

**KESHAV MEMORIAL INSTITUTE OF TECHNOLOGY****(AN AUTONOMOUS INSTITUTION)****Accredited by NBA & NAAC, Approved by AICTE, Affiliated to JNTUH, Hyderabad****B. Tech in COMPUTER SCIENCE AND ENGINEERING****IV Year I Semester COURSE STRUCTURE (KR23 Regulations)****Applicable from A.Y 2023-24 Admitted Batch****IV Year I Semester**

Sr. No.	Course Code	Course Title	L	T	P	Credits
1	23CS701HSM	Business Economics and Financial Analysis	3	0	0	3
2	23CS702PC	SoftwareTestingMethodologies	3	0	0	3
3	PE-IV	Professional Elective-IV	3	0	0	3
4	PE-V	Professional Elective-V	3	0	0	3
5	OE-II	Open Elective-II	3	0	0	3
6	23CS703PC	SoftwareTestingMethodologies Lab	0	0	2	1
7	23CS704PROJ	Project Stage-I	0	0	6	3
8	23CS705PC	Skill Development Course -III	0	0	2	1
9	*23MC706HS	Environmental Science	3	0	0	0
		Total Credits	18	0	10	20

Note: *Mandatory Course (MC)- Satisfactory/Unsatisfactory**Professional Elective-IV**

COURSE CODE	COURSE NAME
23CE711PE	Data Mining
23CE712PE	Scripting Languages
23CS713PE	Soft Computing

Professional Elective-V

COURSE CODE	COURSE NAME
23CE721PE	Large Language Models
23CS722PE	Service Oriented Architecture
23CE723PE	Information Retrieval Systems



Open Elective – II

COURSE CODE	COURSE NAME
23IT700OE	Data Visualization Techniques
23IT701OE	R Programming



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B. Tech in COMPUTER SCIENCE AND ENGINEERING

IV Year II Semester COURSE STRUCTURE (KR23 Regulations)



Applicable from A.Y 2023-24 Admitted Batch

IV Year II Semester

Sr. No.	Course Code	Course Title	L	T	P	Credits
1	23CS801HSM	Management Science	3	0	0	3
2	PE-VI	Professional Elective- VI	3	0	0	3
3	OE-III	Open Elective –III	3	0	0	3
4	23CS802PROJ	Project Stage-II including Seminar	0	0	22	9+2
		Total Credits	9	0	22	20

Professional Elective –VI

COURSE CODE	COURSE NAME
23CE811PE	Software Process and Project Management
23CE812PE	Biometrics
23CE813PE	Computer Graphics



Open Elective – III

COURSE CODE	COURSE NAME
23IT800OE	Linux Programming
23IT801OE	Concurrent Programming



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IV Year B.Tech. CSE, IT, CSE(DS), CSE(AIML)
I Semester Course Syllabus (KR23)

BUSINESS ECONOMICS AND FINANCIAL ANALYSIS (23CS70IHSM)

L	T	P	C
3	0	0	3

Prerequisite/ Corequisite: NIL

Course Objectives: The course will help to

1. Learn Basic Business types. and various Macro Economic Concepts.
2. Study the concepts of demand and Supply analysis.
3. Understand Market Structures, Production, Cost Analysis and Pricing methods.
4. Learn different accounting concepts and Conventions.
5. Know Financial Analysis through various Ratios.

Course Outcomes: After learning the concepts of the course, the student is able to

1. Understand various forms of business and Macro Economic Concepts.
2. Apply Demand Forecasting Techniques.
3. Identify different Market Structures, able to choose suitable pricing strategies.
4. Prepare Financial Statements of Business Organizations.
5. Analyze and interpret the firm's financial position through various Ratios.

UNIT - I

Introduction to Business and Economics:

Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance.

Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply in Inflation, Business Cycle, Features and Phases of Business Cycle, Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

UNIT - II

Demand and Supply Analysis:

Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.

Supply Analysis: Determinants of Supply, Supply Function & Law of Supply.

UNIT - III

Production, Cost, Market Structures & Pricing:
Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions.
Cost analysis: Types of Costs, Short run and Long run Cost Functions.

Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, Monopolistic Competition.
Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, Cost Volume Profit Analysis.

UNIT -IV

Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts.

UNIT - V

Financial Analysis through Ratios: Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems).
Introduction to Fund Flow and Cash Flow Analysis (simple problems).

