

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**  
**B.Tech in CSE (DATA SCIENCE)**  
**III & IV YEAR COURSE STRUCTURE & TENTATIVE SYLLABUS (R18)**

**Applicable From 2020-21 Admitted Batch**

**III YEAR I SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1		Design and Analysis of Algorithms	3	0	0	3
2		Introduction to Data Science	3	0	0	3
3		Computer Networks	3	0	0	3
4		Data Mining	3	0	0	3
5		Professional Elective - I	3	0	0	3
6		Professional Elective - II	3	0	0	3
7		Data Mining Lab	0	0	3	1.5
8		Computer Networks Lab	0	0	3	1.5
9		Advanced Communication Skills Lab	0	0	2	1
10		Intellectual Property Rights	3	0	0	0
		<b>Total Credits</b>	<b>21</b>	<b>0</b>	<b>8</b>	<b>22</b>

**III YEAR II SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1		Compiler Design	3	1	0	4
2		Machine Learning	3	1	0	4
3		Big Data Analytics	3	1	0	4
4		Professional Elective – III	3	0	0	3
5		Open Elective - I	3	0	0	3
6		Machine Learning Lab	0	0	3	1.5
7		Big Data Analytics Lab	0	0	3	1.5
8		Professional Elective - III Lab	0	0	2	1
9		Environmental Science	3	0	0	0
		<b>Total Credits</b>	<b>18</b>	<b>3</b>	<b>8</b>	<b>22</b>

**IV YEAR I SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1		Predictive Analytics	3	0	0	3
2		Web and Social Media Analytics	2	0	0	2
3		Professional Elective – IV	3	0	0	3
4		Professional Elective – V	3	0	0	3
5		Open Elective – II	3	0	0	3
6		Web and Social Media Analytics Lab	0	0	2	1
7		Industrial Oriented Mini Project/ Summer Internship	0	0	0	2*
8		Seminar	0	0	2	1
9		Project Stage – I	0	0	6	3
		<b>Total Credits</b>	<b>14</b>	<b>0</b>	<b>10</b>	<b>21</b>

**IV YEAR II SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1		Organizational Behaviour	3	0	0	3
2		Professional Elective -VI	3	0	0	3
3		Open Elective-III	3	0	0	3
4		Project Stage - II	0	0	14	7
		<b>Total Credits</b>	<b>9</b>	<b>0</b>	<b>14</b>	<b>16</b>

**\*Note:** Industrial Oriented Mini Project/ Summer Internship is to be carried out during the summer vacation between 6th and 7th semesters. Students should submit report of Industrial Oriented Mini Project/ Summer Internship for evaluation.

MC - Environmental Science – Should be Registered by Lateral Entry Students Only.

MC – Satisfactory/Unsatisfactory

**Professional Elective-I**

	Data Warehousing and Business Intelligence
	Artificial Intelligence
	Web Programming
	Image Processing
	Computer Graphics

**Professional Elective - II**

	Spatial and Multimedia Databases
	Information Retrieval Systems
	Software Project Management
	DevOps
	Computer Vision and Robotics

**Professional Elective - III**

	Software Testing Methodologies
	Data Visualization Techniques
	Scripting Languages
	Mobile Application Development
	Cryptography and Network Security

# Courses in PE – III and PE – III Lab must be in 1-1 correspondence.

**Professional Elective –IV**

	Quantum Computing
	Database Security
	Natural Language Processing
	Information Storage Management
	Internet of Things

**Professional Elective - V**

	Privacy Preserving in Data Mining
	Cloud Computing
	Data Science Applications
	Mining Massive Datasets
	Exploratory Data Analysis

**Professional Elective – VI**

	Data Stream Mining
	Web Security
	Video Analytics
	Blockchain Technology
	Parallel and Distributed Computing

**DESIGN AND ANALYSIS OF ALGORITHMS****B.Tech. III Year I Sem.**

L	T	P	C
3	0	0	3

**Prerequisites:**

1. A course on "Computer Programming and Data Structures".
2. A course on "Advanced Data Structures".

**Course Objectives:**

- Introduces the notations for analysis of the performance of algorithms.
- Introduces the data structure disjoint sets.
- Describes major algorithmic techniques (divide-and-conquer, backtracking, dynamic programming, greedy, branch and bound methods) and mention problems for which each technique is appropriate;
- Describes how to evaluate and compare different algorithms using worst-, average-, and best-case analysis.
- Explains the difference between tractable and intractable problems, and introduces the problems that are P, NP and NP complete.

**Course Outcomes:**

- Ability to analyze the performance of algorithms
- Ability to choose appropriate data structures and algorithm design methods for a specified application
- Ability to understand how the choice of data structures and the algorithm design methods impact the performance of programs

**UNIT - I**

**Introduction:** Algorithm, Performance Analysis-Space complexity, Time complexity, Asymptotic Notations- Big oh notation, Omega notation, Theta notation and Little oh notation.

**Divide and conquer:** General method, applications-Binary search, Quick sort, Merge sort, Strassen's matrix multiplication.

**UNIT - II**

**Disjoint Sets:** Disjoint set operations, union and find algorithms

**Backtracking:** General method, applications, n-queen's problem, sum of subsets problem, graph coloring

**UNIT - III**

**Dynamic Programming:** General method, applications- Optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Traveling sales person problem, Reliability design.

**UNIT - IV**

**Greedy method:** General method, applications-Job sequencing with deadlines, knapsack problem, Minimum cost spanning trees, Single source shortest path problem.

**UNIT - V**

**Branch and Bound:** General method, applications - Travelling sales person problem, 0/1 knapsack problem - LC Branch and Bound solution, FIFO Branch and Bound solution.

**NP-Hard and NP-Complete problems:** Basic concepts, non-deterministic algorithms, NP - Hard and NP-Complete classes, Cook's theorem.

**TEXT BOOK:**

1. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharan, University Press.

**REFERENCE BOOKS:**

1. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education.
2. Introduction to Algorithms, second edition, T. H. Cormen, C.E. Leiserson, R. L. Rivest, and C. Stein, PHI Pvt. Ltd./ Pearson Education.
3. Algorithm Design: Foundations, Analysis and Internet Examples, M.T. Goodrich and R. Tamassia, John Wiley and sons.

## INTRODUCTION TO DATA SCIENCE

**B.Tech. III Year I Sem.**

<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:

1. Learn concepts, techniques and tools they need to deal with various facets of data science practice, including data collection and integration
2. Understand the basic types of data and basic statistics
3. Identify the importance of data reduction and data visualization techniques

**Course Outcomes:** After completion of the course, the student should be able to

1. Understand basic terms what Statistical Inference means.
2. Identify probability distributions commonly used as foundations for statistical modelling. Fit a model to data
3. describe the data using various statistical measures
4. utilize R elements for data handling
5. perform data reduction and apply visualization techniques.

### UNIT - I

**Introduction:** Definition of Data Science- Big Data and Data Science hype – and getting past the hype - Datafication - Current landscape of perspectives - Statistical Inference - Populations and samples - Statistical modeling, probability distributions, fitting a model – Over fitting. **Basics of R:** Introduction, R-Environment Setup, Programming with R, Basic Data Types.

### UNIT - II

#### Data Types & Statistical Description

**Types of Data:** Attributes and Measurement, What is an Attribute? The Type of an Attribute, The Different Types of Attributes, Describing Attributes by the Number of Values, Asymmetric Attributes, Binary Attribute, Nominal Attributes, Ordinal Attributes, Numeric Attributes, Discrete versus Continuous Attributes. Basic Statistical Descriptions of Data: Measuring the Central Tendency: Mean, Median, and Mode, Measuring the Dispersion of Data: Range, Quartiles, Variance, Standard Deviation, and Inter-quartile Range, Graphic Displays of Basic Statistical Descriptions of Data.

### UNIT - III

**Vectors:** Creating and Naming Vectors, Vector Arithmetic, Vector sub setting, **Matrices:** Creating and Naming Matrices, Matrix Sub setting, Arrays, Class. **Factors and Data Frames:** Introduction to Factors: Factor Levels, Summarizing a Factor, Ordered Factors, Comparing Ordered Factors, Introduction to Data Frame, subsetting of Data Frames, Extending Data Frames, Sorting Data Frames.

**Lists:** Introduction, creating a List: Creating a Named List, Accessing List Elements, Manipulating List Elements, Merging Lists, Converting Lists to Vectors

### UNIT - IV

**Conditionals and Control Flow:** Relational Operators, Relational Operators and Vectors, Logical Operators, Logical Operators and Vectors, Conditional Statements. **Iterative Programming in R:** Introduction, While Loop, For Loop, Looping Over List. **Functions in R:** Introduction, writing a Function in R, Nested Functions, Function Scoping, Recursion, Loading an R Package, Mathematical Functions in R.

### UNIT - V

**Data Reduction:** Overview of Data Reduction Strategies, Wavelet Transforms, Principal Components Analysis, Attribute Subset Selection, Regression and Log-Linear Models: Parametric Data Reduction, Histograms, Clustering, Sampling, Data Cube Aggregation. **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. Doing Data Science, Straight Talk from The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly, 2014
2. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, 3rd ed. The Morgan Kaufmann Series in Data Management Systems.
3. K G Srinivas, G M Siddesh, "Statistical programming in R", Oxford Publications.

**REFERENCE BOOKS:**

1. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.
2. Brain S. Everitt, "A Handbook of Statistical Analysis Using R", Second Edition, 4 LLC, 2014.
3. Dalgaard, Peter, "Introductory statistics with R", Springer Science & Business Media, 2008.
4. Paul Teetor, "R Cookbook", O'Reilly, 2011.

## COMPUTER NETWORKS

**B.Tech. III Year I Sem.**

<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:**

- A course on “Programming for problem solving”.
- A course on “Data Structures”.

**Course Objectives:**

1. The objective of the course is to equip the students with a general overview of the concepts and fundamentals of computer networks.
2. Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols of the various layers.

**Course Outcomes:**

1. Gain the knowledge of the basic computer network technology.
2. Gain the knowledge of the functions of each layer in the OSI and TCP/IP reference model.
3. Obtain the skills of subnetting and routing mechanisms.
4. Familiarity with the essential protocols of computer networks, and how they can be applied in network design and implementation.

**UNIT - I**

Network hardware, Network software, OSI, TCP/IP Reference models, Example Networks: ARPANET, Internet. Physical Layer: Guided Transmission media: twisted pairs, coaxial cable, fiber optics, Wireless transmission.

**UNIT - II**

Data link layer: Design issues, framing, Error detection and correction. Elementary data link protocols: simplex protocol, A simplex stop and wait protocol for an error-free channel, A simplex stop and wait protocol for noisy channel. Sliding Window protocols: A one-bit sliding window protocol, A protocol using Go-Back-N, A protocol using Selective Repeat, Example data link protocols. Medium Access sub layer: The channel allocation problem, Multiple access protocols: ALOHA, Carrier sense multiple access protocols, collision free protocols. Wireless LANs, Data link layer switching.

**UNIT - III**

Network Layer: Design issues, Routing algorithms: shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, distance vector routing, Congestion Control Algorithms, Quality of Service, Internetworking, The Network layer in the internet.

**UNIT - IV**

Transport Layer: Transport Services, Elements of Transport protocols, Connection management, TCP and UDP protocols.

**UNIT - V**

Application Layer –Domain name system, SNMP, Electronic Mail; the World WEB, HTTP, Streaming audio and video.

**TEXT BOOK:**

1. Computer Networks -- Andrew S Tanenbaum, David. j. Wetherall, 5th Edition. Pearson Education/PHI

**REFERENCE BOOKS:**

1. An Engineering Approach to Computer Networks-S. Keshav, 2nd Edition, Pearson Education
2. Data Communications and Networking – Behrouz A. Forouzan. Third Edition TMH.

**DATA MINING****B.Tech. III Year I Sem.**

L	T	P	C
3	0	0	3

**Pre-Requisites:**

- A course on “Database Management Systems”
- Knowledge of probability and statistics

**Course Objectives:**

- It presents methods for mining frequent patterns, associations, and correlations.
- It then describes methods for data classification and prediction, and data-clustering approaches.
- It covers mining various types of data stores such as spatial, textual, multimedia, streams.

**Course Outcomes:**

- Ability to understand the types of the data to be mined and present a general classification of tasks and primitives to integrate a data mining system.
- Apply preprocessing methods for any given raw data.
- Extract interesting patterns from large amounts of data.
- Discover the role played by data mining in various fields.
- Choose and employ suitable data mining algorithms to build analytical applications
- Evaluate the accuracy of supervised and unsupervised models and algorithms.

**UNIT - I**

**Data Mining:** Data–Types of Data–, Data Mining Functionalities– Interestingness Patterns– Classification of Data Mining systems– Data mining Task primitives –Integration of Data mining system with a Data warehouse–Major issues in Data Mining–Data Preprocessing.

**UNIT - II**

**Association Rule Mining:** Mining Frequent Patterns–Associations and correlations – Mining Methods– Mining Various kinds of Association Rules– Correlation Analysis– Constraint based Association mining. Graph Pattern Mining, SPM.

**UNIT - III**

**Classification:** Classification and Prediction – Basic concepts–Decision tree induction–Bayesian classification, Rule–based classification, Lazy learner.

**UNIT - IV**

**Clustering and Applications:** Cluster analysis–Types of Data in Cluster Analysis–Categorization of Major Clustering Methods– Partitioning Methods, Hierarchical Methods– Density–Based Methods, Grid–Based Methods, Outlier Analysis.

**UNIT - V**

**Advanced Concepts:** Basic concepts in Mining data streams–Mining Time–series data—Mining sequence patterns in Transactional databases– Mining Object– Spatial– Multimedia–Text and Web data – Spatial Data mining– Multimedia Data mining–Text Mining– Mining the World Wide Web.

**TEXT BOOKS:**

1. Data Mining – Concepts and Techniques – Jiawei Han & Micheline Kamber, 3<sup>rd</sup> Edition Elsevier.
2. Data Mining Introductory and Advanced topics – Margaret H Dunham, PEA.

**REFERENCE BOOK:**

1. Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques (Second Edition), Morgan Kaufmann, 2005.

**DATA WAREHOUSING AND BUSINESS INTELLIGENCE (Professional Elective – I)****B.Tech. III Year I Sem.**

L	T	P	C
3	0	0	3

**Course Objectives:**

1. This course is concerned with extracting data from the information systems that deal with the day-to-day operations and transforming it into data that can be used by businesses to drive high-level decision making
2. Students will learn how to design and create a data warehouse, and how to utilize the process of extracting, transforming, and loading (ETL) data into data warehouses.

**Course Outcomes:**

1. Understand architecture of data warehouse and OLAP operations.
2. Understand Fundamental concepts of BI and Analytics
3. Application of BI Key Performance indicators
4. Design of Dashboards, Implementation of Web Analytics
5. Understand Utilization of Advanced BI Tools and their Implementation.
6. Implementation of BI Techniques and BI Ethics.

**UNIT - I**

**DATA WAREHOUSE:** Data Warehouse-Data Warehouse Architecture- Multidimensional Data Model-Data cube and OLAP Technology-Data Warehouse Implementation -DBMS schemas for Decision support - Efficient methods for Data cube computation.

