GLOBAL INSTITUTE OF ENGINEERING AND TECHNOLOGY (AUTONOMOUS)
COURSE CATALOGUE
REGULATIONS B.TECH – GR - 24
COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
III YEAR I SEMESTER

Course Code	Course Name	Subject Area	Category	Periods Per Week			Credits	Scheme of Examination Max Marks		
				L	T	P		CIA	SEE	Total
THEORY										
DS501PC	Design and Analysis of Algorithms	PCC	Core	3	1	0	4	40	60	100
DS502PC	Introduction to Data Science	PCC	Core	3	0	0	3	40	60	100
DS503PC	Big Data Analytics	PCC	Core	3	0	0	3	40	60	100
	Professional Elective-I	PEC	Elective	3	0	0	3	40	60	100
	Professional Elective -II	PEC	Elective	3	0	0	3	40	60	100
PRACTICAL										
DS504PC	R Programming Lab	PCC	Core	0	0	2	1	40	60	100
DS505PC	Big Data Analytics Lab	PCC	Core	0	0	2	1	40	60	100
EN506HS	Advanced English Communication Skills Lab	HSMC	Foundation	0	0	2	1	40	60	100
DS507PC	ETL-Kafka/Talend	PCC	Core	0	0	2	1	40	60	100
			Total Credits	**15**	**1**	**8**	**20**			

Professional Elective – I

DS511PE	Data Warehousing and Business Intelligence
DS512PE	Artificial Intelligence
DS513PE	Web Programming
DS514PE	Image Processing
DS515PE	Computer Graphics

Professional Elective – II

DS521PE	Spatial and Multimedia Databases
DS522PE	Software Project Management
DS523PE	Information Retrieval Systems
DS524PE	Devops
DS525PE	Computer Vision and Robotics

COURSE CONTENT

DESIGN AND ANALYSIS OF ALGORITHMS								
III Year - I Semester: CSE (DS)								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
DS501PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**1**	**-**	**4**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: 16	Practical Classes: Nil				**Total Classes: 64**		
Prerequisite: 1. A course on "Computer Programming and Data Structures". 2. A course on "Advanced Data Structures".								

1. COURSE OVERVIEW

The Design and Analysis of Algorithms course focuses on the fundamental principles of algorithm design and performance evaluation. It introduces students to mathematical techniques for analyzing algorithms and explores various algorithmic paradigms such as divide and conquer, greedy methods, dynamic programming, backtracking, and branch and bound. The course also provides insights into computational complexity, including tractable and intractable problems, and introduces NP-Hard and NP-Complete problems. By the end of the course, students will be equipped to design efficient algorithms and analyze their performance for real-world applications.

2. COURSE OBJECTIVE

The students will try to Learn:

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

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Analyze the time and space complexity of algorithms using asymptotic notations.
CO 2	Apply divide-and-conquer and backtracking techniques to solve computational problems.
CO 3	Design efficient solutions using dynamic programming and greedy strategies.
CO 4	Implement branch and bound techniques to solve optimization problems.
CO 5	Classify problems into P, NP, NP-Hard, and NP-Complete categories and understand their computational complexity.

4. COURSE CONTENT

UNIT – I **(12L)**

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 **(14L)**

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, hamitonian cycles.

UNIT - III **(14L)**

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

UNIT - IV **(12L)**

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 **(12L)**

Branch and Bound: General method, applications - Traveling salesperson 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.

5. TEXT BOOKS

1) Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharan, University press, 1998.

6. 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.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**3**	**2**	**2**	–	–	–	–	–	–	–	**2**		
CO 2	**3**	**3**	**3**	**2**	**2**	–	–	–	–	–	–	**2**		
CO 3	**3**	**3**	**3**	**2**	**2**	–	–	–	–	–	–	**2**		
CO 4	**3**	**3**	**3**	**3**	**2**	–	–	–	–	–	–	**2**		
CO 5	**3**	**3**	**2**	**3**	–	–	–	–	–	–	–	**3**		

COURSE CONTENT

INTRODUCTION TO DATA SCIENCE								
III Year - I Semester: CSE (DS)								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
DS502PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite: Nil								

1. COURSE OVERVIEW

This course provides an introduction to **Data Science** and its role in analyzing and interpreting data. Students will learn **R programming** for handling data, performing statistical analysis, and visualizing results effectively. The syllabus covers **data types, data structures, control flow, functions, and exploratory data analysis** using various charts and graphs. It also introduces **linear and multiple regression techniques** for building basic predictive models.

