th</sup>Edition, Pearson.

### **References Books:**

- 1) The complete Reference Java, 11<sup>th</sup> edition, Herbert Schildt, TMH
- 2) Introduction to Java programming, 7<sup>th</sup>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](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview)



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**R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

	<b>OPERATING SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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 dead lock 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.



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### **R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

#### **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, 10<sup>th</sup> Edition, Wiley, 2018.
2. Modern Operating Systems, Tanenbaum AS, 4<sup>th</sup> Edition, Pearson, 2016

#### **Reference Books:**

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

#### **Online Learning Resources:**

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



# JAWAHARLALNEHRUTECHNOLOGICALUNIVERSITYKAKINADA

KAKINADA-533003, Andhra Pradesh, India

## R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)

	<b>DATA BASE MANAGEMENT SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### 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 data base 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; Threetier 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.



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#### **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 3NF), 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, 3<sup>rd</sup> edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)
- 2) Database System Concepts, 5<sup>th</sup> edition, Silberschatz, Korth, Sudarsan, TMH (For Chapter 1 and Chapter 5)

#### **Reference Books:**

- 1) Introduction to Database Systems, 8<sup>th</sup> edition, CJ Date, Pearson.
- 2) Database Management System, 6<sup>th</sup> edition, Ramez Elmasri, 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\\_01275806667\\_282022456\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667_282022456_shared/overview)



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KAKINADA-533003, Andhra Pradesh, India

## R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)

	<b>COMPUTER NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### Course Objectives:

- To understand the different types of networks
- To discuss the software and hardware components of a network
- To develop an understanding the principles of computer networks.
- To familiarize with OSI model and the functions of layered structure.
- To explain networking protocols, algorithms and design perspectives.

### Course Outcomes (CO):

After completion of the course, students will be able to

- Identify the software and hardware components of a Computer network.(L1)
- Explain the functionality of each layer of a computer network.(L2)
- Identify and analyze flow control, congestion control, and routing issues.(L4)
- Analyze and interpret the functionality and effectiveness of the routing protocols. (L4)
- Choose the appropriate transport protocol based on the application requirements.(L3)

### UNIT-I

**Introduction:** Types of Computer Networks, Broadband Access Networks, Mobile and Wireless Access Networks, Content Provider Networks, Transit networks, Enterprise Networks, Network technology from local to global, Personal Area Networks, Local Area Networks, Home Networks, Metropolitan Area Networks, Wide Area Networks, Internetworks, Network Protocols, Design Goals, Protocol Layering, Connections and Reliability, Service Primitives, The Relationship of Services to Protocols ,Reference Models, The OSI Reference Model, The TCP/IP Reference Model, A Critique of the OSI Model and Protocols, A Critique of the TCP/IP Reference Model and Protocols.

### UNIT-II

**The Data Link Layer:** Guided Transmission Media, Persistent Storage, Twisted Pairs, Coaxial Cable, Power Lines, Fiber Optics, Data Link Layer Design Issues, Services Provided To The Network Layer, Framing Error Control, Flow Control, Error Detection And Correction, Error-Correcting Codes, Error-Detecting Codes, Elementary Data Link Protocols, Initial Simplifying Assumptions Basic Transmission And Receipt, Simplex Link-Layer Protocols, Improving Efficiency, Bidirectional Transmission, Multiple Frames In Flight, Examples Of Full-Duplex, Sliding Window Protocols, The Channel Allocation Problem, Static Channel Allocation, Assumptions For Dynamic Channel Allocation, Multiple Access Protocols, Aloha, Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Limited-Contention Protocols, Wireless LAN Protocols, Ethernet, Classic



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### **R23 B. TECH (COMPUTER SCIENCE AND BUSINESS SYSTEM)**

Ethernet Physical Layer, Classic Ethernet Mac Sublayer Protocol, Ethernet Performance, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, 10-Gigabit Ethernet, 40- And 100-Gigabit Ethernet, Retrospective On Ethernet.

#### **UNIT-III**

**The Network Layer:** 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 In A Single Network, The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing Within a Network, Broadcast Routing, Multicast Routing, Any cast Routing, Traffic Management at The Network Layer, The Need for Traffic Management: Congestion, Approaches To Traffic Management, Internetworking, Internetworks: An Overview, How Networks differ, Connecting Heterogeneous Networks, Connecting Endpoints Across Heterogeneous Networks, Internetwork Routing: Routing Across Multiple Networks Supporting Different Packet Sizes: Packet Fragmentation, The Network Layer In The Internet, The IP Version 4 Protocol, IP Addresses, IP Version 6, Internet Control Protocols, Label Switching and MPLS, OSPF—An Interior Gateway Routing Protocol, BGP—The Exterior Gateway Routing Protocol, Internet Multicasting.

#### **UNIT-IV**

**The Transport Layer:** The Transport Service, Services Provided To The Upper Layers, Transport Service Primitives, Berkeley Sockets, An Example Of Socket Programming: An Internet File Server, Elements Of Transport Protocols, Addressing, Connection Establishment, Connection Release, Error Control And Flow Control, Multiplexing, Crash Recovery, Congestion Control, Desirable Bandwidth Allocation, Regulating The Sending Rate, Wireless Issues, The Internet Transport Protocols: UDP, Introduction To UDP, Remote Procedure Call, Real-Time Transport Protocols, The Internet Transport Protocols: TCP, Introduction To TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release.

#### **UNIT-V**

**The Application Layer:** Electronic Mail, Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery, The World Wide Web, Architectural Overview, Static Web Objects, Dynamic Web Pages and Web Applications, HTTP and HTTPS, Web Privacy, Content Delivery, Content and Internet Traffic, Server Farms and Web Proxies, Content Delivery Networks, Peer-To-Peer Networks, Evolution of The Internet.



