Learn Research
Innovate

UNITED INSTITUTE OF TECHNOLOGY

(An Autonomous Institution)

(Approved by AICTE | Affiliated to Anna University |
Accredited by NAAC with A+ Grade | Certified by ISO 9001:2015)
Periyanaickenpalayam, Coimbatore – 641020

MASTER OF ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

QUESTION BANK

I YEAR

EVEN SEMESTER

ACADEMIC YEAR 2024 – 2025

INDEX

HEAD OF THE DEPARTMENT

ACOE **PRINCIPAL** **CHAIRMAN**

24CSPPC204
ADVANCED SOFTWARE ENGINEERING

UNIT I

SOFTWARE PROCESS &MODELING

Prescriptive Process Models – Agility and Process – Scrum – XP – Kanban – DevOps – Prototype Construction – Prototype Evaluation – Prototype Evolution – Modelling – Principles – Requirements Engineering – Scenario-based Modelling – Class-based Modelling – Functional Modelling – Behavioural Modelling.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define a Prescriptive Process Model	1	1	2
2.	List the different types of Prescriptive Process Models	1	1	2
3.	Compare Agile and Traditional Software Development	1	2	2
4.	Differentiate Scrum and Kanban	1	1	2
5.	State any two roles in Scrum	1	1	2
6.	Distinguish between Prototype Construction and Prototype Evolution.	1	2	2
7.	What is Functional Modeling?	1	2	2
8.	Define Scenario-Based Modeling.	1	1	2
	PART B			
1.	Compare and contrast the Waterfall, Incremental, Spiral, and V-Model in software development	1	5	16
2.	Discuss the principles of Agile methodology and its benefits in software development.	1	2	16
3.	Describe the key components of DevOps and how it enhances the software delivery pipeline.	1	2	16
4.	Analyze the role of Requirements Engineering in software development and its impact on project success	1	4	16

UNIT II

SOFTWARE DESIGN

Design Concepts – Design Model – Software Architecture – Architectural Styles – Architectural Design – Component-Level Design – User Experience Design – Design for Mobility – Pattern- Based Design

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define abstraction in software design.	1	1	2
2.	What is modularity in the context of software engineering?	1	1	2
3.	List the primary components of a design model	1	1	2
4.	Identify two common architectural styles used in software design.	1	1	2
5.	Describe the purpose of component-level design	1	2	2
6.	Explain the significance of user experience (UX) design in software development.	1	2	2
7.	What is design for mobility?	1	2	2
8.	Give an example of a pattern-based design approach	1	2	2
	PART B			
1.	Discuss various design concepts such as abstraction, modularity, encapsulation, and separation of concerns, and analyze their impact on software quality	1	4	16
2.	Compare and contrast different architectural styles in software design, such as layered architecture, client-server architecture, and microservices architecture, highlighting their advantages and disadvantages	1	5	16
3.	Examine the role of user experience (UX) design in software development and discuss methods to enhance usability and accessibility.	1	4	16
4.	Explain the concept of pattern-based design and analyze how design patterns can provide reusable solutions to common software design problems.	1	4	16

UNIT III

SYSTEM DEPENDABILITY AND SECURITY

Dependable Systems – Dependability Properties – Sociotechnical Systems – Redundancy and Diversity – Dependable Processes – Formal Methods and Dependability – Reliability Engineering – Availability and Reliability – Reliability Requirements – Fault-tolerant Architectures – Programming for Reliability – Reliability Measurement – Safety Engineering – Safety-critical Systems – Safety Requirements – Safety Engineering Processes – Safety Cases – Security Engineering – Security and Dependability – Safety and Organizations – Security Requirements – Secure System Design – Security Testing and Assurance – Resilience Engineering – Cybersecurity – Sociotechnical Resilience – Resilient Systems Design.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What are the key properties of a dependable system?	1	1	2
2.	Differentiate between redundancy and diversity in system design.	1	2	2
3.	What is the role of formal methods in ensuring system dependability?	1	1	2
4.	Explain the concept of fault-tolerant architecture.	1	2	2
5.	Describe the purpose of a safety case in safety engineering	1	2	2
6.	What is the relationship between security and dependability?	1	1	2
7.	Explain the importance of resilience engineering	1	2	2
8.	What are resilient systems?	1	1	2
	PART B			
1.	**Explain** the concept of sociotechnical systems and **evaluate** their significance in the development of dependable software solutions	1	5	16
2.	**Discuss** the application of formal methods in improving system dependability and **evaluate** their effectiveness in real-world scenarios.	1	5	16
3.	**Describe** fault-tolerant architectures and **assess** their effectiveness in maintaining system reliability in the presence of faults.	1	5	16
4.	**Discuss** the concept of cybersecurity within the framework of sociotechnical resilience and **evaluate** methods for designing systems that are both secure and resilient.	1	5	16

