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Periyanaickenpalayam, Coimbatore – 641020

MASTER OF ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

QUESTION BANK

I YEAR

ODD SEMESTER

ACADEMIC YEAR 2024 – 2025

INDEX

HEAD OF THE DEPARTMENT

ACOE **PRINCIPAL** **CHAIRMAN**

24MAPFC102

APPLIED PROBABILITY AND STATISTICS FOR COMPUTER SCIENCE ENGINEERS

UNIT I
LINEAR ALGEBRA

Vector spaces – norms – Inner Products – Eigenvalues using QR transformations – QR factorization – generalized eigenvectors – Canonical forms – singular value decomposition and applications – pseudo inverse – least square approximations.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	Define a vector space and give an example.	1	1	2
2	Differentiate between norm and inner product.	1	2	2
3.	What is the significance of eigenvalues and eigenvectors?	1	1	2
4.	What is the QR factorization of a matrix?	1	2	2
5.	State the properties of singular value decomposition (SVD).	1	1	2
6.	Define pseudo-inverse and mention one application.	1	1	2
7.	What is the least squares approximation used for?	1	2	2
8.	Explain the importance of canonical forms in matrix computations.	1	2	2

PART - B

1.	Explain the concept of vector spaces with examples. Discuss the Gram-Schmidt orthogonalization process.	1	4	16
2.	Describe QR factorization with an example. How is QR transformation used to find eigenvalues?	1	4	16
3.	Explain the process of Singular Value Decomposition (SVD) with an example. Discuss its applications in data science.	1	6	16
4.	Derive the least squares approximation for an overdetermined system and explain the role of the Moore-Penrose pseudo-inverse.	1	6	16

UNIT II
PROBABILITY AND RANDOM VARIABLES

Probability – Axioms of probability – Conditional probability – Baye's theorem – Random variables – Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson , Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a random variable.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	Define probability and state its axioms.	2	1	2
2	What is conditional probability? Give an example.	2	2	2
3.	State Bayes' theorem and explain its importance.	2	2	2

4.	Define a random variable and classify its types.	2	1	2
5.	What is a probability mass function (PMF)? Give an example.	2	2	2
6.	Define moment generating function (MGF) and state its significance.	2	1	2
7.	Write the probability density function (PDF) of an exponential distribution.	2	1	2
8.	What is the function of a random variable? Give an example.	2	3	2
	PART - B			
1.	Explain the axioms of probability with examples. Prove Bayes' theorem and discuss an application.	2	6	16
2.	Define moment generating function (MGF). Derive the mean and variance using MGF.	2	4	16
3.	Derive the probability mass function of a Poisson distribution and discuss its applications.	2	4	16
4.	Explain how to find the function of a random variable. Derive the probability density function (PDF) of an exponential distribution.	2	6	16

UNIT III
TWO DIMENSIONAL RANDOM VARIABLES

Joint distributions – Marginal and conditional distributions – Functions of two-dimensional random variables – Regression curve – Correlation.

PART - A

Q.NO	QUESTION	CO	BT L	MARKS
1.	Define joint probability distribution.	3	1	2
2	Differentiate between marginal and conditional distributions.	3	2	2
3.	What is a joint cumulative distribution function (CDF)?	3	1	2
4.	Define conditional expectation.	3	1	2
5.	What is the function of a two-dimensional random variable?	3	2	2
6.	Define regression and mention its types.	3	1	2
7.	What is correlation? How is it different from regression?	3	2	2
8.	Write the formula for covariance and explain its significance.	3	3	2
	PART – B			
1.	Define joint probability distribution. Explain how to derive marginal and conditional distributions from it with an example.	3	4	16
2.	Explain the function of two-dimensional random variables and derive their probability distribution.	3	6	16

3.	Discuss regression curves and derive the equation of the least squares regression line.	3	4	16
4.	Explain correlation and derive the formula for the correlation coefficient. Discuss its significance with examples.	3	6	16

UNIT IV
TESTING OF HYPOTHESIS

Sampling distributions – Type I and Type II errors – Small and Large samples – Tests based on Normal, t, Chi square and F distributions for testing of mean , variance and proportions – Tests for independence of attributes and goodness of fit.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	Define sampling distribution.	4	1	2
2	Differentiate between Type I and Type II errors.	4	2	2
3.	What is the difference between a small sample and a large sample?	4	2	2
4.	Define null hypothesis and alternative hypothesis.	4	1	2
5.	When do you use a **t-test** instead of a **z-test**?	4	3	2
6.	State any two applications of the Chi-square test.	4	1	2
7.	What is the F-distribution used for in hypothesis testing?	4	2	2
8.	Define the goodness-of-fit test.	4	1	2

PART – B

1.	Explain the concept of sampling distributions. Derive the standard error and discuss its role in hypothesis testing.	4		16
2.	Explain **Type I and Type II errors** with examples. Discuss how to minimize these errors in hypothesis testing.	4		16
3.	Derive and explain the tests for mean, variance, and proportion based on **Normal, t, Chi-square, and F distributions** with examples.	4		16
4.	Explain the **Chi-square test for independence of attributes** and **goodness of fit** with applications.	4		16

UNIT V
MULTIVARIATE ANALYSIS

Random vectors and matrices – Mean vectors and covariance matrices – Multivariate normal density and its properties – Principal components – Population principal components – Principal components from standardized variables.