**UNIT - II**

**Business Intelligence:** Introduction – Definition, Leveraging Data and Knowledge for BI, BI Components, BI Dimensions, Information Hierarchy, Business Intelligence and Business Analytics. BI Life Cycle. Data for BI - Data Issues and Data Quality for BI.

**UNIT - III**

**BI Implementation** - Key Drivers, Key Performance Indicators and Performance Metrics, BI Architecture/Framework, Best Practices, Business Decision Making, Styles of BI-vent-Driven alerts - A cyclic process of Intelligence Creation. The value of Business Intelligence-Value driven & Information use.

**UNIT - IV**

**Advanced BI** – Big Data and BI, Social Networks, Mobile BI, emerging trends, Description of different BI-Tools (Pentaho, KNIME)

**UNIT - V**

Business intelligence implementation-Business Intelligence and integration implementation-connecting in BI systems- Issues of legality- Privacy and ethics- Social networking and BI.

**TEXT BOOKS:**

1. Data Mining – Concepts and Techniques - JIAWEI HAN & MICHELINE KAMBER, Elsevier.
2. Rajiv Sabherwal “Business Intelligence” Wiley Publications, 2012.

**REFERENCE BOOKS:**

1. Efraim Turban, Ramesh Sharda, Jay Aronson, David King, Decision Support and Business Intelligence Systems, 9th Edition, Pearson Education, 2009.
2. David Loshin, Business Intelligence - The Savy Manager's Guide Getting Onboard with Emerging IT, Morgan Kaufmann Publishers, 2009.
3. Philo Janus, Stacia Misner, Building Integrated Business Intelligence Solutions with SQL Server, 2008 R2 & Office 2010, TMH, 2011.
4. Business Intelligence Data Mining and Optimization for decision making [Author: Carlo-Verellis] [Publication: (Wiley)].
5. Data Warehousing, Data Mining & OLAP- Alex Berson and Stephen J. Smith- Tata McGraw-Hill Edition, Tenth reprint 2007.
6. Building the Data Warehouse- W. H. Inmon, Wiley Dreamtech India Pvt. Ltd.
7. Data Mining Introductory and Advanced topics –MARGARET H DUNHAM, PEA.

**ARTIFICIAL INTELLIGENCE (Professional Elective – I)****B.Tech. III Year I Sem.**

L	T	P	C
3	0	0	3

**Prerequisites:**

1. A course on “Computer Programming and Data Structures”
2. A course on “Advanced Data Structures”
3. A course on “Design and Analysis of Algorithms”
4. A course on “Mathematical Foundations of Computer Science”
5. Some background in linear algebra, data structures and algorithms, and probability will all be helpful

**Course Objectives:**

- To learn the distinction between optimal reasoning Vs. human like reasoning
- To understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
- To learn different knowledge representation techniques.
- To understand the applications of AI, namely game playing, theorem proving, and machine learning.

**Course Outcomes:**

- Ability to formulate an efficient problem space for a problem expressed in natural language.
- Select a search algorithm for a problem and estimate its time and space complexities.
- Possess the skill for representing knowledge using the appropriate technique for a given problem.
- Possess the ability to apply AI techniques to solve problems of game playing, and machine learning.

**UNIT - I****Problem Solving by Search-I:** Introduction to AI, Intelligent Agents

**Problem Solving by Search –II:** Problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform cost search, Depth-first search, Iterative deepening Depth-first search, Bidirectional search, Informed (Heuristic) Search Strategies: Greedy best-first search, A\* search, Heuristic Functions, Beyond Classical Search: Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces, Searching with Non-Deterministic Actions, Searching with Partial Observations, Online Search Agents and Unknown Environment .

**UNIT - II****Problem Solving by Search-II and Propositional Logic**

**Adversarial Search:** Games, Optimal Decisions in Games, Alpha–Beta Pruning, Imperfect Real-Time Decisions.

**Constraint Satisfaction Problems:** Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems.

**Propositional Logic:** Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses, Forward and backward chaining, Effective Propositional Model Checking, Agents Based on Propositional Logic.

**UNIT - III****Logic and Knowledge Representation**

**First-Order Logic:** Representation, Syntax and Semantics of First-Order Logic, Using First-Order Logic, Knowledge Engineering in First-Order Logic.

**Inference in First-Order Logic:** Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.

**Knowledge Representation:** Ontological Engineering, Categories and Objects, Events. Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information.

#### **UNIT - IV**

##### **Planning**

**Classical Planning:** Definition of Classical Planning, Algorithms for Planning with State-Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches.

**Planning and Acting in the Real World:** Time, Schedules, and Resources, Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multi agent Planning.

#### **UNIT - V**

##### **Uncertain knowledge and Learning**

**Uncertainty:** Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes' Rule and Its Use,

**Probabilistic Reasoning:** Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First-Order Probability, Other Approaches to Uncertain Reasoning; Dempster-Shafer theory.

**Learning:** Forms of Learning, Supervised Learning, Learning Decision Trees. Knowledge in Learning: Logical Formulation of Learning, Knowledge in Learning, Explanation-Based Learning, Learning Using Relevance Information, Inductive Logic Programming.

#### **TEXT BOOK:**

1. Artificial Intelligence A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.

#### **REFERENCE BOOKS:**

1. Artificial Intelligence, 3<sup>rd</sup> Edn, E. Rich and K. Knight (TMH)
2. Artificial Intelligence, 3<sup>rd</sup> Edn., Patrick Henry Winston, Pearson Education.
3. Artificial Intelligence, Shivani Goel, Pearson Education.
4. Artificial Intelligence and Expert systems – Patterson, Pearson Education.

**WEB PROGRAMMING (Professional Elective – I)****B.Tech. III Year I Sem.**

L	T	P	C
3	0	0	3

**Course Objectives:** The student should be able to:

- Understand the technologies used in Web Programming.
- Know the importance of object-oriented aspects of Scripting.
- Understand creating database connectivity using JDBC.
- Learn the concepts of web-based application using sockets.

**Course Outcomes:** Upon Completion of the course, the students will be able to

- Design web pages.
- Use technologies of Web Programming.
- Apply object-oriented aspects to Scripting.
- Create databases with connectivity using JDBC.
- Build web-based application using sockets.

**UNIT - I**

**SCRIPTING:** Web page Designing using HTML, Scripting basics- Client side and server-side scripting. Java Script-Object, names, literals, operators and expressions- statements and features- events - windows -documents - frames - data types - built-in functions- Browser object model - Verifying forms - HTML5-CSS3- HTML 5 canvas - Web site creation using tools.

**UNIT – II**

**JAVA:** Introduction to object-oriented programming-Features of Java – Data types, variables and arrays – Operators – Control statements – Classes and Methods – Inheritance. Packages and Interfaces – Exception Handling – Multithreaded Programming – Input/ Output – Files – Utility Classes – String Handling.

**UNIT – III**

**JDBC:** JDBC Overview – JDBC implementation – Connection class – Statements - Catching Database Results, handling database Queries. Networking– Inet Address class – URL class- TCP sockets – UDP sockets, Java Beans –RMI.

**UNIT – IV**

**APPLETS:** Java applets- Life cycle of an applet – Adding images to an applet – Adding sound to an applet. Passing parameters to an applet. Event Handling. Introducing AWT: Working with Windows Graphics and Text. Using AWT Controls, Layout Managers and Menus. Servlet – life cycle of a servlet. The Servlet API, Handling HTTP Request and Response, using Cookies, Session Tracking. Introduction to JSP.

**UNIT – V**

**XML AND WEB SERVICES:** Xml – Introduction-Form Navigation-XML Documents- XSL – XSLT- Web services-UDDI-WSDL-Java web services – Web resources.

**TEXT BOOKS:**

1. Harvey Deitel, Abbey Deitel, Internet and World Wide Web: How To Program 5th Edition.
2. Herbert Schildt, Java - The Complete Reference, 7th Edition. Tata McGraw- Hill Edition.
3. Michael Morrison XML Unleashed Tech media SAMS.

**REFERENCE BOOKS:**

1. John Pollock, Java script - A Beginners Guide, 3rd Edition — Tata McGraw-Hill Edition.
2. Keyur Shah, Gateway to Java Programmer Sun Certification, Tata McGraw Hill, 2002.

**IMAGE PROCESSING (Professional Elective – I)****B.Tech. III Year I Sem.**

<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:**

1. Students are expected to have knowledge in linear signals and systems, Fourier Transform, basic linear algebra, basic probability theory and basic programming techniques; knowledge of Digital Signal Processing is desirable.
2. A course on “Computational Mathematics”
3. A course on “Computer Oriented Statistical Methods”

**Course Objectives:**

1. Provide a theoretical and mathematical foundation of fundamental Digital Image Processing concepts.
2. The topics include image acquisition; sampling and quantization; preprocessing; enhancement; restoration; segmentation; and compression.

**Course Outcomes:**

1. Demonstrate the knowledge of the basic concepts of two-dimensional signal acquisition, sampling, and quantization.
2. Demonstrate the knowledge of filtering techniques.
3. Demonstrate the knowledge of 2D transformation techniques.
4. Demonstrate the knowledge of image enhancement, segmentation, restoration and compression techniques.

**UNIT - I**

**Digital Image Fundamentals:** Digital Image through Scanner, Digital Camera. Concept of Gray Levels. Gray Level to Binary Image Conversion. Sampling and Quantization. Relationship between Pixels. Imaging Geometry. 2D Transformations-DFT, DCT, KLT and SVD.

**UNIT - II**

Image Enhancement in Spatial Domain Point Processing, Histogram Processing, Spatial Filtering, Enhancement in Frequency Domain, Image Smoothing, Image Sharpening.

**UNIT - III**

Image Restoration Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.

**UNIT - IV**

Image Segmentation Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region Oriented Segmentation.

**UNIT - V**

Image Compression Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Source Encoder and Decoder, Error Free Compression, Lossy Compression.

**TEXT BOOK:**

1. Digital Image Processing: R.C. Gonzalez & R. E. Woods, Addison Wesley/ Pearson Education, 2<sup>nd</sup> Ed, 2004.

**REFERENCE BOOKS:**

1. Fundamentals of Digital Image Processing: A. K. Jain, PHI.
2. Digital Image Processing using MATLAB: Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins: Pearson Education India, 2004.
3. Digital Image Processing: William K. Pratt, John Wiley, 3<sup>rd</sup> Edition, 2004.

**COMPUTER GRAPHICS (Professional Elective – I)**

B.Tech. III Year I Sem.

L	T	P	C
3	0	0	3

**Prerequisites:**

1. Familiarity with the theory and use of coordinate geometry and of linear algebra such as matrix multiplication.
2. A course on “Computer Programming and Data Structures”

**Course Objectives:**

- The aim of this course is to provide an introduction of fundamental concepts and theory of computer graphics.
- Topics covered include graphics systems and input devices; geometric representations and 2D/3D transformations; viewing and projections; illumination and color models; animation; rendering and implementation; visible surface detection;

**Course Outcomes:**

- Acquire familiarity with the relevant mathematics of computer graphics.
- Be able to design basic graphics application programs, including animation
- Be able to design applications that display graphic images to given specifications

**UNIT - I**

**Introduction:** Application areas of Computer Graphics, overview of graphics systems, video-display devices, raster-scan systems, random scan systems, graphics monitors and work stations and input devices. **Output primitives:** Points and lines, line drawing algorithms (Bresenham’s and DDA Algorithm), mid-point circle and ellipse algorithms. **Polygon Filling:** Scan-line algorithm, boundary-fill and flood-fill algorithms

**UNIT - II**

**2-D geometrical transforms:** Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems. **2-D viewing:** The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland algorithms, Sutherland – Hodgeman polygon clipping algorithm.

**UNIT - III**

**3-D object representation:** Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces. Basic illumination models, polygon rendering methods.

**UNIT - IV**

**3-D Geometric transformations:** Translation, rotation, scaling, reflection and shear transformations, composite transformations. **3-D viewing:** Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping.

**UNIT - V**

**Computer animation:** Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications.

**Visible surface detection methods:** Classification, back-face detection, depth-buffer, BSP-tree methods and area sub-division methods.

**TEXT BOOKS:**

1. “Computer Graphics C version”, Donald Hearn and M. Pauline Baker, Pearson Education
2. “Computer Graphics Principles & practice”, second edition in C, Foley, Van Dam, Feiner and Hughes, Pearson Education.
3. Computer Graphics, Steven Harrington, TMH

**REFERENCE BOOKS:**

1. Procedural elements for Computer Graphics, David F Rogers, Tata Mc Graw hill, 2<sup>nd</sup> edition.
2. Principles of Interactive Computer Graphics”, Neuman and Sproul, TMH.
3. Principles of Computer Graphics, Shalini Govil, Pai, 2005, Springer.

**SPATIAL AND MULTIMEDIA DATABASES (Professional Elective – II)****B.Tech. III Year I Sem.**

<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:** Introduce the basic concepts, data models and indexing structures for spatial data, multimedia data.

**Course Outcomes:**

1. Understand data models, storage, indexing and design of spatial databases.
2. Represent image database with R-tree.
3. Store and retrieve multimedia data.

**UNIT - I**

Introduction to Spatial Databases: Overview, beneficiaries, GIA and SDBMS, users, Space taxonomy, query language, query processing, query optimization. Spatial Concepts and Data Models: Models of Spatial information, three step database design, Extending the ER model with spatial concept, object-oriented data modeling. Spatial Query Languages.

**UNIT - II**

Spatial Storage and Indexing: Storage-disks and files, spatial indexing, TR\*, spatial join index. Query processing and optimization – Evaluation of Spatial operations, query optimization, Analysis of Spatial index structures, distributed and parallel spatial database system. Multidimensional Data Structures: k-d Trees, Point Quadrees, The MX-Quadtree, R-Trees, comparison of Different Data Structures.

**UNIT - III**

Image Databases: Raw Images, Compressed Image Representations, Image Processing: Segmentation, Similarity-Based Retrieval, Alternative Image DB Paradigms, Representing Image DBs with Relations, Representing Image DBs with R-Trees, Retrieving Images By Spatial Layout, Implementations. Text/Document Databases: Precision and Recall, Stop Lists, Word Stems, and Frequency Tables, Latent Semantic Indexing, TV-Trees, Other Retrieval Techniques.

**UNIT - IV**

Video Databases : Organizing Content of a Single Video, Querying Content of Video Libraries, Video Segmentation, video Standards Audio Databases : A General Model of Audio Data, Capturing Audio Content through Discrete Transformation, Indexing Audio Data Multimedia Databases : Design and Architecture of a Multimedia Database, Organizing Multimedia Data Based on The Principle of Uniformity, Media Abstractions, Query Languages for Retrieving Multimedia Data, Indexing SMDSS with Enhanced Inverted Indices, Query Relaxation/Expansion.

**UNIT - V**

Creating Distributed Multimedia Presentations: Objects in Multimedia Presentations, Specifying Multimedia Documents with Temporal Constraints, Efficient Solution of Temporal Presentation Constraints, Spatial Constraints. Distributed Media Servers: Distributed multimedia server architecture, distributed retrieval plans, optimal distributed retrieval plans.