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(R23 – III<sup>rd</sup> YEAR COURSE STRUCTURE & SYLLABUS)**

**Textbook:**

1. Andrew Tanenbaum, Feamster Wetherall, Computer Networks, 6<sup>th</sup> Edition, Global Edition.

**Reference Books:**

1. Behrouz A. Forouzan, Data Communications and Networking, 5<sup>th</sup> Edition, McGraw Hill Publication, 2017.
2. James F.Kurose, Keith W.Ross, “Computer Networking: A Top-Down Approach”, 6<sup>th</sup> edition, Pearson, 2019.
3. YouluZheng, Shaki lAkthar, “Networks for Computer Scientists and Engineers”, Oxford Publishers, 2016.

**Online Learning Resources:**

<https://nptel.ac.in/courses/106105183/25>

<http://www.nptelvideos.in/2012/11/computer->

<networks.html> <https://nptel.ac.in/courses/106105183/>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**  
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**R23 B.Tech CS & BS COURSE STRUCTURE AND SYLLABUS**

**B.Tech.– IV Year I Semester**

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	Software Architecture & Design Patterns	3	0	0	3
2	Management Course-II	Operations Management	2	0	0	2
3	Professional Elective-IV	1. Augmented Reality & Virtual Reality 2. Blockchain Technology 3. Deep Learning 4. Embedded System 5. 12-week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
4	Professional Elective-V	1. Agile methodologies 2. Metaverse 3. Computer Vision 4. Data Visualization 5. 12-week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
5	Open Elective-III /Minor-III		3	0	0	3
6	Open Elective-IV /Minor-IV		3	0	0	3
7	Skill Enhancement Course	Prompt Engineering/ SWAYAM Plus – Certificate program in Prompt Engineering and ChatGPT	0	1	2	2
8	Audit Course	Constitution of India	2	0	0	0
9	Internship	Evaluation of Industry Internship / Mini Project	0	0	0	2
<b>Total</b>			<b>19</b>	<b>01</b>	<b>02</b>	<b>21</b>

**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

**MINOR COURSES & HONOR COURSES**

S.No.	Category	L	T	P	Credits
1	Minor Course (Student may select from the specialized minors pool)	3	0	3	4.5
2	Honors Course through SWAYAM/NPTEL(minimum 12week, 3 credit course)	3	0	0	3



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## Open Electives & Minor

**Note:** *To obtain Minor Engineering, student needs to obtain 18 credits by successfully completing any of the following courses in the concern stream.*

**For Minor in BTech -CS &BS:**

	<b>L-T-P-C</b>
1. Operating Systems	3-0-0-3
2. Software Engineering	3-0-0-3
3. Data Analytics	3-0-0-3
4. Financial and cost Accounting	3-0-0-3
5. Marketing Research and Marketing Management	3-0-0-3
6. Business Communication and Value Sciences Lab	0-0-3-1.5
7. Data Analytics Lab	0-0-3-1.5

**Open Electives, offered to other department students:**

- Open Elective I : Java Programming
- Open Elective II : Operating Systems
- Open Elective III : Database Management Systems
- Open Elective IV : 1. Computer Networks  
2. Quantum Science and Technology

**COURSES OFFERED FOR HONOURS DEGREE IN CSBS**

S.No.	Course Name	Contact Hours per week		Credits
		L	T	
1	Operations on Research	3	0	3
2	NoSQL Databases	3	0	3
3	Services science & Service operational Management	3	0	3
4	IT project Management	3	0	3
5	Social Network Analysis	3	0	3
6	Operations on Research lab		3	1.5
7	Services science & Service operational Management lab		3	1.5
				<b>18</b>



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**R23 B.Tech CSBS COURSE STRUCTURE AND SYLLABUS**

<b>I Semester</b>	<b>SOFTWARE ARCHITECTURE &amp; DESIGN PATTERNS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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:** What is a 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 vlis sides, PEARSON Publication,2013





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**R23 B.Tech CSBS COURSE STRUCTURE AND SYLLABUS**

<b>I Semester</b>	<b>OPERATIONS MANAGEMENT</b> <b>(Management Course- II)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**Course Objectives:**

- To impart a comprehensive understanding of Operations Management principles and practices.
- To equip students with knowledge of product and process design principles, innovation, development, and optimization techniques.
- To provide knowledge of supply chain strategies, inventory management, logistics, demand forecasting, and operational efficiency.
- To develop understanding of quality management principles, continuous improvement methods, process optimization, and performance enhancement strategies.
- To equip students with knowledge of operations planning, scheduling, control techniques, resource management, and process optimization.

**Course Outcomes:**

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

- Explain the fundamental concepts and strategic importance of operations management.
- Understand principles of product and process design, innovation, optimization, sustainability, and manufacturing efficiency.
- Develop skills in supply chain strategies, inventory control, demand forecasting, logistics, and operational efficiency.
- Learn quality management principles, continuous improvement techniques, process optimization, and performance measurement strategies.
- Understand operations planning, scheduling, control techniques, resource allocation, and workflow optimization for efficiency.

**Unit -I**

Introduction to Operations Management: Definition, Nature, and Scope of Operations Management: Role and Significance; Evolution of Operations Management: Historical Perspectives; Operations Strategy: Formulation and Implementation

**Unit -II**

Product and Process Design: Product Development Life Cycle and Innovation Strategies; Advanced Product Design Techniques and Prototyping; Process Selection: Strategic Considerations and Frameworks; Production System Classifications: Job, Batch, Mass, and Continuous Production; Facility Design: Layout Planning and Location Optimization

**Unit -III**

Supply Chain and Inventory Management: Overview of Supply Chain Management: Concepts and Importance; Inventory Control Systems: EOQ, ABC Analysis, JIT; Demand Forecasting Techniques: Qualitative and Quantitative Models; Digital Supply Chains: Role of Technology and Automation





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<b>I Semester</b>	<b>AUGMENTED REALITY &amp; VIRTUAL REALITY</b> <b>(Professional Elective-IV)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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.