2. COURSE OBJECTIVE

The students will try to Learn:

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

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Understand the fundamentals of Data Science, statistical modeling, and probability, and set up the R programming environment for data analysis.
CO 2	Classify and describe different types of data using attributes, measures of central tendency, dispersion, and visualize them using basic statistical summaries.
CO 3	Manipulate and analyze vectors, matrices, arrays, lists, factors, and data frames in R to organize and process complex datasets.
CO 4	Apply conditional statements, loops, and user-defined functions to implement iterative and modular data processing in R programs.
CO 5	Perform data visualization using various charts and plots, and build linear and multiple regression models to derive insights and make predictions.

4. COURSE CONTENT

UNIT – I **(10L)**

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 **(10L)**

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 **(10L)**

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 **(10L)**

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 **(8L)**

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.

5. 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.

6. 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 Steinbanch, Pearson Education.
3) Brain 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. CO–PO Mapping

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**2**	**2**	**3**							**2**	**3**	**1**
CO 2	**3**	**3**	**2**	**2**	**2**				**1**	**1**		**2**	**3**	**1**
CO 3	**3**	**3**	**3**	**2**	**3**				**1**	**1**		**2**	**3**	**1**
CO 4	**3**	**3**	**3**	**2**	**3**				**2**	**1**		**2**	**3**	**1**
CO 5	**3**	**3**	**3**	**2**	**3**				**2**	**1**		**2**	**3**	**2**

COURSE CONTENT

BIG DATA ANALYTICS								
III Year - I Semester: CSE (DS)								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
DS503PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite: Nil								

1. COURSE OVERVIEW

This course introduces students to the **concepts of Big Data, Hadoop ecosystem, NoSQL databases, and MongoDB**, along with **R programming** for data analysis. Students learn to handle, process, and analyze large-scale datasets using **MapReduce and R analytics**. The course covers **data classification, Big Data analytics, distributed computing, NoSQL vs SQL, and MongoDB queries**, while providing hands-on experience in **R programming for data manipulation, visualization, and statistical analysis**. By the end, students can leverage Big Data technologies and R to perform advanced data-driven decision-making.

2. COURSE OBJECTIVE

The students will try to Learn:

1) Provide the knowledge of principles and techniques for Big data Analytics and give an exposure of the frontiers of Big data Analytics.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Understand the evolution of Big Data, its classification, and analytics concepts, including challenges and terminology in data-intensive environments.
CO 2	Explain the Hadoop framework, HDFS architecture, and ecosystem components, and differentiate RDBMS vs Hadoop for distributed data processing.
CO 3	Implement MapReduce programming for distributed data processing and compare NoSQL, SQL, and NewSQL databases in industry scenarios.
CO 4	Develop applications using MongoDB, understanding its data types, queries, and differences from relational databases.
CO 5	Apply R programming constructs, data structures, control statements, functions, and graphical tools to analyze and visualize structured and unstructured data.

4. COURSE CONTENT

UNIT – I **(10L)**

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 **(10L)**

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 **(10L)**

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 **(10L)**

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

UNIT – V **(8L)**

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.

5. TEXT BOOKS

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

6. 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.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**2**	**2**	**2**							**2**	**2**	**1**
CO 2	**3**	**3**	**3**	**2**	**3**							**2**	**2**	**2**
CO 3	**3**	**3**	**3**	**2**	**3**				**1**	**1**		**2**	**2**	**2**
CO 4	**3**	**3**	**3**	**2**	**3**				**1**	**1**		**2**	**2**	**1**
CO 5	**3**	**3**	**3**	**2**	**3**				**1**	**1**		**2**	**2**	**1**

COURSE CONTENT

DATA WAREHOUSING AND BUSINESS INTELLIGENCE (Professional Elective – I)								
III Year - I Semester: CSE (DS)								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
DS511PE	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite: Database Management Systems								

1. COURSE OVERVIEW

This course introduces the concepts and applications of **Business Intelligence (BI) and Data Warehousing**, emphasizing data-driven decision-making for organizations. Students will learn data modeling, OLAP operations, and methods for computing data cubes, along with BI frameworks, life cycles, and implementation strategies. The course covers advanced topics including Big Data, social media analytics, and emerging BI tools. Ethical, legal, and integration considerations in BI systems are also discussed, preparing students to leverage BI effectively in real-world business scenarios.

2. COURSE OBJECTIVE

The students will try to Learn:

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

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Explain the fundamentals of data warehousing, data modeling, and OLAP operations, and apply data cube computation methods.
CO 2	Describe business intelligence concepts, components, life cycle, and data quality issues, and analyze information hierarchy for decision-making.
CO 3	Implement BI frameworks, key performance indicators (KPIs), and performance metrics to support business decision-making and evaluate BI best practices.
CO 4	Explore advanced BI concepts including Big Data, social networks, mobile BI, and evaluate BI tools such as Pentaho and KNIME.
CO 5	Integrate BI systems considering legal, ethical, and social networking issues, and demonstrate practical implementation strategies.

