R.M.D. ENGINEERING COLLEGE

(An Autonomous Institution)
REGULATIONS 2024

B.TECH- COMPUTER SCIENCE AND BUSINESS SYSTEMS

CHOICE BASED CREDIT SYSTEM
III & IV SEMESTER CURRICULUM AND SYLLABI

SEMESTER –III								
Sl.No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSE								
1	24GE301	Universal Human Values 2: Understanding Harmony	HSMC	3	2	1	0	3
2	24MA303	Discrete Mathematics and its Applications	BSC	4	3	1	0	4
3	24CS301	Computer Organization & Architecture	PCC	3	3	0	0	3
4	24CB301	Fundamentals of Economics	PCC	3	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENT								
5	24CS303	Database Management Systems (Lab Integrated)	PCC	6	3	0	3	4.5
6	24CS302	Advanced Java Programming (Lab Integrated)	PCC	6	3	0	3	4.5
LABORATORY COURSE								
7	24GE311	Product Development Lab - 1	EEC	2	0	0	2	1
8	24CS311	Aptitude and Coding Skills I	EEC	3	0	0	3	1.5
9	24CB311	Internship/Seminar (1 Week)	EEC	1	0	0	1	0.5
MANDATORY COURSES								
10	24MC301	Indian Constitution (Non Credit)	MC	1	1	0	0	0
			Total	32	18	2	12	25

SEMESTER –IV								
Sl.No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1	24CB401	Marketing Research and Marketing Management	PEC	3	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENT								
2	24MA403	Statistical Methods	BSC	5	3	0	2	4
3	24CB402	Operating Systems	PCC	5	3	0	2	4
4	24IT402	Web Development Frameworks (Lab Integrated)	PCC	6	3	0	3	4.5
5	24CS402	Design and Analysis of Algorithms (Lab Integrated)	PCC	5	3	0	2	4
LABORATORY COURSE								
6		Product Development Lab - 2	EEC	2	0	0	2	1
7	24CS411	Aptitude and Coding Skills II	EEC	3	0	0	3	1.5
AUDIT COURSE								
8		Value Education (Non Credit)	AC	1	1	0	0	0
			Total	30	16	0	14	22

24GE301	UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY (Common to all Branches)	L	T	P	C

	2	**1**	**0**	**3**

OBJECTIVES

Students completing this course are expected to:

- Development of a holistic perspective based on self-exploration about themselves (human beings), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society, and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

UNIT-I	**NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION**	**12**

Purpose and motivation for the course, recapitulation from Universal Human Values-I

- Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
- Continuous Happiness and Prosperity- A look at basic Human Aspirations
- Right understanding, Relationship and Physical Facility- The basic requirements for fulfilment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
- Method to fulfil the above human aspirations: Understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

UNIT-II	**UNDERSTANDING HARMONY IN THE HUMAN BEING – HARMONY IN MYSELF!**	**12**

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'

- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
- Understanding the body as an instrument of 'I' (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
- Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss programs for ensuring health vs dealing with disease.

UNIT-III	**UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY-HARMONY IN HUMAN-HUMAN RELATIONSHIP**	**12**

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

- Understanding the meaning of Trust; Difference between intention and competence
- Understanding the meaning of Respect; Difference between respect and differentiation; the other salient values in relationship
- Understanding the harmony in the society (society being an extension of family): Resolution,

Prosperity, Fearlessness (trust) and co-existence as comprehensive Human Goals

Visualizing a universal harmonious order in society- Undivided society, Universal order-from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institutes extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

UNIT-IV	UNDERSTANDING HARMONY IN NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE	12

Understanding the harmony in nature

- Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
- Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
- Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT-V	IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY IN PROFESSIONAL ETHICS	12

Natural acceptance of human values

- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- Case studies of typical holistic technologies, management models and production systems.
- Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
- Sum up.

Include practice exercises and case studies will be taken up in practice (tutorial) sessions eg. To discuss the conduct as an engineer or scientist etc.

	TOTAL: 60 PERIODS	

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

CO1	be aware of themselves, and their surroundings (family, society, nature).
CO2	be more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind..
CO3	have better critical ability
CO4	become sensitive to their commitment towards what they have understood (human values, human relationships, and human society).
CO5	be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

TEXT BOOKS:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, NewDelhi, 2010.

REFERENCES:

1. A Nagaraj, “Jeevan Vidya: Ek Parichaya”, Jeevan Vidya Prakashan, Amarkantak,1999.
2. E. F Schumacher, "Small is Beautiful", Vintage classics, London, 1993.
3. A.N. Tripathi, “Human Values”, New Age Intl. Publishers, New Delhi, Third Edition 2020.
4. Maulana Abdul Kalam Azad, "India Wins Freedom", Oriental blackswan private limited, Hyderabad, 2020.
5. Mahatma Gandhi, “Hind Swaraj or Indian Home Rule”, Maheswari Publications, Delhi, 2020.
6. Romain Rolland, "The life of Vivekananda and the universal gospel", Publication house of Ramakrishna Math, Kolkata, Thirty second edition 2018.
7. Romain Rolland, "Mahatma Gandhi: The man who become one with the universal being “, Srishti Publishers & Distributors, New Delhi, Sixth Edition 2013.
8. Heaton, Dennis P. "The story of stuff." (2010): 553-556.
9. Gandhi, Mohandas Karamchand, “The story of my experiments with truth: An autobiography”, Om Books International, 2018.
10. Andrews, Cecile, “Slow is beautiful: new visions of community, leisure, and joie de vivre”, New society publishers, 2006.
11. Kumarappa, Joseph Cornelius, “The economy of permanence. CP”, All India Village Industries Assn., 1946.

24MA303	**DISCRETE MATHEMATICS AND ITS APPLICATIONS** (B. Tech. CSBS) **(Theory Course)**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVES:

The Course will enable learners to:

- describe the arguments using connectives and rules of inference.
- impart knowledge of the basics of counting and solving recurrence relations.
- understand the nomenclature of graphs, isomorphism of graphs, paths, cycles and circuits.
- explain group theory, rings and fields
- apply Boolean algebra, basic properties, and Karnaugh’s maps.