TEXT BOOKS:

1. D.D. Chaturvedi, S.L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata McGraw Hill, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata McGraw Hill Education Pvt. Ltd. 2012.

REFERENCES:

1. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.
2. S.N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013.
3. Noted and Approved



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B. Tech. in COMPUTER SCIENCE AND ENGINEERING IV Year I Semester Syllabus (KR23) SOFTWARE TESTING METHODOLOGIES (23CS702PC)

L	T	P	C
3	0	0	3

Pre-requisites/ Co-requisites:

1. 23CC501PC – Software Engineering course.

Course Objectives: The course will help to

1. To provide knowledge of the concepts in software testing
2. To provide knowledge on testing process, criteria, strategies, and methodologies.
3. To discuss various software testing issues and solutions in software unit test, integration and system testing.
4. To expose the advanced software testing topics, such as object-oriented software testing methods.
5. To develop skills in software test automation and management using latest tools.

Course Outcomes: After learning the concepts of this course, the student is able to

1. Outline the necessity of testing, debugging using program control flow.
2. Apply transaction flow, data flow testing to unit and integration testing. Able to test a domain or an application and identify the nice and ugly domains.
3. Apply reduction procedures to a control flow graph and simplify it into a single path expression and the use of decision tables in test case design.
4. Understand the testing of state graphs.
5. Analyze graph matrices for optimizing the code and use of testing tools like WinRunner, JMeter.

UNIT – I

Introduction: Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs.

Flow graphs and Path testing: Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT - II

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

Dataflow testing: Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing.

Domain Testing: domains and paths, Nice & 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 or Win-runner).

TEXT BOOKS:

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

REFERENCE BOOKS:

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



B. Tech. in COMPUTER SCIENCE AND ENGINEERING

IV Year I Semester Syllabus (KR23)

DATA MINING (23CE711PE)

(Professional Elective-IV)

Common to CSE, CSE(AI&ML), IT

L	T	P	C
3	0	0	3

Prerequisites/ Co-requisites:

1. 23CC302PC – Database Management Systems Course
2. 23CC307PC – Object Oriented Programming through Java Lab Course

Course Objectives: The course will help to

1. Introduce methods for mining frequent patterns, associations, and correlations.
2. Describe methods for data classification and prediction, and data-clustering approaches.
3. Analyze various mining types of data stores such as spatial, textual, multimedia, streams.
4. Gain practical intuition about how to apply these techniques on datasets of realistic sizes using modern data analysis frameworks.
5. Learn new, advanced techniques for emerging applications (e.g. social network analysis, stream data mining).

Course Outcomes: After learning the concepts of this course, the student is able to

1. Understand the types of the data to be mined and present a general classification of tasks and primitives to integrate a data mining system.
2. Apply preprocessing methods for any given raw data.
3. Extract interesting patterns from large amounts of data.
4. Discover the role played by data mining in various fields.
5. Choose and employ suitable data mining algorithms to build analytical applications

UNIT - I

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

UNIT - II

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

UNIT - III

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

UNIT - IV

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

UNIT - V

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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



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B. Tech. in COMPUTER SCIENCE AND ENGINEERING

IV Year I Semester Syllabus (KR23)

SERVICE ORIENTED ARCHITECTURE (23CS722PE)

(Professional Elective-V)

L	T	P	C
3	0	0	3

Prerequisites/ Co-requisites:

1. 23CC305PC – Object Oriented Programming through Java Course
2. 23CC501PC - Software Engineering Course

Course Objectives: The course will help to

1. Establish essential coverage of service oriented architectural models and its underlying design paradigm, along with documentation of the methodology
2. Understand advanced concepts such as service composition, orchestration and Choreography
3. Gain understanding of the basic principles of service orientation
4. Learn technology underlying the service design
5. Know about various WS specification standards

Course Outcomes: The student will be able to

1. Analyze problems in service orientation
2. Discuss about the characteristics of SOA
3. Analyze various principles of SOA
4. Apply service-oriented concepts in real world scenarios
5. Understand case studies of service-oriented architectures

UNIT-I:

Understanding Service-Oriented: Introduction to Service-Oriented- Services in Business Automation, Services Are Collections of Capabilities, Service-Oriented as a Design Paradigm, Service Orientation Design Principles.

Problems Solved by Service-Oriented: Effects of Service-Oriented on the Enterprise- Service Orientation and the Concept of Application, Service-Oriented and the Concept of Integration, The Service Composition.