**TEXT BOOKS:**

1. Shashi Shekhar, Sanjiv Chawla, Spatial Databases-A Tour, Pearson Education.
2. V.S. Subrahmanian, Principles of Multimedia Database Systems, Morgan Kauffman.

**REFERENCE BOOK:**

1. Multimedia Databases: An object relational approach, Lynne Dunckley, Pearson Education.
2. Multimedia Database Systems, Prabhakaran, Springer.

**INFORMATION RETRIEVAL SYSTEMS (Professional Elective – II)****B.Tech. III Year I Sem.**

L	T	P	C
3	0	0	3

**Prerequisites:** Data Structures.**Course Objectives:**

1. To learn the important concepts and algorithms in IRS
2. To understand the data/file structures that are necessary to design, and implement information retrieval (IR) systems.

**Course Outcomes:**

1. Ability to apply IR principles to locate relevant information large collections of data
2. Ability to design different document clustering algorithms
3. Implement retrieval systems for web search tasks.
4. Design an Information Retrieval System for web search tasks.

**UNIT - I**

Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses

Information Retrieval System Capabilities: Search Capabilities, Browse Capabilities, Miscellaneous Capabilities

**UNIT - II**

Cataloging and Indexing: History and Objectives of Indexing, Indexing Process, Automatic Indexing, Information Extraction

Data Structure: Introduction to Data Structure, Stemming Algorithms, Inverted File Structure, N-Gram Data Structures, PAT Data Structure, Signature File Structure, Hypertext and XML Data Structures, Hidden Markov Models

**UNIT - III**

Automatic Indexing: Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing, Hypertext Linkages. Document and Term Clustering: Introduction to Clustering, Thesaurus Generation, Item Clustering, Hierarchy of Clusters

**UNIT - IV**

User Search Techniques: Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Selective Dissemination of Information Search, Weighted Searches of Boolean Systems, Searching the INTERNET and Hypertext

Information Visualization: Introduction to Information Visualization, Cognition and Perception, Information Visualization Technologies

**UNIT - V**

Text Search Algorithms: Introduction to Text Search Techniques, Software Text Search Algorithms, Hardware Text Search Systems

Multimedia Information Retrieval: Spoken Language Audio Retrieval, Non-Speech Audio Retrieval, Graph Retrieval, Imagery Retrieval, Video Retrieval

**TEXT BOOK:**

1. Information Storage and Retrieval Systems – Theory and Implementation, Second Edition, Gerald J. Kowalski, Mark T. Maybury, Springer.

**REFERENCE BOOKS:**

1. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.
2. Information Storage & Retrieval By Robert Korfhage – John Wiley & Sons.
3. Modern Information Retrieval By Yates and Neto Pearson Education.

**SOFTWARE PROJECT MANAGEMENT (Professional Elective – II)****B.Tech. III Year I Sem.**

<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:** A course on “Software Engineering”.**Course Objectives**

1. To develop skills in software project management
2. The topics include-software economics; software development life cycle; artifacts of the process; workflows; checkpoints; project organization and responsibilities; project control and process instrumentation.

**Course Outcomes**

1. Gain knowledge of software economics, phases in the life cycle of software development, project organization, project control and process instrumentation.
2. Analyze the major and minor milestones, artifacts and metrics from management and technical perspective.
3. Design and develop software product using conventional and modern principles of software project management

**UNIT - I**

**Conventional Software Management:** The waterfall model, conventional software Management performance. **Evolution of Software Economics:** Software economics, pragmatic software cost estimation.

**UNIT - II**

**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 - III**

**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. **Model based software architectures:** A Management perspective and technical perspective. **Work Flows of the process:** Software process workflows, Iteration workflows.

**UNIT - IV**

**Checkpoints of the process:** Major milestones, Minor Milestones, Periodic status assessments. Iterative Process Planning: work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning. **Project Organizations and Responsibilities:** Line-of-Business Organizations, Project Organizations, evolution of Organizations. Process Automation: Automation building blocks, The Project Environment.

**UNIT - V**

**Project Control and Process instrumentation:** The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation. Tailoring the Process: Process discriminates. **Future Software Project Management:** modern Project Profiles, Next generation Software economics, modern process transitions. **Case Study:** The command Center Processing and Display system- Replacement (CCPDS-R).

**TEXT BOOK:**

1. Software Project Management, Walker Royce: Pearson Education, 2005.

**REFERENCE BOOKS:**

1. Software Project Management, Bob Hughes and Mike Cotterell: Tata McGraw-Hill Edition.
2. Software Project Management, Joel Henry, Pearson Education.
3. Software Project Management in practice, Pankaj Jalote, Pearson Education. 2005.

**DEVOPS (Professional Elective – II)****B.Tech. III Year I Sem.**

L	T	P	C
3	0	0	3

**Course Objectives:** The main objectives of this course are to

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

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

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

**UNIT - I****Introduction:** Introduction, Agile development model, DevOps, and ITIL. DevOps process and Continuous Delivery, Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples**UNIT - II****Software development models and DevOps:** DevOps Lifecycle for Business Agility, DevOps, and Continuous Testing.**DevOps influence on Architecture:** Introducing software architecture, The monolithic scenario, Architecture rules of thumb, The separation of concerns, Handling database migrations, Microservices, and the data tier, DevOps, architecture, and resilience.**UNIT - III****Introduction to project management:** The need for source code control, The history of source code management, Roles and code, source code management system and migrations, Shared authentication, Hosted Git servers, Different Git server implementations, Docker intermission, Gerrit, The pull request model, GitLab.**UNIT - IV****Integrating the system:** Build systems, Jenkins build server, Managing build dependencies, Jenkins plugins, and file system layout, The host server, Build slaves, Software on the host, Triggers, Job chaining and build pipelines, Build servers and infrastructure as code, Building by dependency order, Build phases, Alternative build servers, Collating quality measures.**UNIT - V****Testing Tools and automation:** Various types of testing, Automation of testing Pros and cons, Selenium - Introduction, Selenium features, JavaScript testing, Testing backend integration points, Test-driven development, REPL-driven development**Deployment of the system:** Deployment systems, Virtualization stacks, code execution at the client, Puppet master and agents, Ansible, Deployment tools: Chef, Salt Stack and Docker**TEXT BOOKS:**

1. Joakim Verona. Practical Devops, Second Edition. Ingram short title; 2nd edition (2018). ISBN-10: 1788392574
2. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952

**REFERENCE BOOK:**

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-10.

**COMPUTER VISION AND ROBOTICS (Professional Elective – II)****B.Tech. III Year I Sem.**

<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:** UG level Course in Linear Algebra and Probability.**Course Objectives:**

1. To understand the Fundamental Concepts Related To sources, shadows and shading.
2. To understand the The Geometry of Multiple Views.

**Course Outcomes:**

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

**UNIT - I****CAMERAS:** Pinhole Cameras.**Radiometry – Measuring Light:** 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.**Texture:** 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 Gestalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,**UNIT - IV****Segmentation by Fitting a Model:** The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness**Segmentation and Fitting Using Probabilistic Methods:** Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice.**Tracking With Linear Dynamic Models:** Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples**UNIT - V****Geometric Camera Models:** Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations.**Geometric Camera Calibration:** Least-Squares Parameter Estimation, A Linear Approach to Camera

Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile Robot Localization.

**Model-Based Vision:** Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment.

**TEXT BOOKS:**

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

**REFERENCE BOOKS:**

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

**DATA MINING LAB****B.Tech. III Year I Sem.****L T P C**  
**0 0 3 1.5****Prerequisites:** A course on “Database Management System”.**Course Objectives:**

1. The course is intended to obtain hands-on experience using data mining software.
2. Intended to provide practical exposure of the concepts in data mining algorithms.

**Course Outcomes:**

3. Apply preprocessing statistical methods for any given raw data.
4. Gain practical experience of constructing a data warehouse.
5. Implement various algorithms for data mining in order to discover interesting patterns from large amounts of data.
6. Apply OLAP operations on data cube construction.

**LIST OF EXPERIMENTS:**

Experiments using Weka &amp; Pentaho Tools

1. Data Processing Techniques:
  - (i) Data cleaning
  - (ii) Data transformation – Normalization
  - (iii) Data integration
2. Partitioning - Horizontal, Vertical, Round Robin, Hash based
3. Data Warehouse schemas – star, snowflake, fact constellation
4. Data cube construction – OLAP operations
5. Data Extraction, Transformations & Loading operations
6. Implementation of Attribute oriented induction algorithm
7. Implementation of apriori algorithm
8. Implementation of FP – Growth algorithm
9. Implementation of Decision Tree Induction
10. Calculating Information gain measures
11. Classification of data using Bayesian approach
12. Classification of data using K – nearest neighbour approach
13. Implementation of K – means algorithm
14. Implementation of BIRCH algorithm
15. Implementation of PAM algorithm
16. Implementation of DBSCAN algorithm

**TEXT BOOKS:**

1. Data Mining – Concepts and Techniques - JIAWEI HAN & MICHELINE KAMBER, Elsevier.
2. Data Warehousing, Data Mining & OLAP- Alex Berson and Stephen J. Smith- Tata McGraw-Hill Edition, Tenth reprint 2007.

**REFERENCE BOOK:**

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Anuj Karpatne, Introduction to Data Mining, Pearson Education.

**COMPUTER NETWORKS LAB****B.Tech. III Year I Sem.**

L	T	P	C
0	0	3	1.5

**Course Objectives:**

1. To understand the working principle of various communication protocols.
2. To understand the network simulator environment and visualize a network topology and observe its performance
3. To analyze the traffic flow and the contents of protocol frames

**Course Outcomes:**

1. Implement data link layer framing methods
2. Analyze error detection and error correction codes.
3. Implement and analyze routing and congestion issues in network design.
4. Implement Encoding and Decoding techniques used in presentation layer
5. To be able to work with different network tools

**List of Experiments**

1. Implement the data link layer framing methods such as character, character-stuffing and bit stuffing.
2. Write a program to compute CRC code for the polynomials CRC-12, CRC-16 and CRC CCIP
3. Develop a simple data link layer that performs the flow control using the sliding window protocol, and loss recovery using the Go-Back-N mechanism.
4. Implement Dijkstra's algorithm to compute the shortest path through a network
5. Take an example subnet of hosts and obtain a broadcast tree for the subnet.
6. Implement distance vector routing algorithm for obtaining routing tables at each node.
7. Implement data encryption and data decryption
8. Write a program for congestion control using Leaky bucket algorithm.
9. Write a program for frame sorting techniques used in buffers.
10. Wireshark
  - i. Packet Capture Using Wire shark
  - ii. Starting Wire shark
  - iii. Viewing Captured Traffic
  - iv. Analysis and Statistics & Filters.
11. How to run Nmap scan
12. Operating System Detection using Nmap
13. 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.
  - vi. Simulate to Plot Congestion for Different Source/Destination
  - vii. Simulate to Determine the Performance with respect to Transmission of Packets

**TEXT BOOK:**

1. Computer Networks, Andrew S Tanenbaum, David. j. Wetherall, 5<sup>th</sup> Edition. Pearson Education/PHI.

**REFERENCE BOOKS:**

1. An Engineering Approach to Computer Networks, S. Keshav, 2<sup>nd</sup> Edition, Pearson Education
2. Data Communications and Networking – Behrouz A. Forouzan. 3rd Edition, TMH.

**ADVANCED COMMUNICATION SKILLS LAB****B.Tech. III Year I Sem.**

L	T	P	C
0	0	2	1

**1. INTRODUCTION:**

The introduction of the Advanced Communication Skills Lab is considered essential at 3<sup>rd</sup> year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalized context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information to organize ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.
- Taking part in social and professional communication.

**2. OBJECTIVES:**

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

**3. SYLLABUS:**

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary** - Starting a conversation – responding appropriately and relevantly – using the right body language – Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.
2. **Activities on Reading Comprehension** –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading& effective googling.
3. **Activities on Writing Skills** – Structure and presentation of different types of writing – *letter writing/Resume writing/ e-correspondence/Technical report writing/* – planning for writing – improving one's writing.
4. **Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentations through posters/projects/reports/ e-mails/assignments etc.
5. **Activities on Group Discussion and Interview Skills** – Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

**4. MINIMUM REQUIREMENT:**

The Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:

- Spacious room with appropriate acoustics.
- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system
- P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
- T. V, a digital stereo & Camcorder
- Headphones of High quality

**5. SUGGESTED SOFTWARE:**

The software consisting of the prescribed topics elaborated above should be procured and used.

- Oxford Advanced Learner's Compass, 7<sup>th</sup> Edition
- DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.
- Lingua TOEFL CBT Insider, by Dream tech
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)

**TEXT BOOKS:**

1. Effective Technical Communication by M Asharaf Rizvi. McGraw Hill Education (India) Pvt. Ltd. 2<sup>nd</sup> Edition
2. Academic Writing: A Handbook for International Students by Stephen Bailey, Routledge, 5<sup>th</sup> Edition.

**REFERENCE BOOKS:**

1. Learn Correct English – A Book of Grammar, Usage and Composition by Shiv K. Kumar and Hemalatha Nagarajan. Pearson 2007
2. Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd, 2016.
3. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
4. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
5. English Vocabulary in Use series, Cambridge University Press 2008.
6. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning.
7. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
8. Job Hunting by Colm Downes, Cambridge University Press 2008.
9. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill 2009.

**INTELLECTUAL PROPERTY RIGHTS****B.Tech. III Year I Sem.****L T P C**  
**3 0 0 0****UNIT – I**

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

**UNIT – II**

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

**UNIT – III**

Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

**UNIT – IV**

Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.

Unfair competition: Misappropriation right of publicity, false advertising.

**UNIT – V**

New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits.

International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

**TEXT & REFERENCE BOOKS:**

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata McGraw Hill Publishing company ltd.

**COMPILER DESIGN****B.Tech. III Year II Sem.**

L	T	P	C
3	1	0	4

**Prerequisites:**

1. A course on "Formal Languages and Automata Theory".
2. A course on "Computer Organization and architecture".
3. A course on "Computer Programming and Data Structures".

**Course Objectives:**

- Introduce the major concepts of language translation and compiler design and impart the knowledge of practical skills necessary for constructing a compiler.
- Topics include phases of compiler, parsing, syntax directed translation, type checking use of symbol tables, code optimization techniques, intermediate code generation, code generation and data flow analysis.

**Course Outcomes:**

- Demonstrate the ability to design a compiler given a set of language features.
- Demonstrate the knowledge of patterns, tokens & regular expressions for lexical analysis.
- Acquire skills in using lex tool & yacc tool for developing a scanner and parser.
- Design and implement LL and LR parsers
- Design algorithms to do code optimization in order to improve the performance of a program in terms of space and time complexity.
- Design algorithms to generate machine code.

**UNIT - I**

**Introduction:** The structure of a compiler, the science of building a compiler, programming language basics. **Lexical Analysis:** The Role of the Lexical Analyzer, Input Buffering, Recognition of Tokens, The Lexical-Analyzer Generator Lex, Finite Automata, From Regular Expressions to Automata, Design of a Lexical-Analyzer Generator, Optimization of DFA-Based Pattern Matchers.

