



**B.Tech. in COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE) COURSE
STRUCTURE & SYLLABUS (SR23 Regulations)**

Applicable from AY 2023-24 Batch

III YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	S23501PC	Algorithms Design and Analysis	3	0	0	3
2	S23502PC	Introduction to Data Science	3	1	0	4
3	S23503PC	Computer Networks	3	0	0	3
4		Professional Elective - I	3	0	0	3
5		Professional Elective - II	3	0	0	3
6	S23504PC	R Programming Lab	0	0	2	1
7	S23505PC	Computer Networks Lab	0	0	2	1
8	EN508HS	Advanced English Communication Skills Lab	0	0	2	1
9	S23506PC	ETL-Kafka/Talend	0	0	2	1
10	S23*MC510	Intellectual Property Rights	3	0	0	0
		Total	18	1	08	20

III YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	S23601PC	Automata Theory and Compiler Design	3	0	0	3
2	S23602PC	Machine Learning	3	0	0	3
3	S23603PC	Big Data Analytics	3	0	0	3
4		Professional Elective - III	3	0	0	3
5		Open Elective - I	3	0	0	3
6	S23604PC	Machine Learning Lab	0	0	2	1
7	S23605PC	Big Data Analytics Lab	0	0	2	1
8		Professional Elective - III Lab	0	0	2	1
9	S23606PC	Industrial Oriented Mini Project/ Summer Internship/ Skill Development Course (UI design- Flutter)	0	0	4	2
10	S23*MC609	Environmental Science	3	0	0	0
		Total	18	0	10	20

Environmental Science in III Yr II Sem Should be Registered by Lateral Entry Students Only.

***MC – Satisfactory/Unsatisfactory**

Professional Elective - I

S23511PE	Data Warehousing and Business Intelligence
S23512PE	Artificial Intelligence
S23513PE	Web Programming
S23514PE	Image Processing
S23515PE	Computer Graphics

Professional Elective - II

S23521PE	Spatial and Multimedia Databases
S23522PE	Information Retrieval Systems
S23523PE	Software Project Management
S23524PE	DevOps
S23525PE	Computer Vision and Robotics

Professional Elective - III

S23631PE	Software Testing Methodologies
S23632PE	Data Visualization Techniques
S23633PE	Scripting Languages
S23634PE	Mobile Application Development
S23635PE	Cryptography and Network Security

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

Professional Elective - IV

S23741PE	Quantum Computing
S23742PE	Database Security
S23743PE	Natural Language Processing
S23744PE	Information Storage Management
S23745PE	Internet of Things

Professional Elective - V

S23751PE	Privacy Preserving Data Publishing
S23752PE	Cloud Computing
S23753PE	Data Science Applications
S23754PE	Mining Massive Datasets
S23755PE	Exploratory Data Analysis

Professional Elective - VI

S23861PE	Data Stream Mining
S23862PE	Web Security
S23863PE	Video Analytics
S23864PE	Blockchain Technology
S23865PE	Parallel and Distributed Computing

Open Elective - I

1. S23611OE: Fundamentals of Data Science
2. S23612OE: R Programming

Open Elective - II

1. S23721OE: Data Mining
2. S23722OE: Data Analytics

Open Elective - III

1. S23831OE: Introduction to social media mining
2. S23832OE: Data Visualization using Python

S23501PC: ALGORITHM DESIGN AND ANALYSIS**B.Tech. III Year I Sem.**

L	T	P	C
3	0	0	3

Prerequisites: Programming for problem solving and Data Structures**Course Objectives:**

- Introduces the notations for analysis of the performance of algorithms.
- Describes major algorithmic techniques (divide-and-conquer, backtracking, dynamic programming, greedy, branch and bound methoS23) 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:

1. Analyze the performance of algorithms
2. Choose appropriate data structures and algorithm design methoS23 for a specified application
3. Understand the choice of data structures and the algorithm design methoS23

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, Priority Queue- Heaps, Heapsort**Backtracking:** General method, applications, n-queen's problem, sum of subsets problem, graph Coloring, Hamiltonian cycles.**UNIT - III****Dynamic Programming:** General method, applications- Optimal binary search tree, 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.**Basic Traversal and Search Techniques:** Techniques for Binary Trees, Techniques for Graphs, Connected components, Biconnected components.**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.

S23502PC: INTRODUCTION TO DATA SCIENCE**B.Tech. III Year I Sem.**

L	T	P	C
3	1	0	4

Course Objectives:

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

Course Outcomes:

- Understand basic terms of statistical modeling and data science
- Implementation of R programming concepts
- utilize R elements for data visualization and prediction

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, 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 Interquartile 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

Charts and Graphs: Introduction, Pie Chart: Chart Legend, Bar Chart, Box Plot, Histogram, Line Graph: Multiple Lines in Line Graph, Scatter Plot.

Regression: Linear Regression Analysis, Multiple Linear regression

TEXT BOOKS:

1. Doing Data Science, Straight Talk from The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly, 2014.
2. K G Srinivas, G M Siddesh, "Statistical programming in R", Oxford Publications.

REFERENCE BOOKS:

1. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, 3rd ed. The Morgan Kaufmann Series in Data Management Systems.
2. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbach, Pearson Education.
3. Brian S. Everitt, "A Handbook of Statistical Analysis Using R", Second Edition, 4 LLC, 2014.
4. Dalgaard, Peter, "Introductory statistics with R", Springer Science & Business Media, 2008.
5. Paul Teetor, "R Cookbook", O'Reilly, 2011.

S23503PC: COMPUTER NETWORKS**B.Tech. III Year I Sem.****L T P C**
3 0 0 3**Prerequisites**

1. A course on "Programming for problem solving"
2. A course on "Data Structures"

Course Objectives

- The objective of the course is to equip the students with a general overview of the concepts and fundamentals of computer networks.
- 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

- Gain the knowledge of the basic computer network technology.
- Gain the knowledge of the functions of each layer in the OSI and TCP/IP reference model.
- Obtain the skills of subnetting and routing mechanisms.
- 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.

Data link layer: Design issues, framing, Error detection and correction.

UNIT - II

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 sublayer: 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.

S23511PE: DATA WAREHOUSING AND BUSINESS INTELLIGENCE
(Professional Elective – I)

B.Tech. III Year I Sem.