UNIT-I	LOGIC	12
Propositional calculus- propositions and connectives, syntax; Semantics– truth assignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility-natural deduction system and axiom system; Soundness and completeness.		
UNIT-II	**COMBINATORICS**	**12**
Basic counting, balls and bins problems, generating functions, recurrence relations. Proof techniques, the principle of mathematical induction, pigeon hole principle.		
UNIT-III	**GRAPH THEORY**	**12**
Graphs and digraphs, complement, isomorphism, connectedness and reachability, adjacency matrix, Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs and tournaments. (ore's theorem, Dirac theorem Statement only).		
UNIT-IV	**ABSTRACT ALGEBRA**	**12**
Groups - Subgroups -Homomorphism - Normal subgroup and cosets - Lagrange's theorem - Definitions and examples of Rings and Fields		
UNIT-V	**BOOLEAN ALGEBRA**	**12**
Introduction of Boolean algebra, truth table, basic logic gate, basic postulates of Boolean algebra, the principle of duality, canonical form, Karnaugh map.		
	TOTAL: 60 PERIODS	

OUTCOMES: Upon completion of the course, the students will be able to:

CO1	examine the validity of the arguments.
CO2	demonstrate various proof techniques and application of principles.
CO3	apply graph theory techniques to solve real life problems.
CO4	identify algebraic techniques to formulate and solve group theoretic problems.
CO5	utilize the significance of Boolean algebra in computer science and engineering.
CO6	illustrate different types of recurrence relations and their role in problem-solving.

TEXT BOOKS:

1. J. P. Trembly & Manohar, "Discrete Mathematical Structures with applications to computer science", 1st Edition, McGraw Hill Education, 2017.

2. N. Herstein, "Topics in Algebra", 2nd Edition, John Wiley and Sons, Reprint 2022.

3. M. Morris Mano, "Digital Logic and Computer Design", 1st Edition, Pearson, Reprint 2017.

4. J.A. Bondy and U.S.R. Murty, "Graph Theory with Applications", 5th Edition, Macmillan Press, London, 1982.

REFERENCES:

1. Gilbert Strang, “Introduction to linear algebra”, 6th Edition, Wellesley-Cambridge Press, 2023.
2. R. A. Brualdi, “Introductory Combinatorics”, 5th Edition, Pearson, 2023.
3. N. Deo, “Graph Theory with Applications to Engineering and Computer Science”, 1st Edition, Prentice Hall, Englewood Cliffs, 2018.

24CS301	COMPUTER ORGANIZATION AND ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Describe the basic principles and operations of digital computers.
- Design arithmetic and logic unit for various fixed and floating point operations
- Construct pipeline architectures for RISC processors.
- Explain various memory systems & I/O interfacings
- Discuss parallel processor and multi-processor architectures

UNIT-I	COMPUTER FUNDAMENTALS	9

Computer Types - Functional Units — Basic Operational Concepts - Number Representation and Arithmetic Operations - Performance Measurement - Instruction Set Architecture - Memory Locations and Addresses - Instructions and Instruction Sequencing - Addressing Modes.

UNIT-II	COMPUTER ARITHMETIC	9

Addition and Subtraction of Signed Numbers - Design of Fast Adders - Multiplication of Unsigned Numbers - Multiplication of Signed Numbers - Fast Multiplication - Integer Division - Floating-Point Numbers – Representation and Operations.

Study Experiments: Ripple Carry Adder, Carry Look-a-head Adder, Booth’s Multiplier

UNIT-III	BASIC PROCESSING UNIT AND PIPELINING	9

Basic Processing Unit: Concepts - Instruction Execution - Hardware Components - Instruction Fetch and Execution Steps -Control Signals - Hardwired Control.

Pipelining: Basic Concept - Pipeline Organization- Pipelining Issues - Data Dependencies - Memory Delays - Branch Delays - Resource Limitations - Performance Evaluation -Superscalar Operation.

Study Experiments: Arithmetic Logic Unit, CPU Design

UNIT-IV	I/O AND MEMORY	9

Input/Output Organization: Bus Structure - Bus Operation - Arbitration - The Memory System: Basic Concepts - Semiconductor RAM Memories - Read-only Memories - Direct Memory Access - Memory Hierarchy - Cache Memories - Performance Considerations - Virtual Memory - Memory Management Requirements - Secondary Storage.

Study Experiments: Memory Design, Associative Cache Design, Direct Mapped Cache Design.

UNIT-V	PARALLEL PROCESSING AND MULTICORE COMPUTERS	9

Parallel Processing: Use of Multiple Processors - Symmetric Multiprocessors - Multithreading and Chip Multiprocessors - Clusters - Nonuniform Memory Access Computers - Vector Computation - Multicore Organization.

TOTAL: 45 PERIODS

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

CO1	Infer the basic principles and operations of digital computers.
CO2	Analyze the performance of computers by identifying factors that contribute to performance.
CO3	Apply arithmetic algorithms for various operations.
CO4	Design hardware to solve computationally intensive problems.
CO5	Compare various I/O methods and analyze memory management techniques.
CO6	Demonstrate the concept of parallelism in hardware and software

TEXT BOOKS:

1.Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer organization, Tata McGraw Hill, Sixth edition, 2012.

2.David A. Patterson and John L. Hennessy Computer Organization and Design-The Hardware/Software Interface, 5th edition, Morgan Kaufmann, 2013.

REFERENCES:

1.John P.Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012.

2.David A. Patterson and John L. Hennessy Computer Organization and Design-The Hardware/Software Interface, 6th edition, Morgan Kaufmann, 2021.

3.John L. Hennessy and David A. Patterson, Computer Architecture – A Quantitate Approach, Morgan Kaufmann / Elsevier Publishers, Fifth Edition,2012.

24CB301	FUNDAMENTALS OF ECONOMICS	L	T	P	C
		3	0	0	3

OBJECTIVES

The Course will enable learners to:

- To explain the fundamental principles of micro economics relevant tomanaging an organization.
- To describe the fundamental principles of macroeconomics to have theunderstanding of economic environment of business.
- To understand the various aspects of India's economy.

UNIT-I	INTRODUCTION	9

Principles of Demand and Supply - Supply Curves of Firms - Elasticity of Supply; Demand Curves of Households - Elasticity of Demand; Equilibrium and Comparative Statics (Shift of a Curve and Movement along the Curve).

UNIT-II	CONSUMER ANALYSIS	9

Welfare Analysis - Consumers' and Producers' Surplus - Price Ceilings and Price Floors; Consumer Behaviour - Axioms of Choice - Budget Constraints and Indifference Curves; Consumer's Equilibrium - Effects of a Price Change, Income and Substitution Effects - Derivation of a Demand Curve;

UNIT-III	PRODUCTION AND COSTING	9

Applications - Tax and Subsidies - Intertemporal Consumption - Suppliers' IncomeEffect; Theory of Production - Production Function and Iso-quants - Cost Minimization; Cost Curves - Total, Average and Marginal Costs - Long Run andShort Run Costs; Equilibrium of a Firm Under Perfect Competition; Monopoly and Monopolistic Competition

UNIT-IV	MACROECONOMIC REFORMS	9

National Income and its Components - GNP, NNP, GDP, NDP; Consumption Function; Investment; Simple Keynesian Model of Income Determination and the Keynesian Multiplier; Government Sector - Taxes and Subsidies; External Sector -Exports and Imports; Money - Definitions; Demand for Money –Transactionary and Speculative Demand; Supply of Money - Bank's Credit Creation Multiplier; Integrating Money and Commodity Markets - IS, LM Model.