Goals and Benefits of Service-Oriented Computing: Increased Intrinsic Interoperability, Increased Federation, Increased Vendor Diversification Options, Increased Business and Technology Domain Alignment, Increased ROI, Increased Organizational Agility, Reduced IT Burden.



Four Pillars of Service-Orientation: Teamwork, Education, Discipline, Balanced Scope.

UNIT-II:

Understanding Service Oriented Architecture: Introduction to SOA, The Four Characteristics of SOA Business Driven, Vendor Neutral, Enterprise Centric, Composition Centric, Design Priorities.

The Four Common Types of SOA: Service Architecture, Service Composition Architecture, Service Inventory Architecture, Service Oriented Enterprise Architecture.

The End Result of Service Orientation and SOA: SOA Project and Lifecycle Stages Methodology and Project Delivery Strategies, SOA Project Stages, SOA Adoption Planning, Service Inventory Analysis.

UNIT-III:

Service-Orientation Principles: A profile for the Standardized Service Contract principle, A profile for the Service Loose Coupling principle, A profile for the Service Abstraction principle, A profile for the Service Reusability principle, A profile for the Service Autonomy principle, A profile for the Service Statelessness principle, A profile for the Service Discoverability principle, A profile for the Service Composability principle (Appendix-A of the Textbook)

UNIT-IV:

Service-Oriented Analysis and Design: Web Service Modelling Process, Decompose the Business Process (into Granular Actions), Filter Out Unsuitable Actions, Define Entity Service Candidates, Identify Process-Specific Logic, Apply Service Orientation, Identify Service Composition Candidates, Analyze Processing Requirements, Define Utility Service Candidates, Define Micro service Candidates, Apply Service-Oriented, Revise Service Composition Candidates, Revise Capability Candidate Grouping.

UNIT-V:

Case Study Backgrounds: Case Studies- Transit Line Systems history, technical infrastructure, automation solutions, business goals and obstacles, Inc., Midwest University Association



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B. Tech. in COMPUTER SCIENCE AND ENGINEERING IV Year I Semester Syllabus (KR23) SOFTWARE TESTING METHODOLOGIES LAB (23CS703PC)

L	T	P	C
0	0	2	1

Pre-requisites/ Co-requisites:

1. 23CC505PC – Software Engineering Lab course.

Course Objectives: The course will help to

1. To provide knowledge of Software Testing Methods.
2. To develop skills in software test automation and management using latest tools.
3. To expose the advanced software testing topics, such as object-oriented software testing methods.
4. To develop skills in software test automation and management using latest tools.
5. To discuss various software testing issues and solutions in software unit test, integration and system testing.

Course Outcomes: After learning the concepts of this course, the student is able to

1. Design and develop the best test strategies in accordance to the development model.
2. Outline the necessity of testing, debugging using program control flow.
3. Apply transaction flow, data flow testing to unit and integration testing. Able to test a domain or an application and identify the nice and ugly domains.
4. Understand the testing of state graphs.
5. Analyze graph matrices for optimizing the code and use of testing tools like WinRunner, JMeter.

Software to be used: The students must use Selenium.

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
 - a) Bitmap checkpoint for object/window
 - b) Bitmap checkpoint for screen area
5. Database checkpoint for Default check
6. Database checkpoint for custom check
7. Database checkpoint for runtime record check
 - a) Data driven test for dynamic test data submission
 - b) Data driven test through flat files
 - c) Data driven test through front grids
 - d) Data driven test through excel test
 - e) Batch testing without parameter passing
 - f) Batch testing with parameter passing
8. Data driven batch
9. Silent mode test execution without any interruption
10. Test case for calculator in windows application



TEXT BOOKS:

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

REFERENCE BOOKS:

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



B.Tech. in INFORMATION TECHNOLOGY
IV Year I Semester Course Syllabus (KR23)
DATA VISUALIZATION TECHNIQUES (23IT700OE)
OPEN ELECTIVE-II

L	T	P	C
3	0	0	3

Course Objectives: The course will help to

1. Learn about Data visualization foundations.
2. Learn the basic foundations of visualization
3. Understand the Visualization Techniques and Visualization Spatial Data.
4. Understand Multivariate Data, Text and Document Visualization.
5. Understand Interaction Concepts and Techniques.

Course Outcomes: The student will be able to

1. Visualize the objects in different dimensions.
2. Design and process the data for Virtualization.
3. Apply the visualization techniques for Spatial Data
4. Apply the visualization techniques for text documents.
5. Apply the Interaction Concepts and Techniques for research projects.