PART - A				
Q.NO	**QUESTION**	**CO**	**BTL**	**MARKS**
1.	Define a random vector with an example.	5	1	2
2	What is a covariance matrix?	5	2	2
3.	Define a mean vector and its significance.	5	1	2
4.	Write the equation for multivariate normal density function.	5	2	2
5.	What are the properties of a multivariate normal distribution?	5	1	2
6.	What is the significance of principal component analysis (PCA)?	5	3	2
7.	Differentiate between population principal components and sample principal components.	5	2	2
8.	Why are standardized variables used in PCA?	5	3	2
PART - B				
1.	Explain random vectors and matrices. Derive the mean vector and covariance matrix with examples.	5	6	16
2.	Derive and explain the multivariate normal density function. Discuss its properties.	5	5	16
3.	Explain principal component analysis (PCA) in detail. How are population principal components obtained?	5	6	16
4.	Discuss how principal components are derived from standardized variables. Explain their significance in data analysis.	5	5	16

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24CSPRM102
RESEARCH METHODOLOGY AND IPR

UNIT I
RESEARCH DESIGN

Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	Define research design	1	1	2
2.	List two types of observation studies.	1	1	2
3.	Explain the difference between primary and secondary data.	1	2	2
4.	What is the purpose of exploratory research?	1	1	2
5.	Name two qualitative research methods.	1	1	2
6.	Describe a key feature of qualitative research.	1	2	2
7.	Why is literature review important in the research process?	1	1	2
8.	How does observation differ from surveys?	1	2	2

PART B

1.	Compare and contrast qualitative and quantitative research with examples.	1	4	16
2.	Differentiate between various research designs with suitable examples.	1	4	16
3.	Critically evaluate the role of secondary data in research.	1	5	16
4.	Develop a research proposal on a chosen topic, including design and methodology.	1	6	16

UNIT II
DATA COLLECTION AND SOURCES

Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	What is a nominal scale?	2	1	2
2.	List two types of probability sampling	2	1	2
3.	Define a questionnaire.	2	1	2
4.	What is data cleaning?	2	1	2
5.	Explain the difference between ordinal and interval scales.	2	2	2
6.	What is the purpose of data visualization?	2	2	2

7.	Why is sampling important in research?	2	2	2
8.	Differentiate between probability and non-probability sampling.	2	2	2
	PART B			
1.	Compare and contrast different types of sampling methods with examples.	2	4	16
2.	Explain how measurement scales impact the reliability of research data.	2	4	16
3.	Evaluate the effectiveness of surveys and experiments in business research.	2	5	16
4.	Critically evaluate the role of ratio and interval scales in scientific research	2	5	16

UNIT III
DATA ANALYSIS AND REPORTING

Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	Define multivariate analysis.	3	1	2
2.	List two types of hypothesis testing methods.	3	1	2
3.	What is Pearson's correlation coefficient used for?	3	1	2
4.	Name two types of reports used to present research findings.	3	1	2
5.	Explain the difference between null and alternative hypotheses.	3	2	2
6.	How does regression analysis help in multivariate analysis?	3	2	2
7.	Differentiate between written and oral presentations of research findings.	3	2	2
8.	Explain the purpose of the chi-square test in statistical analysis.	3	2	2
	PART B			
1.	Analyze the advantages and limitations of various hypothesis testing methods.	3	4	16
2.	Explain how written and oral presentations of research findings serve different audiences	3	4	16
3.	Justify the use of different data presentation techniques based on the type of audience.	3	5	16
4.	Design an experiment to test the relationship between employee satisfaction and productivity.	3	6	16

UNIT IV
INTELLECTUAL PROPERTY RIGHTS

Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Biodiversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	Define Intellectual Property Rights (IPR)	4	1	2
2.	What is a trademark?	4	1	2
3.	Name two organizations involved in IPR regulation	4	1	2
4.	What is the full form of WIPO and WTO?	4	1	2
5.	What is the importance of trade secrets in business?	4	2	2
6.	Differentiate between patents and copyrights.	4	2	2
7.	How does IPR contribute to biodiversity conservation?	4	2	2
8.	Describe the function of UNESCO in IPR maintenance.	4	2	2