UNIT-V	POLICY GOVERANCE	9

Business Cycles and Stabilization - Monetary and Fiscal Policy - Central Bank and the Government; The Classical Paradigm - Price and Wage Rigidities - Voluntary and Involuntary Unemployment

	TOTAL: 45 PERIODS	

OUTCOMES: On completion of the course, students will be able to:

CO1	Become familiar with both principles of micro and macroeconomics.
CO2	Understand the approaches to consumer behaviour and relation between production and cost function.
CO3	Describe and discuss on interaction of product and factor market.
CO4	Get awareness about importance and development of Indian economy and economic reforms.
CO5	Have thorough knowledge in the areas of inflation, unemployment, monetary policy, fiscal policy and international trade.

TEXT BOOKS:

1. Pindyck, Robert S., and Daniel L. Rubinfeld, Microeconomics, Pearson Education, 9th edition 2022
2. Dornbusch, Fischer and Startz, Macroeconomics, McGraw Hill Ltd., 12th edition, 2019
3. Paul Anthony Samuelson, William D. Nordhaus, Economics, Tata McGraw Hill,19th edition, 2011

REFERENCES:

1. Hal R, Varian, W W Norton, Intermediate Microeconomics: A Modern Approach, 9th edition, 1987
2. N. Gregory Mankiw, Cengage Learning, Principles of Macroeconomics, 7th edition, 2021

24CS303	DATABASE MANAGEMENT SYSTEMS (Lab Integrated)	L	T	P	C

	(Common to CSE, CSD, ADS, CSBS, IT, EEE, ECE, ECA and EEV)				
		3	**0**	**3**	**4.5**

OBJECTIVES

The Course will enable learners to:

- To understand the basic concepts of Data Modeling and Database Systems.
- To understand SQL and effective relational database design concepts.
- To learn relational algebra, calculus and normalization.
- To know the fundamental concepts of transaction processing, concurrency control techniques, recovery procedure and data storage techniques.
- To understand query processing, efficient data querying and advanced databases

UNIT-I	**DATABASE CONCEPTS**	**9+9**

Concept of Database and Overview of DBMS - Characteristics of databases -Data Models, Schemas and Instances - Three-Schema Architecture - Database Languages and Interfaces- Introductions to data models types- ER Model- ER Diagrams - Enhanced ER Model - reducing ER to table Applications: ER model of University Database Application – Relational Database Design by ER- and EER-to-Relational Mapping.

List of Exercise/Experiments

Case Study using real life database applications anyone from the following list

a) Inventory Management for a EMart Grocery Shop

b) Society Financial Management

c) Cop Friendly App – Eseva

d) Property Management – eMall

e) Star Small and Medium Banking and Finance

Build Entity Model diagram. The diagram should align with the business and functional goals stated in the application.

UNIT-II	**STRUCTURED QUERY LANGUAGE**	**9+9**

SQL Data Definition and Data Types – Constraints – Queries – INSERT, UPDATE, and DELETE in SQL - Views - Integrity Procedures, Functions, Cursor and Triggers - Embedded SQL - Dynamic SQL.

List of Exercise/Experiments

Case Study using real life database applications anyone from the following list and do the following exercises.

a) Inventory Management for a EMart Grocery Shop

b) Society Financial Management

c) Cop Friendly App – Eseva

d) Property Management – eMall
e) Star Small and Medium Banking and Finance

1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements
2. Database Querying – Simple queries, Nested queries, Sub queries and Joins
3. Views, Sequences, Synonyms
4. Database Programming: Implicit and Explicit Cursors
5. Procedures and Functions
6. Triggers
7. Exception Handling

UNIT-III	RELATIONAL ALGEBRA, CALCULUS AND NORMALIZATION	9+9

Relational Algebra – Operations - Domain Relational Calculus- Tuple Relational Calculus - Fundamental operations.
Relational Database Design - Functional Dependency – Normalization (1NF, 2NF 3NF and BCNF) –Multivalued Dependency and 4NF –Joint Dependencies and 5NF - De-normalization.

List of Exercise/Experiments

1. Case Study using real life database applications anyone from the following list
   a) Inventory Management for a EMart Grocery Shop
   b) Society Financial Management
   c) Cop Friendly App – Eseva
   d) Property Management – eMall
   e) Star Small and Medium Banking and Finance.

Apply Normalization rules in designing the tables in scope.

UNIT-IV	TRANSACTIONS, CONCURRENCY CONTROL AND DATA STORAGE	9+9

Transaction Concepts – ACID Properties – Schedules based on Recoverability, Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Transaction Recovery –Concepts – Deferred Update – Immediate Update.

Organization of Records in Files – Unordered, Ordered – Hashing Techniques – RAID – Ordered Indexes – Multilevel Indexes - B+ tree Index Files – B tree Index Files.

List of Exercise/Experiments

Case Study using real life database applications anyone from the following list
a) Inventory Management for a EMart Grocery Shop
b) Society Financial Management
c) Cop Friendly App – Eseva

d) Property Management – eMall
e) Star Small and Medium Banking and Finance

Ability to showcase ACID Properties with sample queries with appropriate settings for the above scenario.

UNIT-V	QUERY OPTIMIZATION AND ADVANCED DATABASES	9+9

Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics.

Distributed Database Concepts – Design –Concurrency Control and Recovery – NOSQL Systems – Document-Based NOSQL Systems and MongoDB.

Explain Plan Statement – Parsing Output – Join Orders and Methods – Indexes - Standard Issues – Query Tuning - Explain Plan vs Explain Analyses.

List of Exercise/Experiments

Case Study using real life database applications anyone from the following list

a) Inventory Management for a EMart Grocery Shop
b) Society Financial Management
c) Cop Friendly App – Eseva
d) Property Management – eMall
e) Star Small and Medium Banking and Finance

Build PL SQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.

TOTAL: 45+45=90 PERIODS

OUTCOMES: After completing the course, students will have the ability to

CO1	Map ER model to Relational model to perform database design effectively.
CO2	Implement SQL and effective relational database design concepts.
CO3	Apply relational algebra, calculus and normalization techniques in database design
CO4	Understand the concepts of transaction processing, concurrency control, recovery procedure and data storage techniques.
CO5	Evaluate and implement transaction processing, concurrency control mechanisms, and recovery procedures to maintain data integrity.
CO6	Analyze and optimize database queries and understand the features and applications of advanced and distributed database systems, including NoSQL.