UNIT-I:

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

UNIT-II:

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

UNIT-III:

Visualization Techniques: Spatial Data: One-Dimensional Data, Two-Dimensional Data, Three-Dimensional Data, Dynamic Data, Combining Techniques.

Visualizing Spatial Data: Visualization of Point Data, Visualization of Line Data, and Visualization of Area Data, Other Issues in Geospatial Data Visualization.

UNIT-IV:

Multivariate Data: Point-Based Techniques, Line- Based Techniques, Region-Based Techniques, and Combinations of Techniques, Trees Displaying Hierarchical Structures, Graphics and Networks, Displaying Arbitrary Graphs/Networks.

Text and Document Visualization: Levels of Text Representations, the Vector Space Model.

Single Document Visualizations: Document, Collection Visualizations, Extended Text Visualizations.

UNIT-V:

Interaction Concepts: Interaction Operators: Interaction Operands and Space.

Interaction Techniques: Screen Space, Object Space, Data Space Attribute Space, Data Structure Space, Visualization Structure, Animating Transformations, Interaction Control.

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

TEXT BOOKS:

1. "Interactive Data Visualization Foundations, Techniques, Applications "Matthew Ward, Georges Grinstein and Daniel Keim, 2010.
2. "Information Visualization Perception for Design", 4th edition, Colin Ware, Morgan Kaufmann Publishers, 2020.

REFERENCE BOOKS:

1. "Information visualization – Design for interaction", Robert Spence, Pearson Education, 2nd Edition, 2007.
2. "Data Visualization: Principles and Practice, Second Edition" Alexandru C. Telea, A. K. Peters Ltd, 2014.



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B. Tech. in INFORMATION TECHNOLOGY

B.Tech. in INFORMATION TECHNOLOGY IV Year I Semester Course Syllabus (KR23) R PROGRAMMING (23IT701OE) OPEN ELECTIVE-II

L	T	P	C
3	0	0	3

Course Objectives: The course will help

1. Understand and able to use basic programming concepts.
2. Automate data analysis.
3. Working collaboratively and openly on code.
4. Knowing how to generate dynamic documents.
5. Being able to use a continuous test-driven development approach.

Course Outcomes: After learning the concepts of this course, the student is able to

1. Demonstrate concepts of R Language through programs.
2. Apply R to solve statistical problems.
3. Implement and describe Monte Carlo the technology.
4. Develop Minimize and maximize functions using R.
5. Apply Object Oriented Programming concepts in R Programming.

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 Sub table.

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:

OBJECT-ORIENTED PROGRAMMING: S Classes, S Generic Functions, Writing S Classes, Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Function on an S Class, visualization, Simulation, code profiling, Statistical Analysis with R, data manipulation.

TEXT BOOKS:

- 1.R Programming for Data Science by Roger D. Peng. Published by Roger D. Peng, 2015
- 2.The Art of R Programming by Prashanth singh, Vive kMourya, Cengage Learning India.

REFERENCE BOOKS:

1. G. Grolemond, " R Programming An Approach to Data Analytics," Mjp Publisher, 2021.

B.Tech in COMPUTER SCIENCE AND ENGINEERING

IV Year I Semester Syllabus (KR23)

INFORMATION RETRIEVAL SYSTEMS (23CE723PE)

(Professional Elective-V)

Common to CSE, CSE(AI&ML), IT

Prerequisites/Co-requisites:

L	T	P	C
3	0	0	3

1. 23CC402PC-Data Structures Course.

Course Objectives : The course will help to

1. Gain knowledge on information retrieval system capabilities.
2. Understand the different computational search problems and evaluate search engines.
3. Demonstrate automatic indexing and Term clusters.
4. Analyze different applications of informational retrieval techniques in the internet or web environment.
5. Analyze information visualization and system evaluation.

Course Outcomes: After learning the concepts of this course, the student is able to

1. Understand various functionalities and capabilities of Information Retrieval System.
2. Analyze cataloging and data structure methodology for IRS.
3. Select various clustering algorithms and indexing.
4. Differentiate various user search techniques and system search techniques.
5. Understand the concepts of information visualization and text search.

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, and Hypertext Link ages Document and Term Clustering: Introduction to Clustering, Thesaurus Generation, Item Clustering, and 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.

TEXTBOOK:

1. Information Storage and Retrieval Systems-Theory and Implementation, Greisd J. Kowalski, Mark T. Maybury 2nd Edition., Springer.