4. COURSE CONTENT

UNIT – I **(10L)**

Data Warehouse, Data Warehouse Modelling, OLAP operations, Data Qube Computation methods.

UNIT – II **(10L)**

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 **(10L)**

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

UNIT – IV **(10L)**

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

UNIT – V **(8L)**

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

5. TEXT BOOKS

1) Data Mining – Concepts and Techniques - JIAWEI HAN & MICHELINE KAMBER, Elsevier, 4th Edition.
2) Rajiv Sabherwal "Business Intelligence" Wiley Publications, 2012.

6. 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 McGrawHill 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.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**2**	**2**	**1**								**2**	**1**
CO 2	**2**	**3**	**2**	**2**	**1**								**3**	**1**
CO 3	**2**	**3**	**3**	**2**	**2**								**3**	**1**
CO 4	**2**	**2**	**2**	**3**	**1**								**2**	**1**
CO 5	**1**	**2**	**3**	**2**	**3**								**2**	**1**

COURSE CONTENT

ARTIFICIAL INTELLIGENCE (Professional Elective – I)								
III Year - I Semester: CSE (DS)								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
DS512PE	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite: Nil								

1. COURSE OVERVIEW

This course introduces the core concepts of Artificial Intelligence, focusing on intelligent agents and problem-solving through search techniques. It covers uninformed, informed, adversarial, and constraint-based search methods. Logical reasoning is developed using propositional and first-order logic for knowledge-based agents. Knowledge representation through ontologies, categories, events, and planning techniques is explored. The course emphasizes classical planning and reasoning with default information. It also addresses decision-making under uncertainty using probabilistic reasoning, Bayesian networks, and Dempster–Shafer theory.

2. COURSE OBJECTIVE

The students will try to Learn:

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

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Explain the fundamental concepts of Artificial Intelligence, intelligent agents, and problem-solving approaches.
CO 2	Apply uninformed, informed, adversarial, and constraint-based search techniques to solve AI problems.
CO 3	Use propositional and first-order logic to represent knowledge and perform logical inference.
CO 4	Design knowledge-based systems using ontological engineering, categories, events, and planning methods.
CO 5	Apply probabilistic reasoning methods, including Bayesian networks and Dempster–Shafer theory, to handle uncertainty in intelligent systems.

4. COURSE CONTENT

UNIT – I **(10L)**

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 **(10L)**

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 **(10L)**

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 **(10L)**

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 **(8L)**

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.

5. TEXT BOOKS

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

6. 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

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**2**	**2**	**2**					**1**	**2**	**2**	**3**	**1**
CO 2	**2**	**3**	**3**	**2**	**2**					**1**	**2**	**2**	**3**	**1**
CO 3	**2**	**3**	**2**	**2**	**2**					**1**	**2**	**2**	**3**	**1**
CO 4	**3**	**3**	**2**	**2**	**2**					**2**	**2**	**2**	**3**	**1**
CO 5	**2**	**3**	**2**	**3**	**2**					**2**	**2**	**2**	**3**	**1**

COURSE CONTENT

WEB PROGRAMMING (Professional Elective – I)								
III Year - I Semester: CSE (DS)								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
DS513PE	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite: Basic knowledge of computer programming and internet fundamentals.								

1. COURSE OVERVIEW

This course provides comprehensive knowledge of **web technologies and Java programming**, focusing on client-side and server-side development. Students will learn to design interactive web pages using **HTML, CSS, JavaScript, HTML5, and CSS3,** and develop robust applications using **Java and object-oriented principles**. The course also introduces **database connectivity using JDBC, network programming, applets, servlets, JSP,** and **XML-based web services,** enabling students to build dynamic, data-driven, and distributed web applications.

2. COURSE OBJECTIVE

The students will try to Learn:

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

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Apply **HTML, CSS, JavaScript, and HTML5 features** to design and validate interactive client-side web pages.
CO 2	Demonstrate **object-oriented programming concepts in Java** to develop modular, reusable, and secure applications.
CO 3	Develop **database-driven and network-based applications** using JDBC, Java networking, and distributed technologies.
CO 4	Build **event-driven web components** using Java Applets, AWT, Servlets, and JSP for dynamic web applications.
CO 5	Design and implement **XML-based web services** using XML, XSLT, WSDL, UDDI, and Java web service technologies.

4. COURSE CONTENT

UNIT – I **(10L)**

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 **(10L)**

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 **(10L)**

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 **(10L)**

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 **(8L)**

XML AND WEB SERVICES

Xml – Introduction-Form Navigation-XML Documents- XSL – XSLT- Web services-UDDI-WSDL-Java web services – Web resources.