PART B

1.	Analyze the impact of WTO regulations on global IPR practices	4	4	16
2.	Discuss the importance of common IPR rules in international trade.	4	4	16
3.	Justify the need for biodiversity protection under IPR regulations.	4	5	16
4.	Develop strategies for protecting indigenous knowledge through IPR mechanisms.	4	6	16

UNIT V
PATENTS

Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filing, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licenses, Licensing of related patents, patent agents, Registration of patent agents.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	What is the duration of a patent?	5	1	2

2.	Name two types of patent applications.	5	1	2
3.	What is the purpose of a patent specification?	5	1	2
4.	Explain the term "inventive step" in patents.	5	2	2
5.	Differentiate between a provisional and a complete patent application	5	2	2
6.	Why is patent revocation necessary?	5	2	2
7.	How does a compulsory license work in patents?	5	2	2
8.	Explain the significance of the Patent Cooperation Treaty (PCT).	5	2	2
PART B				
1.	Compare and contrast the different types of patent applications.	5	4	16
2.	How can an inventor use patents for commercial success? Provide real-world examples.	5	3	16
3.	Critically evaluate the advantages and disadvantages of patent protection.	5	5	16
4.	Design a model patent licensing agreement that balances innovation protection and market competition.	5	6	16

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24CSPPC103
ADVANCED DATA STRUCTURES AND ALGORITHMS

UNIT I
ROLE OF ALGORITHMS IN COMPUTING & COMPLEXITY ANALYSIS

Algorithms – Algorithms as a Technology -Time and Space complexity of algorithms-Asymptoticanalysis-Average and worst-case analysis-Asymptotic notation-Importance of efficient algorithms- Program performance measurement - Recurrences: The Substitution Method – The Recursion-Tree Method- Data structures and algorithms.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	What is an algorithm?	1	1	2
2.	Why are algorithms considered a technology?	1	2	2
3.	What are the common asymptotic notations used in algorithm analysis?	1	1	2
4.	Define time complexity and space complexity.	1	1	2
5.	Differentiate between average-case and worst-case analysis of an algorithm.	1	3	2
6.	What is asymptotic analysis?	1	1	2
7.	What is the substitution method for solving recurrences?	1	1	2
8.	Why is it important to design efficient algorithms?	1	2	2

PART B

1.	Explain the significance of algorithms in computing. Discuss how algorithms serve as a technology.	1	4	16
2.	Describe different types of asymptotic notations with examples. Compare their significance in complexity analysis.	1	5	16
3.	Explain the recursion-tree method and substitution method for solving recurrences with examples.	1	4	16
4.	Discuss the importance of efficient algorithms in computing. Explain program performance measurement techniques.	1	5	16

UNIT II
HIERARCHICAL DATA STRUCTURES

Binary Search Trees: Basics – Querying a Binary search tree – Insertion and Deletion- Red Black trees: Properties of Red-Black Trees – Rotations – Insertion – Deletion -B-Trees: Definition of B - trees – Basic operations on B-Trees – Deleting a key from a B-Tree- Heap – Heap Implementation – Disjoint Sets - Fibonacci Heaps: structure – Mergeable-heap operations- Decreasing a key and deleting a node-Bounding the maximum degree.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	What is a Binary Search Tree (BST)?	2	1	2
2.	How do you search for an element in a BST?	2	2	2

3.	What are the properties of a Red-Black Tree?	2	1	2
4.	What is the purpose of rotations in Red-Black Trees?	2	2	2
5.	Define a B-Tree and mention its use.	2	2	2
6.	What are the basic operations performed on a heap?	2	1	2
7.	What is the significance of Fibonacci Heaps in algorithm design?	2	2	2
8.	What is the purpose of disjoint sets in data structures?	2	1	2
PART B				
1.	Explain the operations of a Binary Search Tree (BST) with an example. Discuss insertion and deletion in BST.	2	5	16
2.	Explain B-Trees in detail, including basic operations and deletion of a key from a B-Tree.	2	5	16
3.	Describe the properties of Red-Black Trees and explain how insertion and deletion are performed using rotations.	2	6	16
4.	Discuss Fibonacci Heaps, their structure, mergeable-heap operations, and how the maximum degree is bounded	2	6	16

UNIT III
GRAPHS

Elementary Graph Algorithms: Representations of Graphs – Breadth-First Search – Depth-First Search – Topological Sort – Strongly Connected Components- Minimum Spanning Trees: Growing a Minimum Spanning Tree – Kruskal and Prim- Single-Source Shortest Paths: The Bellman-Ford algorithm – Single-Source Shortest paths in Directed Acyclic Graphs – Dijkstra‘s Algorithm; Dynamic Programming - All-Pairs Shortest Paths: Shortest Paths and Matrix Multiplication – The Floyd-Warshall Algorithm