REFERENCEBOOKS:

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



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B. Tech. in COMPUTER SCIENCE AND ENGINEERING

IV Year I Semester Syllabus (KR23)

SKILL DEVELOPMENT COURSE-III (23CS705PC)

Common to CSE, CSE (DS), CSE (AI&ML), IT

L	T	P	C
0	0	2	1

Pre-requisites/ Co-requisites:

1. 23CS503PC - Web Technologies Course

Course Objectives: The course will help to

1. Provide an understanding of the fundamentals of ReactJS for developing modern web applications.
2. Explain the concepts of JSX, components, props, and state for building reusable user interface components.
3. Enable students to use React Hooks for effective state management and handling side effects.
4. Introduce client-side routing techniques using React Router for single-page applications.
5. Develop the ability to build interactive, data-driven applications using forms, conditional rendering, and API integration.

Course Outcomes: After learning the concepts of the course, the student is able to

1. Understand the core concepts of ReactJS and develop applications using JSX and functional components.
2. Apply props and state to manage data flow and user interactions in React applications.
3. Use React Hooks such as useState and useEffect to manage component state and lifecycle behavior.
4. Implement routing and navigation in single-page applications using React Router.
5. Design and develop complete ReactJS applications that consume external APIs and handle user input effectively.

List of Experiments:

1. Build a React application to demonstrate JSX and Virtual DOM
2. Create a product listing page using multiple stateless React components. The page should include a header, product cards displaying name, price, and category, and a "Buy Now" button that responds to user interactions using props.
3. Develop an inventory management application using React Hooks such as useState, useEffect, useContext, useRef, and useMemo. The application should allow adding products, searching products, calculating total inventory value, and toggling between light and dark themes dynamically.
4. Build a simplified e-commerce application using React Router. The application should include Home, Products, Product Details, Contact, Login, Cart, and 404 pages with dynamic routing, protected routes, and navigation links.

5. Create a React form where input fields are dynamically generated from a JavaScript configuration object. The form should store user input using state and display the submitted data below the form.
6. Develop a React single-page application with routing between Home and Users pages. Fetch user data from a public API using `useEffect` and `useState`, display the data conditionally, and show a loading indicator while data is being fetched.

TEXT BOOKS:

1. Learning React, Alex Banks, Eve Porcello, O'Reilly Media.
2. React Up & Running, Stoyan Stefanov, O'Reilly Media.

REFERENCE BOOKS:

1. Full stack React, Anthony Accomazzo et al., Fullstack.io.
2. Pro React, Adam Freeman, Apress.
3. The Road to Learn React, Robin Wieruch.



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B.Tech in COMPUTER SCIENCE AND ENGINEERING

IV Year I Semester Syllabus (KR23)

ENVIRONMENTAL SCIENCE(*23MC706HS)

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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). Towards Sustainable Future: Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 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.



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IV Year B.Tech. CSE, IT, CSE(DS), CSE(AIML)

II Semester Course Syllabus (KR23)

MANAGEMENT SCIENCE (23CS801HSM)

Prerequisite/ Corequisite: Nil

L T P C

Course Objectives: The course will help to

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1. Learn various concepts of Management, different approaches and theories.
2. Study Plant Layout methods and Statistical Quality Control Techniques.
3. Learn the concepts of Human Resource Management and Industrial Relations
4. Learn and evaluate Project Management Techniques.
5. Study the concepts of Strategic and Contemporary management issues.

Course Outcomes: After learning the concepts of this course, the student is able to

1. Understand the Concepts of Management and Organization framework.
2. Apply the Concepts of SQC and learn about various Marketing Strategies.
3. Know about HRM, HRD and Personnel Management and Industrial Relations
4. Apply the concepts of Project Management Techniques like PERT/CPM.
5. Identify the Strategic Management issues and able to conduct SWOT Analysis, Value Chain Analysis etc.

UNIT –I

Introduction to Management and Organisation- Concepts of Management and organization- nature, importance and Functions of Management, Systems Approach to Management-Taylor's Scientific Management Theory Fayol's Principles of Management-Maslow's theory of Hierarchy of Human Needs-Douglas McGregor's Theory X and Theory Y-Hertzberg Two Factor Theory of Motivation - Leadership Styles, Social responsibilities of Management. Planning-Process, Types- Decision Making and problem solving. Principles of Organization-Organizational Structures.