L T P C
3 0 0 3

Course Objectives:

- 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
- 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:

- Understand architecture of data warehouse and OLAP operations.
- Understand Fundamental concepts of BI
- Application of BI Key Performance indicators
- Understand Utilization of Advanced BI Tools and their Implementation.
- Implementation of BI Techniques and BI Ethics.

UNIT - I

Data Warehouse, Data Warehouse Modelling, OLAP operations, Data Cube Computation methods

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-driven alerts-A cyclic process of Intelligence Creation. The value of Business Intelligence-Value driven and 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 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, 4th Edition.
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.

S23512PE: ARTIFICIAL INTELLIGENCE (Professional Elective – I)**B.Tech. III Year I Sem.**

L	T	P	C
3	0	0	3

Prerequisites:

1. Programming for problem solving, Data Structures.

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:

- Understand search strategies and intelligent agents
- Understand different adversarial search techniques
- Apply propositional logic, predicate logic for knowledge representation
- Apply AI techniques to solve problems of game playing, and machine learning.

UNIT - I

Introduction to AI, Intelligent Agents, 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

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.

UNIT - IV

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

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

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.

TEXT BOOK:

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

REFERENCE BOOKS:

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

S23513PE: WEB PROGRAMMING (Professional Elective – I)**B.Tech. III Year I Sem.**

L	T	P	C
3	0	0	3

Course Objectives:

- 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:

- 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 Client side Programming**HTML-** Basic Tags- List, Tables, Images, Forms, Frames, CSS**JAVA Script -**

Web page Designing using HTML, Scripting basics- Client side and server side scripting. Java ScriptObject, 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- InetAddress 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, Javascript - A Beginners Guide, 3rd Edition -- Tata McGraw-Hill Edition.
2. Keyur Shah, Gateway to Java Programmer Sun Certification, Tata McGraw Hill, 2002.

S23514PE: IMAGE PROCESSING (Professional Elective – I)**B.Tech. III Year I Sem.**

L	T	P	C
3	0	0	3

Prerequisites

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 MethoS23"

Course Objectives

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

Course Outcomes

- Demonstrate the knowledge of the basic concepts of two-dimensional signal acquisition, sampling, and quantization.
- Demonstrate the knowledge of filtering techniques.
- Demonstrate the knowledge of 2D transformation techniques.
- 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 MethoS23, 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. WooS23, Addison Wesley/ Pearson Education, 2nd 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. WooS23, Steven L. Eddins: Pearson Education India, 2004.
3. Digital Image Processing: William K. Pratt, John Wiley, 3rd Edition, 2004.

S23515PE: COMPUTER GRAPHICS (Professional Elective – I)**B.Tech. III Year I Sem.****L T P C**
3 0 0 3**Prerequisites**

1. Programming for problem solving and Data Structures

Course Objectives

- Provide the basics of graphics systems including Points and lines, line drawing algorithms, 2D, 3D objective transformations

Course Outcomes

- Explore applications of computer graphics
- Understand 2D, 3D geometric transformations and clipping algorithms
- Understand 3D object representations, curves, surfaces, polygon rendering methoS23, color models
- Analyze animation sequence and visible surface detection methoS23

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 (DDA and Bresenham's Algorithm) circle-generating algorithms and ellipse - generating algorithms

Polygon Filling: Scan-line algorithm, boundary-fill and flood-fill algorithms

UNIT - II

2-D geometric transformations: 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, clipping operations, point clipping, Line clipping-Cohen Sutherland algorithms, Polygon clipping-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, Polygon rendering methoS23, color models and color applications.

UNIT - IV

3-D Geometric transformations: Translation, rotation, scaling, reflection and shear transformations, composite transformations.

3-D viewing: Viewing pipeline, viewing coordinates, projections, view volume and general projection transforms and clipping.

UNIT - V

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

Visible surface detection methoS23: Classification, back-face detection, depth-buffer method, BSP-tree method, area sub-division method and octree method.

TEXT BOOKS:

1. "Computer Graphics C version", Donald Hearn and M. Pauline Baker, Pearson Education

REFERENCE BOOKS:

1. Procedural elements for Computer Graphics, David F Rogers, Tata Mc Graw hill, 2nd edition.
2. Principles of Interactive Computer Graphics", Neuman and Sproul, TMH.
3. Principles of Computer Graphics, Shalini Govil, Pai, 2005, Springer.
4. "Computer Graphics Principles & practice", second edition in C, Foley, Van Dam, Feiner and Hughes, Pearson Education.
5. Computer Graphics, Steven Harrington, TMH.

S23521PE: SPATIAL AND MULTIMEDIA DATABASES (Professional Elective - II)**B.Tech. III Year I Sem.**

L	T	P	C
3	0	0	3

Course Objective:

- Introduce the basic concepts, data models and indexing structures for spatial data, multimedia data.

Course Outcomes:

- Understand data models, storage, indexing and design of spatial databases.
- Evaluate multidimensional data structures
- Represent image database with R-tree
- Store and retrieve audio, video and 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 StandarS23

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 SMS23s 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 BOOKS:

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

S23522PE: INFORMATION RETRIEVAL SYSTEMS (Professional Elective - II)**B.Tech. III Year I Sem.**

L	T	P	C
3	0	0	3

Prerequisites:

1. Data Structures

Course Objectives:

- To learn the concepts and algorithms in Information Retrieval Systems
- To understand the data/file structures that are necessary to design, and implement information retrieval (IR) systems.

Course Outcomes:

- Ability to apply IR principles to locate relevant information large collections of data
- Ability to design different document clustering algorithms
- Implement retrieval systems for web search tasks.
- 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.

S23523PE: SOFTWARE PROJECT MANAGEMENT (Professional Elective – II)**B.Tech. III Year I Sem.**

L	T	P	C
3	0	0	3

Prerequisites:

1. A course on “Software Engineering”.

Course Objectives

- To acquire knowledge on software process management
- To acquire managerial skills for software project development
- To understand software economics, workflows and frameworks.

Course Outcomes

- Understand the software economics to improve various phases of development.
- Examine the life cycle phases, artifacts, workflows and checkpoints of a process.
- Demonstrate the software project framework components.
- Analyze the need for various software management disciplines and metrics.

UNIT - I**Software Management Renaissance**

Conventional Software Management: The waterfall model, conventional software Management performance. Evolution of Software Economics-Software economics, pragmatic software cost estimation. Improving Software Economics- Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.