**Course Outcomes:**

- Understand the fundamental concepts and design principles of augmented reality and virtual reality.
- Understand the mathematical foundations, hardware, and software development tools required for VR and AR.
- Design and develop immersive AR/VR experiences by applying principles of user interface design, interaction design, and user experience
- Analyze existing code for anti-patterns and refactor the code
- Analyze human factor issues, user performance, sensorial conflict aspects of VR/AR/MR

**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 Behavior of Light, Lenses, Optical Aberrations, The Human Eye, Cameras, Displays



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#### **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 Color Visual 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. Sanni Siltanen- 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



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**R23 B.Tech CSBS COURSE STRUCTURE AND SYLLABUS**

<b>I Semester</b>	<b>BLOCKCHAIN TECHNOLOGY</b> (Professional Elective-IV)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objectives:**

- To learn the fundamentals of Block Chain and various types of block chain and consensus mechanism.
- To understand public block chain system, Private block chain system and consortium block chain.
- Able to know the security issues of blockchain technology.

**UNIT – I:**

**Fundamentals of Blockchain:** Introduction, Origin of Blockchain, Blockchain Solution, Components of Blockchain, Block in a Blockchain, The Technology and the Future. **Blockchain Types and Consensus Mechanism:** Introduction, Decentralization and Distribution, Types of Blockchain, Consensus Protocol. **Cryptocurrency:** Bitcoin, Altcoin and Token: Introduction, Bitcoin and the Cryptocurrency, Cryptocurrency Basics, Types of Cryptocurrencies, Cryptocurrency Usage.

**UNIT – II:**

**Public Blockchain System:** Introduction, Public Blockchain, Popular Public Blockchains, The Bitcoin Blockchain, Ethereum Blockchain. **Smart Contracts:** Introduction, Smart Contract, Characteristics of a Smart Contract, Types of Smart Contracts, Types of Oracles, Smart Contracts in Ethereum, Smart Contracts in Industry.

**UNIT – III:**

**Private Blockchain System:** Introduction, Key Characteristics of Private Blockchain, Private Blockchain, Private Blockchain Examples, Private Blockchain and Open Source, E-commerce Site Example, Various Commands (Instructions) in E-commerce Blockchain, Smart Contract in Private Environment, State Machine, Different Algorithms of Permissioned Blockchain, Byzantine Fault, Multichain. **Consortium Blockchain:** Introduction, Key Characteristics of Consortium Blockchain, Need of Consortium Blockchain, Hyperledger Platform, Overview of Ripple, Overview of Corda.

**Initial Coin Offering:** Introduction, Blockchain Fundraising Methods, Launching an ICO, Investing in an ICO, Pros and Cons of Initial Coin Offering, Successful Initial Coin Offerings, Evolution of ICO, ICO Platforms.

**UNIT – IV:**

**Security in Blockchain:** Introduction, Security Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, Identity Management and Authentication, Regulatory Compliance and Assurance, Safeguarding Blockchain Smart Contract (DApp), Security Aspects in Hyperledger Fabric. **Applications of Blockchain:** Introduction, Blockchain in Banking and Finance, Blockchain in Education, Blockchain in Energy, Blockchain in Healthcare, Blockchain in Real-estate, Blockchain in Supply Chain, The Blockchain and IoT. Limitations and Challenges of Blockchain.



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**UNIT – V:**

Blockchain Case Studies:

Case Study 1 – Retail,

Case Study 2 – Banking and Financial Services,

Case Study 3 – Healthcare,

Case Study 4 – Energy and Utilities.

Blockchain Platform using Python: Introduction, Learn How to Use Python Online Editor, Basic Programming Using Python, Python Packages for Blockchain.

Blockchain platform using Hyperledger Fabric: Introduction, Components of Hyperledger Fabric Network, Chain codes from Developer.ibm.com, Blockchain Application Using Fabric Java SDK.

**Text book:**

1. “Block chain Technology”, Chandramouli Subramanian, Asha A.George, Abhilasj K A and Meena Karthikeyan , Universities Press.

**Reference Books:**

1. Blockchain Blue print for Economy, Melanie Swan, SPD O’reilly.
2. Blockchain for Business, Jai Singh Arun, Jerry Cuomo, Nitin Gauar, Pearson Addition Wesley



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<b>I Semester</b>	<b>DEEP LEARNING</b> (Professional Elective-IV)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objectives:**

The objective of this course is to cover the fundamentals of neural networks as well as some advanced topics such as recurrent neural networks, long short-term memory cells and convolution neural networks.

**Course Outcomes:**

After completion of course, students would be able to:

- Explore feedforward networks and Deep Neural networks
- Mathematically understand the deep learning approaches and paradigms
- Apply the deep learning techniques for various applications
- Understanding adopting to advanced technologies and algorithms.
- Analyzing recent trends in deep learning.

**UNIT-I**

**Basics-** Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability, Convergence theorem for Perceptron Learning Algorithm.

**UNIT-II**

**Feedforward Networks-** Multilayer Perceptron, Gradient Descent, Back propagation, Empirical Risk Minimization, regularization, auto encoders. **Deep Neural Networks:** Difficulty of training deep neural networks, Greedy layer wise training.

**UNIT-III**

**Better Training of Neural Networks-** Newer optimization methods for neural networks (Adagrad, adadelata, rmsprop, adam, NAG), second order methods for training, Saddle point problem in neural networks, Regularization methods (dropout, drop connect, batch normalization).