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	What are the different ways to represent a graph?	3	1	2
2.	What is the difference between BFS and DFS?	3	2	2
3.	Define topological sorting and mention its application.	3	1	2
4.	What are Strongly Connected Components (SCCs) in a graph?	3	2	2
5.	What is a Minimum Spanning Tree (MST)?	3	1	2
6.	Differentiate between Kruskal’s and Prim’s algorithm.	3	1	2
7.	State the principle behind Dijkstra’s algorithm.	3	2	2
8.	What is the Floyd-Warshall algorithm used for?	3	2	2
PART B				
1.	Explain the different graph representations and describe BFS and DFS algorithms with examples.	3	5	16

2.	Discuss the concept of Minimum Spanning Trees (MST). Explain Kruskal's and Prim's algorithms with examples.	3	6	16
3.	Explain the Floyd-Warshall algorithm for all-pairs shortest paths and discuss its use in dynamic programming.	3	5	16
4.	Describe the Bellman-Ford algorithm and Dijkstra's algorithm for single-source shortest paths with their differences.	3	6	16

UNIT IV
ALGORITHM DESIGN TECHNIQUES

Dynamic Programming: Matrix-Chain Multiplication – Elements of Dynamic Programming – Longest Common Subsequence- Greedy Algorithms: – Elements of the Greedy Strategy- An Activity-Selection Problem - Huffman Coding.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	What is the purpose of the MapReduce framework?	4	1	2
2.	What are the main components of Hadoop?	4	1	2
3.	Differentiate between the Map phase and Reduce phase in MapReduce.	4	2	2
4.	What is HDFS, and why is it used in Hadoop?	4	2	2
5.	What is the role of the Shuffle and Sort phase in MapReduce?	4	3	2
6.	How does Hadoop ensure fault tolerance?	4	3	2
7.	Why is MapReduce suitable for Big Data processing?	4	4	2
8.	What are the advantages of using MapReduce over traditional data processing methods?	4	4	2

PART B

1.	Explain the MapReduce framework with an example. Discuss its advantages in Big Data processing.	4	4	16
2.	Describe the architecture of Hadoop and explain how it supports MapReduce execution.	4	6	16
3.	Explain the steps involved in writing a Hadoop MapReduce program, from loading data into HDFS to executing the Reduce phase.	4	4	16
4.	Discuss Matrix-Vector Multiplication using MapReduce with an example and step-by-step explanation.	4	6	16

UNIT V
NP COMPLETE AND NP HARD

NP-Completeness: Polynomial Time – Polynomial-Time Verification – NP- Completeness and Reducibility – NP-Completeness Proofs – NP-Complete Problems.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	What is polynomial time complexity?	5	1	2
2.	Define NP-completeness.	5	1	2
3.	What is the difference between P and NP problems?	5	2	2
4.	What is polynomial-time verification?	5	2	2
5.	Explain the concept of NP-hard problems.	5	3	2
6.	Why is reducibility important in NP-completeness proofs?	5	3	2
7.	What are some examples of NP-complete problems?	5	4	2
8.	How do you prove that a problem is NP-complete?	5	4	2
	PART B			
1.	Explain NP-completeness and its significance in computational complexity.	5	5	16
2.	Describe polynomial-time verification with an example. How does it help define NP problems?	5	6	16
3.	Discuss NP-completeness proofs and the concept of reducibility with an example.	5	6	16
4.	Explain NP-hard problems and their relationship with NP-complete problems. Provide examples.	5	5	16

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24CSPPC104
ADVANCED DATABASE PRACTICES

UNIT I
RELATIONAL DATA MODEL

Entity Relationship Model – Relational Data Model – Mapping Entity Relationship Model to Relational Model – Relational Algebra – Structured Query Language – Database Normalization.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	What is an Entity-Relationship (ER) model?	1	1	2
2.	Define the Relational Data Model.	1	1	2
3.	What are the key differences between an entity and an attribute?	1	2	2
4.	How is an ER model mapped to a relational model?	1	2	2
5.	What are the basic operations in Relational Algebra?	1	3	2
6.	What is the purpose of Structured Query Language (SQL)?	1	3	2
7.	Why is database normalization important?	1	4	2
8.	What are the different types of normal forms in normalization?	1	5	2

PART B

1.	Explain the Entity-Relationship (ER) model with examples and discuss how it represents real-world data.	1	5	16
2.	Describe the Relational Data Model and explain how an ER model is mapped to a relational schema.	1	6	16
3.	Explain the different normal forms in database normalization and how they help in reducing data redundancy.	1	5	16
4.	Discuss Relational Algebra in detail with examples. How is it useful in database query processing?	1	6	16