5. 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

6. 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.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**2**	**1**	**3**		**3**							**1**	**3**	**2**
CO 2	**3**	**2**	**3**		**2**				**1**			**2**	**2**	**1**
CO 3	**3**	**3**	**3**	**2**	**3**				**2**			**2**	**2**	**1**
CO 4	**2**	**2**	**3**		**3**				**2**			**1**	**2**	**1**
CO 5	**2**	**2**	**3**	**2**	**3**				**1**			**2**	**2**	**1**

COURSE CONTENT

IMAGE PROCESSING (Professional Elective – I)								
III Year - I Semester: CSE (DS)								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
DS514PE	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		

Prerequisite:

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

1. COURSE OVERVIEW

This course introduces the fundamental concepts and techniques of **Digital Image Processing.** It covers image acquisition, sampling and quantization, image transformations, enhancement, restoration, segmentation, and compression. Students will gain both theoretical understanding and practical insight into how digital images are represented, processed, analyzed, and efficiently stored or transmitted for real-world applications such as medical imaging, remote sensing, multimedia, and computer vision.

2. COURSE OBJECTIVE

The students will try to Learn:

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

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Explain the fundamentals of digital images, image formation, sampling, quantization, and apply 2D transforms such as DFT, DCT, KLT, and SVD.
CO 2	Apply spatial and frequency domain techniques to enhance images through smoothing, sharpening, and histogram-based processing.
CO 3	Analyze image degradation models and apply appropriate restoration techniques to recover degraded images.
CO 4	Implement image segmentation techniques to detect edges, boundaries, and meaningful regions in digital images.
CO 5	Evaluate and apply image compression techniques using lossless and lossy methods based on fidelity criteria and redundancy removal.

4. COURSE CONTENT

UNIT – I **(10L)**

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 **(9L)**

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

UNIT - III **(10L)**

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

UNIT - IV **(10L)**

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

UNIT - V **(9L)**

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

5. TEXT BOOKS

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

6. REFERENCE BOOKS

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

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**2**		**2**							**1**	**2**	**1**
CO 2	**3**	**3**	**3**		**2**							**1**	**2**	**1**
CO 3	**3**	**3**	**2**	**2**	**2**							**1**	**2**	**1**
CO 4	**2**	**3**	**3**		**2**							**1**	**2**	**1**
CO 5	**2**	**2**	**3**		**2**							**1**	**2**	**1**

COURSE CONTENT

COMPUTER GRAPHICS (Professional Elective – I)								
III Year - I Semester: CSE (DS)								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
DS515PE	**Elective**	**3**	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite: Nil								

1. **COURSE OVERVIEW**

This course introduces the fundamental concepts and techniques of Computer Graphics, focusing on both theoretical foundations and practical algorithms used in graphical systems. It covers graphics hardware, output primitives, polygon filling, 2-D and 3-D transformations, viewing pipelines, object representations, animation techniques, and visible surface detection methods. The course equips students with the ability to design, analyze, and implement graphics algorithms used in modern visualization, animation, CAD/CAM, gaming, and multimedia applications.

2. **COURSE OBJECTIVE**

The students will try to Learn:

1) The basics of graphics systems including Points and lines, line drawing algorithms, 2D, 3D objective transformations

3. **COURSE OUTCOMES**

After successful completion of the course, students should be able to:

CO 1	Understand the basic components of computer graphics systems, display devices, input devices, and implement fundamental output primitives and polygon filling algorithms.
CO 2	Apply 2-D geometric transformations, viewing transformations, and clipping algorithms to manipulate and display graphical objects effectively.
CO 3	Analyze and represent 3-D objects using polygonal and curved surface representations, and apply rendering techniques and color models.
CO 4	Implement 3-D geometric transformations and viewing pipelines including projections, view volumes, and clipping operations.
CO 5	Design computer animation sequences and evaluate visible surface detection algorithms for realistic scene generation.

4. **COURSE CONTENT**

UNIT - I **(10L)**

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 **(10L)**

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 **(10L)**

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 methods, color models and color applications.

UNIT - IV **(9L)**

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 **(9L)**

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

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

5. TEXT BOOKS

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

6. 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.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**2**		**1**							**1**	**2**	**1**
CO 2	**3**	**3**	**2**	**1**	**2**							**1**	**2**	**1**
CO 3	**3**	**2**	**3**	**2**	**2**							**1**	**1**	**1**
CO 4	**3**	**3**	**2**	**2**	**2**							**1**	**2**	**1**
CO 5	**2**	**3**	**2**	**2**	**2**							**2**	**1**	**1**

COURSE CONTENT

SPATIAL AND MULTIMEDIA DATABASES (Professional Elective – II)								
III Year - I Semester: CSE (DS)								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
DS521PE	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite: Database Management Systems (DBMS)								

1. COURSE OVERVIEW

This course provides an in-depth study of **spatial, image, text, audio, video, and multimedia database systems**. It introduces spatial data models, spatial query languages, indexing and query optimization techniques, and multidimensional data structures. The course also covers image, text, video, and audio database retrieval techniques, multimedia database architectures, and distributed multimedia presentation systems.