UNIT IV

SERVICE-ORIENTED SOFTWARE ENGINEERING, SYSTEMS ENGINEERING AND REAL-TIME SOFTWARE ENGINEERING

Service-oriented Architecture – RESTful Services – Service Engineering – Service Composition – Systems Engineering – Sociotechnical Systems – Conceptual Design – System Procurement – System Development – System Operation and Evolution – Real-time Software Engineering – Embedded System Design – Architectural Patterns for Real-time Software – Timing Analysis – Real-time Operating Systems.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define Service-Oriented Architecture (SOA)	1	1	2
2.	List two key activities involved in service engineering	1	1	2
3.	Define systems engineering	1	1	2
4.	Explain the purpose of conceptual design in systems engineering	1	2	2
5.	What is system procurement?	1	1	2
6.	Explain the role of architectural patterns in real-time software.	1	2	2
7.	What is timing analysis in real-time systems?	1	1	2
8.	Describe the function of real-time operating systems	1	2	2
	PART B			
1.	Explain the characteristics of RESTful services and evaluate their advantages in web service implementation	1	5	16
2.	Describe the role of systems engineering in the development of complex systems and evaluate its impact on project success.	1	5	16
3.	Explain the unique challenges of real-time software engineering and evaluate strategies to address timing constraints in embedded systems.	1	5	16
4.	Describe the functions of real-time operating systems and analyze their role in managing hardware resources for real-time applications	1	4	16

UNIT V

SOFTWARE TESTING AND SOFTWARE CONFIGURATION MANAGEMENT

Software Testing Strategy – Unit Testing – Integration Testing – Validation Testing – System Testing – Debugging – White-Box Testing – Basis Path Testing – Control Structure Testing – Black-Box Testing – Software Configuration Management (SCM) – SCM Repository – SCM Process – Configuration Management for Web and Mobile Apps.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define software testing.	5	1	2
2.	What is basis path testing?	5	1	2
3.	Define black-box testing.	5	1	2
4.	What is software configuration management (SCM)?	5	1	2
5.	What is an SCM repository?	5	1	2
6.	Define configuration management for web applications.	5	1	2
7.	What is the role of CI/CD in SCM?	5	1	2
8.	Name two techniques used in control structure testing.	5	1	2
	PART B			
1.	Explain black-box testing with different testing techniques.	5	4	16
2.	Discuss configuration management for web and mobile applications.	5	4	16
3.	What are the challenges in managing configurations for mobile apps?	5	4	16
4.	Explain SCM repository and version control systems with examples.	5	2	16

-----END----

24CSPPC202

MULTICORE ARCHITECTURE AND PROGRAMMING

UNIT I

MULTI-CORE PROCESSORS

Single core to Multi-core architectures – SIMD and MIMD systems – Interco networks – Symmetric and Distributed Shared Memory Architectures – Cache coh Performance Issues – Parallel program design**.**