**UNIT - II**

**Syntax Analysis:** Introduction, Context-Free Grammars, Writing a Grammar, Top-Down Parsing, Bottom-Up Parsing, Introduction to LR Parsing: Simple LR, More Powerful LR Parsers, Using Ambiguous Grammars and Parser Generators.

**UNIT - III**

**Syntax-Directed Translation:** Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax-Directed Translation, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's. **Intermediate-Code Generation:** Variants of Syntax Trees, Three-Address Code, Types and Declarations, Type Checking, Control Flow, Switch-Statements, Intermediate Code for Procedures.

**UNIT - IV**

**Run-Time Environments:** Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management, Introduction to Garbage Collection, Introduction to Trace-Based Collection.

**Code Generation:** Issues in the Design of a Code Generator, The Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, A Simple Code Generator, Peephole Optimization, Register Allocation and Assignment, Dynamic Programming Code-Generation.

**UNIT - V**

**Machine-Independent Optimization:** The Principal Sources of Optimization, Introduction to Data-Flow Analysis, Foundations of Data-Flow Analysis, Constant Propagation, Partial-Redundancy Elimination, Loops in Flow Graphs.

**TEXT BOOK:**

1. Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman.

**REFERENCE BOOKS:**

1. Lex & Yacc – John R. Levine, Tony Mason, Doug Brown, O'reilly
2. Compiler Construction, Loudon, Thomson.

**MACHINE LEARNING****B.Tech. III Year II Sem.**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Prerequisites**

1. Data Structures.
2. Knowledge on statistical methods.

**Course Objectives**

- This course explains machine learning techniques such as decision tree learning, Bayesian learning etc.
- To understand computational learning theory.
- To study the pattern comparison techniques.

**Course Outcomes**

- Understand the concepts of computational intelligence like machine learning.
- Ability to get the skill to apply machine learning techniques to address the real time problems in different areas.
- Understand the Neural Networks and its usage in machine learning application.

**UNIT - I**

Introduction - Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning.

Concept learning and the general to specific ordering – introduction, a concept learning task, concept learning as search, find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, remarks on version spaces and candidate elimination, inductive bias.

**Decision Tree Learning** – Introduction, decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning.

**UNIT - II**

**Artificial Neural Networks-1**– Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back-propagation algorithm.

**Artificial Neural Networks-2**- Remarks on the Back-Propagation algorithm, An illustrative example: face recognition, advanced topics in artificial neural networks.

**Evaluation Hypotheses** – Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms.

**UNIT - III**

**Bayesian learning** – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classifier, Gibbs algorithm, Naïve Bayes classifier, an example: learning to classify text, Bayesian belief networks, the EM algorithm.

**Computational learning theory** – Introduction, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis space, sample complexity for infinite hypothesis spaces, the mistake bound model of learning.

**Instance-Based Learning**- Introduction, *k*-nearest neighbour algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning.

**UNIT- IV**

**Genetic Algorithms** – Motivation, Genetic algorithms, an illustrative example, hypothesis space search, genetic programming, models of evolution and learning, parallelizing genetic algorithms.

**Learning Sets of Rules** – Introduction, sequential covering algorithms, learning rule sets: summary, learning First-Order rules, learning sets of First-Order rules: FOIL, Induction as inverted deduction, inverting resolution.

**Reinforcement Learning** – Introduction, the learning task, Q-learning, non-deterministic, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.

#### **UNIT - V**

**Analytical Learning-1**- Introduction, learning with perfect domain theories: PROLOG-EBG, remarks on explanation-based learning, explanation-based learning of search control knowledge.

**Analytical Learning-2**-Using prior knowledge to alter the search objective, using prior knowledge to augment search operators.

**Combining Inductive and Analytical Learning** – Motivation, inductive-analytical approaches to learning, using prior knowledge to initialize the hypothesis.

#### **TEXT BOOK:**

1. Machine Learning – Tom M. Mitchell, - MGH.

#### **REFERENCE BOOK:**

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis.

**BIG DATA ANALYTICS****B.Tech. III Year II Sem.**

L	T	P	C
3	1	0	4

**Course Objectives:**

1. The purpose of this course is to provide the students with the knowledge of Big data Analytics principles and techniques.
2. This course is also designed to give an exposure of the frontiers of Big data Analytics

**Courses Outcomes:**

1. Ability to explain the foundations, definitions, and challenges of Big Data and various Analytical tools.
2. Ability to program using HADOOP and Map reduce, NOSQL
3. Ability to understand the importance of Big Data in Social Media and Mining.

**UNIT - I**

**Introduction to Big Data:** Big Data and its Importance – Four V's of Big Data – Drivers for Big Data – Introduction to Big Data Analytics – Big Data Analytics applications.

**UNIT - II**

**Big Data Technologies:** Hadoop's Parallel World – Data discovery – Open source technology for Big Data Analytics – cloud and Big Data – Predictive Analytics – Mobile Business Intelligence and Big Data

**UNIT - III**

**Introduction Hadoop:** Big Data – Apache Hadoop & Hadoop Eco System – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.

**UNIT - IV**

**Hadoop Architecture:** Hadoop: RDBMS Vs Hadoop, Hadoop Overview, Hadoop distributors, HDFS, HDFS Daemons, Anatomy of File Write and Read., Name Node, Secondary Name Node, and Data Node, HDFS Architecture, Hadoop Configuration, Map Reduce Framework, Role of HBase in Big Data processing, HIVE, PIG.

**UNIT - V**

**Data Analytics with R Machine Learning:** Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering, Social Media Analytics, Mobile Analytics, Big Data Analytics with BigR.

**TEXT BOOKS:**

1. Big Data Analytics, Seema Acharya, Subhasini Chellappan, Wiley 2015.
2. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Michael Minelli, Michehe Chambers, 1<sup>st</sup> Edition, Ambiga Dhiraj, Wiely CIO Series, 2013.
3. Hadoop: The Definitive Guide, Tom White, 3<sup>rd</sup> Edition, O'Reilly Media, 2012.
4. Big Data Analytics: Disruptive Technologies for Changing the Game, Arvind Sathi, 1<sup>st</sup> Edition, IBM Corporation, 2012.

**REFERENCE BOOKS:**

1. Big Data and Business Analytics, Jay Liebowitz, Auerbach Publications, CRC press (2013)
2. Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop, Tom Plunkett, Mark Hornick, McGraw-Hill/Osborne Media (2013), Oracle press.
3. Professional Hadoop Solutions, Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, Wiley, ISBN: 9788126551071, 2015.
4. Understanding Big data, Chris Eaton, Dirk deroos et al. McGraw Hill, 2012.
5. Intelligent Data Analysis, Michael Berthold, David J. Hand, Springer, 2007.
6. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Bill Franks, 1<sup>st</sup> Edition, Wiley and SAS Business Series, 2012.

**SOFTWARE TESTING METHODOLOGIES (Professional Elective – III)****B.Tech. III Year II Sem.**

L	T	P	C
3	0	0	3

**Prerequisites:** A course on “Software Engineering”.**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 latest tools.

**Course Outcomes:** Design and develop the best test strategies in accordance to the development model.**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. Dataflow testing: Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing. Domain Testing: domains and paths, Nice &amp; 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 &amp; path expression, reduction procedure, applications, regular expressions &amp; 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 &amp; bad state graphs, state testing, Testability tips.

**UNIT - V**

Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools. (Student should be given an exposure to a tool like JMeter or Win-runner).

**TEXT BOOKS:**

1. Software Testing techniques - Baris Beizer, 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.

**DATA VISUALIZATION TECHNIQUES (Professional Elective – III)****B.Tech. III Year II Sem.**

L	T	P	C
3	0	0	3

**Course Objective:** To understand various data visualization techniques.**Course Outcomes:**

1. Visualize the objects in different dimensions.
2. Design and process the data for Virtualization.
3. Apply the visualization techniques in physical sciences, computer science, applied mathematics and medical science.
4. Apply the virtualization techniques for research projects. (K1, K3).

**UNIT - I**

**Introduction and Data Foundation:** Basics - Relationship between Visualization and Other Fields - The Visualization Process - Pseudo code Conventions - The Scatter plot. Data Foundation - Types of Data - Structure within and between Records - Data Preprocessing - Data Sets

**UNIT - II**

**Foundations for Visualization:** Visualization stages - Semiology of Graphical Symbols - The Eight Visual Variables - Historical Perspective - Taxonomies - Experimental Semiotics based on Perception Gibson's Affordance theory – A Model of Perceptual Processing.

**UNIT - III**

**Visualization Techniques: Spatial Data:** One-Dimensional Data - Two-Dimensional Data – Three-Dimensional Data - Dynamic Data - Combining Techniques. **Geospatial Data:** Visualizing Spatial Data - Visualization of Point Data -Visualization of Line Data - Visualization of Area Data - Other Issues in Geospatial Data Visualization **Multivariate Data:** Point-Based Techniques - Line- Based Techniques - Region-Based Techniques - Combinations of Techniques – Trees Displaying Hierarchical Structures – Graphics and Networks- Displaying Arbitrary Graphs/Networks.

**UNIT - IV**

**Interaction Concepts and Techniques: Text and Document Visualization:** Introduction - Levels of Text Representations - The Vector Space Model - Single Document Visualizations -Document Collection Visualizations - Extended Text Visualizations **Interaction Concepts:** Interaction Operators - Interaction Operands and Spaces - A Unified Framework. **Interaction Techniques:** Screen Space - Object-Space -Data Space -Attribute Space- Data Structure Space - Visualization Structure - Animating Transformations -Interaction Control

**UNIT - V**

**Research Directions in Virtualizations:** Steps in designing Visualizations – Problems in designing effective Visualizations- Issues of Data. Issues of Cognition, Perception, and Reasoning. Issues of System Design Evaluation, Hardware and Applications.

**TEXT BOOKS:**

1. Matthew Ward, Georges Grinstein and Daniel Keim, "Interactive Data Visualization Foundations, Techniques, Applications", 2010.
2. Colin Ware, "Information Visualization Perception for Design", 2nd edition, Morgan Kaufmann Publishers, 2004.

**REFERENCE BOOKS:**

1. Robert Spence "Information visualization – Design for interaction", Pearson Education, 2<sup>nd</sup> Edition, 2007.
2. Alexandru C. Telea, "Data Visualization: Principles and Practice," A. K. Peters Ltd, 2008.

**SCRIPTING LANGUAGES (Professional Elective – III)****B.Tech. III Year II Sem.**

<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:**

1. A course on “Computer Programming and Data Structures”.
2. A course on “Object Oriented Programming Concepts”.

**Course Objectives:**

- This course introduces the script programming paradigm.
- Introduces scripting languages such as Perl, Ruby and TCL.
- Learning TCL

**Course Outcomes:**

- Comprehend the differences between typical scripting languages and typical system and application programming languages.
- Gain knowledge of the strengths and weakness of Perl, TCL and Ruby; and select an appropriate language for solving a given problem.
- Acquire programming skills in scripting language.

**UNIT - I**

Introduction: Ruby, Rails, The structure and Execution of Ruby Programs, Package Management with RUBYGEMS, Ruby and web: Writing CGI scripts, cookies, Choice of Webservers, SOAP and webservices

RubyTk – Simple Tk Application, widgets, Binding events, Canvas, scrolling

**UNIT - II**

Extending Ruby: Ruby Objects in C, the Jukebox extension, Memory allocation, Ruby Type System, Embedding Ruby to Other Languages, Embedding a Ruby Interpreter

**UNIT - III**

Introduction to PERL and Scripting

Scripts and Programs, Origin of Scripting, Scripting Today, Characteristics of Scripting Languages, Uses for Scripting Languages, Web Scripting, and the universe of Scripting Languages. PERL- Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines.

**UNIT - IV**

Advanced perl

Finer points of looping, pack and unpack, filesystem, eval, data structures, packages, modules, objects, interfacing to the operating system, Creating Internet ware applications, Dirty Hands Internet Programming, security Issues.

**UNIT - V****TCL**

TCL Structure, syntax, Variables and Data in TCL, Control Flow, Data Structures, input/output, procedures, strings, patterns, files, Advance TCL- eval, source, exec and uplevel commands, Name spaces, trapping errors, event driven programs, making applications internet aware, Nuts and Bolts Internet Programming, Security Issues, C Interface.

**Tk**

Tk-Visual Tool Kits, Fundamental Concepts of Tk, Tk by example, Events and Binding, Perl-Tk.

**TEXT BOOKS:**

1. The World of Scripting Languages, David Barron, Wiley Publications.
2. Ruby Programming language by David Flanagan and Yukihiro Matsumoto O'Reilly
3. "Programming Ruby" The Pragmatic Programmers guide by Dabve Thomas Second edition

**REFERENCE BOOKS:**

1. Open Source Web Development with LAMP using Linux Apache, MySQL, Perl and PHP, J. Lee and B. Ware (Addison Wesley) Pearson Education.
2. Perl by Example, E. Quigley, Pearson Education.
3. Programming Perl, Larry Wall, T. Christiansen and J. Orwant, O'Reilly, SPD.
4. Tcl and the Tk Tool kit, Ousterhout, Pearson Education.
5. Perl Power, J. P. Flynt, Cengage Learning.

**MOBILE APPLICATION DEVELOPMENT (Professional Elective – III)****B.Tech. III Year II Sem.**

<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:**

1. Acquaintance with JAVA programming.
2. A Course on DBMS.

**Course Objectives:**

- To demonstrate their understanding of the fundamentals of Android operating systems
- To improve their skills of using Android software development tools
- To demonstrate their ability to develop software with reasonable complexity on mobile platform
- To demonstrate their ability to deploy software to mobile devices
- To demonstrate their ability to debug programs running on mobile devices

**Course Outcomes:**

- Student understands the working of Android OS Practically.
- Student will be able to develop Android user interfaces
- Student will be able to develop, deploy and maintain the Android Applications.

**UNIT - I**

Introduction to Android Operating System: Android OS design and Features – Android development framework, SDK features, Installing and running applications on Android Studio, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools

Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Resources for different devices and languages, Runtime Configuration Changes  
Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes

**UNIT - II**

Android User Interface: Measurements – Device and pixel density independent measuring UNIT - s  
Layouts – Linear, Relative, Grid and Table Layouts

User Interface (UI) Components – Editable and non-editable TextViews, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers

Event Handling – Handling clicks or changes of various UI components

Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities

**UNIT - III**

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS

Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity

Notifications – Creating and Displaying notifications, Displaying Toasts

**UNIT - IV**

Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference

**UNIT - V**

Database – Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and etindelg data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update)

**TEXT BOOKS:**

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012.
2. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013.

**REFERENCE BOOK:**

2. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013.