2. COURSE OBJECTIVE

The students will try to Learn:

1) The basic concepts, data models and indexing structures for spatial data, multimedia data.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Understand spatial database concepts, spatial data models, and spatial query languages.
CO 2	Analyze spatial storage techniques, indexing methods, and multidimensional data structures for efficient query processing.
CO 3	Apply image and text database retrieval techniques for similarity-based and content-based information access.
CO 4	Design and evaluate video, audio, and multimedia database systems including indexing and query processing techniques.
CO 5	Develop distributed multimedia presentations and analyze distributed multimedia server architectures and retrieval strategies.

4. COURSE CONTENT

UNIT – I **(10L)**

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 **(10L)**

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 Quadtrees, The MX-Quadtree, R-Trees, comparison of Different Data Structures.

UNIT – III **(10L)**

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 **(10L)**

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

UNIT – V **(8L)**

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.

5. TEXT BOOKS

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

6. REFERENCE BOOKS

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

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**1**		**1**							**1**	**2**	**1**
CO 2	**3**	**3**	**2**	**2**	**2**							**1**	**2**	**1**
CO 3	**2**	**3**	**3**	**2**	**2**							**1**	**2**	**1**
CO 4	**2**	**3**	**3**	**2**	**3**							**1**	**2**	**1**
CO 5	**2**	**2**	**3**	**2**	**3**							**2**	**2**	**1**

COURSE CONTENT

SOFTWARE PROJECT MANAGEMENT (Professional Elective – II)								
III Year - I Semester: CSE (DS)								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
DS522PE	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite: Software Engineering								

1. COURSE OVERVIEW

This course focuses on modern software management principles that address the limitations of conventional software development approaches. It emphasizes software economics, iterative development, model-based architectures, process frameworks, project planning, control, and metrics-driven management. The course equips students with the skills required to manage large-scale software projects efficiently by applying iterative processes, automation, quality assurance, and performance measurement techniques used in contemporary software organizations.

2. COURSE OBJECTIVE

The students will try to Learn:

1) To acquire knowledge on software process management
2) To acquire managerial skills for software project development
3) To understand software economics, workflows and frameworks.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Understand the evolution of software management, software economics, and techniques for improving software productivity and quality.
CO 2	Explain modern software management process frameworks, life-cycle phases, and process artifacts.
CO 3	Analyze model-based software architectures, workflows, and project checkpoints for effective project monitoring.
CO 4	Apply iterative planning techniques, organizational structures, and process automation for software project execution.
CO 5	Evaluate software project control mechanisms, metrics, process tailoring strategies, and emerging trends in software project management.

4. COURSE CONTENT

UNIT – I **(10L)**

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 **(10L)**

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 **(10L)**

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 processMajor milestones, Minor Milestones, Periodic status assessments.

UNIT – IV **(10L)**

Software Management Discipline-I Iterative Process Planning- Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning. Project Organizations and ResponsibilitiesLine-of-Business Organizations, Project Organizations, evolution of Organizations. Process Automation: Automation building blocks, The Project Environment.

UNIT – V **(8L)**

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 (CCPDS-R).

5. TEXT BOOKS

1) Software Project Management, Walker Royce, Addison-Wesley Pearson Education, 2005.

6. 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.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**1**		**1**							**1**	**2**	**1**
CO 2	**3**	**2**	**2**	**2**	**1**							**1**	**2**	**1**
CO 3	**2**	**3**	**2**	**2**	**2**							**1**	**3**	**1**
CO 4	**2**	**2**	**3**	**2**	**2**				**2**	**1**	**2**	**1**	**3**	**2**
CO 5	**2**	**3**	**2**	**2**	**2**				**1**	**1**	**3**	**2**	**2**	**3**

COURSE CONTENT

INFORMATION RETRIEVAL SYSTEMS (Professional Elective – II)								
III Year - I Semester: CSE (DS)								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
DS523PE	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite: Nil								

1. COURSE OVERVIEW

This course introduces the principles, models, and techniques of **Information Retrieval Systems (IRS)** used for storing, indexing, searching, and retrieving large volumes of textual and multimedia information. It covers indexing methods, data structures, automatic indexing, clustering techniques, user search strategies, information visualization, and text and multimedia retrieval algorithms. The course enables students to design efficient retrieval systems for applications such as search engines, digital libraries, and multimedia information systems.