TEXT BOOKS:

1. Elmasri R. and S. Navathe, “Fundamentals of Database Systems”, Pearson Education, 7th Edition, 2016.

2.Abraham Silberschatz, Henry F.Korth, “Database System Concepts”, Tata McGraw Hill , 7th Edition, 2021.

REFERENCES:

1. Elmasri R. and S. Navathe, Database Systems: Models, Languages, Design and Application Programming, Pearson Education, 2013.Raghu Ramakrishnan, Gehrke “Database Management Systems”, MCGraw Hill, 3rd Edition 2014.

2. Plunkett T., B. Macdonald, “Oracle Big Data Hand Book” , McGraw Hill, First Edition, 2013

3. Gupta G K , “Database Management Systems” , Tata McGraw Hill Education Private Limited, New Delhi, 2011
4. C. J. Date, A. Kannan, S. Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2015.
5. Maqsood Alam, Aalok Muley, Chaitanya Kadaru, Ashok Joshi, Oracle NoSQL Database: Real-Time Big Data Management for the Enterprise, McGraw Hill Professional, 2013.
6. Thomas Connolly, Carolyn Begg, “Database Systems: A Practical Approach to Design, Implementation and Management”, Pearson, 6th Edition, 2015.

7. Database Management System Part – 1

   https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0127580666728202245 6_shared/overview
8. Database Management System Part – 2

   https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0127673005629194241_shared/overview
9. Online Resources:

10. https://infyspringboard.onwingspan.com/web/en/page/home

24CS302	ADVANCED JAVA PROGRAMMING (Lab Integrated) (Common to All Branches)	L	T	P	C
		3	0	3	4.5

OBJECTIVES:

The Course will enable learners to:

- Gain a comprehensive understanding of the Java Collections Framework and its various interfaces and implementations.
- Learn the details of Java I/O streams and utility classes for managing dates, numbers, and currencies.
- Develop a thorough understanding of the Stream API introduced in Java 8 and its various operations.
- Explore advanced object serialization and string tokenizing techniques, including pattern matching with regular expressions.
- Understand advanced Stream API features and gain proficiency in using regular expressions for text processing.

UNIT I	COLLECTIONS FRAMEWORK AND UTILITY CLASSES	9+9

Introduction to Collections Framework - Collection Interface- Methods in Collection Interface - Iterable and Iterator Interfaces - List Interface- ArrayList - LinkedList - Set Interface - HashSet- LinkedHashSet - TreeSet - Map Interface - HashMap -LinkedHashMap- TreeMap - Queue Interface -PriorityQueue - Deque Interface - Utility Classes.

List of Experiments

1. Write a program that measures the time taken for insertion, deletion, and search operations on ArrayList, LinkedList, HashSet, and TreeSet for varying sizes of input data.
2. Implement a custom data structure that combines features of a list and a set.
3. Write a Java program to create a HashMap where the keys are strings, and the values are integers Add five key-value pairs to the map. Print all the keys and values in the map. Remove an entry by key. Update the value associated with a specific key. Check if the map contains a specific key and a specific value.

UNIT II	DATE HANDLING AND SERIALIZATION	9+9

Date – Calendar – Comparable interface – Observer Interface — Serialization – Dates - Numbers, and Currency - Working with Dates - Numbers and Currencies - Object Serialization - Serializable Interface - Writing and Reading Serializable Objects -Transient Keyword- SerialVersionUID.

List of Experiments

1. Create a class representing a complex object with nested data structures. Serialize the object to a file, then deserialize it back and verify that the object remains intact.
2. Write a program that formats dates and currencies according to different locales.

Create a class hierarchy representing different types of objects (e.g., Person, Employee). Serialize

instances of these classes to a file using object serialization.

UNIT III	STREAM API AND FUNCTIONAL PROGRAMMING PARADIGMS	9+9

Overview of Stream API - Importance of Stream API in Java 8 and Beyond – Functional Programming Concepts - Creating Streams - Stream Interface Methods - Stream Operations - Intermediate Filtering (filter)-Mapping (map, flat Map)-Sorting (sorted)-Distinct (distinct) - Limit and Skip (limit, skip) - Terminal Operations -Collecting Results (collect) - Reducing and Summarizing(reduce, summary Statistics)-Iterating (for Each) –Matching and Finding (any Match, all Match, none Match, find First, find Any) -Counting (count).

List of Experiments

1. Write a program that performs stream operations like filtering, mapping, and reducing.
2. Create an infinite stream generator that generates prime numbers. Implement methods to check for primality and generate the next prime number.
3. Write a program that reads a text file containing sentences. Tokenize each sentence into words, filter out stopwords, and print the remaining words.

UNIT IV	ADVANCED STRING PROCESSING AND I/O TECHNIQUES	9+9

String Tokenizer – Parsing - Tokenizing and Formatting - Locating Data via Pattern Matching, Tokenizing - Streams - Types of Streams - The Byte-stream I/O hierarchy - Character Stream Hierarchy – Random Access File class – the java.io. Console Class - Advanced I/O - Piped Streams (Piped Input Stream and Piped Output Stream) – Sequence Input Stream – Pushback Input Stream and Pushback Reader.

List of Experiments

1. Write a program that reads a text file and tokenizes it into sentences using the String Tokenizer class.
2. Implement a java program that allows users to open a text file, navigate through it using random access, insert, delete, and modify text at specific positions within the file.
3. Implement a program that uses advanced I/O techniques like Piped Input Stream, Piped Output Stream, Sequence Input Stream, and Pushback Input Stream.

UNIT V	ADVANCED STREAM FEATURES AND REGULAR EXPRESSIONS	9+9

Importance and Use Cases of Advanced Stream Features - Creating Custom Streams -Stream Generators (Stream.generate, Stream.iterate) - Infinite Streams - Using Spliterators – Advanced Stream Operations - FlatMapping - Chaining Stream Operations - Stream Peeking (peek) - Advanced Filtering Techniques - Introduction to Regular Expressions - Character Classes - Quantifiers - Pattern Matching - Groups and Capturing - Regex in Java - java.util.regex Package Pattern Class - Matcher Class - String Manipulation with Regex - Splitting Strings - Replacing Text (replaceAll, replaceFirst) - Replacing with Backreferences.

List of Experiments

1. Implement custom stream generators using Stream.generate and Stream.iterate methods.
2. Write a program that demonstrates advanced stream operations like flat Mapping, chaining stream operations, and peeking.
3. Develop a program that utilizes regular expressions to perform string manipulation tasks such as splitting strings, replacing text, and extracting specific patterns.