**CRYPTOGRAPHY AND NETWORK SECURITY (Professional Elective – III)****B.Tech. III Year II Sem.**

L	T	P	C
3	0	0	3

**Course Objectives:**

- Explain the objectives of information security.
- Explain the importance and application of each of confidentiality, integrity, authentication and availability.
- Understand various cryptographic algorithms.
- Understand the basic categories of threats to computers and networks.
- Describe public-key cryptosystem.
- Describe the enhancements made to IPv4 by IPSec.
- Understand Intrusions and intrusion detection.
- Discuss the fundamental ideas of public-key cryptography.
- Generate and distribute a PGP key pair and use the PGP package to send an encrypted e-mail message.
- Discuss Web security and Firewalls.

**Course Outcomes:**

- Student will be able to understand basic cryptographic algorithms, message and web authentication and security issues.
- Ability to identify information system requirements for both of them such as client and server.
- Ability to understand the current legal issues towards information security.

**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 Concepts and Techniques:** Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.

**UNIT - II**

**Symmetric key Ciphers:** Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4.

**Asymmetric key Ciphers:** Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm.

**UNIT - III**

**Cryptographic Hash Functions:** Message Authentication, Secure Hash Algorithm (SHA-512),

**Message authentication codes:** Authentication requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme.

**Key Management and Distribution:** Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure.

**UNIT - IV**

**Transport-level Security:** Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH).

**Wireless Network Security:** Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN, IEEE 802.11i Wireless LAN Security.

**UNIT - V**

**E-Mail Security:** Pretty Good Privacy, S/MIME **IP Security:** IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, Combining security associations, Internet Key Exchange.

**Case Studies on Cryptography and security:** Secure Multiparty Calculation, Virtual Elections, Single sign On, Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability.

**TEXT BOOKS:**

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6<sup>th</sup> Edition.
2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3<sup>rd</sup> Edition.

**REFERENCE BOOKS:**

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1<sup>st</sup> Edition.
2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3<sup>rd</sup> Edition.
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH.
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning.
6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning.

**MACHINE LEARNING LAB****B.Tech. III Year II Sem.**

<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 Objective:** The objective of this lab is to get an overview of the various machine learning techniques and can able to demonstrate them using python.

**Course Outcomes:** After the completion of the course the student can able to:

- understand complexity of Machine Learning algorithms and their limitations;
- understand modern notions in data analysis-oriented computing;
- be capable of confidently applying common Machine Learning algorithms in practice and implementing their own;
- Be capable of performing experiments in Machine Learning using real-world data.

**List of Experiments**

1. The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school days in a week, the probability that it is Friday is 20 %. What is the probability that a student is absent given that today is Friday? Apply Baye's rule in python to get the result. (Ans: 15%)
2. Extract the data from database using python
3. Implement k-nearest neighbours classification using python
4. Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of k-means clustering with 3 means (i.e., 3 centroids)

VAR1	VAR2	CLASS
1.713	1.586	0
0.180	1.786	1
0.353	1.240	1
0.940	1.566	0
1.486	0.759	1
1.266	1.106	0
1.540	0.419	1
0.459	1.799	1
0.773	0.186	1

5. The following training examples map descriptions of individuals onto high, medium and low credit-worthiness.

medium skiing design single twenties no -> highRisk  
 high golf trading married forties yes -> lowRisk  
 low speedway transport married thirties yes -> medRisk  
 medium football banking single thirties yes -> lowRisk  
 high flying media married fifties yes -> highRisk  
 low football security single twenties no -> medRisk  
 medium golf media single thirties yes -> medRisk  
 medium golf transport married forties yes -> lowRisk  
 high skiing banking single thirties yes -> highRisk  
 low golf unemployed married forties yes -> highRisk

Input attributes are (from left to right) income, recreation, job, status, age-group, home-owner. Find the unconditional probability of `golf` and the conditional probability of `single` given `medRisk` in the dataset?

6. Implement linear regression using python.
7. Implement Naïve Bayes theorem to classify the English text
8. Implement an algorithm to demonstrate the significance of genetic algorithm
9. Implement the finite words classification system using Back-propagation algorithm

**BIG DATA ANALYTICS LAB****B.Tech. III Year II Sem.**

<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:**

1. The purpose of this course is to provide the students with the knowledge of Big data Analytics principles and techniques.
2. This course is also designed to give an exposure of the frontiers of Big data Analytics

**Course Outcomes:**

1. Use Excel as an Analytical tool and visualization tool.
2. Ability to program using HADOOP and Map reduce.
3. Ability to perform data analytics using ML in R.
4. Use cassandra to perform social media analytics.

**List of Experiments:**

1. Implement a simple map-reduce job that builds an inverted index on the set of input documents (Hadoop)
2. Process big data in HBase
3. Store and retrieve data in Pig
4. Perform Social media analysis using cassandra
5. Buyer event analytics using Cassandra on suitable product sales data.
6. Using Power Pivot (Excel) Perform the following on any dataset
  - a) Big Data Analytics
  - b) Big Data Charting
7. Use R-Project to carry out statistical analysis of big data
8. Use R-Project for data visualization of social media data

**TEXT BOOKS:**

1. Big Data Analytics, Seema Acharya, Subhashini Chellappan, Wiley 2015.
2. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Michael Minelli, Michehe Chambers, 1<sup>st</sup> Edition, Ambiga Dhiraj, Wiely CIO Series, 2013.
3. Hadoop: The Definitive Guide, Tom White, 3<sup>rd</sup> Edition, O'Reilly Media, 2012.
4. Big Data Analytics: Disruptive Technologies for Changing the Game, Arvind Sathi, 1<sup>st</sup> Edition, IBM Corporation, 2012.

**REFERENCE BOOKS:**

1. Big Data and Business Analytics, Jay Liebowitz, Auerbach Publications, CRC press (2013).
2. Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop, Tom Plunkett, Mark Hornick, McGraw-Hill/Osborne Media (2013), Oracle press.
3. Professional Hadoop Solutions, Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, Wiley, ISBN: 9788126551071, 2015.
4. Understanding Big data, Chris Eaton, Dirk deroos et al., McGraw Hill, 2012.
5. Intelligent Data Analysis, Michael Berthold, David J. Hand, Springer, 2007.
6. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Bill Franks, 1<sup>st</sup> Edition, Wiley and SAS Business Series, 2012.

**SOFTWARE TESTING METHODOLOGIES LAB (PE – III Lab)****B.Tech. III Year II Sem.**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Prerequisites:** A basic knowledge of programming.**Course Objectives:**

- To provide knowledge of Software Testing Methods.
- To develop skills in software test automation and management using latest tools.

**Course Outcome:**

- Design and develop the best test strategies in accordance to the development model.

**List of Experiments:**

1. Recording in context sensitive mode and analog mode
2. GUI checkpoint for single property
3. GUI checkpoint for single object/window
4. GUI checkpoint for multiple objects
5. a) Bitmap checkpoint for object/window  
a)Bitmap checkpoint for screen area
6. Database checkpoint for Default check
7. Database checkpoint for custom check
8. Database checkpoint for runtime record check
9. a) Data driven test for dynamic test data submission  
b) Data driven test through flat files  
c) Data driven test through front grids  
d) Data driven test through excel test
10. a) Batch testing without parameter passing  
b) Batch testing with parameter passing
11. Data driven batch
12. Silent mode test execution without any interruption
13. Test case for calculator in windows application

**TEXT BOOKS:**

1. Software Testing techniques - Baris Beizer, 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.

**DATA VISUALIZATION TECHNIQUES LAB (PE – III Lab)****B.Tech. III Year II Sem.**

L	T	P	C
0	0	2	1

**Course Objectives:**

1. Understand the various types of data, apply and evaluate the principles of data visualization.
2. Acquire skills to apply visualization techniques to a problem and its associated dataset.

**Course Outcomes:**

1. Identify the different data types, visualization types to bring out the insight.
2. Relate the visualization towards the problem based on the dataset to analyze and bring out valuable insight on a large dataset.
3. Demonstrate the analysis of a large dataset using various visualization techniques and tools.
4. Identify the different attributes and showcasing them in plots. Identify and create various visualizations for geospatial and table data.
5. Ability to create and interpret plots using R/Python.

**List of Experiments:**

1. Acquiring and plotting data.
2. Statistical Analysis – such as Multivariate Analysis, PCA, LDA, Correlation regression and analysis of variance.
3. Financial analysis using Clustering, Histogram and HeatMap.
4. Time-series analysis – stock market.
5. Visualization of various massive dataset - Finance - Healthcare - Census – Geospatial.
6. Visualization on Streaming dataset (Stock market dataset, weather forecasting).
7. Market-Basket Data analysis-visualization.
8. Text visualization using web analytics.

**TEXT BOOKS:**

1. Matthew Ward, Georges Grinstein and Daniel Keim, “Interactive Data Visualization Foundations, Techniques, Applications”, 2010.
2. Colin Ware, “Information Visualization Perception for Design”, 2nd edition, Morgan Kaufmann Publishers, 2004.

**REFERENCE BOOKS:**

1. Robert Spence “Information visualization – Design for interaction”, Pearson Education, 2 nd Edition, 2007.
2. Alexandru C. Telea, “Data Visualization: Principles and Practice,” A. K. Peters Ltd, 2008.

**SCRIPTING LANGUAGES LAB (PE – III Lab)****B.Tech. III Year II Sem.**

L	T	P	C
0	0	2	1

**Prerequisites:** Any High-level programming language (C, C++).**Course Objectives:**

1. To Understand the concepts of scripting languages for developing web-based projects
2. To understand the applications the of Ruby, TCL, Perl scripting languages

**Course Outcomes:**

1. Ability to understand the differences between Scripting languages and programming languages
2. Able to gain some fluency programming in Ruby, Perl, TCL

**List of Experiments:**

1. Write a Ruby script to create a new string which is n copies of a given string where n is a non-negative integer
2. Write a Ruby script which accept the radius of a circle from the user and compute the parameter and area.
3. Write a Ruby script which accept the user's first and last name and print them in reverse order with a space between them
4. Write a Ruby script to accept a filename from the user print the extension of that
5. Write a Ruby script to find the greatest of three numbers
6. Write a Ruby script to print odd numbers from 10 to 1
7. Write a Ruby script to check two integers and return true if one of them is 20 otherwise return their sum
8. Write a Ruby script to check two temperatures and return true if one is less than 0 and the other is greater than 100
9. Write a Ruby script to print the elements of a given array
10. Write a Ruby program to retrieve the total marks where subject name and marks of a student stored in a hash
11. Write a TCL script to find the factorial of a number
12. Write a TCL script that multiplies the numbers from 1 to 10
13. Write a TCL script for Sorting a list using a comparison function
14. Write a TCL script to (i)create a list (ii )append elements to the list (iii)Traverse the list (iv)Concatenate the list
15. Write a TCL script to comparing the file modified times.
16. Write a TCL script to Copy a file and translate to native format.
17. a) Write a Perl script to find the largest number among three numbers.  
b) Write a Perl script to print the multiplication tables from 1-10 using subroutines.
18. Write a Perl program to implement the following list of manipulating functions  
a)Shift  
b)Unshift  
c)Push
19. a) Write a Perl script to substitute a word, with another word in a string.  
b) Write a Perl script to validate IP address and email address.
20. Write a Perl script to print the file in reverse order using command line arguments

**TEXT BOOKS:**

1. The World of Scripting Languages, David Barron,Wiley Publications.
2. Ruby Programming language by David Flanagan and Yukihiro Matsumoto O'Reilly

3. "Programming Ruby" The Pragmatic Programmer's guide by Dabve Thomas Second edition

**REFERENCE BOOKS:**

1. Open Source Web Development with LAMP using Linux Apache, MySQL, Perl and PHP, J.Lee and B. Ware (Addison Wesley) Pearson Education.
2. Perl by Example, E. Quigley, Pearson Education.
3. Programming Perl, Larry Wall, T. Christiansen and J. Orwant, O'Reilly, SPD.
4. Tcl and the Tk Tool kit, Ousterhout, Pearson Education.
5. Perl Power, J. P. Flynt, Cengage Learning.

**MOBILE APPLICATION DEVELOPMENT LAB (PE - III Lab)****B.Tech. III Year II Sem.**

L	T	P	C
0	0	2	1

**Course Objectives:**

1. To learn how to develop Applications in android environment.
2. To learn how to develop user interface applications.
3. To learn how to develop URL related applications.

**Course Outcomes:**

1. Students understand the working of Android OS Practically.
2. Students will be able to develop user interfaces.
3. Students will be able to develop, deploy and maintain the Android Applications.

**List of Experiments:**

1. Create an Android application that shows Hello + name of the user and run it on an emulator.  
(b) Create an application that takes the name from a text box and shows hello message along with the name entered in text box, when the user clicks the OK button.
2. Create a screen that has input boxes for User Name, Password, Address, Gender (radio buttons for male and female), Age (numeric), Date of Birth (Date Picket), State (Spinner) and a Submit button. On clicking the submit button, print all the data below the Submit Button. Use (a) Linear Layout (b) Relative Layout and (c) Grid Layout or Table Layout.
3. Develop an application that shows names as a list and on selecting a name it should show the details of the candidate on the next screen with a "Back" button. If the screen is rotated to landscape mode (width greater than height), then the screen should show list on left fragment and details on right fragment instead of second screen with back button. Use Fragment transactions and Rotation event listener.
4. Develop an application that uses a menu with 3 options for dialing a number, opening a website and to send an SMS. On selecting an option, the appropriate action should be invoked using intents.
5. Develop an application that inserts some notifications into Notification area and whenever a notification is inserted, it should show a toast with details of the notification.
6. Create an application that uses a text file to store user names and passwords (tab separated fields and one record per line). When the user submits a login name and password through a screen, the details should be verified with the text file data and if they match, show a dialog saying that login is successful. Otherwise, show the dialog with Login Failed message.
7. Create a user registration application that stores the user details in a database table.
8. Create a database and a user table where the details of login names and passwords are stored. Insert some names and passwords initially. Now the login details entered by the user should be verified with the database and an appropriate dialog should be shown to the user.
9. Create an admin application for the user table, which shows all records as a list and the admin can select any record for edit or modify. The results should be reflected in the table.
10. Develop an application that shows all contacts of the phone along with details like name, phone number, mobile number etc.

11. Create an application that saves user information like name, age, gender etc. in shared preference and retrieves them when the program restarts.

12. Create an alarm that rings every Sunday at 8:00 AM. Modify it to use a time picker to set alarm time.

13. Create an application that shows the given URL (from a text field) in a browser

**TEXT BOOKS:**

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012.
2. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013.

**REFERENCE BOOK:**

1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013.

**CRYPTOGRAPHY AND NETWORK SECURITY LAB (PE – III Lab)****B.Tech. III Year II Sem.**

L	T	P	C
0	0	2	1

**Course Objectives:**

1. Explain the objectives of information security.
2. Explain the importance and application of each of confidentiality, integrity, authentication and availability.
3. Understand various cryptographic algorithms.

**Course Outcomes:**

1. Understand basic cryptographic algorithms, message and web authentication and security issues.
2. Identify information system requirements for both of them such as client and server.
3. Understand the current legal issues towards information security.