UNIT –II

Operations and Marketing Management: Principles and Types of Plant Layout-Methods of production (Job, batch and Mass Production), Work Study-Basic procedure involved in Method Study and Work Measurement – Business Process Reengineering (BPR) - Statistical Quality Control: control charts for Variables and Attributes (simple Problems) and Acceptance Sampling, TQM, Six Sigma, Deming's contribution to quality. Functions of Marketing, Marketing Mix, and Marketing Strategies based on Product Life Cycle, Channels of distribution.

UNIT –III

Human Resources Management (HRM): Concepts of HRM, HRD and Personnel Management and Industrial Relations (PMIR), HRM vs PMIR, Basic functions of HR Manager: HR planning, Recruitment, Selection, Training and Development, Placement, Compensation and Reward Management, Promotion, Transfer, Separation, Performance Appraisal, Capability Maturity Model (CMM) Levels – Performance Management System.

UNIT –IV

Project Management (PERT/CPM): Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing (simple problems).

UNIT –V

Strategic Management and Contemporary Strategic Issues: Vision, Mission, Goals, Policy, Strategy, Programmes, Elements of Corporate Planning Process, Environmental Scanning, Value Chain Analysis, SWOT Analysis, Steps in Strategy Formulation and Implementation, Generic Strategy alternatives. Bench Marking and Balanced Score Card as Contemporary Business Strategies.

TEXT BOOKS:

1. Stoner, Freeman, Gilbert, *Management*, 6th Ed, Pearson Education, New Delhi, 2004
2. P. Vijaya Kumar, N. Appa Rao and Ashima B. Chhalil, Cengage Learning India Pvt Ltd, 2012.

REFERENCE BOOKS:

1. Kotler Philip and Keller Kevin Lane: *Marketing Management*, Pearson, 2012.
2. Koontz and Weihrich: *Essentials of Management*, McGraw Hill, 2012.
3. Thomas N. Duening and John M. Ivancevich *Management—Principles and Guidelines*, Biztantra, 2012.
4. Kanishka Bedi, *Production and Operations Management*, Oxford University Press, 2012.
5. Samuel C. Certo: *Modern Management*, 2012.
6. Frederick S. Hiller | Mark S. Hiller : *Introduction to Management Science. (Case Studies)*. McGraw Hill, 2019.
7. Parnell: *Strategic Management*, Cengage, 2012.
8. Lawrence R. Jauch, R. Gupta and William F. Glueck: *Business Policy and Strategic Management*, Frank Bros. 2012.
9. Aryasri: *Management Science*, McGraw Hill, 2012



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B. Tech. in COMPUTER SCIENCE AND ENGINEERING
IV Year II Semester Syllabus (KR23)
SOFTWARE PROCESS AND PROJECT MANAGEMENT (23CE811PE)
(Professional Elective-VI)
Common to CSE, CSE(DS), CSE(AI&ML), IT

L	T	P	C
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Prerequisite/ Corequisite:

1. 23CC501PC- Software Engineering Course

Course Objectives: The course will help to

1. Acquire knowledge on phases in the life cycle of software development.
2. Acquire knowledge on project organization, project control and process instrumentation
3. Acquire knowledge on software process management
4. Acquire managerial skills for software project development
5. Understand software economics

Course Outcomes: After learning the concepts of this course, the student is able to

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

UNIT – I:

Software Process Maturity: Software maturity Framework, Principles of Software Process Change, Software Process Assessment, The Initial Process, The Repeatable Process, The Defined Process, The Managed Process, The Optimizing Process.

Process Reference Models: Capability Maturity Model (CMM), CMMI, PCMM, PSP, TSP).

UNIT – II:

Software Project Management Renaissance: Conventional Software Management, Evolution of Software Economics, Improving Software Economics, The old way and the new way.

Life-Cycle Phases and Process artifacts: Engineering and Production stages, inception phase, elaboration phase, construction phase, transition phase, artifact sets, management artifacts, engineering artifacts and pragmatic artifacts, model-based software architectures.

UNIT – III:

Workflows and Checkpoints of process: Software process workflows, Iteration workflows, Major milestones, minor milestones, periodic status assessments.



Process Planning: Work breakdown structures, Planning guidelines, cost and schedule estimating process, iteration planning process, Pragmatic planning.

UNIT – IV:

Project Organizations: Line-of- business organizations, project organizations, evolution of organizations, process automation.