TOTAL: 45+45 = 90 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Implement various data structures by utilizing core Java features and libraries

CO2: Demonstrate proficiency in handling Java I/O operations, including file manipulation for efficient data storage and retrieval.

CO3: Apply and Analyze the Stream API for functional programming and data processing.

CO4: Implement advanced object serialization for complex data structures.

CO5: Utilize regular expressions for text parsing and string manipulation.

CO6: Build applications using advanced Java programming techniques.

TEXT BOOK:

1. Cay S. Horstmann, "Core Java Volume I--Fundamentals," 12th Edition, 2019.
2. Joshua Bloch, "Effective Java," 3rd Edition, 2018.
3. Raoul-Gabriel Urma, "Java 8 in Action: Lambdas, Streams, and Functional-Style Programming," 1st Edition, 2014.
4. Herbert Schildt, "Java: The Complete Reference," 11th Edition, 2018.

Alan Mycroft and Martin Odersky, "Programming in Scala," 4th Edition, 2020.

REFERENCES:

1. Bruce Eckel, "Thinking in Java," 4th Edition, 2006.
2. Herbert Schildt, "Java: A Beginner's Guide," 8th Edition, 2019.

3.Richard Warburton, "Java 8 Lambdas: Pragmatic Functional Programming," 1st Edition, 2014.

LIST OF EQUIPMENTS:

JDK/Eclipse

	APTITUDE AND CODING SKILLS – I	L	T	P	C

24CS311	(Common to All Branches)	0	0	3	1.5

OBJECTIVES:

The Course will enable learners to:

- Develop vocabulary for effective communication and reading skills.
- Build the logical reasoning and quantitative skills.
- Develop error correction and debugging skills in programming.

List of Exercises:

1. **English – Phase I**

Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension ordering

2. **Logical Reasoning – Phase I**

Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern andNumber series pattern recognition, Analogy and Classification pattern recognition, Abductive Reasoning: Logical word sequence, Data sufficiency

3. **Quantitative Ability - Phase I**

Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations, Probability

4. **Automata Fix – Phase I**

Logical, Compilation and Code reuse

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to: CO1: Develop vocabulary for effective communication skills.

CO2: Build the logical reasoning enhance critical thinking.

CO3: Develop error correction and debugging skills in programming. **CO4:** Apply programming skills to develop programs efficiently

CO5: Solve problems using quantitative skills

CO6: Develop effective reading and listening skills.

24MC301	INDIAN CONSTITUTION (Non Credit)	L	T	P	C
		1	0	0	0

OBJECTIVES:

The Course will enable learners to:

- To have some knowledge about Indian Constitution.
- To understand the concept of fundamental rights.
- To learn about Lok Sabha and Rajya Sabha.
- To have some knowledge about Legislative Assembly and Legislative Council.
- To learn about Local Self Government

UNIT-I	**INTRODUCTION**	**3**
Meaning and Importance of Constitution, Preamble and Salient Features of the Constitution		
UNIT-II	**FUNDAMENTAL RIGHTS**	**3**
Fundamental Rights, Right to Equality, Right to Freedom, Right against exploitation, Right to freedom of religion, Cultural and Educational Rights, Right to Constitutional Remedies and Duties, Directive Principles of State Policy.		
UNIT-III	**LOK SABHA AND RAJYA SABHA**	**3**
Union Government – Lok Sabha and Rajya Sabha Composition, Powers, and functions: The President, The Prime Minister, and Supreme Court: Role Position and Powers/ functions.		
UNIT-IV	**LEGISLATIVE ASSEMBLY AND LEGISLATIVE COUNCIL**	**3**
State Government - Legislative Assembly and Legislative Council: Composition, Powers and functions: The Governor, Chief Minister and High Court: Role, Position and Powers/ functions		
UNIT-V	**LOCAL SELF GOVERNMENT**	**3**
Local self-Government, Panchayat Raj System in India; Election Commission; Public Service Commissions, Role, powers, and function		
	TOTAL: 15 PERIODS	

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

CO1	Interpret the knowledge on Indian Constitution
CO2	Demonstrate the knowledge gained through fundamental rights concept.
CO3	Relate the concept of Lok Sabha and Rajya Sabha.
CO4	Illustrate the concept of Legislative Assembly and Legislative Council.
CO5	Analyze the concept of Local Self Government.

TEXT BOOKS:

1.M V Pylee, An Introduction to The Constitution of India, Vikas Publishing House Pvt. Ltd., 5 th Edition

REFERENCES:

1. Durga Das Basu, Introduction to the Constitution of India, 19th Edition Reprint 2009.
2. Sharma, Brij Kishore, ―Introduction to the Constitution of India‖, Prentice Hall of India, 7 th Edition, 2015.

SEMESTER –IV

24CB401	**MARKETING RESEARCH AND MARKETING MANAGEMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
OBJECTIVES					

The Course will enable learners to:

- Understand basic marketing concepts
- Comprehend the dynamics of marketing.
- Leverage marketing concepts for effective decision making
- Understand basic concepts and application of statistical tools in Marketingresearch
- Apply Internet marketing strategies.

UNIT-I	INTRODUCTION	9

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

UNIT-II	MARKET SEGMENTATION AND PRODUCTION MANAGEMENT	9

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

UNIT-III	PRICING, PROMOTION AND DISTRIBUTION STRATEGY	9

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

UNIT-IV	MARKETING RESEARCH	9

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

UNIT-V	INTERNET MARKETING	9

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

	TOTAL: 45 PERIODS	

OUTCOMES: Upon completion of the course, the students will be able to:

CO1	Understand the marketing concepts and its evolution
CO2	Analyze the market based on segmentation, targeting and positioning
CO3	Leverage marketing concepts for decision making on product, price, promotion mix and distribution
CO4	Apply the concepts of market research and analyse data using statistical tools
CO5	Apply internet marketing strategies for businesses

TEXT BOOKS:

1. Philip Kotler, Marketing Management (Analysis, Planning, Implementation & Control) –16th Ed. Pearson Education, 2022
2. V.S. Ramaswamy and S. Namakumari, Marketing Management, Macmillan, 2024
3. Rajendra Nargundkar, Marketing Research –4th Ed. McGraw Hill Limited, 2019
4. G.C. Beri, Market Research –6th Ed., McGraw Hill Limited, 2020
5. Cooper Schindler, Market Research, Concepts, & Cases –McGraw Hill LTD,2010

REFERENCES:

1. Rajan Saxena, Marketing Management –6th Ed., McGraw Hill Limited, 2020
2. S.A. Sherlekar, Marketing Management –Himalaya Publishing House, 2022
3. S.M. Zha, Service Marketing –Himalaya Publishing House, 2006
4. Journals – The IUP Journal of Marketing Management, Harvard Business Review
5. Research for Marketing Decisions by Paul Green, Donald, Tull, Prentice Hall of India, 2005
6. David M Levine at al, Business Statistics, A First Course, Pearson Publication, 7th Ed., Pearson Education, 2021

24MA403	**STATISTICAL METHODS** (B.Tech. CSBS) **(Theory course with Laboratory Component)**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**

OBJECTIVES

The course will enable the learners to:

- elucidate the fundamental concepts of random sampling and the Hypothesis test.
- foster comprehension of the principles of estimation theory.
- illustrate the fundamental principles of linear statistical models.
- illustrate the fundamental principles of non-parametric tests.
- impart knowledge of time series analysis and forecasting.