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is the difference between single-core and multi-core processors?	1	1	2
2.	Define SIMD and MIMD architectures.	1	1	2
3.	What are interconnection networks in multi-core processors?	1	1	2
4.	Differentiate between Symmetric and Distributed Shared Memory architectures.	1	2	2
5.	What is cache coherence?	1	1	2
6.	List any two cache coherence protocols.	1	1	2
7.	State Amdahl's Law and its significance.	1	2	2
8.	What is the role of parallel program design in multi-core processors?	1	2	2
	PART B			
1.	Explain the evolution from single-core to multi-core architectures.	1	5	16
2.	Describe SIMD and MIMD architectures in detail.	1	6	16
3.	Discuss cache coherence in multi-core processors.	1	6	16
4.	Explain parallel program design methodologies for multi-core processors.	1	5	16

UNIT II

PARALLEL PROGRAM CHALLENGES

Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define performance in parallel programming.	2	1	2
2.	What is scalability in parallel computing?	2	1	2
3.	What is a data race? How does it occur?	2	2	2
4.	Differentiate between deadlock and livelock.	2	2	2
5.	List any two synchronization primitives used in parallel programming.	2	1	2
6.	What is the purpose of mutexes in synchronization?	2	2	2
7.	Explain the role of message queues in inter-thread communication.	2	2	2
8.	Mention two methods to prevent deadlocks in parallel programs.	2	3	2
	PART B			
1.	Explain performance and scalability issues in parallel programming. Discuss factors affecting performance with examples.	2	5	16
2.	Describe data races in parallel programs. How can they be detected and avoided?	2	6	16
3.	Explain different synchronization primitives (mutexes, locks, semaphores, barriers) with real-time examples.	2	5	16
4.	Discuss deadlocks and livelocks in parallel programming. Explain various techniques to prevent them.	2	6	16

UNIT III

SHARED MEMORY PROGRAMMING WITH OpenMP

OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs – Library functions – Handling Data and Functional Parallelism – Handling Loops – Performance Considerations.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is OpenMP?	3	1	2
2.	Define the execution model of OpenMP.	3	1	2
3.	What are the different types of memory in the OpenMP memory model?	3	2	2
4.	List any two OpenMP directives used for parallelism.	3	1	2
5.	What are work-sharing constructs in OpenMP?	3	2	2
6.	Give two examples of OpenMP library functions and their use.	3	3	2
7.	What is the role of #pragma omp for in loop parallelization?	3	2	2
8.	Mention any two performance issues in OpenMP programming.	3	3	2
	PART B			
1.	Explain the execution model and memory model of OpenMP with examples.	3	5	16
2.	Describe different OpenMP directives and their usage with examples.	3	6	16
3.	Discuss work-sharing constructs in OpenMP. Explain their impact on performance with real-time examples.	3	6	16
4.	Explain performance considerations in OpenMP programming. How can we optimize parallel execution?	3	5	16

UNIT IV

DISTRIBUTED MEMORY PROGRAMMING WITH MPI

MPI program execution – MPI constructs – libraries – MPI send and receive – point and Collective communication – MPI derived datatypes – Performance evalua

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is an N-Body problem?	5	1	2
2.	Mention one real-world application of N-Body solvers.	5	1	2
3.	Define Tree Search in parallel programming.	5	2	2
4.	How does OpenMP differ from MPI?	5	2	2
5.	What is load balancing in tree search algorithms?	5	3	2
6.	List two challenges in parallelizing an N-Body problem.	5	2	2
7.	What are hybrid parallel programming models?	5	3	2
8.	Name two performance factors in choosing OpenMP vs. MPI.	5	4	2
	PART B			
1.	Explain the implementation of N-Body solvers using OpenMP and MPI. Compare their performance.	5	5	16
2.	Describe the parallelization of tree search algorithms and their applications.	5	6	16
3.	Discuss OpenMP and MPI implementations with a case study. Compare their advantages and limitations.	5	6	16
4.	Explain hybrid programming models using OpenMP and MPI. Discuss when they should be used.	5	5	16