UNIT II
DISTRIBUTED DATABASES, ACTIVE DATABASES AND OPEN DATABASE CONNECTIVITY

Distributed Database Architecture – Distributed Data Storage – Distributed Transactions – Distributed Query Processing – Distributed Transaction Management – Event Condition Action Model – Design and Implementation Issues for Active Databases – Open Database Connectivity.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	What is a distributed database?	2	1	2
2.	List the different types of distributed database architectures.	2	2	2
3.	What is distributed data storage?	2	1	2

4.	What are distributed transactions?	2	2	2
5.	Define distributed query processing.	2	3	2
6.	What is the Event-Condition-Action (ECA) model in active databases?	2	3	2
7.	What are the challenges in designing an active database?	2	2	2
8.	What is Open Database Connectivity (ODBC), and why is it important?	2	4	2
PART B				
1.	Explain the architecture of distributed databases and discuss the advantages and challenges of distributed data storage.	2	5	16
2.	Describe distributed transaction management and discuss how concurrency and recovery are handled.	2	6	16
3.	Explain the Event-Condition-Action (ECA) model in active databases with examples. Discuss the design and implementation issues.	2	5	16
4.	What is Open Database Connectivity (ODBC)? Explain its architecture, components, and how it facilitates database interoperability.	2	6	16

UNIT III
XML DATABASES

Structured, Semi structured, and Unstructured Data – XML Hierarchical Data Model – XML Documents – Document Type Definition – XML Schema – XML Documents and Databases – XML Querying – XPath – XQuery

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	What are structured, semi-structured, and unstructured data?	3	1	2
2.	Define the XML hierarchical data model.	3	1	2
3.	What is an XML Document?	3	2	2
4.	Differentiate between Document Type Definition (DTD) and XML Schema.	3	3	2
5.	What is the role of XML in databases?	3	1	2
6.	Explain XPath and its use in XML querying.	3	5	2
7.	Why is XML Schema preferred over DTD?	3	1	2
8.	How does XQuery enhance XML data retrieval?	3	5	2
PART B				
1.	Explain structured, semi-structured, and unstructured data with examples. How does XML handle semi-structured data?	3	4	16

2.	Describe XML Documents and their structure. Explain DTD and XML Schema with examples.	3	4	16
3.	Discuss how XML is used in databases. Explain XML Querying with XPath and XQuery.	3	6	16
4.	Compare and contrast XML Schema and DTD. Explain how XML Schema improves data validation in databases.	3	6	16

UNIT IV
NOSQL DATABASES AND BIG DATA STORAGE SYSTEMS

NoSQL – Categories of NoSQL Systems – CAP Theorem – Document-Based NoSQL Systems and MongoDB – MongoDB Data Model – MongoDB Distributed Systems Characteristics – NoSQL Key-Value Stores – DynamoDB Overview – Voldemort Key-Value Distributed Data Store – Wide Column NoSQL Systems – Hbase Data Model – Hbase Crud Operations – Hbase Storage and Distributed System Concepts – NoSQL Graph Databases and Neo4j – Cypher Query Language of Neo4j – Big Data – MapReduce – Hadoop – YARN.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	What is NoSQL, and how does it differ from SQL databases?	4	1	2
2.	List the different categories of NoSQL databases.	4	1	2
3.	What is the CAP theorem in NoSQL databases?	4	2	2
4.	Explain the MongoDB data model.	4	2	2
5.	How does DynamoDB implement key-value storage?	4	3	2
6.	What are the CRUD operations in HBase? Why are graph databases like Neo4j used for highly connected data?	4	3	2
7.	Why are graph databases like Neo4j used for highly connected data?	4	4	2
8.	How does MapReduce work in Big Data processing?	4	4	2

PART B

1.	Explain NoSQL databases and their different categories. Compare them with relational databases.	4	4	16
2.	Describe MongoDB's data model, its distributed system characteristics, and how it handles large-scale data.	4	6	16
3.	Explain the architecture of HBase and discuss its CRUD operations and distributed storage system concepts.	4	4	16
4.	Discuss the role of MapReduce in Big Data processing. Explain the Hadoop ecosystem and YARN in detail.	4	6	16