UNIT – II**A Software Management Process Framework-I**

The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process. Life cycle phases- Engineering and production stages, inception, Elaboration, construction, transition phases. Artifacts of the process- The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

UNIT – III**A Software Management Process Framework-II**

Model based software architectures- A Management perspective and technical perspective. Work Flows of the process- Software process workflows, Iteration workflows. Checkpoints of the process- Major milestones, Minor Milestones, Periodic status assessments.

UNIT – IV**Software Management Discipline-I**

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**Software Management Discipline-II**

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 (CCPS23-R).

TEXT BOOK:

1. Software Project Management, Walker Royce, Addison-Wesley 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.

S23524PE: DEVOPS (Professional Elective – II)**B.Tech. III Year I Sem.**

L	T	P	C
3	0	0	3

Pre-Requisites:

1. Software Engineering
2. Software Project Management

Course Objectives:

- Understand the skill sets and high-functioning teams involved in Agile, DevOps and related methods to reach a continuous delivery capability.
- Implement automated system update and DevOps lifecycle.

Course Outcomes:

- Understand the various components of DevOps environment.
- Identify Software development models and architectures of DevOps
- Use different project management and integration tools.
- Select an appropriate testing tool and deployment model for project.

UNIT-I**Introduction to DevOps:**

Introduction, Agile development model, DevOps and ITIL. DevOps process and Continuous Delivery, Release management, Scrum, Kanban, delivery pipeline, identifying bottlenecks.

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, Micro services 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 Deployment:**

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, SaltStack and Docker.

TEXT BOOK:

1. Joakim Verona., Practical DevOps, Packt Publishing, 2016.

REFERENCE BOOKS:

1. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications.
2. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley.

S23525PE: COMPUTER VISION AND ROBOTICS (Professional Elective – II)**B.Tech. III Year II Sem.**

L	T	P	C
3	0	0	3

Pre-Requisites: Linear Algebra and Probability.**Course Objectives:**

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

Course Outcomes:

- Implement fundamental image processing techniques required for computer vision
- Implement boundary tracking techniques
- Apply chain codes and other region descriptors, Hough Transform for line, circle, and ellipse detections.
- Apply 3D vision techniques and Implement motion related techniques.
- 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 PyramiS23, 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:** 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**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**UNIT - V****Introduction to Robotics:** Social Implications of Robotics, Brief history of Robotics, Attributes of hierarchical paradigm, Closed world assumption and frame problem, Representative Architectures, Attributes of Reactive Paradigm, Subsumption Architecture, Potential fieldS23 and Perception

Common sensing techniques for Reactive Robots: Logical sensors, Behavioural Sensor Fusion, Pro- prioceptive sensors, Proximity Sensors, Topological Planning and Metric Path Planning

TEXT BOOKS:

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.
2. Robin Murphy, Introduction to AI Robotics, MIT Press

REFERENCE BOOKS:

1. E. R. Davies: Computer and Machine Vision - Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.
2. The Robotics premier, Maja J Matari, MIT Press
3. Richard Szeliski “Computer Vision: Algorithms and Applications” Springer-Verlag London Limited 2011.

S23504PC: R PROGRAMMING LAB**B.Tech. III Year II Sem.****L T P C**
0 0 2 1**Pre-requisites:** Any programming language.**Course Objectives:**

- Familiarize with R basic programming concepts, various data structures for handling datasets, various graph representations and Exploratory Data Analysis concepts

Course Outcomes:

- Setup R programming environment.
- Understand and use R - Data types and R - Data Structures.
- Develop programming logic using R - Packages.
- Analyze data sets using R - programming capabilities

LIST OF EXPERIMENTS:

1. Download and install R-Programming environment and install basic packages using `install.packages()` command in R.
2. Learn all the basics of R-Programming (Data types, Variables, Operators etc.,)
3. Write R command to
 - i) Illustrate summation, subtraction, multiplication, and division operations on vectors using vectors.
 - ii) Enumerate multiplication and division operations between matrices and vectors in R console
4. Write R command to
 - i) Illustrates the usage of Vector subsetting and Matrix subsetting
 - ii) Write a program to create an array of 3×3 matrixes with 3 rows and 3 columns.
5. Write an R program to draw
 - i) Pie chart
 - ii) 3D Pie Chart
 - iii) Bar Chart along with chart legend by considering suitable CSV file
6. Create a CSV file having Speed and Distance attributes with 1000 records. Write R program to draw
 - i) Box plots
 - ii) Histogram
 - iii) Line Graph
 - iv) Multiple line graphs
 - v) Scatter plot to demonstrate the relation between the cars speed and the distance.
7. Implement different data structures in R (Vectors, Lists, Data Frames)
8. Write an R program to read a csv file and analyze the data in the file using EDA (Explorative Data Analysis) techniques.
9. Write an R program to illustrate Linear Regression and Multi linear Regression considering suitable CSV file

TEXT BOOKS:

1. R Programming for Data Science by Roger D. Peng
2. The Art of R Programming by Norman Matloff Cengage Learning India.

REFERENCE BOOKS:

1. Hadley Wickham, Garrett Grolemund, R for Data Science: Import, Tidy, Transform, Visualize, and Model Data 1st Edition, O'Reilly
2. Tilman M. Davies, The book of R a first course in programming and statistics, no starch press

S23505PC: COMPUTER NETWORKS LAB**B.Tech. III Year I Sem.****L T P C**
0 0 2 1**Course Objectives**

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

Course Outcomes

- Implement data link layer framing methods
- Analyze error detection and error correction codes.
- Implement and analyze routing and congestion issues in network design.
- Implement Encoding and Decoding techniques used in presentation layer
- 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.

How to run Nmap scan

Operating System Detection using Nmap

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, 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. 3rd Edition, TMH.

EN508HS: ADVANCED ENGLISH COMMUNICATION SKILLS LAB**B.Tech III Year I Sem.**

L	T	P	C
0	0	2	1

1. Introduction

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

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

1. Gathering ideas and information to organise ideas relevantly and coherently.
2. Making oral presentations.
3. Writing formal letters.
4. Transferring information from non-verbal to verbal texts and vice-versa.
5. Writing project/research reports/technical reports.
6. Participating in group discussions.
7. Engaging in debates.
8. Facing interviews.
9. 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, with a focus on vocabulary
- To enable them to listen to English spoken at normal conversational speed by educated English speakers
- To respond appropriately in different socio-cultural and professional contexts
- To communicate their ideas relevantly and coherently in writing
- To prepare the students for placements.