UNIT V

PARALLEL PROGRAM DEVELOPMENT

Case studies – n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is MPI?	4	1	2
2.	Define MPI program execution.	4	1	2
3.	What are MPI constructs?	4	2	2
4.	Differentiate between Point-to-Point and Collective Communication.	4	2	2
5.	What are MPI derived datatypes?	4	2	2
6.	List two MPI functions used for communication.	4	1	2
7.	What is the role of MPI_Send and MPI_Recv?	4	2	2
8.	Mention two performance factors in MPI programming.	4	3	2
	PART B			
1.	Explain MPI program execution with suitable examples.	4	5	16
2.	Describe different MPI constructs and libraries used for distributed memory programming.	4	6	16
3.	Explain point-to-point and collective communication in MPI with examples.	4	5	16
4.	Discuss performance evaluation in MPI programming and techniques to optimize communication overhead.	4	6	16

-----END----

24CSPPC201

INTERNET OF THINGS

UNIT I

INTRODUCTION

Internet of Things- Domain Specific IoTs - IoT and M2M-Sensors for IoT Applications– Structure of IoT– IoT Map Device- IoT System Management with NETCONF-YANG

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define the Internet of Things	1	1	2
2.	Name two domain-specific IoT applications	1	1	2
3.	What is Machine-to-Machine (M2M) communication?	1	1	2
4.	Why are sensors important in IoT systems?	1	2	2
5.	Explain the role of edge computing in IoT architecture.	1	2	2
6.	How does an IoT map device help in device management?	1	2	2
7.	How does YANG help in managing IoT devices?	1	2	2
8.	What is an IoT map device?	1	1	2
	PART B			
1.	Explain the concept of Machine-to-Machine (M2M) communication. How does it integrate with IoT? Discuss its benefits, challenges, and use cases.	1	3	16
2.	Describe the layered architecture of an IoT system. Explain the role of each layer in IoT communication and data processing with examples.	1	4	16
3.	Explain the role of NETCONF and YANG in IoT system management. Design an IoT management system using these protocols and explain how it improves device configuration and data management.	1	6	16
4.	What is an IoT map device? Explain its significance in device management and monitoring. Provide an example of how it is used in real-world applications.	1	3	16

UNIT II

IoT ARCHITECTURE, GENERATIONS AND PROTOCOLS

IETF architecture for IoT - IoT reference architecture -First Generation – Description & Characteristics–Advanced Generation – Description & Characteristics–Integrated IoT Sensors – Description & Characteristics

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is the role of IETF in IoT architecture?	2	1	2
2.	What is an IoT reference architecture?	2	1	2
3.	Why is a reference architecture important in IoT system design?	2	2	2
4.	Mention two characteristics of First-Generation IoT	2	2	2
5.	What is Advanced Generation IoT?	2	1	2
6.	What are Integrated IoT Sensors?	2	1	2
7.	How does Advanced Generation IoT differ from First-Generation IoT?	2	2	2
8.	How do Integrated IoT Sensors improve IoT applications?	2	2	2
	PART B			
1.	Explain the **IETF architecture for IoT** and discuss the key protocols and standards used in IoT communication. How do these protocols enable interoperability in IoT systems?	2	4	16
2.	Describe the **IoT reference architecture** and explain its key layers. How does this architecture help in designing scalable and efficient IoT systems?	2	5	16
3.	Explain the role of **Integrated IoT Sensors** in modern IoT applications. How do they enhance data collection and processing? Provide examples of their real-world usage.	2	3	16
4.	Compare and contrast **First-Generation IoT** with **Advanced Generation IoT**. How have advancements in technology improved IoT applications?	2	4	16

UNIT III

IoT PROTOCOLS AND TECHNOLOGY

SCADA and RFID Protocols - BACnet Protocol -Zigbee Architecture - 6LowPAN - CoAP -Wireless Sensor Structure–Energy Storage Module–Power Management Module–RF Module–Sensing Module