UNIT V
DATABASE SECURITY

Database Security Issues – Discretionary Access Control Based on Granting and Revoking Privileges – Mandatory Access Control and Role-Based Access Control for Multilevel Security – SQL Injection – Statistical Database Security – Flow Control – Encryption and Public Key Infrastructures – Preserving Data Privacy – Challenges to Maintaining Database Security – Database Survivability – Oracle Label-Based Security.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	What are the common database security issues?	5	1	2
2.	Define discretionary access control in databases.	5	1	2
3.	Differentiate between discretionary and mandatory access control.	5	2	2
4.	What is SQL Injection, and how can it be prevented?	5	2	2
5.	Explain statistical database security.	5	3	2
6.	What is the role of encryption in database security?	5	3	2
7.	How does role-based access control (RBAC) enhance database security?	5	4	2
8.	What are the key challenges in maintaining database security?	5	4	2
	PART B			
1.	Explain the different types of database security threats and their countermeasures.	5	5	16
2.	Describe discretionary access control, mandatory access control, and role-based access control with examples.	5	6	16
3.	Discuss SQL Injection attacks, their types, and techniques for prevention in databases.	5	6	16
4.	Explain encryption techniques and public key infrastructures used for database security. Discuss their role in preserving data privacy.	5	5	16

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24CSPPC105

NETWORK TECHNOLOGIES

UNIT I
NETWORKING CONCEPTS

Peer To Peer Vs Client-Server Networks. Network Devices. Network Terminology. Network Speeds. Network throughput, delay. Osi Model. Packets, Frames, And Headers. Collision And Broadcast Domains. LAN Vs WAN. Network Adapter. Hub. Switch. Router. Firewall, IP addressing.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	Define a network frame.	1	1	2
2.	Differentiate between a packet and a frame.	1	2	2
3.	What is a broadcast domain?	1	1	2
4.	State the functions of a network switch.	1	1	2
5.	List any two advantages of the Client-Server model.	1	2	2
6.	What is network throughput?	1	1	2
7.	Differentiate between LAN and WAN.	1	2	2
8.	What is the purpose of a firewall in networking?	1	1	2

PART B

1.	Explain the OSI model with a neat diagram. Discuss the functions of each layer.	1	5	16
2.	Compare Peer-to-Peer and Client-Server networks. Explain their advantages and disadvantages with examples.	1	5	16
3.	Discuss the different types of network devices (Hub, Switch, Router, Firewall) with their working principles and use cases.	1	6	16
4.	Describe in detail about IP addressing (IPv4 and IPv6), its classifications, subnetting, and address allocation methods.	1	6	16

UNIT II
WIRELESS NETWORKS

Wireless access techniques- IEEE 802.11a, 802.11g, 802.11e, 802.11n/ac/ax/ay/ba/be, QoS – Bluetooth – Protocol Stack – Security – Profiles – zigbee.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	Define Wireless Access Techniques.	2	1	2
2.	Differentiate between IEEE 802.11a and IEEE 802.11g.	2	2	2
3.	What is the significance of QoS in wireless networks?	2	2	2
4.	List any two features of IEEE 802.11ax (Wi-Fi 6).	2	1	2
5.	What is a Bluetooth Protocol Stack?	2	1	2

6.	Define Zigbee and mention one of its applications.	2	2	2
7.	Mention any two security features in wireless networks.	2	1	2
8.	What are Bluetooth Profiles? Give an example.	2	2	2
	PART B			
1.	Explain different IEEE 802.11 wireless standards (802.11a, 802.11g, 802.11e, 802.11n/ac/ax/ay/ba/be) with their features, advantages, and applications.	2	4	16
2.	Describe the Bluetooth protocol stack with a neat diagram. Explain the functionalities of each layer.	2	4	16
3.	Discuss the role of Zigbee in wireless communication. Explain its frame structure, advantages, and applications in IoT.	2	6	16
4.	Analyze various security mechanisms in wireless networks. Explain the threats and countermeasures to ensure secure communication.	2	6	16

UNIT III
MOBILE DATA NETWORKS

4G Networks and Composite Radio Environment – Protocol Boosters – Hybrid 4G Wireless Networks Protocols – Green Wireless Networks – Physical Layer and Multiple Access – Channel Modelling for 4G – Concepts of 5G – channel access –air interface -Cognitive Radio- spectrum management – C-RAN architecture - Vehicular communications-protocol – Network slicing – MIMO, mmWave, Introduction to 6G.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	What is a composite radio environment in 4G networks?	3	1	2
2.	Define Protocol Boosters in mobile networks.	3	2	2
3.	What is the role of Hybrid 4G Wireless Network Protocols?	3	1	2
4.	List any two advantages of Green Wireless Networks.	3	2	2
5.	What is Cognitive Radio, and why is it important?	3	1	2
6.	Differentiate between MIMO and mmWave technology.	3	2	2
7.	What is Network Slicing in 5G networks?	3	1	2
8.	Mention one key feature of 6G networks.	3	2	2
	PART B			
1.	Explain the architecture of 4G networks, including the composite radio environment and protocol boosters.	3	6	16
2.	Describe Cognitive Radio and its role in spectrum management. How does it enhance wireless communication?	3	5	16
3.	Discuss in detail the C-RAN (Cloud Radio Access Network) architecture. Explain its advantages and challenges in modern mobile	3	5	16

	networks.			
4.	Compare 4G, 5G, and 6G technologies in terms of air interface, network slicing, vehicular communication, and channel modeling.	3	6	16