UNIT-I	SAMPLING DISTRIBUTION	15

Sampling Techniques – Random sampling – Sampling from finite and infinite populations – Estimates and standard error (sampling with replacement and sampling without replacement) – Sampling distribution of the sample mean.

Experiments using R statistical programming language:

1. Introduction to R
2. Functions

UNIT-II	THEORY OF ESTIMATION	15

Estimation – Point estimation – criteria for good estimates (unbiasedness, consistency, Efficiency, Sufficiency)– Estimation methods including maximum likelihood estimation. Sufficient Statistic – Concept and examples Test of hypothesis – Concept and formulation – Type I and Type II errors – Neyman Pearson lemma (excluding proof) – Testing procedures.

Experiments using R statistical programming language:

1. Control flow and Loops
2. Working with Vectors and Matrices

UNIT-III	LINEAR STATISTICAL MODELS	15

Linear Statistical Models – Scatter diagram – Linear regression and correlation – Least Squares method – Rank correlation —Analysis of variance (one way two-way without interaction).

Experiments using R statistical programming language:

1. Reading in Data.
2. Writing Data.
3. Working with Data.

UNIT-IV	NON-PARAMETRIC TEST	15

Non-parametric Inference – Comparison with parametric inference – Use of order statistics – Sign test – Wilcoxon signed rank test – Mann-Whitney test – Run test –Kolmogorov – Smirnov test – Spearman's and Kendall's test.

Experiments using R statistical programming language:

1. Manipulating Data
2. Simulation.

UNIT-V	TIME SERIES ANALYSIS	15

Basics of Time Series Analysis and Forecasting – Stationary–Identification – Estimation and Forecasting.

Experiments using R statistical programming language:

1. Linear model
2. Data Frame

3. Graphics in R	
TOTAL: 75 PERIODS	
OUTCOMES: Upon completion of the course, the students will be able to:	
CO1	determine the sampling distribution's standard error and sample mean by applying the sampling distribution principles.
CO2	evaluate the properties of estimators.
CO3	generate regression and correlation curves.
CO4	implement hypothesis testing methodologies to solve real-life problems.
CO5	analyze time series data and apply forecasting techniques for real-world situations.
CO6	apply R programming to examine statistical information.

TEXT BOOKS:

1. I. R. Miller, J.E. Freund and R. Johnson, "Probability and Statistics for Engineers", Prentice Hall India Learning Private Limited, 4th Edition, 2012.
2. A. Goon, M. Gupta, and B. Das Gupta, "Fundamentals of Statistics", Volume I & II, World Press. 8th Edition, 2002.
3. Chris Chat field, "The Analysis of Time Series: An Introduction with R", Chapman & Hall / CRC, 7th Edition, 2019.

REFERENCES:

1. D.C. Montgomery and E. Peck, "Introduction to Linear Regression Analysis", Wiley –Inter science, 6th edition 2021.
2. A.M. Mood, F.A. Gray bill and D.C. Boes, "Introduction to the Theory of Statistics", McGraw Hill, 3rd Edition, 2007.
3. N. Draper and H. Smith, "Applied Regression Analysis", Wiley-Inter science, 3rd Edition, 2014.
4. R. Garrett Grolemund, "Hands-on Programming with R", O'Reilly, 2014.
5. Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley Professional, 2nd Edition, 2014.

S. No.	Software Requirement	Remarks
1	www.rbi.org.in	Open Source

24CB402	OPERATING SYSTEMS	L	T	P	C
		3	0	2	4

OBJECTIVES

The Course will enable learners to:

- Understand the basic concepts of operating systems and processes.
- Analyze various CPU Scheduling algorithms and Threads.
- Understand Process Synchronization and concepts of Deadlocks.
- Analyze various memory management schemes.
- Understand I/O management and File systems.

UNIT-I	INTRODUCTION TO OPERATING SYSTEMS AND PROCESSES	9+6

Introduction: Concept of Operating Systems (OS), Generations of OS, Types of OS, OS Services, Interrupt handling and System Calls, Basic architectural concepts of an OS, Concept of Virtual Machine, Resource Manager view, process view and hierarchical view of an OS.

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching.

List of Exercise/Experiments:

1. Basic Unix file system commands such as ls, cd, mkdir, rmdir, cp, rm, mv, more, lpr, man, grep, sed, etc.,
2. Implementation using Shell Programming.
3. Implementation of Unix System Calls.

UNIT-II	PROCESS MANAGEMENT AND THREADS	9+6

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.

Scheduling algorithms: Pre-emptive and non-pre-emptive, FCFS, SJF, RR, Multiprocessor scheduling, Real Time scheduling: RM and EDF.

Thread: Definition, Various states, Benefits of threads, Types of threads, Concepts of multithreading.

List of Exercise/Experiments:

1. Implementation of CPU Scheduling Algorithms.
2. Implement the concept of Threading and Synchronization.

UNIT-III	PROCESS SYNCHRONISATION AND DEADLOCKS	9+6

Inter-process Communication: Concurrent processes, precedence graphs, Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Semaphores, Strict Alternation, Peterson's Solution, The Producer / Consumer Problem, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem, Barber's shop problem.

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

List of Exercise/Experiments:

1. Semaphore Implementation of Producer-Consumer problem.
2. Implementation of Bankers Algorithm for Deadlock Avoidance.

UNIT-IV	MEMORY MANAGEMENT	9+6

Memory Management: Contiguous Memory Allocation - Paging - Structure of the Page Table – Swapping.

Virtual Memory: Demand Paging – Copy-on write – Page Replacement – Allocation of frames – Thrashing – Memory Compression.