3. Syllabus:

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

1. **Activities on Listening and Reading Comprehension:** Active Listening - Development of Listening Skills Through Audio clips - Benefits of Reading - Methods and Techniques of Reading - Basic Steps to Effective Reading - Common Obstacles - Discourse Markers or Linkers - Sub-skills of reading - Reading for facts, negative facts and Specific Details- Guessing Meanings from Context, Inferring Meaning - Critical Reading – Reading Comprehension - Exercises for Practice.
2. **Activities on Writing Skills:** Vocabulary for Competitive Examinations - Planning for Writing – Improving Writing Skills - Structure and presentation of different types of writing - Free Writing and Structured Writing - Letter Writing -Writing a Letter of Application -Resume vs. Curriculum Vitae - Writing a Résumé – Styles of Résumé - e-Correspondence - Emails - Blog Writing - (N)etiquette - Report Writing – Importance of Reports – Types and Formats of Reports- Technical Report Writing- Exercises for Practice.
3. **Activities on Presentation Skills** - Starting a conversation - responding appropriately and relevantly - using the right language and body language - Role Play in different situations including Seeking Clarification, Making a Request, Asking for and Refusing Permission, Participating in a Small Talk - Oral presentations (individual and group) through JAM sessions- PPTs - Importance of Presentation Skills - Planning, Preparing, Rehearsing and Making a Presentation - Dealing with

- Glossophobia or Stage Fear – Understanding Nuances of Delivery - Presentations through Posters/Projects/Reports - Checklist for Making a Presentation and Rubrics of Evaluation
4. **Activities on Group Discussion (GD):** Types of GD and GD as a part of a Selection Procedure - Dynamics of Group Discussion- Myths of GD - Intervention, Summarizing - Modulation of Voice, Body Language, Relevance, Fluency and Organization of Ideas – Do's and Don'ts - GD Strategies – Exercises for Practice.
 5. **Interview Skills:** Concept and Process - Interview Preparation Techniques - Types of Interview Questions - Pre-interview Planning, Opening Strategies, Answering Strategies - Interview Through Tele-conference & Video-conference - 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 aiS23
- LCD Projector
- Public Address system
- One PC with latest configuration for the teacher
- 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.

- **TOEFL & GRE** (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- **Oxford Advanced Learner's Dictionary**, 10th Edition
- **Cambridge Advanced Learner's Dictionary**
- **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.**
- **Lingua TOEFL CBT Insider**, by Dreamtech

6. Books Recommended:

1. Rizvi, M. Ashraf (2018). *Effective Technical Communication*. (2nd ed.). McGraw Hill Education (India) Pvt. Ltd.
2. Suresh Kumar, E. (2015). *Engineering English*. Orient BlackSwan Pvt. Ltd.
3. Bailey, Stephen. (2018). *Academic Writing: A Handbook for International Students*. (5th Edition). Routledge.
4. Koneru, Aruna. (2016). *Professional Communication*. McGraw Hill Education (India) Pvt. Ltd.
5. Raman, Meenakshi & Sharma, Sangeeta. (2022). *Technical Communication, Principles and Practice*. (4TH Edition) Oxford University Press.
6. Anderson, Paul V. (2007). *Technical Communication*. Cengage Learning Pvt. Ltd. New Delhi.
7. McCarthy, Michael; O'Dell, Felicity & Redman, Stuart. (2017). *English Vocabulary in Use Series*. Cambridge University Press
8. Sen, Leela. (2009). *Communication Skills*. PHI Learning Pvt Ltd., New Delhi.
9. Elbow, Peter. (1998). *Writing with Power*. Oxford University Press.
10. Goleman, Daniel. (2013). *Emotional Intelligence: Why it can matter more than IQ*. Bloomsbury Publishing.

S23506PC: ETL- KAFKA/TALEND**B.Tech. III Year I Sem.****L T P C**
0 0 2 1**Course Objectives:**

- Develop a comprehensive understanding of Extract, Transform, Load (ETL) processes using Apache Kafka and Talend.
- Understand how to scale Kafka clusters seamlessly to handle growing data volumes, ensuring optimal performance for ETL operations.

Course Outcomes:

- Learn to design and deploy fault-tolerant Kafka clusters, ensuring data integrity and availability in real-world scenarios.
- Gain practical experience in cluster management, topic creation, and basic operations such as producing and consuming messages.

LIST OF EXPERIMENTS:

1. Install Apache Kafka on a single node.
2. Demonstrate setting up a single-node, single-broker Kafka cluster and show basic operations such as creating topics and producing/consuming messages.
3. Extend the cluster to multiple brokers on a single node.
4. Write a simple Java program to create a Kafka producer and Produce messages to a topic.
5. Implement sending messages both synchronously and asynchronously in the producer.
6. Develop a Java program to create a Kafka consumer and subscribe to a topic and consume messages.
7. Write a script to create a topic with specific partition and replication factor settings.
8. Simulate fault tolerance by shutting down one broker and observing the cluster behavior.
9. Implement operations such as listing topics, modifying configurations, and deleting topics.
10. Introduce Kafka Connect and demonstrate how to use connectors to integrate with external systems.
11. Implement a simple word count stream processing application using Kafka Stream
12. Implement Kafka integration with the Hadoop ecosystem.

TEXT BOOK:

1. Neha Narkhede, Gwen Shapira, Todd Palino, Kafka - The Definitive Guide: Real-time data and stream processing at scale, O'Reilly

MC510: INTELLECTUAL PROPERTY RIGHTS*B.Tech. III Year I Sem.****L T P C**
3 0 0 0**Course Objectives:**

- Significance of intellectual property and its protection
- Introduce various forms of intellectual property

Course Outcomes:

- Distinguish and Explain various forms of IPRs.
- Identify criteria to fit one's own intellectual work in particular form of IPRs.
- Apply statutory provisions to protect particular form of IPRs.
- Appraise new developments in IPR laws at national and international level

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 copyrights: Fundamental of copyright law, originality of material, rights of reproduction, rights to perform the work publicly, copyright ownership issues, copyright registration, notice of copyright, International copyright law.

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

UNIT – IV

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

Unfair competition: Misappropriation right of publicity, false advertising.

UNIT – V

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

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

TEXT BOOK:

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.

REFERENCE BOOK:

1. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata McGraw Hill Publishing company Ltd.