**UNIT-IV**

**Recurrent Neural Networks-** Back propagation through time, Long Short-term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs. Convolutional Neural Networks: LeNet, AlexNet. Generative models: Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines.

**UNIT-V**

**Recent trends-** Variational Auto encoders, Transformers, GPT Applications: Vision, NLP, Speech



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**Text Books:**

1. Deep Learning, Ian Good fellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016.

**Reference Books:**

1. Neural Networks: A Systematic Introduction, Raúl Rojas,1996
2. Pattern Recognition and Machine Learning, Christopher Bishop,2007
3. Deep Learning with Python, François Chollet, Manning Publications,2017



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**R23 B.Tech CSBS COURSE STRUCTURE AND SYLLABUS**

<b>I Semester</b>	<b>EMBEDDED SYSTEM</b> <b>(Professional Elective-IV)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Outcomes:**

Upon completing this course, the student will be able to

- To understand the selection procedure of Processors in the embedded domain.
- Design Procedure for Embedded Firmware.
- To visualize the role of Real time Operating Systems in Embedded Systems.
- To evaluate the Correlation between task synchronization and latency issues

**UNIT-I**

**Introduction to Embedded Systems:** Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

**UNIT-II**

**Typical Embedded System:** Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

**UNIT-III**

**Embedded Firmware:** Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

**UNIT-IV**

**RTOS Based Embedded System Design:** Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

**UNIT-V**

**Task Communication:** Shared Memory, Message Passing, Remote Procedure Call and Sockets, **Task Synchronization:** Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, Methods to Choose an RTOS.

**Text Books:**

1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.

**Reference Books:**

1. Embedded Systems - Raj Kamal, TMH.
2. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
3. Embedded Systems – Lyla, Pearson, 2013
4. An Embedded Software Primer - David E. Simon, Pearson Education.



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<b>I Semester</b>	<b>AGILE METHODOLOGIES</b> (Professional Elective-V)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objectives:**

The main objectives of this course are to

- Introduce the important concepts of Agile software development Process.
- Emphasize the role of stand-up meetings in software collaboration.
- Impart the knowledge on values and principles in understanding agility.

**UNIT-I**

**Learning Agile:** Getting Agile into your brain, Understanding Agile values, No Silver Bullet, Agile to the Rescue, adding Agile makes a difference. A fractured perspective, How a fractured perspective causes project problems. The Agile Manifesto, Purpose behind Each Practice. Individuals and Interactions Over Processes and Tools, Working Software over Comprehensive Documentation, Customer Collaboration over Contract Negotiation, Responding to Change over Following a Plan, Principles over Practices. Understanding the Elephant, Methodologies Help You Get It All in Place at Once, Where to Start with a New Methodology.

**UNIT-II**

**The Agile Principles:** The 12 Principles of Agile Software, The Customer Is Always Right, “Do As I Say, Not As I Said”. Delivering the Project, Better Project Delivery for the Ebook Reader Project. Communicating and Working Together, Better Communication for the Ebook Reader Project. Project Execution—Moving the Project Along, a Better Working Environment for the Ebook Reader Project Team. Constantly Improving the Project and the Team. The Agile Project: Bringing All the Principles Together

**UNIT-III**

**SCRUM and Self-Organizing Teams:** The Rules of Scrum, Act I: I Can Haz Scrum?, Everyone on a Scrum Team owns the Project, The Scrum Master Guides the Team’s Decisions, The Product Owner Helps the Team Understand the Value of the Software, Everyone Owns the Project, Scrum Has Its Own Set of Values ,Status Updates Are for Social Networks!, The Whole Team Uses the Daily Scrum, Feedback and the Visibility-Inspection-Adaptation Cycle, The Last Responsible Moment, How to Hold an Effective Daily Scrum. Sprinting into a Wall, Sprints, Planning, and Retrospectives, Iterative or Incremental?, The Product Owner Makes or Breaks the Sprint, Visibility and Value, How to Plan and Run an Effective Scrum Sprint

**Scrum Planning And Collective Commitment:** Not Quite Expecting the Unexpected, User Stories, Velocity, and Generally Accepted Scrum Practices, Make Your Software Useful, User Stories Help Build Features Your Users Will Use, Conditions of Satisfaction, Story Points and Velocity, Burn down Charts, Planning and Running a Sprint Using Stories, Points, Tasks, and a Task Board. Victory Lap, Scrum Values Revisited, Practices Do Work Without the Values (Just Don’t Call It Scrum), Is Your Company’s Culture Compatible with Scrum Values.



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#### **UNIT-IV**

**XP And Embracing Change:** Going into Overtime, The Primary Practices of XP, Programming Practices, Integration Practices, Planning Practices, Team Practices, Why Teams Resist Changes, and How the Practices Help. The Game Plan Changed, but We're Still Losing, The XP Values Help the Team Change Their Mindset, XP Helps Developers Learn to Work with Users, Practices Only "Stick" When the Team Truly Believes in Them, An Effective Mindset Starts with the XP Values, The XP Values, Paved with Good Intentions. The Momentum Shifts, Understanding the XP Principles Helps You Embrace Change, The Principles of XP, XP Principles Help You Understand Planning, XP Principles Help You Understand Practices—and Vice Versa, Feedback Loops.

**XP, Simplicity, and Incremental Design:** Code and Design, Code Smells and Antipatterns (or, How to Tell If You're Being Too Clever), XP Teams Look for Code Smells and Fix Them, Hooks, Edge Cases, and Code That Does Too Much. Make Code and Design Decisions at the Last Responsible Moment, Fix Technical Debt by Refactoring Mercilessly, Use Continuous Integration to Find Design Problems, Avoid Monolithic Design, Incremental Design and the Holistic XP Practices. Teams Work Best When They Feel Like They Have Time to Think, Team Members Trust Each Other and Make Decisions Together. The XP Design, Planning, Team, and Holistic Practices Form an Ecosystem Incremental Design Versus Designing for Reuse, When Units Interact in a Simple Way, the System Can Grow Incrementally, and Great Design Emerges from Simple Interactions, Final Score.