**List of Experiments:**

1. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should XOR each character in this string with 0 and displays the result.
2. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should AND or and XOR each character in this string with 127 and display the result.
3. Write a Java program to perform encryption and decryption using the following algorithms
  - a. Ceaser cipher
  - b. Substitution cipher
  - c. Hill Cipher
4. Write a C/JAVA program to implement the DES algorithm logic.
5. Write a C/JAVA program to implement the Blowfish algorithm logic.
6. Write a C/JAVA program to implement the Rijndael algorithm logic.
7. Write the RC4 logic in Java Using Java cryptography; encrypt the text "Hello world" using Blowfish. Create your own key using Java key tool.
8. Write a Java program to implement RSA algorithm.
9. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript.
10. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.
11. Calculate the message digest of a text using the MD5 algorithm in JAVA.

**TEXT BOOKS:**

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6th Edition.
2. Cryptography and Network Security: Atul Kahate, McGraw Hill, 3rd Edition.

**REFERENCE BOOKS:**

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
2. Cryptography and Network Security: Forouzan Mukhopadhyay, McGraw Hill, 3rd Edition.
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH.
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning.
6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning.

## ENVIRONMENTAL SCIENCE

**B.Tech. III Year II Sem.**

L	T	P	C
3	0	0	0

**Course Objectives:**

- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures.
- Understanding the environmental policies and regulations

**Course Outcomes:**

- Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development

**UNIT-I**

**Ecosystems:** Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

**UNIT-II**

**Natural Resources: Classification of Resources:** Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

**UNIT-III**

**Biodiversity And Biotic Resources:** Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

**UNIT-IV**

**Environmental Pollution and Control Technologies: Environmental Pollution:** Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary. Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Issues and Global Efforts:** Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC-Gol Initiatives.

**UNIT-V**

**Environmental Policy, Legislation & EIA:** Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-

economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

**TEXT BOOKS:**

- 1 Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
- 2 Environmental Studies by R. Rajagopalan, Oxford University Press.

**REFERENCE BOOKS:**

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4<sup>th</sup> Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.
6. Introduction to Environmental Science by Y. Anjaneyulu, BS. Publications.

**PREDICTIVE ANALYTICS****B.Tech. IV Year I Sem.**

L	T	P	C
3	0	0	3

**Course Objectives:** The course serves to advance and refine expertise on theories, approaches and techniques related to prediction and forecasting.

**Course Outcomes**

1. Understand prediction-related principles, theories and approaches.
2. Learn model assessment and validation.
3. Understand the basics of predictive techniques and statistical approaches.
4. Analyze supervised and unsupervised algorithms.

**UNIT - I**

Linear Methods for Regression and Classification: Overview of supervised learning, Linear regression models and least squares, Multiple regression, Multiple outputs, Subset selection, Ridge regression, Lasso regression, Linear Discriminant Analysis, Logistic regression, Perceptron learning algorithm.

**UNIT - II**

Model Assessment and Selection: Bias, Variance, and model complexity, Bias-variance trade off, Optimism of the training error rate, Estimate of In-sample prediction error, Effective number of parameters, Bayesian approach and BIC, Cross-validation, Boot strap methods, conditional or expected test error.

**UNIT - III**

Additive Models, Trees, and Boosting: Generalized additive models, Regression and classification trees, Boosting methods-exponential loss and AdaBoost, Numerical Optimization via gradient boosting, Examples (Spam data, California housing, New Zealand fish, Demographic data).

**UNIT - IV**

Neural Networks (NN), Support Vector Machines (SVM), and K-nearest Neighbor: Fitting neural networks, Back propagation, Issues in training NN, SVM for classification, Reproducing Kernels, SVM for regression, K-nearest – Neighbour classifiers (Image Scene Classification).

**UNIT - V**

Unsupervised Learning and Random forests: Association rules, Cluster analysis, Principal Components, Random forests and analysis.

**TEXT BOOK:**

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning-Data Mining, Inference, and Prediction, Second Edition, Springer Verlag, 2009.

**REFERENCE BOOKS:**

1. C.M.Bishop –Pattern Recognition and Machine Learning, Springer, 2006.
2. L. Wasserman-All of statistics.
3. Gareth James. Daniela Witten. Trevor Hastie Robert Tibshirani. An Introduction to Statistical Learning with Applications in R.

**WEB AND SOCIAL MEDIA ANALYTICS****B.Tech. IV Year I Sem.**

L	T	P	C
2	0	0	2

**Course Objectives:** Exposure to various web and social media analytic techniques.**Course Outcomes:**

1. Knowledge on decision support systems.
2. Apply natural language processing concepts on text analytics.
3. Understand sentiment analysis.
4. Knowledge on search engine optimization and web analytics.

**UNIT - I**

**An Overview of Business Intelligence, Analytics, and Decision Support:** Analytics to Manage a Vaccine Supply Chain Effectively and Safely, Changing Business Environments and Computerized Decision Support, Information Systems Support for Decision Making, The Concept of Decision Support Systems (DSS), Business Analytics Overview, Brief Introduction to Big Data Analytics.

**UNIT - II**

**Text Analytics and Text Mining:** Machine Versus Men on Jeopardy!: The Story of Watson, Text Analytics and Text Mining Concepts and Definitions, Natural Language Processing, Text Mining Applications, Text Mining Process, Text Mining Tools.

**UNIT - III**

**Sentiment Analysis:** Sentiment Analysis Overview, Sentiment Analysis Applications, Sentiment Analysis Process, Sentiment Analysis and Speech Analytics.

**UNIT - IV**

**Web Analytics, Web Mining:** Security First Insurance Deepens Connection with Policyholders, Web Mining Overview, Web Content and Web Structure Mining, Search Engines, Search Engine Optimization, Web Usage Mining (Web Analytics), Web Analytics Maturity Model and Web Analytics Tools.

**UNIT - V**

**Social Analytics and Social Network Analysis:** Social Analytics and Social Network Analysis, Social Media Definitions and Concepts, Social Media Analytics.

**Prescriptive Analytics - Optimization and Multi-Criteria Systems:** Multiple Goals, Sensitivity Analysis, What-If Analysis, and Goal Seeking.

**TEXT BOOK:**

1. Ramesh Sharda, Dursun Delen, Efraim Turban, BUSINESS INTELLIGENCE AND ANALYTICS: SYSTEMS FOR DECISION SUPPORT, Pearson Education.

**REFERENCE BOOKS:**

1. Rajiv Sabherwal, Irma Becerra-Fernandez, "Business Intelligence – Practice, Technologies and Management", John Wiley 2011.
2. Lariss T. Moss, ShakuAtre, "Business Intelligence Roadmap", Addison-Wesley It Service.
3. Yuli Vasiliev, "Oracle Business Intelligence: The Condensed Guide to Analysis and Reporting", SPD Shroff, 2012.

**QUANTUM COMPUTING (Professional Elective – IV)****B.Tech. IV Year I Sem.**

<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:**

1. To introduce the fundamentals of quantum computing
2. The problem-solving approach using finite dimensional mathematics

**Course Outcomes:**

1. Understand basics of quantum computing
2. Understand physical implementation of Qubit
3. Understand Quantum algorithms and their implementation
4. Understand the Impact of Quantum Computing on Cryptography

**UNIT - I**

**Introduction to Essential Linear Algebra:** Some Basic Algebra, Matrix Math, Vectors and Vector Spaces, Set Theory. **Complex Numbers:** Definition of Complex Numbers, Algebra of Complex Numbers, Complex Numbers Graphically, Vector Representations of Complex Numbers, Pauli Matrices, Transcendental Numbers.

**UNIT - II**

**Basic Physics for Quantum Computing:** The Journey to Quantum, Quantum Physics Essentials, Basic Atomic Structure, Hilbert Spaces, Uncertainty, Quantum States, Entanglement.

**Basic Quantum Theory:** Further with Quantum Mechanics, Quantum Decoherence, Quantum Electrodynamics, Quantum Chromodynamics, Feynman Diagram Quantum Entanglement and QKD, Quantum Entanglement, Interpretation, QKE.

**UNIT - III**

**Quantum Architecture:** Further with Qubits, Quantum Gates, More with Gates, Quantum Circuits, The D-Wave Quantum Architecture. **Quantum Hardware:** Qubits, How Many Qubits Are Needed? Addressing Decoherence, Topological Quantum Computing, Quantum Essentials.

**UNIT - IV**

**Quantum Algorithms:** What Is an Algorithm? Deutsch's Algorithm, Deutsch-Jozsa Algorithm, Bernstein-Vazirani Algorithm, Simon's Algorithm, Shor's Algorithm, Grover's Algorithm.

**UNIT - V**

**Current Asymmetric Algorithms:** RSA, Diffie-Hellman, Elliptic Curve. **The Impact of Quantum Computing on Cryptography:** Asymmetric Cryptography, Specific Algorithms, Specific Applications.

**TEXT BOOKS:**

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press
2. Dr. Chuck Easttom, Quantum Computing Fundamentals, Pearson

**REFERENCE BOOKS:**

1. Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. Basic Concepts. Vol. Basic Tools and Special Topics, World Scientific.
3. Pittenger A. O., An Introduction to Quantum Computing Algorithms.

**DATABASE SECURITY (Professional Elective – IV)****B.Tech. IV Year I Sem.**

L	T	P	C
3	0	0	3

**Course Objectives:**

- To learn the security of databases
- To learn the design techniques of database security
- To learn the secure software design

**Course Outcomes:**

- Ability to carry out a risk analysis for large database.
- Ability to set up, and maintain the accounts with privileges and roles.

**UNIT - I**

**Introduction:** Introduction to Databases Security Problems in Databases Security Controls Conclusions.

**Security Models -1:** Introduction Access Matrix Model Take-Grant Model Acten Model PN Model Hartson and Hsiao's Model Fernandez's Model Bussolati and Martella's Model for Distributed databases.

**UNIT - II**

**Security Models -2:** Bell and LaPadula's Model Biba's Model Dion's Model Sea View Model Jajodia and Sandhu's Model The Lattice Model for the Flow Control conclusion.

**Security Mechanisms:** Introduction User Identification/Authentication Memory Protection Resource Protection Control Flow Mechanisms Isolation Security Functionalities in Some Operating Systems Trusted Computer System Evaluation Criteria.

**UNIT - III**

**Security Software Design:** Introduction A Methodological Approach to Security Software Design, Secure Operating System Design, Secure DBMS Design Security Packages Database Security Design

**Statistical Database Protection & Intrusion Detection Systems:** Introduction Statistics Concepts and Definitions, Types of Attacks, Inference Controls, Evaluation Criteria for Control Comparison. Introduction IDES System RETISS System ASES System Discovery.

**UNIT - IV**

**Models for the Protection of New Generation Database Systems -1:** Introduction A Model for the Protection of Frame Based Systems A Model for the Protection of Object-Oriented Systems SORION Model for the Protection of Object-Oriented Databases.

**UNIT - V**

**Models for the Protection of New Generation Database Systems -2:** A Model for the Protection of New Generation Database Systems: the Orion Model ajodia and Kogan's Model A Model for the Protection of Active Databases Conclusions.

**TEXT BOOKS:**

1. Database Security by Castano, Pearson Edition
2. Database Security and Auditing: Protecting Data Integrity and Accessibility, 1st Edition, Hassan Afyouni, THOMSON Edition.

**REFERENCE BOOK:**

1. Database security by Alfred basta, melissazgola, CENGAGE learning.

**NATURAL LANGUAGE PROCESSING (Professional Elective – IV)****B.Tech. IV Year I Sem.**

<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:** Data structures, finite automata and probability theory**Course Objectives:**

- Introduce to some of the problems and solutions of NLP and their relation to linguistics and statistics.

**Course Outcomes:**

- Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.
- Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems
- Able to manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.
- Able to design, implement, and analyze NLP algorithms
- Able to design different language modeling Techniques.

**UNIT - I****Finding the Structure of Words:** Words and Their Components, Issues and Challenges, Morphological Models**Finding the Structure of Documents:** Introduction, Methods, Complexity of the Approaches, Performances of the Approaches**UNIT - II****Syntax Analysis:** Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues**UNIT - III****Semantic Parsing:** Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software.**UNIT - IV**

Predicate-Argument Structure, Meaning Representation Systems, Software.

**UNIT - V****Discourse Processing:** Cohension, Reference Resolution, Discourse Cohension and Structure**Language Modeling:** Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Cross lingual Language Modeling**TEXT BOOKS:**

1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication.
2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary.

**REFERENCE BOOK:**

1. Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications.

**INFORMATION STORAGE MANAGEMENT (Professional Elective – IV)****B.Tech. IV Year I Sem.**

<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:**

1. To understand the basic components of Storage System Environment.
2. To understand the Storage Area Network Characteristics and Components.
3. To examine emerging technologies including IP-SAN.
4. To describe the different backup and recovery topologies and their role in providing disaster recovery and business continuity capabilities.
5. To understand the local and remote replication technologies.

**Course Outcomes:**

1. Understand the logical and physical components of a Storage infrastructure.
2. Evaluate storage architectures, including storage subsystems, DAS, SAN, NAS, and CAS.
3. Understand the various forms and types of Storage Virtualization.
4. Describe the different roles in providing disaster recovery and business continuity capabilities.
5. Distinguish different remote replication technologies.

**UNIT - I**

**Introduction to Storage Technology:** Data proliferation and the varying value of data with time & usage, Sources of data and states of data creation, Data center requirements and evolution to accommodate storage needs, Overview of basic storage management skills and activities, The five pillars of technology, Overview of storage infrastructure components, Evolution of storage, Information Lifecycle Management concept, Data categorization within an enterprise, Storage and Regulations.

**UNIT - II**

**Storage Systems Architecture:** Intelligent disk subsystems overview, Contrast of integrated vs. Modular arrays, Component architecture of intelligent disk subsystems, Disk physical structure-components, properties, performance, and specifications, Logical partitioning of disks, RAID & parity algorithms, hot sparing, Physical vs. logical disk organization, protection, and back end management, Array caching properties and algorithms, Front end connectivity and queuing properties, Front end to host storage provisioning, mapping, and operation, Interaction of file systems with storage, Storage system connectivity protocols.

**UNIT - III**

**Introduction to Networked Storage:** JBOD, DAS, SAN, NAS, & CAS evolution, Direct Attached Storage (DAS) environments: elements, connectivity, & management, Storage Area Networks (SAN): elements & connectivity, Fibre Channel principles, standards, & network management principles, SAN management principles, Network Attached Storage (NAS): elements, connectivity options, connectivity protocols (NFS, CIFS, ftp), & management principles, IP SAN elements, standards (iSCSI, FCIP, iFCP), connectivity principles, security, and management principles, Content Addressable Storage (CAS): elements, connectivity options, standards, and management principles, Hybrid Storage - solutions overview including technologies like virtualization & appliances.

**UNIT - IV**

**Introductions to Information Availability:** Business Continuity and Disaster Recovery Basics, Local business continuity techniques, Remote business continuity techniques, Disaster Recovery principles & techniques. **Managing & Monitoring:** Management philosophies (holistic vs. system & component), Industry management standards (SNMP, SMI-S, CIM), Standard framework applications, Key management metrics (thresholds, availability, capacity, security, performance), Metric analysis methodologies & trend analysis, Reactive and proactive management best practices, Provisioning &

configuration change planning, Problem reporting, prioritization, and handling techniques, Management tools overview.