S23601PC: AUTOMATA THEORY AND COMPILER DESIGN**B.Tech. III Year II Sem.****L T P C**
3 0 0 3**Course Objectives**

- To introduce the fundamental concepts of formal languages, grammars and automata theory.
- To understand deterministic and non-deterministic machines and the differences between decidability and undecidability.
- 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, intermediate code generation

Course Outcomes

- Able to employ finite state machines for modeling and solving computing problems.
- Able to design context free grammars for formal languages.
- Able to distinguish between decidability and undecidability.
- Demonstrate the knowledge of patterns, tokens & regular expressions for lexical analysis.
- Acquire skills in using lex tool and design LR parsers

UNIT - I

Introduction to Finite Automata: Structural Representations, Automata and Complexity, the Central Concepts of Automata Theory - Alphabets, Strings, Languages, Problems.

Nondeterministic Finite Automata: Formal Definition, an application, Text Search, Finite Automata with Epsilon-Transitions.

Deterministic Finite Automata: Definition of DFA, How A DFA Process Strings, The language of DFA, Conversion of NFA with ϵ -transitions to NFA without ϵ -transitions. Conversion of NFA to DFA

UNIT - II

Regular Expressions: Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Conversion of Finite Automata to Regular Expressions.

Pumping Lemma for Regular Languages:

Statement of the pumping lemma, Applications of the Pumping Lemma.

Context-Free Grammars: Definition of Context-Free Grammars, Derivations Using a Grammar, Leftmost and Rightmost Derivations, the Language of a Grammar, Parse Trees, Ambiguity in Grammars and Languages.

UNIT - III

Push Down Automata: Definition of the Pushdown Automaton, the Languages of a PDA, Equivalence of PDA's and CFG's, Acceptance by final state

Turing Machines:

Introduction to Turing Machine, Formal Description, Instantaneous description, The language of a Turing machine

Undecidability:

Undecidability, A Language that is Not Recursively Enumerable, An Undecidable Problem That is RE, Undecidable Problems about Turing Machines

UNIT - IV

Introduction: The structure of a compiler

Lexical Analysis: The Role of the Lexical Analyzer, Input Buffering, Recognition of Tokens, The Lexical- Analyzer Generator Lex

Syntax Analysis: Introduction, Context-Free Grammars, Writing a Grammar, Top-Down Parsing, Bottom-Up Parsing, Introduction to LR Parsing: Simple LR, More Powerful LR Parsers

UNIT - V

Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's.

Intermediate-Code Generation: Variants of Syntax Trees, Three-Address Code

Run-Time Environments: Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management

TEXT BOOKS:

1. Introduction to Automata Theory, Languages, and Computation, 3rd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
2. Theory of Computer Science- Automata languages and computation, Mishra and Chandrashekar, 2nd Edition, PHI.

REFERENCE BOOKS:

1. Compilers: Principles, Techniques and Tools, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, 2nd Edition, Pearson.
2. Introduction to Formal languages Automata Theory and Computation, Kamala Krithivasan, Rama R, Pearson.
3. Introduction to Languages and The Theory of Computation, John C Martin, TMH.
4. lex & yacc - John R. Levine, Tony Mason, Doug Brown, O'reilly
5. Compiler Construction, Kenneth C. Loudon, Thomson. Course Technology.

S23602PC: MACHINE LEARNING**B.Tech. III Year II Sem.**

L	T	P	C
3	0	0	3

Course Objectives:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To have a thorough understanding of the Supervised and Unsupervised learning techniques
- To study the various probability-based learning techniques

Course Outcomes:

- Distinguish between, supervised, unsupervised and semi-supervised learning
- Understand algorithms for building classifiers applied on datasets of non-linearly separable classes
- Understand the principles of evolutionary computing algorithms
- Design an ensembler to increase the classification accuracy

UNIT - I

Learning - Types of Machine Learning - Supervised Learning - The Brain and the Neuron - Design a Learning System - Perspectives and Issues in Machine Learning - Concept Learning Task - Concept Learning as Search - Finding a Maximally Specific Hypothesis - Version Spaces and the Candidate Elimination Algorithm - Linear Discriminants: - Perceptron - Linear Separability - Linear Regression.

UNIT - II

Multi-layer Perceptron- Going Forward - Going Backward: Back Propagation Error - Multi-layer Perceptron in Practice - Examples of using the MLP - Overview - Deriving Back-Propagation - Radial Basis Functions and Splines - Concepts - RBF Network - Curse of Dimensionality - Interpolations and Basis Functions - Support Vector Machines

UNIT - III

Learning with Trees - Decision Trees - Constructing Decision Trees - Classification and Regression Trees - Ensemble Learning - Boosting - Bagging - Different ways to Combine Classifiers - Basic Statistics - Gaussian Mixture Models - Nearest Neighbor Methods - Unsupervised Learning - K means Algorithms

UNIT - IV

Dimensionality Reduction - Linear Discriminant Analysis - Principal Component Analysis - Factor Analysis - Independent Component Analysis - Locally Linear Embedding - Isomap - Least Squares Optimization
Evolutionary Learning - Genetic algorithms - Genetic Offspring: - Genetic Operators - Using Genetic Algorithms

UNIT - V

Reinforcement Learning - Overview - Getting Lost Example
Markov Chain Monte Carlo Methods - Sampling - Proposal Distribution - Markov Chain Monte Carlo - Graphical Models - Bayesian Networks - Markov Random Fields - Hidden Markov Models - Tracking Methods

TEXT BOOKS:

1. Stephen Marsland, "Machine Learning – An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

REFERENCE BOOKS:

1. Tom M Mitchell, "Machine Learning, First Edition, McGraw Hill Education, 2013.
2. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012.
3. Jason Bell, "Machine learning - Hands-on for Developers and Technical Professionals", First Edition, Wiley, 2014
4. Ethem Alpaydin, "Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press, 2014

S23603PC: BIG DATA ANALYTICS**B.Tech. III Year II Sem.****L T P C**
3 0 0 3**Course Objectives**

- Provide the knowledge of principles and techniques for Big data Analytics and give an exposure of the frontiers of Big data Analytics

Courses Outcomes

- Understand the importance of big data analytics and its types
- Perform analytics on big data
- Proficiency in big data storage and processing in Hadoop
- Data analytics through MongoDB
- Data analytics through R

UNIT - I

Types of Digital data: Classification of Digital Data, Introduction to Big Data: Evolution of Big Data, definition of big data, Traditional Business Intelligence vs BigData, Coexistence of Big Data and Data Warehouse. Big Data Analytics: introduction to Big Data Analytics, What Big Data Analytics Isn't, Sudden Hype Around Big Data Analytics, Classification of Analytics, Greatest Challenges that Prevent Business from Capitalizing Big Data, Top Challenges Facing Big Data, Big Data Analytics Importance, Data Science, Terminologies used in Big Data Environments.