2. COURSE OBJECTIVE

The students will try to Learn:

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

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Understand the fundamentals, objectives, and capabilities of Information Retrieval Systems and their relationship with databases and digital libraries.
CO 2	Analyze cataloging, indexing processes, and data structures used in information retrieval systems.
CO 3	Apply automatic indexing and document clustering techniques for efficient information organization and retrieval.
CO 4	Evaluate user search techniques, ranking methods, relevance feedback, and information visualization approaches.
CO 5	Design and implement text and multimedia information retrieval algorithms for diverse retrieval applications.

4. COURSE CONTENT

UNIT - I **(10L)**

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 **(10L)**

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 **(10L)**

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 **(9L)**

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 **(9L)**

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

5. TEXT BOOKS

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

6. 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.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**1**		**1**							**1**	**2**	**1**
CO 2	**3**	**3**	**2**	**2**	**2**							**1**	**3**	**1**
CO 3	**2**	**3**	**3**	**2**	**2**							**1**	**3**	**1**
CO 4	**2**	**3**	**3**	**2**	**2**							**1**	**2**	**2**
CO 5	**2**	**3**	**3**	**2**	**3**							**2**	**3**	**2**

COURSE CONTENT

DEVOPS (Professional Elective – II)								
III Year - I Semester: CSE (DS)								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
DS524PE	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite: 1. Software Engineering 2. Software Project Management								

1. COURSE OVERVIEW

The *DevOps* course introduces students to modern software development practices that integrate development and operations to enable continuous delivery and deployment. It focuses on Agile methodologies, DevOps culture, automation, continuous integration, continuous testing, and deployment strategies. The course also emphasizes architectural considerations, project management tools, build automation, testing frameworks, and deployment technologies used in real-world DevOps environments.

2. COURSE OBJECTIVE

The students will try to Learn:

1. To understand Agile, DevOps, and related methodologies for achieving continuous delivery.
2. To understand the DevOps lifecycle and its role in business agility.
3. To learn software development models and architectural patterns supporting DevOps.
4. To use version control, project management, integration, and automation tools.
5. To implement automated testing and deployment strategies in DevOps environments.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Explain the principles, practices, and components of the DevOps environment.
CO 2	Identify software development models and architectural styles supporting DevOps.
CO 3	Use version control systems, project management, and continuous integration tools.
CO 4	Apply build automation and integration techniques for continuous delivery pipelines.
CO 5	Select appropriate testing tools and deployment models for DevOps-based projects.

4. COURSE CONTENT

UNIT – I **(10L)**

Introduction to DevOps: Introduction, Agile development model, DevOps and ITIL, DevOps processes and continuous delivery, release management, Scrum, Kanban, delivery pipeline, identifying bottlenecks.

UNIT – II **(10L)**

Software Development Models and DevOps: DevOps lifecycle for business agility, DevOps and continuous testing.

DevOps Influence on Architecture: Introduction to software architecture, monolithic architecture, architecture rules of thumb, separation of concerns, handling database migrations, microservices and data tier, DevOps, architecture, and resilience.

UNIT – III **(10L)**

Project Management and Source Code Control: Need for source code control, history of source code management, roles and code, source code management systems and migrations, shared authentication, hosted Git servers, Git server implementations, Docker intermission, Gerrit, pull request model, GitLab.

UNIT – IV **(9L)**

System Integration: Build systems, Jenkins build server, managing build dependencies, Jenkins plugins and file system layout, host server and build slaves, triggers, job chaining and build pipelines, infrastructure as code, build phases, alternative build servers, collating quality measures.

UNIT – V **(9L)**

Testing Tools and Deployment: Types of testing, automation of testing – pros and cons, Selenium (introduction and features), JavaScript testing, backend integration testing, test-driven development, REPL-driven development.

Deployment of Systems: Deployment systems, virtualization stacks, client-side code execution, Puppet master and agents, Ansible, deployment tools – Chef, SaltStack, Docker.

5. TEXT BOOKS

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

6. 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.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**2**	**2**	**1**
CO 2	**3**	**3**	**2**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**2**	**2**	**1**
CO 3	**3**	**3**	**3**	**2**	**3**	**–**	**–**	**–**	**–**	**–**	**–**	**2**	**2**	**1**
CO 4	**3**	**3**	**3**	**3**	**3**	**–**	**–**	**–**	**–**	**–**	**–**	**2**	**2**	**1**
CO 5	**3**	**3**	**2**	**2**	**3**	**–**	**–**	**–**	**–**	**–**	**–**	**3**	**2**	**1**

COURSE CONTENT

COMPUTER VISION AND ROBOTICS (Professional Elective – II)								
III Year - I Semester: CSE (DS)								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
DS525PE	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite: Linear Algebra and Probability.								

1. COURSE OVERVIEW

This course provides a comprehensive introduction to **Computer Vision and Robotics**, covering image formation, radiometry, shading, color perception, image filtering, edge detection, texture analysis, multiple-view geometry, stereo vision, image segmentation, camera modeling and calibration, and foundational robotics concepts. The course emphasizes the integration of vision algorithms with robotic perception and planning, enabling students to design intelligent systems capable of interpreting visual data and interacting with real-world environments.