Project Control and process instrumentation: The seven-core metrics, management indicators, quality indicators, life-cycle expectations, Pragmatic software metrics, metrics automation.

UNIT – V:

CCPDS-R: Case Study, analysis of CCPDS-R's project management strategies and Future Software Project Management Practices, Agile methodologies vs traditional project management, Modern Project Profiles, Next-Generation software Economics, Cost estimation models for modern software projects, Modern Process Transitions.

TEXT BOOKS:

1. Managing the Software Process, Watts S. Humphrey, Pearson Education, 2013.
2. Software Project Management, Walker Royce, Pearson Education, 2014.

REFERENCE BOOKS:

1. An Introduction to the Team Software Process, Watts S. Humphrey, Pearson Education, 2000
Process Improvement essentials, James R. Persse, O'Reilly, 2006
2. Software Project Management, Bob Hughes & Mike Cotterell, fourth edition, TMH, 2006
3. Applied Software Project Management, Andrew Stellman & Jennifer Greene, O'Reilly, 2006
4. Head First PMP, Jennifer Greene & Andrew Stellman, O'Reilly, 2007
5. Software Engineering Project Management, Richard H. Thayer & Edward Yourdon, 2nd edition, Wiley India, 2004.
6. Agile Project Management, Jim Highsmith, Pearson education, 2004.



B.Tech. in INFORMATION TECHNOLOGY

IV Year II Semester Course Syllabus (KR23)

LINUX PROGRAMMING (23IT800OE)

OPEN ELECTIVE-III

L	T	P	C
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Course Objectives:

1. To understand and make effective use of Linux utilities and Shell scripting language(bash) to solve Problems.
2. To implement in C some standard Linux utilities such as ls, mv, cp etc. using systemcalls.
3. To develop the skills necessary for systems programming including file systemprogramming, process and signal management, and interprocess communication.
4. To develop the basic skills required to write network programs using Sockets.
5. Gain Proficiency in Advanced Linux Configuration and Automation

Course Outcomes:

1. Work confidently in Linux environment.
2. Work with shell script to automate different tasks as Linux administration.
3. acquire advanced skills in text processing and data manipulation using Linux command-line tools
4. gain a deep understanding of IPC methods such as pipes, FIFOs, message queues, semaphores, and shared memory.
5. effectively manage and manipulate the Linux file system, including understanding file permissions, file types, and directory structures.

UNIT I:

Essential Linux Utilities and Shell Programming: Core File Handling Utilities basic file operations- creating, reading, writing, and deleting files. Understanding and setting file permissions for security. Process Utilities, managing processes- viewing, starting, and stopping processes. Disk management- disk usage, formatting, and partitioning. Networking Commands basic networking utilities- ping, ifconfig, netstat. Text Processing and Filters- Using grep, sed, awk for text manipulation and data extraction, backup Utilities, Sed and Awk Programming basic scripts, operations, and applications, Awk: Execution, fields and records, basic patterns, actions, and array usage.

Shell Programming with Bash: Bash and its responsibilities, pipes, redirection, here documents. Writing and running shell scripts. Shell programming basics: variables, loops, control structures. Basic debugging techniques for shell scripts.

UNIT II:

Files and Directories: File concept ,File types, File system structure, File Metadata and Inodes. Kernel support for files and handling files. System calls for file IO operations- open, creat, read, write, close, lseek, dup2, file status and information stat family, file and record locking- fcntl function, file permissions - chmod, fchmod, file ownership-chown, lchown, fchown, links-soft links and hard links – symlink, link, unlink. **Directories** - Creating, removing and changing Directories-mkdir, rmdir, chdir, obtaining current working directory-getcwd, Directory contents, Scanning Directories-opendir, readdir, closedir, rewinddir functions.

UNIT III:

Processes and Signal Management in Linux: Process concept, Layout of a C program image in main memory, Process environment-environment list, environment variables, getenv, setenv, Kernel support for process, process identification, process control - process creation and image replacement, managing process states: waiting, termination, zombie and orphan processes. System call interface for process management -fork, vfork, exit, wait, waitpid, exec family. Process Groups, Sessions and Controlling Terminal, Differences between threads and processes.

Signals: Exploring various signal functions: kill, raise, alarm, pause, abort, sleep, unreliable vs reliable signals.

UNIT IV:

Interprocess Communication (IPC) in Linux: Introduction to IPC, Overview of IPC and its importance in Linux, Differentiating IPC on a single system vs. across multiple systems.