UNIT - II

Hadoop: Features of Hadoop, Key advantages of hadoop, versions of hadoop, overview of hadoop ecosystem, Hadoop distributions. Need of hadoop, RDBMS vs Hadoop, Distribution computing challenges, History of hadoop, Hadoop overview, HDFS

UNIT - III

Processing data with hadoop, introduction to mapreduce programming, mapper, reducer, combiner, partitioner
NoSQL: Types of NoSQL Databases, advantages of NoSQL, Use of NoSQL in industry, SQL vs NoSQL, newSQL, comparison of Nosql, sql and newsql

UNIT - IV

MongoDB, necessity of mongodb, terms used in mongodb and RDBMS, datatypes in mongoDB, mongodb query language

UNIT - V

Introduction to R programming, operators, control statements and functions, interfacing with R, vectors, matrices, lists, data frames, factors and tables, accessing input and output, graphs in R, R apply family

TEXT BOOKS:

1. Big Data Analytics, Seema Acharya, Subhashini Chellappan, Wiley 2015.
2. R programming for beginners, sandhya arora, latesh malik, university press.

REFERENCE BOOKS:

1. chandramouli subramanian, Asha A Geroge, C R Rene Robin, big data analytics, University press.
2. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Michael Minelli, Michehe Chambers, 1st Edition, Ambiga Dhiraj, Wiley CIO Series, 2013.
3. Hadoop: The Definitive Guide, Tom White, 3rd Edition, O'Reilly Media, 2012.
4. Big Data Analytics: Disruptive Technologies for Changing the Game, Arvind Sathi, 1st Edition, IBM Corporation, 2012.

S23631PE: SOFTWARE TESTING METHODOLOGIES (Professional Elective – III)**B.Tech. III Year II Sem.**

L	T	P	C
3	0	0	3

Prerequisites

1. 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 the latest tools.

Course Outcomes

- Understand purpose of testing and path testing
- Understand strategies in data flow testing and domain testing
- Develop logic-based test strategies
- Understand graph matrices and its applications
- Implement test cases using any testing automation tool

UNIT - I

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

UNIT - II

Transaction Flow Testing: transaction flows, transaction flow testing techniques.

Data Flow testing: Basics of data flow testing, strategies in data flow testing, application of data flow testing.

Domain Testing: domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domain and interface testing, domains and testability.

UNIT - III

Paths, Path products and Regular expressions: path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.

Logic Based Testing: overview, decision tables, path expressions, kv charts, specifications.

UNIT - IV

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

UNIT - V

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

TEXT BOOKS:

1. Software Testing techniques - 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 methoS23 of Software Testing, Perry, John Wiley.
5. Art of Software Testing - Meyers, John Wiley.

S23632PE: DATA VISUALIZATION TECHNIQUES (Professional Elective – III)**B.Tech. III Year II Sem.****L T P C**
3 0 0 3**Course Objectives:**

- To understand various data visualization techniques

Course Outcomes:

- Know the historical development and evolution of data visualization techniques.
- Analyze and visualize high-dimensional datasets using appropriate techniques.
- Visualize large multidimensional datasets using appropriate methoS23.
- Create insightful visual representations for diverse types of data.

UNIT - I

Introduction, A Brief History of Data Visualization, Good Graphics, Static Graphics.

UNIT - II

Data Visualization Through Their Graph Representations, Graph-theoretic Graphics, High-dimensional Data Visualization, Multivariate Data Glyphs: Principles and Practice, Linked Views for Visual Exploration, Linked Data Views, Visualizing Trees and Forests.

UNIT - III

Multidimensional Scaling, Huge Multidimensional Data Visualization, Multivariate Visualization by Density Estimation, Structured Sets of Graphs, Structural Adaptive Smoothing by Propagation-Separation MethoS23, Smoothing Techniques for Visualization.

UNIT - IV

Data Visualization via Kernel Machines, Visualizing Cluster Analysis and Finite Mixture Models, Visualizing Contingency Tables, Mosaic Plots and their Variants.

UNIT - V

Parallel Coordinates: Visualization, Exploration and Classification of High- Dimensional Data, Matrix Visualization, Visualization in Bayesian Data Analysis.

TEXT BOOKS:

1. Handbook of Data Visualization by Chun-houh Chen, 2008.
2. Matthew Ward, Georges Grinstein and Daniel Keim, "Interactive Data Visualization Foundations, Techniques, Applications", 2010.
3. Colin Ware, "Information Visualization Perception for Design", 2nd edition, Margon Kaufmann Publishers, 2004.

REFERENCE BOOKS:

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

S23633PE: SCRIPTING LANGUAGES (Professional Elective – III)**B.Tech. III Year II Sem.**

L	T	P	C
3	0	0	3

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 Web servers, SOAP and web services

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 HanS23 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 commandS23, 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.

S23634PE: MOBILE APPLICATION DEVELOPMENT (Professional Elective – III)**B.Tech. III Year II Sem.****L T P C**
3 0 0 3**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

- Understand the working of Android OS Practically.
- Develop Android user interfaces
- 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 AVS23, 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 BOOK:

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012

REFERENCE BOOKS:

1. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013
2. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013

S23635PE: 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 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

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 toward S23 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, 6th Edition
2. Cryptography and Network Security: Atul Kahate, Mc Graw 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, Mc Graw 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

S23611OE: FUNDAMENTALS OF DATA SCIENCE (Open Elective – I)**B.Tech. III Year II Sem.****L T P C**
3 0 0 3**Course Objectives:**

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

Course Outcomes:

- Understand basic terms of statistical modeling and data science
- Implementation of R programming concepts
- utilize R elements for data visualization and prediction

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, 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 Interquartile 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

Charts and Graphs: Introduction, Pie Chart: Chart Legend, Bar Chart, Box Plot, Histogram, Line Graph: Multiple Lines in Line Graph, Scatter Plot.