List of Exercise/Experiments:

1. Analysis and Simulation of Memory Allocation and Management Techniques
   i. First Fit ii. Best Fit iii. Worst Fit
2. Implementation of Page Replacement Techniques

i.FIFO ii. LRU iii. Optimal page replacement

UNIT-V	STORAGE MANAGEMENT	9+6

Mass Storage Structure: Overview of Mass Storage Structure- HDD scheduling – Swap Space Management, I/O systems: I/O Hardware, Application I/O interface, Kernel I/O Subsystem,
File System Interface: File Concept – Access Methods – Directory Structure – Protection. **File-System Implementation:** File-System Structure- File-System Operations - Directory Implementation - Allocation Methods - Free-Space Management, - Case Study-Linux

List of Exercise/Experiments:

1.Simulation of File Allocation Techniques
   i. Sequential ii. Linked list iii. indexed
2. Implementation of File Organization Strategies

   i.Single level directory ii. Two level directory iii. Hierarchical level directory

TOTAL: 45+30 PERIODS

OUTCOMES: Upon completion of the course, the students will be able to:

CO1	Demonstrate the basic concepts of operating systems and processes
CO2	Implement various scheduling algorithms and thread mechanism.
CO3	Implement the concepts of process synchronization and deadlocks.
CO4	Apply various memory management schemes for the suitable scenario.
CO5	Describe various I/O and file management techniques.
CO6	Develop practical skills in developing system-level programming.

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts” II, 10th Edition, John Wiley and Sons Inc., 2018.

2.Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022 New Delhi.

REFERENCES:

1. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.

2.Achyut S.Godbole, Atul Kahate, “Operating Systems”, McGraw Hill Education, 2016.

LIST OF EQUIPMENTS:

1.Standalone desktops with C/C++/Java/Equivalent compiler

24IT402	WEB DEVELOPMENT FRAMEWORKS	L	T	P	C
		3	0	3	4.5

COURSE OBJECTIVES:

The Course will enable the learners:

- To understand web semantics and related tools and framework
- Able to get hands on latest JS based web frameworks
- To develop a scalable and responsive web application
- To develop an industry ready application web enterprise feature

UNIT I	ADVANCED TYPESCRIPT	9+9

Introduction to HTML5 and CSS3, Media Queries, JS, DOM, BootStrap, Variables, Loops, Operators, Scope, Hoisting, Arrays, Spread, REST, DeStructuring

Introduction, Advantage of Using TS over JS, and where to Use and not to use TS - Understanding the Compiler (Transpiler), and its options, Scope of TS - Variable Scopes, Static Data Types - String, Number,Interface, Date - Union, Tuple, Undefined Data Types, Unknown vs any vs Never - Object Oriented , Arrow Funcions - Types, KeyOf, TypeOf, InstanceOf ,Narrowing, Conditional Types - Generics,Enum ,Required / Partial / Optional - Arrays, Modules ,Async Processing w Call backs ,Type Inference, Type Compatability, Utility Type - Unit Testing,TSLint

List of Exercise/Experiments

1. Create a TS Object for Bank Account (w attributes like à customer name, account type, balance, data of creation, bank name, branch name, pan card number). Using JS Object keyword, try to perform following activities
    - List down all the entries of the bank object
    - Check the existence of a key
    - If key found, get the value for the key
2. Spread Operator
    - Merge Customer and Account Arrays
    - Update the Customer Object with the new values
    - Develop a function that takes an Spread Argument and calculates total balance.

UNIT II	**INTRODUCTION TO REACTJS**	**9+9**

Introduction to React - ES6 Features, What is React?, React Features - Setting up React Development Environment:- Node.js and npm installation, Create React App,Project structure - JSX (JavaScript XML):- What is JSX?,JSX Syntax and Rules,JSX Expressions - Components in React:- Functional Components,Class Components, Props and Prop Types - State and Lifecycle :- State and setState,Lifecycle Methods,Mounting, Updating, and Unmounting, Handling Events in React - Event Handling in React :- Synthetic Events,Event Binding, - Conditional Rendering:-If-else Statements, Ternary Operator ,Logical && Operator Lists and Keys:-Rendering Lists,Keys and Reconciliation,Extracting Components.

List of Exercise/Experiments

1. A leading bank from APAC wants to modernize their banking services and decided to build a online multi channel mobile ecommerce platform. As part of the drive, starting building following feature set in a staggered model emplying ReactJS as front end library and associated libs from React eco system. Feature to be implemented are
    - User Login Page
    - Account Summary
    - Funds Transfer (within bank and outside bank)
    - Recurring and Fixed deposits
    - Letter of Credit
    - Salary or 3rd Party Payment
2. Unit 2 Scope – Project Setup, Web App Layout Completion using BootStrap or Tailwind, Login Page Implementation, Landing Page Implementation, Authentication and Authorization Implementation.

UNIT III	REACTJS COMPONENTS	9+9

Forms and Controlled Components :- Form Handling in React, Controlled Components, Uncontrolled Components - Basic Hooks :- useState,useRef,useEffect, - Routing in React:- Introduction to React Router,Route, Link, and Switch Components, Route Parameters,useNavigate,useParams, - REST API – Axios GET/PUT/Delete/Remove, Interceptor, Headers, Authorization Token, Promise and Observables (via rxjs)

List of Exercise/Experiments

1. Extend the Project developed in previous section with newly learnt concepts
    - Unit 3 Scope – Forms and Validation (React Form Validation), Integration of Back End Apis via Axios,API Security Implementaiton, Routes and Navigation with Priviate Routes, Usage of useEffect, UseContext hooks

UNIT IV	REACT PRO TOOLKIT: ERROR MANAGEMENT, ABSTRACTIONS AND DATA HANDLING	9+9

Error Handling :- Error Boundaries,componentDidCatch,Error Handling Strategies Higher-Order Components (HOCs) :- What are HOCs?,Creating and Using HOCs,HOCs vs Render Props,Code Splitting and Lazy Loading,Server-Side Rendering - Data Fetching with React Query :- React Query,Introduction to React Query,Query Keys and Query Functions, Query Invalidation and Refetching.

List of Exercise/Experiments

1. Extend the Project developed in previous section with newly learnt concepts
    - Unit 4 Scope – Completion of Remaining Modules, Error Handling, HOC and AUX implementation, Lazy loaded components for improved performance
2. Extend the Project developed in previous section with newly learnt concepts

UNIT V	REACT UNDER THE HOOD: TESTING, CONTEXT API, AND REDUX	9+9

Testing React Components :- Introduction to Testing,Jest Framework,React Testing Library

Context API :- Creating Context,Providing and Consuming Context,useContext Hook

Redux Overview :- What is Redux?,Redux Principles,Single Source of Truth - Redux Actions and Reducers :- Redux Actions,Redux Reducers,Combining Reducers.

List of Exercise/Experiments

1. Extend the Project developed in previous section with newly learnt concepts

Unit 5 Scope – Unit Testing using JEST, Redux implementation for state management.