UNIT IV
SOFTWARE DEFINED NETWORKS

SDN Architecture. Characteristics of Software-Defined Networking. SDN- and NFV-Related Standards. SDN Data Plane. Data Plane Functions. Data Plane Protocols. OpenFlow Logical Network Device. Flow Table Structure. Flow Table Pipeline. The Use of Multiple Tables. Group Table. OpenFlow Protocol. SDN Control Plane Architecture. Control Plane Functions. Southbound Interface. Northbound Interface. Routing. ITU-T Model. OpenDaylight. OpenDaylight Architecture. OpenDaylight Helium. SDN Application Plane Architecture. Northbound Interface. Network Services Abstraction Layer. Network Applications. User Interface.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	What is Software-Defined Networking (SDN)?	4	1	2
2.	List any two characteristics of SDN.	4	2	2
3.	What is the role of the SDN data plane?	4	1	2
4.	Define OpenFlow and its significance in SDN.	4	2	2
5.	What is the function of a Flow Table in OpenFlow?	4	1	2
6.	Differentiate between the SDN control plane and data plane.	4	2	2
7.	What is the role of the Southbound Interface in SDN?	4	1	2
8.	Mention any two features of OpenDaylight.	4	2	2

PART B

1.	Explain the SDN architecture in detail with its characteristics and layers.	4	5	16
2.	Describe OpenFlow's logical network device, its flow table structure, and the use of multiple tables.	4	6	16
3.	Discuss the SDN Control Plane architecture, including control plane functions, routing, and interfaces (Northbound & Southbound).	4	6	16
4.	Analyze OpenDaylight and its architecture. Explain its role in SDN and describe OpenDaylight Helium.	4	5	16

UNIT V
NETWORK FUNCTIONS VIRTUALIZATION

Motivation-Virtual Machines –NFV benefits-requirements – architecture- NFV Infrastructure - Virtualized Network Functions - NFV Management and Orchestration- NFV Use Cases- NFV and SDN –Network virtualization – VLAN and VPN.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	What are the key characteristics of SDN?	5	1	2
2.	Define SDN Data Plane and its function.	5	2	2
3.	What is the role of the SDN Control Plane?	5	1	2
4.	Differentiate between Northbound and Southbound Interfaces in SDN.	5	2	2
5.	What is the purpose of Flow Table Pipeline in OpenFlow?	5	2	2
6.	Mention any two functions of the OpenFlow Protocol.	5	1	2
7.	What is Network Function Virtualization (NFV), and how is it related to SDN?	5	2	2
8.	List two advantages of using OpenDaylight in SDN.	5	1	2
	PART B			
1.	Explain the SDN architecture in detail, including the data plane, control plane, and application plane.	5	6	16
2.	Describe OpenFlow Logical Network Device, its Flow Table Structure, and Group Table functionality.	5	6	16
3.	Discuss SDN Control Plane Architecture, its functions, Southbound and Northbound Interfaces, and Routing.	5	6	16
4.	Analyze OpenDaylight, its architecture, and its role in SDN. Explain the features of OpenDaylight Helium.	5	6	16

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24CSPPC106
ESSENTIALS OF DATA SCIENCE

UNIT I
INTRODUCTION TO DATA SCIENCE

Data science process – roles, stages in data science project – working with data from files – working with relational databases – exploring data – managing data – cleaning and sampling for modeling and validation – introduction to NoSQL

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	What is Data Science? List the stages in a Data Science project.	1	1	2
2.	What are the key roles in a Data Science team?	1	1	2
3.	List the stages in a Data Science project.	1	2	2
4.	Differentiate between structured and unstructured data.	1	2	2
5.	What is the purpose of data cleaning in Data Science?	1	2	2
6.	Mention two differences between relational databases and NoSQL databases.	1	1	2
7.	What is data sampling, and why is it important in modeling?	1	2	2
8.	Define NoSQL and give an example.	1	1	2

PART B

1.	Explain the Data Science process in detail with its various stages.	1	5	16
2.	Describe different roles in a Data Science project and their responsibilities.	1	6	16
3.	Explain how to work with data from files and relational databases. Provide examples.	1	5	16
4.	Discuss the importance of data cleaning and sampling for modeling and validation. Explain with real-world examples.	1	6	16