#### **UNIT - V**

**Securing Storage and Storage Virtualization:** Define storage security. List the critical security attributes for information systems, describe the elements of a shared storage model and security extensions, Define storage security domains, List and analyze the common threats in each domain, Identify different virtualization technologies, describe block-level and file level virtualization technologies and processes.

#### **TEXT BOOKS:**

1. Marc Farley Osborne, "Building Storage Networks", Tata McGraw Hill, 2001.
2. Robert Spalding and Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill, 2003.
3. Meeta Gupta, "Storage Area Network Fundamentals", Pearson Education Ltd., 2002.

#### **REFERENCE BOOKS:**

1. Gerald J Kowalski and Mark T Maybury," Information Storage Retrieval Systems theory & Implementation", BS Publications, 2000.
2. Thejendra BS, "Disaster Recovery & Business continuity", Shroff Publishers & Distributors, 2006.

**INTERNET OF THINGS (Professional Elective – IV)****B.Tech. III Year II Sem.**

L	T	P	C
3	0	0	3

**Course Objectives:**

1. To introduce the terminology, technology and its applications
2. To introduce the concept of M2M (machine to machine) with necessary protocols
3. To introduce the Python Scripting Language which is used in many IoT devices
4. To introduce the Raspberry PI platform, that is widely used in IoT applications
5. To introduce the implementation of web-based services on IoT devices

**Course Outcomes:**

1. Interpret the impact and challenges posed by IoT networks leading to new architectural models.
2. Compare and contrast the deployment of smart objects and the technologies to connect them to the network.
3. Appraise the role of IoT protocols for efficient network communication.
4. Elaborate the need for Data Analytics and Security in IoT.
5. Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

**UNIT - I**

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

**UNIT - II**

IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

**UNIT - III**

Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib

**UNIT - IV**

IoT Physical Devices and Endpoints - Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

**UNIT - V**

IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API

**TEXT BOOKS:**

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.

**PRIVACY PRESERVING IN DATA MINING (Professional Elective – V)****B.Tech. IV Year I Sem.**

L	T	P	C
3	0	0	3

**Prerequisites:** A course on “Data Mining”.**Course Objectives:**

1. The aim of the course is to introduce the fundamentals of Privacy Preserving Data Mining Methods
2. The course gives an overview of - Anonymity and its Measures, Multiplicative Perturbation for Privacy-Preserving Data Mining, techniques for Utility-based Privacy Preserving Data

**Course Outcomes:**

1. Understand the concepts of Privacy Preserving Data Mining Models and Algorithms.
2. Demonstrate a comprehensive understanding of different tasks associated in Inference Control Methods for Privacy-Preserving Data Mining.
3. Understand the concepts of Data Anonymization Methods and its Measures.
4. Evaluate and Appraise the solution designed for Multiplicative Perturbation.
5. Formulate, Design and Implement the solutions for Utility-based Privacy Preserving Data.

**UNIT - I**

Introduction, Privacy-Preserving Data Mining Algorithms, The Randomization Method, Group Based Anonymization, Distributed Privacy-Preserving Data Mining

**UNIT - II****Interface Control Methods**

Introduction, A Classification of Microdata Protection Methods, Perturbative Masking Methods, Non-Perturbative Masking Methods, Synthetic Microdata Generation, Trading off Information Loss and Disclosure Risk.

**UNIT - III****Measure of Anonymity**

Data Anonymization Methods, A Classification of Methods, Statistical Measure of Anonymity, Probabilistic Measure of Anonymity, Computational Measure of Anonymity, reconstruction Methods for Randomization, Application of Randomization

**UNIT - IV****Multiplicative Perturbation**

Definition of Multiplicative Perturbation, Transformation Invariant Data Mining Models, Privacy Evaluation for Multiplicative Perturbation, Attack Resilient Multiplicative Perturbation, Metrics for Quantifying Privacy Level, Metrics for Quantifying Hiding Failure, Metrics for Quantifying Data Quality.

**UNIT - V****Utility-Based Privacy-Preserving Data**

Types of Utility-Based Privacy Preserving Methods, Utility-Based Anonymization Using Local Recording, The Utility-Based Privacy Preserving Methods in Classification Problems, Anonymization Marginal: Injection Utility into Anonymization Data Sets.

**TEXT BOOK:**

1. Privacy – Preserving Data Mining: Models and Algorithms Edited by Charu C. Aggarwal and S. Yu, Springer.

**REFERENCE BOOKS:**

1. Charu C. Agarwal, Data Mining: The Textbook, 1st Edition, Springer.
2. J. Han and M. Kamber, Data Mining: Concepts and Techniques, 3rd Edition, Elsevier.
3. Privacy Preserving Data Mining by Jaideep Vaidya, Yu Michael Zhu and Christopher W. Clifton, Springer.

**CLOUD COMPUTING (Professional Elective – V)**

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

**Pre-requisites:** Courses on Computer Networks, Operating Systems, Distributed Systems.**Course Objectives:**

1. This course provides an insight into cloud computing.
2. Topics covered include- distributed system models, different cloud service models, service-oriented architectures, cloud programming and software environments, resource management.

**Course Outcomes:**

1. Ability to understand various service delivery models of a cloud computing architecture.
2. Ability to understand the ways in which the cloud can be programmed and deployed.
3. Understanding cloud service providers.

**UNIT - I**

**Computing Paradigms:** High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Bio computing, Mobile Computing, Quantum Computing, Optical Computing, Nano computing.

**UNIT - II**

**Cloud Computing Fundamentals:** Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Definition of Cloud computing, Cloud Computing Is a Service, Cloud Computing Is a Platform, Principles of Cloud computing, Five Essential Characteristics, Four Cloud Deployment Models.

**UNIT - III**

**Cloud Computing Architecture and Management:** Cloud architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications, on the Cloud, Managing the Cloud, Managing the Cloud Infrastructure Managing the Cloud application, Migrating Application to Cloud, Phases of Cloud Migration Approaches for Cloud Migration.

**UNIT - IV**

**Cloud Service Models:** Infrastructure as a Service, Characteristics of IaaS. Suitability of IaaS, Pros and Cons of IaaS, Summary of IaaS Providers, Platform as a Service, Characteristics of PaaS, Suitability of PaaS, Pros and Cons of PaaS, Summary of PaaS Providers, Software as a Service, Characteristics of SaaS, Suitability of SaaS, Pros and Cons of SaaS, Summary of SaaS Providers, Other Cloud Service Models.

**UNIT V**

**Cloud Service Providers:** EMC, EMC IT, Captiva Cloud Toolkit, Google, Cloud Platform, Cloud Storage, Google Cloud Connect, Google Cloud Print, Google App Engine, Amazon Web Services, Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon Simple Queue ,service, Microsoft, Windows Azure, Microsoft Assessment and Planning Toolkit, SharePoint, IBM, Cloud Models, IBM Smart Cloud, SAP Labs, SAP HANA Cloud Platform, Virtualization Services Provided by SAP, Sales force, Sales Cloud, Service Cloud: Knowledge as a Service, Rack space, VMware, Manjra soft, Aneka Platform.

**TEXT BOOK:**

1. Essentials of cloud Computing: K. Chandrasekhran, CRC press, 2014

**REFERENCE BOOKS:**

1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.
3. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp 2011.

**DATA SCIENCE APPLICATIONS (Professional Elective – V)****B.Tech. IV Year I Sem.**

L	T	P	C
3	0	0	3

**Course Objective:** To give deep knowledge of data science and how it can be applied in various fields to make life easy.

**Course Outcomes:** After completion of course, students would:

1. To correlate data science and solutions to modern problems.
2. To decide when to use which type of technique in data science.

**UNIT - I**

Data Science Applications in various domains, Challenges and opportunities, tools for data scientists, Recommender systems – Introduction, methods, application, challenges.

**UNIT - II**

Time series data – stock market index movement forecasting. Supply Chain Management – Real world case study in logistics.

**UNIT – III**

Data Science in Education, Social media.

**UNIT - IV**

Data Science in Healthcare, Bioinformatics.

**UNIT - V**

Case studies in data optimization using Python.

**TEXT BOOKS:**

1. Aakanksha Sharaff, G.K.Sinha , “Data Science and its applications “, CRC Press, 2021.
2. Q. A. Menon, S. A. Khoja, “Data Science: Theory, Analysis and Applications”, CRC Press, 2020.

**MINING MASSIVE DATASETS (Professional Elective – V)****B.Tech. IV Year I Sem.**

L	T	P	C
3	0	0	3

**Prerequisites:** Students should be familiar with Data mining, algorithms, basic probability theory and Discrete math.

**Course Objectives:**

1. This course will cover practical algorithms for solving key problems in mining of massive datasets.
2. This course focuses on parallel algorithmic techniques that are used for large datasets.
3. This course will cover stream processing algorithms for data streams that arrive constantly, page ranking algorithms for web search, and online advertisement systems that are studied in detail.

**Course Outcomes:**

1. Handle massive data using MapReduce.
2. Develop and implement algorithms for massive data sets and methodologies in the context of data mining.
3. Understand the algorithms for extracting models and information from large datasets
4. Develop recommendation systems.
5. Gain experience in matching various algorithms for particular classes of problems.

**UNIT - I**

**Data Mining**-Introduction-Definition of Data Mining-Statistical Limits on Data Mining, **MapReduce and the New Software Stack**-Distributed File Systems, MapReduce, Algorithms Using MapReduce.

**UNIT - II**

**Similarity Search:** Finding Similar Items-Applications of Near-Neighbor Search, Shingling of Documents, Similarity-Preserving Summaries of Sets, Distance Measures. **Streaming Data:** Mining Data Streams-The Stream Data Model, Sampling Data in a Stream, Filtering Streams.

**UNIT - III**

**Link Analysis**-PageRank, Efficient Computation of PageRank, Link Spam. **Frequent Itemsets** - Handling Larger Datasets in Main Memory, Limited-Pass Algorithms, Counting Frequent Items in a Stream. **Clustering**-The CURE Algorithm, Clustering in Non-Euclidean Spaces, Clustering for Streams and Parallelism.

**UNIT - IV**

**Advertising on the Web**-Issues in On-Line Advertising, On-Line Algorithms, The Matching Problem, The Adwords Problem, Adwords Implementation. **Recommendation Systems** - A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering, Dimensionality Reduction, The NetFlix Challenge.

**UNIT - V**

**Mining Social-Network Graphs**-Social Networks as Graphs, Clustering of Social-Network Graphs, Partitioning of Graphs, Simrank, Counting Triangles.

**TEXT BOOKS:**

1. Jure Leskovec, Anand Rajaraman, Jeff Ullman, Mining of Massive Datasets, 3<sup>rd</sup> Edition.

**REFERENCE BOOKS:**

1. Jiawei Han & Micheline Kamber, Data Mining – Concepts and Techniques 3<sup>rd</sup> Edition Elsevier.
2. Margaret H Dunham, Data Mining Introductory and Advanced topics, PEA.
3. Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques, Morgan Kaufmann.

**EXPLORATORY DATA ANALYSIS (Professional Elective – V)****B.Tech. IV Year I Sem.**

L	T	P	C
3	0	0	3

**Course Objectives:**

1. This course introduces the methods for data preparation and data understanding.
2. It covers essential exploratory techniques for understanding multivariate data by summarizing it through statistical methods and graphical methods.
3. Supports to Summarize the insurers use of predictive analytics, data science and Data Visualization.

**Course Outcomes:**

1. Handle missing data in the real-world data sets by choosing appropriate methods.
2. Summarize the data using basic statistics. Visualize the data using basic graphs and plots.
3. Identify the outliers if any in the data set.
4. Choose appropriate feature selection and dimensionality reduction.
5. Techniques for handling multi-dimensional data.

**UNIT - I:**

**Introduction to Exploratory Data Analysis:** Data Analytics lifecycle, Exploratory Data Analysis (EDA)– Definition, Motivation, Steps in data exploration, The basic data types Data Type Portability.

**UNIT - II:**

**Preprocessing - Traditional Methods and Maximum Likelihood Estimation:** Introduction to Missing data, Traditional methods for dealing with missing data, Maximum Likelihood Estimation – Basics, Missing data handling, Improving the accuracy of analysis. **Preprocessing Bayesian Estimation:** Introduction to Bayesian Estimation, Multiple Imputation-Imputation Phase, Analysis and Pooling Phase, Practical Issues in Multiple Imputation, Models for Missing Notation Random Data.

**UNIT - III:**

**Data Summarization & Visualization:** Statistical data elaboration, 1-D Statistical data analysis, 2-D Statistical data Analysis, N-D Statistical data analysis.

**UNIT - IV:**

**Outlier Analysis:** Introduction, Extreme Value Analysis, Clustering based, Distance Based and Density Based outlier analysis, Outlier Detection in Categorical Data. **Feature Subset Selection:** Feature selection algorithms: filter methods, wrapper methods and embedded methods, Forward selection backward elimination, Relief, greedy selection, genetic algorithms for features selection.

**UNIT - V**

**Dimensionality Reduction:** Introduction, Principal Component Analysis (PCA), Kernel PCA, Canonical Correlation Analysis, Factor Analysis, Multidimensional scaling, Correspondence Analysis.

**TEXT BOOKS:**

1. Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining, by Glenn J. Myatt.

**REFERENCE BOOKS:**

1. Charu C. Aggarwal, "Data Mining The Text book", Springer, 2015.
2. Craig K. Enders, "Applied Missing Data Analysis", The Guilford Press, 2010.
3. Inge Koch, "Analysis of Multivariate and High dimensional data", Cambridge University Press, 2014.
4. Michael Jambu, "Exploratory and multivariate data analysis", Academic Press Inc., 1990.
5. Charu C. Aggarwal, "Data Classification Algorithms and Applications", CRC press, 2015.

**WEB AND SOCIAL MEDIA ANALYTICS LAB****B.Tech. IV Year I Sem.****L T P C**  
**0 0 2 1****Course Objectives:** Exposure to various web and social media analytic techniques.**Course Outcomes:**

1. Knowledge on decision support systems.
2. Apply natural language processing concepts on text analytics.
3. Understand sentiment analysis.
4. Knowledge on search engine optimization and web analytics.

**List of Experiments**

1. Preprocessing text document using NLTK of Python
  - a. Stopword elimination
  - b. Stemming
  - c. Lemmatization
  - d. POS tagging
  - e. Lexical analysis
2. Sentiment analysis on customer review on products
3. Web analytics
  - a. Web usage data (web server log data, clickstream analysis)
  - b. Hyperlink data
4. Search engine optimization- implement spamdexing
5. Use Google analytics tools to implement the following
  - a. Conversion Statistics
  - b. Visitor Profiles
6. Use Google analytics tools to implement the Traffic Sources.

**Resources:**

1. Stanford core NLP package
2. [GOOGLE.COM/ANALYTICS](https://www.google.com/analytics)

**TEXT BOOKS:**

1. Ramesh Sharda, Dursun Delen, Efraim Turban, BUSINESS INTELLIGENCE AND ANALYTICS: SYSTEMS FOR DECISION SUPPORT, Pearson Education.