Business Use Case Implementations

1. Student Management System
2. Retail Bank System
3. eCommerce System
4. Student LMS Management System

TOTAL: 45+45=90 PERIODS

COURSE OUTCOMES:

After completing the course, students will have the ability to

CO1. Understand and apply modern web technologies including HTML5, CSS3, JavaScript, and advanced TypeScript concepts to build dynamic web components.

CO2. Develop responsive and modular front-end applications using ReactJS, including component creation, state management, and routing.

CO3. Implement advanced React features like hooks (useState, useEffect, useRef), React Router, and REST API integration using Axios for dynamic content handling.

CO4. Utilize higher-order components (HOCs), lazy loading, and server-side rendering to optimize and abstract React applications.

CO5. Perform unit testing using Jest and RTL, and manage global application state efficiently using Context API and Redux.

CO6. Design and deliver scalable and real-world enterprise web applications with complete user interface flow, security, and error handling.

TEXTBOOKS:

1. David Flanagan, Javascript The Definitive Guide, Paperback, 7th Edition, 2020.
2. David Choi ,Full-Stack React, TypeScript, and Node: Build cloud-ready web applications using React 17 with Hooks and GraphQL Paperback – Import, 18 December 2020.
3. Mehul Mohan, Advanced Web Development with React Paperback – 1 January 2020.

E-RESOURCES:

1. Parental Website - https://reactjs.org/
2. The Road to Learn React: Your journey to master plain yet pragmatic React.js by Robin Wieruch
3. Learning React: Functional Web Development with React and Redux by Alex Banks and Eve Porcello
4. Learning React by KirupaChinnathambi
5. "React Up & Running" by StoyanStefanov
6. https://www.edureka.co/reactjs-redux-certification-training
7. CodePen
8. CodeSandbox (Preferred)
9. Stackblitz

LIST OF EQUIPMENTS:

- NodeJS (v22.11.2)
- Github as code repository
- Visual studio code as IDE
- RTL as unit testing framework
- Responsive design w bootstrap
- ReactJS installation (v17)
- Chrome / FIreFox Browsers (latest)

- Responsive using Media Queries & Bootstrap Material&Antdesign
- Design based Apps

24CS402	DESIGN AND ANALYSIS OF ALGORITHMS (Common to CSE, IT, ADS and CSD)	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- Critically analyse the efficiency of alternative algorithmic solutions for the same problem
- Illustrate brute force and divide and conquer design techniques.
- Explain dynamic programming for solving various problems.
- Apply greedy technique and iterative improvement technique to solve optimization problems
- Examine the limitations of algorithmic power and handling it in different problems.

UNIT I	INTRODUCTION	9+6

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving –Fundamentals of the Analysis of Algorithmic Efficiency – Asymptotic Notations and their properties. Analysis Framework – Mathematical analysis for Recursive and Non-recursive algorithms

List of Exercise/Experiments:

1. Perform the recursive algorithm analysis.
2. Perform the non-recursive algorithm analysis.

UNIT II	BRUTE FORCE AND DIVIDE AND CONQUER	9+6

Brute Force - String Matching - Exhaustive Search - Knapsack Problem - Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort - Multiplication of Large Integers – Closest-Pair and Convex Hull Problems - Transform and Conquer Method: Heap Sort

List of Exercise/Experiments:

1. Write a program to search an element using binary search
2. Write a program to sort the elements using merge sort and find time complexity.

UNIT III	DYNAMIC PROGRAMMING	9+6

Dynamic programming – Principle of optimality – Floyd's algorithm – Multi stage graph - Optimal Binary Search Trees - Longest common subsequence - Matrix-chain multiplication – Travelling Salesperson Problem – Knapsack Problem and Memory functions.

List of Exercise/Experiments:

1. Solve Floyd's algorithm
2. Write a program to find the longest common subsequence

UNIT IV	GREEDY TECHNIQUE AND ITERATIVE IMPROVEMENT	9+6

Greedy Technique – Prim's algorithm and Kruskal's Algorithm – Huffman Trees. The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs - The Stable marriage Problem

List of Exercise/Experiments:

1. Write a program to find minimum spanning tree using Prim's algorithm
2. Implement Kruskal's algorithm to find minimum spanning tree

UNIT V	BACKTRACKING AND BRANCH AND BOUND	9+6

P, NP NP- Complete and NP Hard Problems. Backtracking – N-Queen problem - Subset Sum Problem. Branch and Bound – LIFO Search and FIFO search - Assignment problem – Knapsack Problem - Approximation Algorithms for NP-Hard Problems – Travelling Salesman problem

List of Exercise/Experiments:

1. Write a program to implement sum of subset problem.
2. Solve knapsack problem using branch and bound technique

TOTAL: 45+30=75 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Understand the different algorithm design paradigms.

CO2: Design algorithms for real world problems using algorithmic design techniques.

CO3: Analyse the efficiency of simple recursive and non-recursive algorithms.

CO4: Analyse the algorithm's worst, best and average case behaviour in terms of time and space.

CO5: Understand the approximation algorithms for solving NP Hard problems

CO6: Solve the problems by selecting suitable algorithmic design techniques

TEXT BOOKS:

1. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012.

2.Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2019.

REFERENCES:

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012.
2. S. Sridhar, Design and Analysis of Algorithms, Oxford university press, 2014.

3.http://nptel.ac.in/

LIST OF EQUIPMENTS:

1. Standalone PC with C/C++/Java

24CS411	APTITUDE AND CODING SKILLS – II (Common to All Branches)	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

The Course will enable learners to:

- Develop advanced vocabulary for effective communication and reading skills.
- Build an enhanced level of logical reasoning and quantitative skills.
- To develop error correction and debugging skills in programming.
- To apply data structures and algorithms in problem solving.

List of Exercises:

1. **English – Phase II**

Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension ordering

2. **Logical Reasoning – Phase II**

Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern and Number series pattern recognition, Analogy and Classification pattern recognition, Abductive

Reasoning: Logical word sequence, Data sufficiency

3. **Quantitative Ability - Phase II**

Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations, Probability

4. **Automata Fix – Phase II**

Logical, Compilation and Code reuse

5. **Automata - Phase II**

Data Structure Concepts: Array and Matrices, Linked list, String processing and manipulation, Stack/Queue, Sorting and Searching

Advanced Design and Analysis Techniques: Greedy Algorithms, Minimum Spanning Trees, String Matching, Divide and Conquer, Computational Geometry

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Develop advanced vocabulary for effective communication skills.

CO2: Build an enhanced level of logical reasoning and quantitative skills.

CO3: Develop error correction and debugging skills in programming.

CO4: Apply data structures and algorithms in problem solving.

CO5: Develop advanced vocabulary for effective reading skills

CO6: Apply advanced algorithm design techniques to develop programs