UNIT II
MODELING METHODS

Choosing and evaluating models – mapping problems to machine learning, evaluating clustering models, validating models – cluster analysis – K-means algorithm, Naïve Bayes – Memorization Methods – Linear and logistic regression – unsupervised methods.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	What are the key steps in choosing a machine learning model?	2	1	2
2.	Define model validation in machine learning.	2	2	2
3.	What is clustering in data science?	2	1	2
4.	Mention any two evaluation metrics for clustering models.	2	2	2

5.	Explain the K-means algorithm in brief.	2	2	2
6.	Differentiate between Linear Regression and Logistic Regression.	2	1	2
7.	What is Naïve Bayes classifier used for?	2	2	2
8.	Define unsupervised learning with an example.	2	1	2
	PART B			
1.	Explain the process of choosing and evaluating machine learning models. Describe various evaluation metrics.	2	5	16
2.	Describe cluster analysis in detail. Explain the K-means algorithm with a suitable example.	2	6	16
3.	Discuss Naïve Bayes classifier and Memorization Methods in machine learning with examples.	2	6	16
4.	Compare Linear Regression and Logistic Regression. Explain their applications in real-world problems.	2	5	16

UNIT III
INTRODUCTION TO R

Reading and getting data into R – ordered and unordered factors – arrays and matrices – lists and data frames – reading data from files – probability distributions – statistical models in R manipulating objects – data distribution.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	How do you read data into R from a file?	3	1	2
2.	Differentiate between ordered and unordered factors in R.	3	2	2
3.	What is the difference between an array and a matrix in R?	3	1	2
4.	Define a data frame in R and mention its uses.	3	2	2
5.	What are probability distributions in R? Give an example.	3	2	2
6.	List any two statistical models available in R.	3	1	2
7.	What are lists in R? How do they differ from vectors?	3	2	2
8.	How can you manipulate objects in R?	3	1	2
	PART B			
1.	Explain various methods to read and get data into R from different sources.	3	6	16
2.	Describe arrays and matrices in R with suitable examples.	3	5	16
3.	Discuss probability distributions in R. Explain how they are used in statistical modeling.	3	5	16

4.	Explain data manipulation techniques in R, including working with lists, data frames, and data distributions.	3	6	16

UNIT IV
MAP REDUCE

Introduction – distributed file system – algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce – Hadoop - Understanding the Map Reduce architecture - Writing Hadoop MapReduce Programs - Loading data into HDFS - Executing the Map phase - Shuffling and sorting - Reducing phase execution.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	What is MapReduce?	4	1	2
2.	What is the role of the Distributed File System in MapReduce?	4	2	2
3.	List the key components of the Hadoop framework.	4	1	2
4.	What is the purpose of the Shuffle and Sort phase in MapReduce?	4	2	2
5.	Differentiate between Map and Reduce functions in MapReduce.	4	2	2
6.	What is the function of HDFS in Hadoop?	4	1	2
7.	Explain the significance of the Map phase in MapReduce.	4	2	2
8.	What are the main steps involved in executing a Hadoop MapReduce job?	4	1	2

PART B

1.	Explain the MapReduce framework in detail with an example. Discuss its advantages in big data processing.	4	4	16
2.	Describe the architecture of Hadoop and how it supports MapReduce execution.	4	6	16
3.	Explain the steps involved in writing a Hadoop MapReduce program, from loading data into HDFS to executing the Reduce phase.	4	4	16
4.	Discuss Matrix-Vector Multiplication using MapReduce. Provide an example with a step-by-step explanation.	4	6	16

UNIT V
DATA VISUALIZATION

Documentation and deployment – producing effective presentations – Introduction to graphical analysis – plot() function – displaying multivariate data – matrix plots – multiple plots in one window - exporting graph using graphics parameters - Case studies.

PART - A

Q.NO	QUESTION	CO	BTL	MARKS
1.	What is data visualization, and why is it important?	5	1	2
2.	What is the purpose of the plot() function in R?	5	2	2
3.	List two methods for displaying multivariate data.	5	1	2
4.	What is a matrix plot, and when is it used?	5	2	2
5.	How can multiple plots be displayed in one window in R?	5	2	2
6.	What are graphical parameters in R, and how are they used?	5	1	2
7.	Explain how to export graphs in R.	5	1	2
8.	What are the key components of an effective data visualization presentation?	5	2	2
	PART B			
1.	Explain the process of documentation and deployment in data visualization. How can visualizations be effectively presented?	5	5	16
2.	Describe the plot() function in R with examples. How can it be used for different types of graphical analysis?	5	6	16
3.	Discuss different techniques for visualizing multivariate data. Explain matrix plots and multiple plots in one window with examples.	5	6	16
4.	Explain how to export graphs using graphical parameters in R. Provide a case study demonstrating effective data visualization.	5	5	16

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