Regression: Linear Regression Analysis, Multiple Linear regression

TEXT BOOKS:

1. Doing Data Science, Straight Talk from The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly, 2014.
2. K G Srinivas, G M Siddesh, "Statistical programming in R", Oxford Publications.

REFERENCE BOOKS:

1. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, 3rd ed. The Morgan Kaufmann Series in Data Management Systems.
2. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbach, Pearson Education.
3. Brian S. Everitt, "A Handbook of Statistical Analysis Using R", Second Edition, CRC, 2014.
4. Dalgaard, Peter, "Introductory statistics with R", Springer Science & Business Media, 2008.
5. Paul Teetor, "R Cookbook", O'Reilly, 2011.

S23612OE: R PROGRAMMING (Open Elective – I)**B.Tech. III Year II Sem.**

L	T	P	C
3	0	0	3

Course Objectives:

- Understanding and being able to use basic programming concepts
- Automate data analysis
- Working collaboratively and openly on code
- Knowing how to generate dynamic documents
- Being able to use a continuous test-driven development approach

Course Outcomes:

- Understand to use and program in the programming language R
- Understand to use R to solve statistical problems
- Implement and describe Monte Carlo the technology
- Implement minimize and maximize functions using R

UNIT – I

Introduction: Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Installing R, Running R, Packages in R, Calculations, Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers, Factors, Logical operations

UNIT – II

Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations

UNIT – III

Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, DATA FRAMES, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations

UNIT - IV

Factors And Tables: Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables, Extracting a Subtable, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions

UNIT - V

Graphics: Creating Graphs, Customizing Graphs, Saving Graphs to Files, Customizing Graphs, Creating Three-Dimensional Plots.

Debugging: Fundamental Principles of Debugging, Why Use a Debugging Tool?, Using R Debugging Facilities, Moving Up in the World: More Convenient Debugging Tools, Ensuring Consistency in Debugging Simulation Code, Syntax and Runtime Errors, Running GDB on R Itself.

TEXT BOOKS:

1. The Art of R Programming by Norman Matloff, Cengage Learning India.

REFERENCE BOOKS:

1. R Programming for Data Science by Roger D. Peng
2. Hadley Wickham, Garrett Golemund, R for Data Science: Import, Tidy, Transform, Visualize, and Model Data 1st Edition, O'Reilly
3. Tilman M. Davies, The book of R a first course in programming and statistics, no starch press.

S23604PC: MACHINE LEARNING LAB**B.Tech. III Year II Sem.****L T P C**
0 0 2 1**Course Objective:**

- The objective of this lab is to get an overview of the various machine learning techniques and can demonstrate them using python.

Course Outcomes:

- Understand modern notions in predictive data analysis
- Select data, model selection, model complexity and identify the trend
- Understand a range of machine learning algorithms along with their strengths and weaknesses
- Build predictive models from data and analyze their performance

List of Experiments

1. Write a python program to compute Central Tendency Measures: Mean, Median, Mode
Measure of Dispersion: Variance, Standard Deviation
2. Study of Python Basic Libraries such as Statistics, Math, Numpy and Scipy
3. Study of Python Libraries for ML application such as Pandas and Matplotlib
4. Write a Python program to implement Simple Linear Regression
5. Implementation of Multiple Linear Regression for House Price Prediction using sklearn
6. Implementation of Decision tree using sklearn and its parameter tuning
7. Implementation of KNN using sklearn
8. Implementation of Logistic Regression using sklearn
9. Implementation of K-Means Clustering
10. Performance analysis of Classification Algorithms on a specific dataset (Mini Project)

TEXT BOOK:

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

REFERENCE BOOK:

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

S23605PC: BIG DATA ANALYTICS LAB**B.Tech. III Year II Sem.**

L	T	P	C
0	0	2	1

Course Objectives

- Provide knowledge of Big data Analytics principles and techniques.
- Designed to give an exposure of the frontiers of Big data Analytics

Course Outcomes

- Use Excel as an Analytical tool and visualization tool.
- Ability to program using HADOOP and Map reduce
- Ability to perform data analytics using ML in R.
- Use MongoDB to perform data analytics

List of Experiments

1. Create a Hadoop cluster
2. Implement a simple map-reduce job that builds an inverted index on the set of input documents (Hadoop)
3. Process big data in HBase
4. Store and retrieve data in Pig
5. Perform data analysis using MongoDB
6. Using Power Pivot (Excel) Perform the following on any dataset
 - a. Big Data Analytics
 - b. Big Data Charting

TEXT BOOKS:

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

S23611PE: SOFTWARE TESTING METHODOLOGIES LAB (Professional Elective – III)**B.Tech. III Year II Sem.****L T P C**
0 0 2 1**Prerequisites**

- A basic knowledge of programming.

Course Objectives

- To provide knowledge of software testing methoS23.
- To develop skills in automation of software testing and software test automation management using the latest tools.

Course Outcomes

1. Design and develop the best test strategies in accordance with the development model.
2. Design and develop GUI, Bitmap and database checkpoints
3. Develop database checkpoints for different checks
4. Perform batch testing with and without parameter passing

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
 - b. Bitmap checkpoint for screen area
6. Database checkpoint for Default check
6. Database checkpoint for custom check
6. Database checkpoint for runtime record check
6.
 - a. Data driven test for dynamic test data submission
 - b. Data driven test through flat files
 - c. Data driven test through front griS23
 - d. Data driven test through excel test
- a. Batch testing without parameter passing
- b. Batch testing with parameter passing
11. Data driven batch
11. Silent mode test execution without any interruption
12. Test case for calculator in windows application

TEXT BOOKS

1. Software Testing techniques, Baris Beizer, 2nd Edition, Dreamtech.
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 methoS23 of Software Testing, Perry, John Wiley.
5. Art of Software Testing, Meyers, John Wiley.

S23612PE: DATA VISUALIZATION TECHNIQUES LAB (Professional Elective – III)**B.Tech. III Year II Sem.****L T P C**
0 0 2 1**Course Objectives:**

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

Course Outcomes:

- Identify the different data types, visualization types to bring out the insight.
- Relate the visualization toward the problem based on the dataset to analyze and bring out valuable insight on a large dataset.
- Demonstrate the analysis of a large dataset using various visualization techniques and tools.
- Identify the different attributes and showcasing them in plots. Identify and create various visualizations for geospatial and table data.
- 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, 2nd Edition, 2007.
2. Alexandru C. Telea, "Data Visualization: Principles and Practice," A. K. Peters Ltd, 2008.