#### **UNIT-V**

**Lean, Eliminating Waste, and Seeing the whole:** Lean Thinking, Commitment, Options Thinking, and Set-Based Development, Creating Heroes and Magical Thinking. Eliminate Waste, Use a Value Stream Map to Help See Waste Clearly, Gain a Deeper Understanding of the Product, See the Whole, Find the Root Cause of Problems That You Discover. Deliver As Fast As Possible; Use an Area Chart to Visualize Work in Progress, Control Bottlenecks by Limiting Work in Progress.

**Kanban, Flow, and Constantly Improving:** The Principles of Kanban, Find a Starting Point and Flow with WIP Limits Naturally Creates Slack. Make Process Policies Explicit So Evolve Experimentally from There. Stories Go into the System; Code Comes Out, Improving Your Process with Kanban, Visualize the Workflow, Limit Work in Progress. Measure and Manage Flow, Managing Everyone Is on the Same Page. Emergent Behavior with Kanban.

**The Agile Coach:** Coaches Understand Why People Don't Always Want to Change. The Principles of Coaching.

#### **Text Books:**

1. Andrew Stellman, Jill Alison Hart, Learning Agile, O'Reilly, 2015.

#### **Reference Books:**

1. Andrew stellman, Jennifer Green, Head first Agile, O'Reilly, 2017.
2. Rubin K , Essential Scrum : A practical guide to the most popular Agile process, Addison-Wesley, 2013



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<b>I Semester</b>	<b>METAVERSE</b> (Professional Elective-V)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objectives:**

- To understand the fundamental concepts of the Metaverse, including its architecture, technologies, and applications.
- To explore Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) as core components of the Metaverse.
- To study blockchain, NFTs, and decentralized finance (DeFi) as economic foundations of the Metaverse.
- To analyze Metaverse-based social interactions, business models, and ethical considerations.
- To gain hands-on experience with tools and platforms used to develop Metaverse applications.

**UNIT -I**

Introduction to Metaverse Definition and Evolution of the Metaverse, Key Components: VR, AR, MR, AI, and Blockchain, Applications of Metaverse: Gaming, Education, Healthcare, and Business. Challenges and Ethical Issues in the Metaverse

**UNIT -II**

Virtual Reality (VR) and Augmented Reality (AR) Fundamentals of VR and AR Technologies, Hardware and Software Requirements Interaction Techniques and User Experience, Metaverse Platforms: Oculus, Microsoft Mesh, Horizon Worlds, Hands-on: Creating a Simple VR/AR Environment

**UNIT -III**

Blockchain and Decentralization in the Metaverse Introduction to Blockchain Technology, Cryptocurrencies, NFTs, and Smart Contracts, Decentralized Applications (DApps) and Web3, Security and Privacy Considerations Hands-on: Deploying an NFT on a Test Blockchain

**UNIT -IV**

Metaverse Economy and Social Structures Digital Goods, Virtual Real Estate, and Digital Identity, Economic Models: Play to-Earn, DeFi, and Tokenomics, Social and Ethical Aspects: Digital Citizenship and Governance, Future Trends in Metaverse Economy

**UNIT -V**

Tools and Development in the Metaverse Metaverse Development Platforms: Unity, Unreal Engine, and WebXR, AI and Cloud Computing in the Metaverse, 3D Asset Creation and Interoperability Standards, Hands-on: Building a Basic Metaverse Application





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<b>I Semester</b>	<b>COMPUTER VISION</b> (Professional Elective-V)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objectives:**

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

**UNIT –I**

**CAMERAS:** Pinhole Cameras Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: 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**

**Grouping and Model Fitting:** 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.





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<b>I Semester</b>	<b>DATA VISUALIZATION</b> (Professional Elective-V)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites: Computer Graphics, Image Processing**

**Course Objective:**

- familiarize students with the basic and advanced techniques of information visualization and scientific visualization
- learn key techniques of the visualization process
- a detailed view of visual perception, the visualized data and the actual visualization, interaction and distorting techniques

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

CO	Course Outcomes	Knowledge Level (K)#
CO1	<b>Explain</b> Visualization and representation of data	<b>K6</b>
CO2	<b>Creating</b> visual representations and visualization reference model of applications	<b>K3</b>
CO3	<b>Classify</b> the visualization systems in a data representation	<b>K4</b>
CO4	<b>Identify</b> Visualization of groups and trees	<b>K3</b>
CO5	<b>Determine</b> the visualization of volumetric different data sets in applications	<b>K6</b>

#Based on suggested Revised BTL

**Mapping of course outcomes with program outcomes**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1		3	2		1		1			1			1	3	
CO 2	2	1	2		2	1							2	2	3
CO 3		3	2							1			1	1	3
CO 4	1	2	3	1	2								2	2	
CO 5	1	1	2			2		2		1			1	3	2

(Please fill the above with Levels of Correlation, viz., L-1, M-2, H-3)

**UNIT -I**

**Introduction:** What Is Visualization? History of Visualization, Relationship between visualization and Other Fields. The Visualization Process, Introduction of visual perception, visual representation of data, Gestalt principles and information overloads.

**UNIT -II**

Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications.





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<b>I Semester</b>	<b>PROMPT ENGINEERING (Skill Enhancement Course)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		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



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classification or translation); compare outputs for accuracy, consistency, and adherence to examples.