2. COURSE OBJECTIVE

The students will try to Learn:

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

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Understand image formation, radiometry, shading, and color models used in computer vision systems.
CO 2	Apply linear filtering, edge detection, and texture analysis techniques for image processing applications.
CO 3	Analyze multiple-view geometry, stereo vision, and segmentation techniques for scene understanding.
CO 4	Implement geometric camera models, calibration techniques, and model-based segmentation methods.
CO 5	Understand robotics fundamentals, sensing techniques, and planning strategies for autonomous robotic systems.

4. COURSE CONTENT

UNIT – I **(10L)**

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 **(10L)**

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

UNIT – III **(10L)**

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

UNIT – IV **(10L)**

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 **(8L)**

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 fields and Perception.

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

5. 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.

6. 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.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**1**		**1**							**1**	**2**	**1**
CO 2	**3**	**3**	**2**	**2**	**2**							**1**	**3**	**1**
CO 3	**2**	**3**	**2**	**2**	**2**							**1**	**3**	**1**
CO 4	**2**	**3**	**3**	**3**	**3**							**1**	**3**	**2**
CO 5	**2**	**2**	**3**	**3**	**2**							**2**	**2**	**3**

COURSE CONTENT

R PROGRAMMING LAB								
III Year - I Semester: CSE (DS)								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
DS504PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	**-**	**2**	**1**	**40**	**60**	**100**
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 32				**Total Classes: 32**		
Prerequisite: Nil								

1. COURSE OVERVIEW

This laboratory course introduces students to **R programming for data science applications**, focusing on data manipulation, visualization, statistical analysis, and basic predictive modelling.

2. COURSE OBJECTIVE

The students will try to Learn:

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

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Install R environment, learn R programming basics, and perform arithmetic and matrix operations.
CO 2	Apply vector and matrix subsetting techniques, and create arrays for data manipulation in R.
CO 3	Perform data visualization using pie charts, 3D pie charts, bar charts, line plots, and multiple line plots using CSV datasets.
CO 4	Implement and manipulate different R data structures including vectors, lists, and data frames, and perform Exploratory Data Analysis (EDA) on CSV datasets.
CO 5	Apply linear regression and multiple linear regression techniques to model relationships between variables using R.

4. LIST OF EXPERIMENTS

Practice Sessions / 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.

5. TEXT BOOKS

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

6. 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.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**1**		**3**							**1**	**3**	**1**
CO 2	**3**	**2**	**2**	**1**	**3**							**1**	**3**	**1**
CO 3	**2**	**3**	**3**	**2**	**3**					**1**		**1**	**3**	**2**
CO 4	**2**	**3**	**3**	**2**	**3**				**2**	**1**		**1**	**3**	**2**
CO 5	**2**	**3**	**3**	**2**	**3**				**1**	**1**		**1**	**3**	**3**

COURSE CONTENT

BIG DATA ANALYTICS LAB								
III Year - I Semester: CSE (DS)								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
DS505PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	**-**	**2**	**1**	**40**	**60**	**100**
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 32				**Total Classes: 32**		
Prerequisite: Nil								

1. COURSE OVERVIEW

This laboratory course introduces students to Big Data technologies and analytics tools. It covers practical exposure to Hadoop ecosystem, MapReduce programming, HBase, Pig, MongoDB, and data analysis with Power Pivot in Excel.

2. COURSE OBJECTIVE

The students will try to Learn:

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

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Create and configure a Hadoop cluster for distributed data processing.
CO 2	Implement MapReduce jobs, such as building an inverted index, to process large datasets efficiently.
CO 3	Store, retrieve, and process big data using HBase for scalable database solutions.
CO 4	Use Pig for data manipulation, and perform data analysis using MongoDB.
CO 5	Perform big data analytics and visualization using **Power Pivot in Excel** for effective decision-making.

4. COURSE CONTENT

LIST OF EXPERIMENTS

5. TEXT BOOKS

1) Big Data Analytics, Seema Acharya, Subhashini Chellappan, Wiley 2015.
2) Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Michael Minelli, Michehe Chambers, 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.

6. REFERENCE BOOKS

1) Big Data and Business Analytics, Jay Liebowitz, Auerbach Publications, CRC press (2013)
2) Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop, Tom Plunkett, Mark Hornick, McGraw-Hill/Osborne Media (2013), Oracle press.
3) Professional Hadoop Solutions, Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, Wiley, ISBN: 9788126551071, 2015.