**REFERENCE BOOKS:**

1. Rajiv Sabherwal, Irma Becerra- Fernandez, "Business Intelligence –Practice, Technologies and Management", John Wiley 2011.
2. Lariss T. Moss, Shaku Atre, "Business Intelligence Roadmap", Addison-Wesley It Service.
3. Yuli Vasiliev, "Oracle Business Intelligence: The Condensed Guide to Analysis and Reporting", SPD Shroff, 2012.

**ORGANIZATIONAL BEHAVIOUR****B.Tech. IV Year II Sem.**

L	T	P	C
3	0	0	3

**Course Objectives:** The objective of the course is to provide the students with the conceptual framework and the theories underlying Organizational Behavior.

**Course Outcomes:**

1. Demonstrate the applicability of analyzing the complexities associated with management of individual behavior in the organization.
2. Analyze the complexities associated with management of the group behavior in the organization.
3. Demonstrate how the organizational behavior can integrate in understanding the motivation (why) behind behavior of people in the organization.

**UNIT - I:**

Introduction to OB - Definition, Nature and Scope – Environmental and organizational context – Impact of IT, globalization, Diversity, Ethics, culture, reward systems and organizational design on Organizational Behaviour. Cognitive Processes-I: Perception and Attribution: Nature and importance of Perception – Perceptual selectivity and organization – Social perception – Attribution Theories – Locus of control –Attribution Errors –Impression Management.

**UNIT- II:**

Cognitive Processes-II: Personality and Attitudes – Personality as a continuum – Meaning of personality - Johari Window and Transactional Analysis - Nature and Dimension of Attitudes – Job satisfaction and organizational commitment-Motivational needs and processes- Work-Motivation Approaches Theories of Motivation- Motivation across cultures - Positive organizational behaviour: Optimism – Emotional intelligence – Self-Efficacy.

**UNIT - III:**

Dynamics of OB-I: Communication – types – interactive communication in organizations – barriers to communication and strategies to improve the follow of communication - Decision Making: Participative decision-making techniques – creativity and group decision making. Dynamics of OB –II Stress and Conflict: Meaning and types of stress –Meaning and types of conflict - Effect of stress and intra-individual conflict - strategies to cope with stress and conflict.

**UNIT - IV:**

Dynamics of OB –III Power and Politics: Meaning and types of power – empowerment - Groups Vs. Teams – Nature of groups – dynamics of informal groups – dysfunctions of groups and teams – teams in modern work place.

**UNIT - V:**

Leading High performance: Job design and Goal setting for High performance- Quality of Work Life- Socio technical Design and High-performance work practices - Behavioural performance management: reinforcement and punishment as principles of Learning –Process of Behavioural modification - Leadership theories - Styles, Activities and skills of Great leaders.

**REFERENCE BOOKS:**

1. Luthans, Fred: Organizational Behaviour 10/e, McGraw-Hill, 2009
2. McShane: Organizational Behaviour, 3e, TMH, 2008
3. Nelson: Organizational Behaviour, 3/e, Thomson, 2008.

4. Newstrom W. John & Davis Keith, Organisational Behaviour-- Human Behaviour at Work, 12/e, TMH, New Delhi, 2009.
5. Pierce and Gardner: Management and Organisational Behaviour: An Integrated perspective, Thomson, 2009.
6. Robbins, P. Stephen, Timothy A. Judge: Organisational Behaviour, 12/e, PHI/Pearson, New Delhi, 2009.
7. Pareek Udai: Behavioural Process at Work: Oxford & IBH, New Delhi, 2009.
8. Schermerhorn: Organizational Behaviour 9/e, Wiley, 2008.
9. Hitt: Organizational Behaviour, Wiley, 2008
10. Aswathappa: Organisational Behaviour, 7/e, Himalaya, 2009
11. Mullins: Management and Organisational Behaviour, Pearson, 2008.
12. McShane, Glinow: Organisational Behaviour--Essentials, TMH, 2009.
13. Ivancevich: Organisational Behaviour and Management, 7/e, TMH, 2008.

**DATA STREAM MINING (Professional Elective – VI)****B.Tech. IV Year II Sem.**

<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**

1. A basic knowledge of “Data Mining”

**Course Objectives:**

1. The aim of the course is to introduce the fundamentals of Data Stream Mining.
2. The course gives an overview of – Mining Strategies, methods and algorithms for data stream mining.

**Course Outcomes:**

1. Understand how to formulate a knowledge extraction problem from data streams.
2. Ability to apply methods / algorithms to new data stream analysis problems.
3. Evaluate the results and understand the functioning of the methods studied.
4. Demonstrate decision tree and adaptive Hoeffding Tree concepts

**UNIT - I**

MOA Stream Mining, Assumptions, Requirements, Mining Strategies, Change Detection Strategies, MOA Experimental Settings, Previous Evaluation Practices, Evaluation Procedures for Data Streams, Testing Framework, Environments, Data Sources, Generation Speed and Data Size, Evolving Stream Experimental Setting.

**UNIT - II**

Hoeffding Trees, The Hoeffding Bound for Tree Induction, The Basic Algorithm, Memory Management, Numeric Attributes, Batch Setting Approaches, Data Stream Approaches.

**UNIT - III**

Prediction Strategies, Majority Class, Naïve Bayes Leaves, Adaptive Hybrid, Hoeffding Tree Ensembles, Data Stream Setting, Realistic Ensemble Sizes.

**UNIT - IV**

Evolving Data Streams, Algorithms for Mining with Change, A Methodology for Adaptive Stream Mining, Optimal Change Detector and Predictor, Adaptive Sliding Windows, Introduction, Maintaining Updated Windows of Varying Length.

**UNIT - V**

Adaptive Hoeffding Trees, Introduction, Decision Trees on Sliding Windows, Hoeffding Adaptive Trees, Adaptive Ensemble Methods, New methods of Bagging using trees of different size, New method of bagging using ADWIN, Adaptive Hoeffding Option Trees, Method performance.

**TEXT BOOK:**

1. DATA STREAM MINING: A Practical Approach by Albert Bifet and Richard Kirkby.

**REFERENCE BOOKS:**

1. Knowledge discovery from data streams by Gama João. ISBN: 978-1-4398-2611-9.
2. Machine Learning for Data Streams by Albert Bifet, Ricard Gavaldà; MIT Press, 2017.

**WEB SECURITY (Professional Elective – VI)****B.Tech. IV Year II Sem.**

L	T	P	C
3	0	0	3

**Course Objectives:**

- Give an Overview of information security
- Give an overview of Access control of relational databases

**Course Outcomes:** Students should be able to

- Understand the Web architecture and applications
- Understand client side and service side programming
- Understand how common mistakes can be bypassed and exploit the application
- Identify common application vulnerabilities

**UNIT - I**

The Web Security, The Web Security Problem, Risk Analysis and Best Practices.

Cryptography and the Web: Cryptography and Web Security, Working Cryptographic Systems and Protocols, Legal Restrictions on Cryptography, Digital Identification.

**UNIT - II**

The Web's War on Your Privacy, Privacy-Protecting Techniques, Backups and Antitheft, Web Server Security, Physical Security for Servers, Host Security for Servers, Securing Web Applications.

**UNIT - III**

Database Security: Recent Advances in Access Control, Access Control Models for XML, Database Issues in Trust Management and Trust Negotiation, Security in Data Warehouses and OLAP Systems.

**UNIT - IV**

Security Re-engineering for Databases: Concepts and Techniques, Database Watermarking for Copyright Protection, Trustworthy Records Retention, Damage Quarantine and Recovery in Data Processing Systems, Hippocratic Databases: Current Capabilities and Future Trends.

**UNIT - V**

Privacy in Database Publishing: A Bayesian Perspective, Privacy-enhanced Location-based Access Control, Efficiently Enforcing the Security and Privacy Policies in a Mobile Environment.

**TEXT BOOKS:**

1. Web Security, Privacy and Commerce Simson G Arfinkel, Gene Spafford, O'Reilly.
2. Handbook on Database security applications and trends Michael Gertz, Sushil Jajodia.

**VIDEO ANALYTICS (Professional Elective – VI)****B.Tech. IV Year II Sem.**

L	T	P	C
3	0	0	3

**Course Objectives:** To acquire the knowledge of extracting information from surveillance videos, understand the models used for recognition of objects, humans in videos and perform gait analysis.

**Course Outcomes:**

1. Understand the basics of video- signals and systems.
2. Able to estimate motion in a video.
3. Able to detect the objects and track them.
4. Recognize activity and analyze behaviour.
5. Evaluate face recognition technologies.

**UNIT - I**

INTRODUCTION Multidimensional signals and systems: signals, transforms, systems, sampling theorem. Digital Images and Video: human visual system and color, digital video, 3D video, digital-video applications, image and video quality.

**UNIT - II**

MOTION ESTIMATION Image formation, motion models, 2D apparent motion estimation, differential methods, matching methods, non-linear optimization methods, transform domain methods, 3D motion and structure estimation.

**UNIT - III**

VIDEO ANALYTICS Introduction- Video Basics - Fundamentals for Video Surveillance- Scene Artifacts- Object Detection and Tracking: Adaptive Background Modelling and Subtraction- Pedestrian Detection and Tracking Vehicle Detection and Tracking- Articulated Human Motion Tracking in Low-Dimensional Latent Spaces.

**UNIT - IV**

BEHAVIORAL ANALYSIS & ACTIVITY RECOGNITION Event Modelling- Behavioral Analysis- Human Activity Recognition-Complex Activity Recognition Activity modelling using 3D shape, Video summarization, shape-based activity models- Suspicious Activity Detection.

**UNIT - V**

HUMAN FACE RECOGNITION & GAIT ANALYSIS Introduction: Overview of Recognition algorithms – Human Recognition using Face: Face Recognition from still images, Face Recognition from video, Evaluation of Face Recognition Technologies- Human Recognition using gait: HMM Framework for Gait Recognition, View Invariant Gait Recognition, Role of Shape and Dynamics in Gait Recognition.

**TEXT BOOKS:**

1. Murat Tekalp, "Digital Video Processing", second edition, Pearson, 2015
2. Rama Chellappa, Amit K. Roy-Chowdhury, Kevin Zhou. S, "Recognition of Humans and their Activities using Video", Morgan & Claypool Publishers, 2005.
3. Yunqian Ma, Gang Qian, "Intelligent Video Surveillance: Systems and Technology", CRC Press (Taylor and Francis Group), 2009.

**REFERENCE BOOKS:**

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2011.
2. Yao Wang, JornOstermann and Ya-Qin Zhang, "Video Processing and Communications", Prentice Hall, 2001.
3. Thierry Bouwmans, FatihPorikli, Benjamin Höferlin and Antoine Vacavant, "Background Modeling and Foreground Detection for Video Surveillance: Traditional and Recent Approaches, Implementations, Benchmarking and Evaluation", CRC Press, Taylor and Francis Group, 2014.
4. Md. Atiqur Rahman Ahad, "Computer Vision and Action Recognition-A Guide for Image Processing and Computer Vision Community for Action Understanding", Atlantis Press, 2011.

**BLOCKCHAIN TECHNOLOGY (Professional Elective – VI)****B.Tech. IV Year II Sem.**

L	T	P	C
3	0	0	3

**Prerequisites:**

1. Knowledge in security and applied cryptography.
2. Knowledge in distributed databases.

**Course Objectives:** To Introduce block chain technology and Cryptocurrency.**Course Outcomes:**

1. Learn about research advances related to one of the most popular technological areas today.
2. Understand Extensibility of Blockchain concepts.
3. Understand and Analyze Blockchain Science.
4. Understand Technical challenges, Business model challenges.

**UNIT - I**

Introduction: Block chain or distributed trust, Protocol, Currency, Cryptocurrency, How a Cryptocurrency works, Crowdfunding.

**UNIT - II**

Extensibility of Blockchain concepts, Digital Identity verification, Block chain Neutrality, Digital art, Blockchain Environment.

**UNIT - III**

Blockchain Science: Gridcoin, Folding coin, Blockchain Genomics, Bitcoin MOOCs.

**UNIT - IV**

Currency, Token, Tokenizing, Campuscoin, Coindrop as a strategy for Public adoption, Currency Multiplicity, Demurrage currency.

**UNIT - V**

Technical challenges, Business model challenges, Scandals and Public perception, Government Regulations.

**TEXT BOOK:**

1. Melanie Swan, Blockchain Blueprint for Economy, O'reilly.

**REFERENCE BOOKS:**

1. Building Blockchain Apps, Michael Juntao Yuan, Pearson Education
2. Daniel Drescher, Blockchain Basics: A Non-Technical Introduction in 25 Steps 1st Edition
3. Bradley Lakeman, Blockchain Revolution: Understanding the Crypto Economy of the Future. A Non-Technical Guide to the Basics of Cryptocurrency Trading and Investing, ISBN: 1393889158.

**PARALLEL AND DISTRIBUTED COMPUTING (Professional Elective – VI)****B.Tech. IV Year II Sem.**

L	T	P	C
3	0	0	3

**Course Objectives:**

1. To learn core ideas behind parallel and distributed computing.
2. To explore the methodologies adopted for parallel and distributed environments.
3. To understand the networking aspects of parallel and distributed computing.
4. To provide an overview of the computational aspects of parallel and distributed computing.
5. To learn parallel and distributed computing models.

**Course Outcomes:**

1. Explore the methodologies adopted for parallel and distributed environments.
2. Analyze the networking aspects of Distributed and Parallel Computing.
3. Explore the different performance issues and tasks in parallel and distributed computing.
4. Tools usage for parallel and distributed computing.
5. Understanding high performance computing techniques.

**UNIT - I**

Parallel and Distributed Computing— Introduction- Benefits and Needs- Parallel and Distributed Systems- Programming Environment- Theoretical Foundations - Parallel Algorithms— Introduction- Parallel Models and Algorithms- Sorting - Matrix Multiplication- Convex Hull- Pointer Based Data Structures.

**UNIT - II**

Synchronization- Process Parallel Languages- Architecture of Parallel and Distributed Systems- Consistency and Replication- Security- Parallel Operating Systems.

**UNIT - III**

Management of Resources in Parallel Systems- Tools for Parallel Computing- Parallel Database Systems and Multimedia Object Servers.

**UNIT - IV**

Networking Aspects of Distributed and Parallel Computing- Process- Parallel and Distributed Scientific Computing.

**UNIT - V**

High-Performance Computing in Molecular Sciences- Communication Multimedia Applications for Parallel and Distributed Systems- Distributed File Systems.

**TEXT BOOKS:**

1. Jacek Błażewicz, et al., "Handbook on parallel and distributed processing", Springer Science & Business Media, 2013.
2. Andrew S. Tanenbaum, and Maarten Van Steen, "Distributed Systems: Principles and Paradigms". Prentice-Hall, 2007.

**REFERENCE BOOKS:**

1. George F.Coulouris, Jean Dollimore, and Tim Kindberg, "Distributed systems: concepts and design", Pearson Education, 2005.
2. Gregor Kosec and Roman Trobec, "Parallel Scientific Computing: Theory, Algorithms, and Applications of Mesh Based and Meshless Methods", Springer, 2015.