2. **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.
3. **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:





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<b>I Semester</b>	<b>CONSTITUTION OF INDIA</b> <b>(Audit Course)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

**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: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: 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, 1<sup>st</sup> Edition, (Bare Act), Government Publication, 1950
2. Framing of Indian Constitution, 1<sup>st</sup> Edition, Dr. S. N. Busi, Dr. B. R. Ambedkar 2015

**Reference Books:**

1. Indian Constitution Law, 7<sup>th</sup> Edition, M. P. Jain, Lexis Nexis, 2014





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	<b>OPERATING SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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.



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**Text Books:**

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

**Reference Books:**

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

**Online Learning Resources:**

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



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	<b>SOFTWARE ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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 characterise 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.





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	<b>DATA ANALYTICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Outcomes:**

After completion of this course students will be able to

1. Understand the impact of data analytics for business decisions and strategy
2. Carry out data analysis/statistical analysis
3. To carry out standard data visualization and formal inference procedures
4. Design Data Architecture
5. Understand various Data Sources

**UNIT-I**

**Data Management:** Design Data Architecture and manage the data for analysis, understand and various sources of Data like Sensors/Signals/GPS etc. Data Management, Data Quality (noise, outliers, missing values, duplicate data) and Data Processing & Processing.

**UNIT-II**

**Data Analytics:** Introduction to Analytics, Introduction to Tools and Environment, Application of Modeling in Business, Databases & Types of Data and variables, Data Modeling Techniques, Missing Imputations etc. Need for Business Modeling.

**UNIT-III**

**Regression** – Concepts, Linear property assumptions, Least Square Estimation, Variable Rationalization, and Model Building etc. Logistic Regression: Model Theory, Model fit Statistics, Model Construction, Analytics applications to various Business Domains etc.

**UNIT-IV**

**Object Segmentation:** Regression Vs Segmentation – Supervised and Unsupervised Learning, Tree Building – Regression, Classification, Overfitting, Pruning and Complexity, Multiple Decision Trees etc. Time Series Methods: Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height, Average Energy etc and Analyse for prediction.

**UNIT-V**

**Data Visualization:** Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations.

**TEXT BOOKS:**

1. Student's Handbook for Associate Analytics – II, III.
2. Data Mining Concepts and Techniques, Han, Kamber, 3rd Edition, Morgan Kaufmann Publishers.

**REFERENCE BOOKS:**

1. Introduction to Data Mining, Tan, Steinbach and Kumar, Addison Wesley, 2006.
2. Data Mining Analysis and Concepts, M. Zaki and W. Meira
3. Mining of Massive Datasets, Jure Leskovec Stanford Univ. Anand Rajaraman Millway Labs Jeffrey D Ullman Stanford Univ.



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**R23 B.Tech CSBS COURSE STRUCTURE AND SYLLABUS**

	<b>FINANCIAL AND COST ACCOUNTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Outcome(s):**

This course will help students

- To create an awareness about the importance and usefulness of the accounting concepts and their managerial implications
- To develop an understanding of the financial statements and the underlying principles and learn to interpret financial statements
- To create an awareness about cost accounting, different types of costing and cost management

**UNIT-I**

**Accounting Concept:** Introduction, Techniques and Conventions, Financial Statements-Understanding & Interpreting Financial Statements

**UNIT-II**

**Accounting Process:** Book Keeping and Record Maintenance, Fundamental Principles and Double Entry, Journal, Ledger, Trial Balance, Balance Sheet, Final Accounts, Cash Book and Subsidiary Books, Rectification of Errors

**UNIT-III**

**Financial Statements:** Form and Contents of Financial Statements, Analysing and Interpreting Financial Statements, Accounting Standards. Class Discussion: Corporate Accounting Fraud- A Case Study of Satyam

**Cash Flow and Fund Flow Techniques:** Introduction, how to prepare, Difference between them

**UNIT-IV**

**Costing Systems:** Elements of Cost, Cost Behaviour, Cost Allocation, OH Allocation, Unit Costing, Process Costing, Job Costing, Absorption Costing, Marginal Costing, Cost Volume Profit Analysis, Budgets, ABC Analysis

Class Discussion: Application of costing concepts in the Service Sector

**UNIT-V**

**Company Accounts and Annual Reports:** Audit Reports and Statutory Requirements, Directors Report, Notes to Accounts, Pitfalls.

**Text Books:**

1. Robert N Anthony, David Hawkins, Kenneth Marchant, *Accounting: Texts and Cases*, McGraw-Hill
2. Case Study Materials: To be distributed for class discussion



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	<b>MARKETING RESEARCH AND MARKETING MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Outcome(s):**

Students will be able to

- Understand basic marketing concepts
- Comprehend the dynamics of marketing and analyze how its various components interact with each other in the real world
- Leverage marketing concepts for effective decision making
- Understand basic concepts and application of statistical tools in Marketing research

**UNIT-I**

**Marketing Concepts and Applications:** Introduction to Marketing & Core Concepts, Marketing of Services, Importance of marketing in service sector. **Marketing Planning & Environment:** Elements of Marketing Mix, Analyzing needs & trends in Environment - Macro, Economic, Political, Technical & Social. **Understanding the consumer:** Determinants of consumer behavior, Factors influencing consumer behavior

**UNIT-II**

**Market Segmentation:** Meaning & Concept, Basis of segmentation, selection of segments, Market Segmentation strategies, Target Marketing, Product Positioning. **Product Management:** Product Life cycle concept, New Product development & strategy, Stages in New Product development, Product decision and strategies, Branding & packaging

**UNIT-III**

**Pricing, Promotion and Distribution Strategy:** Policies & Practices – Pricing Methods & Price determination Policies. Marketing Communication – The promotion mix, Advertising & Publicity, 5 M's of Advertising Management. Marketing Channels, Retailing, Marketing Communication, Advertising