S23613PE: SCRIPTING LANGUAGES LAB (Professional Elective – III)**B.Tech. III Year II Sem.****L T P C**
0 0 2 1**Prerequisites:** Any High level programming language (C, C++)**Course Objectives**

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

Course Outcomes

- Ability to understand the differences between Scripting languages and programming languages
- 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 users 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 Pramatic Progammmers 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.

S23614PE: MOBILE APPLICATION DEVELOPMENT LAB (Professional Elective – III)**B.Tech. III Year II Sem.****L T P C**
0 0 2 1**Course Objectives:**

- To learn how to develop Applications in an android environment.
- To learn how to develop user interface applications.
- To learn how to develop URL related applications.

Course Outcomes:

- Understand the working of Android OS Practically.
- Develop user interfaces.
- 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 the 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 (Datepicker), 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 the right fragment instead of the second screen with the back button. Use Fragment transactions and Rotation event listeners.
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 usernames 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 a 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.

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, 2013.

REFERENCE BOOK:

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

S23615PE: CRYPTOGRAPHY AND NETWORK SECURITY LAB (Professional Elective – III)**B.Tech. III Year II Sem.****L T P C**
0 0 2 1**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.

Course Outcomes:

- Understand basic cryptographic algorithms, message and web authentication and security issues.
- Identify information system requirements for both of them such as client and server.
- Understand the current legal issues toward S23 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 display 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 the 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

S23606PC: UI DESIGN - FLUTTER**B.Tech. III Year II Sem.****L T P C**
0 0 4 2**Course Objectives:**

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

Course Outcomes:

- Implements Flutter Widgets and Layouts
- Responsive UI Design and with Navigation in Flutter
- Create custom widgets for specific UI elements and also Apply styling using themes and custom styles.
- Design a form with various input fields, along with validation and error handling
- Fetches data and write code for unit Test for UI components and also animation

List of Experiments: Students need to implement the following experiments

1. a) Install Flutter and Dart SDK.
b) Write a simple Dart program to understand the language basics.
2. a) Explore various Flutter widgets (Text, Image, Container, etc.).
b) Implement different layout structures using Row, Column, and Stack widgets.
3. a) Design a responsive UI that adapts to different screen sizes.
b) Implement media queries and breakpoints for responsiveness.
4. a) Set up navigation between different screens using Navigator.
b) Implement navigation with named routes.
5. a) Learn about stateful and stateless widgets.
b) Implement state management using setState and Provider.
6. a) Create custom widgets for specific UI elements.
b) Apply styling using themes and custom styles.
7. a) Design a form with various input fields.
b) Implement form validation and error handling.
8. a) Add animations to UI elements using Flutter's animation framework.
b) Experiment with different types of animations (fade, slide, etc.).
9. a) Fetch data from a REST API.
b) Display the fetched data in a meaningful way in the UI.
10. a) Write unit tests for UI components.
b) Use Flutter's debugging tools to identify and fix issues.

TEXT BOOK:

1. Marco L. Napoli, Beginning Flutter: A Hands-on Guide to App Development.

MC609: 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-GOI 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). **TowardS23 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: towardS23 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, 4th 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.

S23611OE: FUNDAMENTALS OF DATA SCIENCE (Open Elective – I)**B.Tech. III Year II Sem.**

L	T	P	C
3	0	0	3

Course Objectives:

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

Course Outcomes:

- Understand basic terms of statistical modeling and data science
- Implementation of R programming concepts
- utilize R elements for data visualization and prediction

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, 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 Interquartile 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

Charts and Graphs: Introduction, Pie Chart: Chart Legend, Bar Chart, Box Plot, Histogram, Line Graph: Multiple Lines in Line Graph, Scatter Plot.

Regression: Linear Regression Analysis, Multiple Linear regression

TEXT BOOKS:

3. Doing Data Science, Straight Talk from The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly, 2014.
4. K G Srinivas, G M Siddesh, "Statistical programming in R", Oxford Publications.

REFERENCE BOOKS:

6. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, 3rd ed. The Morgan Kaufmann Series in Data Management Systems.
7. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbach, Pearson Education.
8. Brian S. Everitt, "A Handbook of Statistical Analysis Using R", Second Edition, CRC, 2014.
9. Dalgaard, Peter, "Introductory statistics with R", Springer Science & Business Media, 2008.
10. Paul Teetor, "R Cookbook", O'Reilly, 2011.

S23612OE: R PROGRAMMING (Open Elective – I)**B.Tech. III Year II Sem.**

L	T	P	C
3	0	0	3

Course Objectives:

- Understanding and being able to use basic programming concepts
- Automate data analysis
- Working collaboratively and openly on code
- Knowing how to generate dynamic documents
- Being able to use a continuous test-driven development approach

Course Outcomes:

- Understand to use and program in the programming language R
- Understand to use R to solve statistical problems
- Implement and describe Monte Carlo the technology
- Implement minimize and maximize functions using R

UNIT – I

Introduction: Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Installing R, Running R, Packages in R, Calculations, Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers, Factors, Logical operations

UNIT – II

Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations

UNIT – III

Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, DATA FRAMES, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations

UNIT - IV

Factors And Tables: Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables, Extracting a Subtable, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions

UNIT - V

Graphics: Creating Graphs, Customizing Graphs, Saving Graphs to Files, Customizing Graphs, Creating Three-Dimensional Plots.

Debugging: Fundamental Principles of Debugging, Why Use a Debugging Tool?, Using R Debugging Facilities, Moving Up in the World: More Convenient Debugging Tools, Ensuring Consistency in Debugging Simulation Code, Syntax and Runtime Errors, Running GDB on R Itself.

TEXT BOOKS:

2. The Art of R Programming by Norman Matloff, Cengage Learning India.

REFERENCE BOOKS:

4. R Programming for Data Science by Roger D. Peng
5. Hadley Wickham, Garrett Grolemund, R for Data Science: Import, Tidy, Transform, Visualize, and Model Data 1st Edition, O'Reilly
6. Tilman M. Davies, The book of R a first course in programming and statistics, no starch press.

1. Data Mining Concepts and Techniques, Han, Kamber, 3rd Edition, Morgan Kaufmann Publishers.

REFERENCE BOOKS:

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