Pipes and FIFOs- creating pipes for IPC between related processes, using FIFOs (Named Pipes) for IPC between unrelated processes, differences between unnamed and named pipes, utilizing popen and pclose library functions.

Message Queues - Kernel support for messages, APIs for message queues, client/server example. **Semaphores** - Kernel support for semaphores, APIs for semaphores, file locking with semaphores.

UNIT- V:

Shared Memory - Kernel support for shared memory, APIs for shared memory, shared memory example.

Sockets - Introduction to Berkeley Sockets, IPC over a network, Client- Server model, Socket address structures (Unix domain and Internet domain), Socket system calls for connection oriented protocol and connectionless protocol, example-client/server programs-Single Server-Client connection, Multiple simultaneous clients, Socket options- setsockopt and fcntl system calls, Comparison of IPC mechanisms.

TEXT BOOKS:

1. Unix System Programming using C++, T. Chan, PHI.
2. Unix Concepts and Applications, 4th Edition, Sumitabha Das, TMH.
3. Unix Network Programming, W. R. Stevens, PHI.

REFERENCE BOOKS:

1. Beginning Linux Programming, 4th Edition, N. Matthew, R. Stones, Wrox, WileyIndia Edition.
2. Unix for programmers and users, 3rd Edition, Graham Glass, King Ables, Pearson.
3. System Programming with C and Unix, A. Hoover, Pearson.
4. Unix System Programming, Communication, Concurrency and Threads, K. A. Robbins and S. Robbins, Pearson Education.
5. Unix shell Programming, S. G. Kochan and P. Wood, 3rd edition, Pearson Education.



B.Tech. in INFORMATION TECHNOLOGY

IV Year II Semester Course Syllabus (KR23)

CONCURRENT PROGRAMMING (23IT801OE)

OPEN ELECTIVE- III

L	T	P	C
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Course Objectives: The course will help to

1. Explore the abstractions used in concurrent programming.
2. Understand shared objects and mutual exclusion.
3. Understand concurrent objects, linearizability and locks.
4. Understand synchronization operations and universality.
5. Understand concurrent queues and stacks.

Course Outcomes: After learning the concepts of this course, the student is able to

1. Implement the mechanisms for communication among concurrent processes.
2. Implement the mechanisms for co-ordination among concurrent processes.
3. Understand and reason about concurrency and concurrent objects
4. Implement the locking and non-blocking mechanisms
5. Understand concurrent objects

UNIT – I:

Introduction: Shared Objects and Synchronization, A Fable, Properties of Mutual Exclusion, The Moral, The Producer–Consumer Problem, The Harsh Realities of Parallelization. Mutual Exclusion - Time, Critical Sections, 2-Thread Solutions, The Peterson Lock, The Filter Lock, Lamport's Bakery Algorithm.

UNIT – II:

Concurrent Objects :Concurrency and Correctness, Sequential Objects, Quiescent consistency, Sequential Consistency, Linearizability, Linearization Points, Formal Definitions Linearizability, Compositional Linearizability, The Nonblocking Property, Progress conditions, Dependent Progress Conditions, The Java Memory Model, Locks and synchronized Blocks, Volatile Fields, Final Fields.

UNIT – III:

Synchronization Operations, Consensus Numbers, Consensus Protocols, The compareAndSet() Operation, Introduction Universality, A Lock-Free Universal, Construction Wait-Free Universal Construction, Spin Locks , Test-And-Set Locks.

UNIT – IV:

Linked Lists: The Role of Locking, Introduction, List-Based Sets, Concurrent Reasoning, Coarse- Grained Synchronization, Fine-Grained Synchronization, Optimistic Synchronization, Lazy Synchronization, Non-Blocking Synchronization.

UNIT – V:

Concurrent Queues and the ABA Problem, Concurrent Stacks and Elimination, Transactional Memories.

TEXT BOOKS:

1. The Art of Multiprocessor Programming, by Maurice Herlihy and NirShavit, Morgan Kaufmman Publishers, 1st Edition, Indian Reprint 2012.

REFERENCE BOOKS:

1. Java Concurrency in Practice by Brian Goetz, Tim Peierls, Joshua Block, Joseph Bowbeer, David Holmes and Doug Lea, Addison Wesley, 1st Edition, 2006.
2. Concurrent Programming in Java™: Design Principles and Patterns, Second Edition by Doug Lea, Publisher: Addison Wesley, Pub Date: October 01, 1999.