**UNIT-IV**

**Marketing Research:** Introduction, Type of Market Research, Scope, Objectives & Limitations. Marketing Research Techniques, Survey Questionnaire design & drafting, Pricing Research, Media Research, Qualitative Research. **Data Analysis:** Use of various statistical tools – Descriptive & Inference Statistics, Statistical Hypothesis Testing, Multivariate Analysis - Discriminant Analysis, Cluster Analysis, Segmenting and Positioning, Factor Analysis

**UNIT-V**

**Internet Marketing:** Introduction to Internet Marketing. Mapping fundamental concepts of Marketing (7Ps, STP); Strategy and Planning for Internet Marketing. **Business to Business Marketing:** Fundamental of business markets. Organizational buying process. Business buyer needs. Market and sales potential. Product in business markets. Price in business markets. Place in business markets. Promotion in business markets. Relationship, networks and customer relationship management. Business to Business marketing strategy





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	<b>BUSINESS COMMUNICATION AND VALUE SCIENCES LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

**Course Objectives:**

- To augment students’ overall communication and thus aid in helping them
- To improve their interpersonal skills by engaging them in group activities
- To emerge as professionals.

**Course Outcomes:**

- Speak fluently in English without errors in the sentence construction and hence present themselves as effective English communicators.
- Differentiate between vocabularies used as adjectives, verbs.
- Deliver a public speech according to the need of the audience and also be aware of positive body language to be manifested during a speech.
- Deal with the deeper parameters of working in teams like team motivation, multicultural team activity and team conflict resolution.
- Set realistic goals in terms of personal and professional growth.

**List of Experiments:**

1. Introducing Oneself and Sharing Information
2. Writing letters and creating mails
3. Construction of paragraphs and essays
4. Speaking skills and methods of speech
5. Leadership, Communication and Interpersonal skills
6. Being a motivator and role model
7. Presentation on the persona of any well-known person & Role-Play
8. Corporate Etiquettes
9. Professionalism in the workplace
10. Engineering ethics, rights and responsibilities
11. Managing cultural diversities and global diversities
12. Right use of social media
13. Create a podcast on a topic
14. Maintaining the image and pride of the organization
15. Winning formula for a successful manager/leader
16. Listening to TED

**List of Equipment’s:(30 Students Per Batch)**

1. Systems with Rosetta stone and Globarena

**Text Books:**

1. Bovee, Thill and Raina, Business Communication Today, Pearson Education, 2017.
2. APAART: Speak Well 1 (English Language and Communication)
3. APAART: Speak Well 2 (Soft Skills)

**Reference Books:**

1. Charles Marsh , Strategic Communication, New International Edition, 2013.
2. Alan Mccarthy and Odell, English Vocabulary in Use, Cambridge University Press, 4th edition, 2017.
3. Dr. Saroj Hiremath , Business Communication, Nirali Prakashan, 2018.





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# OPEN ELECTIVES



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	<b>JAVA PROGRAMMING</b> (Open Electives-I)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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,



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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, ResultSet 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, 4<sup>th</sup> Edition, Pearson.

#### **References Books:**

- 1) The complete Reference Java, 11<sup>th</sup> edition, Herbert Schildt, TMH
- 2) Introduction to Java programming, 7<sup>th</sup> 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](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview)



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	<b>OPERATING SYSTEMS</b> (Open Electives-II)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### 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.





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	<b>DATABASE MANAGEMENT SYSTEMS</b> (Open Electives-III)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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 Databases 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).





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	<b>COMPUTER NETWORKS</b> <b>(Open Electives-IV)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objectives:**

- To understand the different types of networks
- To discuss the software and hardware components of a network
- To develop an understanding the principles of computer networks.
- To familiarize with OSI model and the functions of layered structure.
- To explain networking protocols, algorithms and design perspectives.

**Course Outcomes (CO):**

After completion of the course, students will be able to

- Identify the software and hardware components of a Computer network. (L1)
- Explain the functionality of each layer of a computer network. (L2)
- Identify and analyze flow control, congestion control, and routing issues. (L4)
- Analyze and interpret the functionality and effectiveness of the routing protocols. (L4)
- Choose the appropriate transport protocol based on the application requirements. (L3)

**UNIT-I**

**Introduction:** Types of Computer Networks, Broadband Access Networks, Mobile and Wireless Access Networks, Content Provider Networks, Transit networks, Enterprise Networks, Network technology from local to global, Personal Area Networks, Local Area Networks, Home Networks, Metropolitan Area Networks, Wide Area Networks, Internetworks, Network Protocols, Design Goals, Protocol Layering, Connections and Reliability, Service Primitives, The Relationship of Services to Protocols ,Reference Models, The OSI Reference Model, The TCP/IP Reference Model, A Critique of the OSI Model and Protocols, A Critique of the TCP/IP Reference Model and Protocols.

**UNIT-II**

**The Data Link Layer:** Guided Transmission Media, Persistent Storage, Twisted Pairs, Coaxial Cable, Power Lines, Fiber Optics, Data Link Layer Design Issues, Services Provided To The Network Layer, Framing Error Control, Flow Control, Error Detection And Correction, Error-Correcting Codes, Error-Detecting Codes, Elementary Data Link Protocols, Initial Simplifying Assumptions Basic Transmission And Receipt, Simplex Link-Layer Protocols, Improving Efficiency, Bidirectional Transmission, Multiple Frames In Flight, Examples Of Full-Duplex, Sliding Window Protocols, The Channel Allocation Problem, Static Channel Allocation, Assumptions For Dynamic Channel Allocation, Multiple Access Protocols, Aloha, Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Limited-Contention Protocols, Wireless LAN Protocols, Ethernet, Classic Ethernet Physical Layer, Classic Ethernet Mac Sublayer Protocol, Ethernet Performance, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, 10-Gigabit Ethernet,40- And 100-Gigabit Ethernet, Retrospective On Ethernet.