4) Understanding Big data, Chris Eaton, Dirk deroos et al., McGraw Hill, 2012.
5) Intelligent Data Analysis, Michael Berthold, David J. Hand, Springer, 2007.
6) Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Bill Franks, 1st Edition, Wiley and SAS Business Series, 2012.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**2**	**1**	**3**				**1**			**1**	**3**	**1**
CO 2	**3**	**3**	**3**	**2**	**3**				**1**			**1**	**3**	**2**
CO 3	**2**	**3**	**2**	**2**	**3**				**1**			**1**	**3**	**2**
CO 4	**2**	**3**	**3**	**2**	**3**				**2**	**1**		**1**	**3**	**2**
CO 5	**2**	**2**	**3**	**2**	**3**				**2**	**2**		**1**	**3**	**3**

COURSE CONTENT

ADVANCED ENGLISH COMMUNICATION SKILLS LAB								
III Year - I Semester: CSE (DS)								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
EN506HS	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	**-**	**2**	**1**	**40**	**60**	**100**
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 32				**Total Classes: 32**		
Prerequisite: Computer with Headphones, OALD & Interactive Communication Skills Lab								

1. COURSE OVERVIEW

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 & 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. COURSE OBJECTIVE

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

1. To improve the students' fluency in English, with a focus on vocabulary
2. To enable them to listen to English spoken at normal conversational speed by educated English speakers
3. To respond appropriately in different socio-cultural and professional contexts
4. To communicate their ideas relevantly and coherently in writing
5. To prepare the students for placements.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Demonstrate the fundamentals of writing, Grammar & Vocabulary.
CO 2	Develop different types of writing.
CO 3	Analyse writing tasks and adapt style, tone, and format
CO 4	Produce academic & Professional documents like Letters, Reports, emails etc.
CO 5	Use the language in real life situations

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**

2. **For Practice:** 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.

3. **Activities on Writing Skills:** Vocabulary for Competitive Examinations – Planning for Writing – Improving Writing Skills- Structure and presentation of different types of writing – Structured writing – Letter writing – Writing a letter of Application – Resume vs. Curriculum Vitae – Writing a Resume – Styles of Resume – e-Correspondence – Emails – Blog Writing –(N) etiquette – Report Writing – Importance of Reports – Types of Reports – Technical Report Writing – Exercises for practice.

4. **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 Clarifications, Making a Request, Asking for and Refusing Permission, Participating in a Small Talk – Oral Presentations (individual and group) through JAM sessions – PPT's – 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.

5. **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.

6. **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.

5. MINIMUM REQUIREMENT:

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

- Spacious room with appropriate acoustics
- Round Tables with movable chairs
- Audio – visual aids
- LCD Projector
- Public Address System
- One PC with latest configuration for the teacher
- T.V. a digital stereo & Camcorder
- Headphones of High quality

6. 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

7. 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 Black Swan Pvt. Ltd.
3. Bailey, Stephen. (2018) Academic Writing: A Handbook for International Students. (5th ed). 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 ed) Oxford University Press.
6. Anderson, Paul V. (2007) Technical Communication. Cengage Learning Pvt. Ltd. New Delhi.
7. Mc Carthy, 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.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1									**2**	**3**		**3**		**2**
CO 2									**2**	**3**		**3**		**2**
CO 3									**2**	**3**		**3**		**2**
CO 4									**2**	**3**		**3**		**2**
CO 5									**2**	**3**		**3**		**2**

COURSE CONTENT

ETL-KAFKA/TALEND								
III Year - I Semester: CSE (DS)								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
DS507PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	**-**	**2**	**1**	**40**	**60**	**100**
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 32				**Total Classes: 32**		
Prerequisite: Nil								

1. COURSE OVERVIEW

This course provides a comprehensive understanding of Apache Kafka as a distributed event streaming platform. It covers Kafka architecture, cluster setup, topic management, producer–consumer APIs, fault tolerance, and administrative operations.

2. COURSE OBJECTIVE

The students will try to Learn:

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

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Understand and set up Apache Kafka architecture and perform basic topic, producer, and consumer operations.
CO 2	Develop Kafka producers and consumers using Java and implement synchronous and asynchronous messaging.
CO 3	Configure and manage Kafka clusters with multiple brokers and demonstrate fault tolerance mechanisms.
CO 4	Implement Kafka Connect and Kafka Streams applications for real-time data integration and stream processing.
CO 5	Integrate Kafka with the Hadoop ecosystem for scalable data ingestion and analytics pipelines.

4. COURSE CONTENT

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.

5. TEXT BOOKS

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

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**1**		**2**								**2**	
CO 2	**2**	**2**	**3**		**3**								**2**	**1**
CO 3	**2**	**3**	**2**	**2**	**3**								**3**	**1**
CO 4	**1**	**2**	**3**	**2**	**3**								**3**	**3**
CO 5	**1**	**2**	**2**	**2**	**3**								**3**	**3**