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### **UNIT-III**

**The Network Layer:** 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 In A Single Network, The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing Within a Network, Broadcast Routing, Multicast Routing, Anycast Routing, Traffic Management at The Network Layer, The Need for Traffic Management: Congestion, Approaches To Traffic Management, Internetworking, Internetworks: An Overview, How Networks differ, Connecting Heterogeneous Networks, Connecting Endpoints Across Heterogeneous Networks, Internetwork Routing: Routing Across Multiple Networks Supporting Different Packet Sizes: Packet Fragmentation, The Network Layer In The Internet, The IP Version 4 Protocol, IP Addresses, IP Version 6, Internet Control Protocols, Label Switching and MPLS, OSPF—An Interior Gateway Routing Protocol, BGP—The Exterior Gateway Routing Protocol, Internet Multicasting.

### **UNIT-IV**

**The Transport Layer:** The Transport Service, Services Provided To The Upper Layers, Transport Service Primitives, Berkeley Sockets, An Example Of Socket Programming: An Internet File Server, Elements Of Transport Protocols, Addressing, Connection Establishment, Connection Release, Error Control And Flow Control, Multiplexing, Crash Recovery, Congestion Control, Desirable Bandwidth Allocation, Regulating The Sending Rate, Wireless Issues, The Internet Transport Protocols: UDP, Introduction To UDP, Remote Procedure Call, Real-Time Transport Protocols, The Internet Transport Protocols: TCP, Introduction To TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release.

### **UNIT-V**

**The Application Layer:** Electronic Mail, Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery, The World Wide Web, Architectural Overview, Static Web Objects, Dynamic Web Pages and Web Applications, HTTP and HTTPS, Web Privacy, Content Delivery, Content and Internet Traffic, Server Farms and Web Proxies, Content Delivery Networks, Peer-To-Peer Networks, Evolution of The Internet.





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<b>IV Year – I Semester</b>	<b>QUANTUM SCIENCE AND TECHNOLOGY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Prerequisites:** Basic Physics, Linear Algebra, and Introduction to Modern Physics

**Course Objectives:**

1. To introduce fundamental concepts of quantum mechanics and its mathematical formalism.
2. To explore quantum computing and communication principles and technologies.
3. To understand the physical implementation and limitations of quantum systems.
4. To enable students to relate quantum theory to practical applications in computing, cryptography, and sensing.
5. To familiarize students with the emerging trends in quantum technologies.

**Course Outcomes:**

After completing this course, students will be able to:

- CO1. Explain core principles of quantum mechanics and their technological implications.
- CO2. Analyze quantum phenomena like superposition and entanglement.
- CO3. Apply mathematical tools to model and solve quantum systems.
- CO4. Demonstrate understanding of quantum algorithms and quantum circuits.
- CO5. Evaluate potential applications and challenges in quantum communication and sensing.

**Unit 1: Fundamentals of Quantum Mechanics:** Historical background: Blackbody radiation, photoelectric effect, and Compton scattering; Dual nature of light and matter; De Broglie hypothesis; Schrödinger equation; Free particle, infinite potential well, step potential; Operators and observables: position, momentum, Hamiltonian; Commutation relations and uncertainty principle; Quantum postulates and measurement theory; Eigenvalues, eigenfunctions.

**Unit 2: Quantum Information Theory:** Classical vs. quantum information; Qubit representation using Bloch sphere; Quantum superposition and quantum entanglement; Dirac notation (bra-ket), tensor products, and composite systems; Bell states and EPR paradox; Quantum gates: Pauli-X, Y, Z; Hadamard; Phase; T; CNOT; Quantum circuit models and notation; Measurement in computational basis; Quantum teleportation and no-cloning theorem; Quantum state tomography (introductory)

**Unit 3: Quantum Computing:** Classical computing review and limitations; Quantum parallelism and interference; Deutsch and Deutsch-Jozsa algorithms; Grover's search algorithm, Oracle and amplitude amplification; Shor's factoring algorithm (overview and significance); Quantum Fourier Transform (QFT); Quantum error correction: Bit-flip, phase-flip, and Shor's 9-qubit code; Introduction to quantum programming: Qiskit, Cirq, IBM Quantum Experience (overview)



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**Unit 4: Quantum Communication:** Introduction to quantum cryptography; Quantum key distribution (QKD): BB84 protocol; Entanglement-based QKD: Ekert protocol (E91); Eavesdropping and security of QKD; Quantum teleportation (circuit and protocol); Quantum dense coding; Quantum networks and entanglement swapping; Role of quantum repeaters; Single-photon sources and detectors; Implementation challenges (loss, decoherence, noise)

**Unit 5: Quantum Technologies and Applications:** Quantum sensors: magnetometry, gravimetry; Quantum metrology: standard time, atomic clocks; Quantum imaging and lithography; Quantum materials: topological insulators, graphene, quantum dots; NV centers in diamonds for sensing; Hardware platforms: Superconducting qubits, Trapped ions, Photonic quantum processors; Quantum supremacy and NISQ era; Global initiatives: IBM, Google, D-Wave, IonQ, India's NQM; Ethical concerns and future prospects

**Text Books:**

1. **"Quantum Computation and Quantum Information"** by Michael A. Nielsen and Isaac L. Chuang
2. **"Quantum Mechanics: Concepts and Applications"** by Nouredine Zettili

**Online Learning Resources:**

1. <https://nptel.ac.in/courses/104104082>
  2. <https://nptel.ac.in/courses/115104096>
- <https://nptel.ac.in/courses/122106034>



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**B.Tech. – IV Year II Semester**

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