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is the BACnet protocol used for?	3	1	2
2.	What are the main components of Zigbee architecture?	3	1	2
3.	Why is Zigbee preferred for low-power IoT applications?	3	2	2
4.	How does 6LoWPAN enable IPv6 communication in IoT?	3	2	2
5.	What is CoAP in IoT?	3	1	2
6.	What are the main components of a wireless sensor node?	3	1	2
7.	Why is energy storage critical for wireless IoT devices?	3	2	2
8.	What is the role of the power management module in an IoT system?	3	1	2
	PART B			
1.	Explain the architecture and working of **SCADA systems** in industrial automation. Compare SCADA with **RFID technology** and discuss their role in IoT-based monitoring and control systems.	3	4	16
2.	Describe the **BACnet protocol** and its significance in **building automation systems**. How does BACnet improve interoperability between IoT devices used in smart buildings?	3	5	16
3.	Explain the **Zigbee architecture** and discuss its importance in low-power, short-range communication. Compare Zigbee with other wireless communication protocols used in IoT applications.	3	4	16
4.	Explain the **CoAP protocol** in IoT applications. Compare its features with **HTTP and MQTT**, and evaluate its advantages and limitations for constrained IoT devices.	3	5	16

UNIT IV

CLOUD ARCHITECTURE BASICS

The Cloud types; IaaS, PaaS, SaaS.- Development environments for service development; Amazon, Azure, Google Appcloud platform in industry

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What are the three main types of cloud computing services?	4	1	2
2.	What is **IaaS** in cloud computing?	4	1	2
3.	How does **PaaS** help developers in application deployment?	4	2	2
4.	Why are cloud development platforms important for industries?	4	2	2
5.	Name three popular cloud platforms used for service development.	4	2	2
6.	How does **Azure** help in AI and machine learning services?	4	2	2
7.	What is **Google Cloud Platform (GCP)**?	4	1	2
8.	What are the key advantages of using **GCP** over other cloud providers?	4	2	2
	PART B			
1.	Explain the different types of cloud computing services: **IaaS, PaaS, and SaaS**. Compare their functionalities, advantages, and use cases with suitable examples.	4	4	16
2.	Discuss the concept of **Infrastructure as a Service (IaaS)**. Evaluate its benefits and challenges in cloud computing. Provide real-world examples of **IaaS providers** and their applications.	4	5	16
3.	Discuss the role of **development environments** in cloud computing. Design a **cloud-based application development strategy** using **AWS, Azure, or Google Cloud**.	4	6	16
4.	Discuss the **Google Cloud Platform (GCP)** and its role in cloud computing. Compare its features, pricing, and advantages over AWS and Azure.	4	5	16

UNIT V

IOT PROJECTS ON RASPBERRY PI

Building IOT with RASPBERRY PI- Creating the sensor project - Preparing Raspberry Pi - Clayster libraries – Hardware Interacting with the hardware - Interfacing the hardware- Internal representation of sensor values - Persisting data - External representation of sensor values - Exporting sensor data

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is Raspberry Pi, and why is it used in IoT?	5	1	2
2.	What are the basic components required to create a sensor-based IoT project using Raspberry Pi?	5	1	2
3.	How do sensors interact with Raspberry Pi in an IoT project?	5	2	2
4.	Why is it important to update and configure Raspberry Pi before deploying an IoT project?	5	2	2
5.	What are **Clayster libraries**, and how do they help in IoT development?	5	1	2
6.	Name two interfaces used to connect sensors with Raspberry Pi.	5	1	2
7.	Why is the I2C protocol useful in interfacing multiple sensors with Raspberry Pi?	5	2	2
8.	What is meant by the internal representation of sensor values?	5	1	2
	PART B			
1.	Explain the architecture of **Raspberry Pi** and analyze its role in IoT applications. Compare its features with other IoT development boards like Arduino and ESP8266.	5	4	16
2.	Design a **sensor-based IoT project** using Raspberry Pi. Explain the hardware and software requirements, data collection methods, and possible real-time applications.	5	6	16
3.	Explain the significance of **Clayster libraries** in IoT projects. How do these libraries simplify sensor data processing and cloud integration?	5	4	16
4.	Describe how sensor data is internally represented in **Raspberry Pi**. Explain data types, encoding methods, and data processing techniques used in IoT applications.	5	3	16

-----END----

24CSPPC203
MACHINE LEARNING

UNIT I

INTRODUCTION AND MATHEMATICAL FOUNDATIONS

What is Machine Learning? Need –History – Definitions – Applications - Advantages, Disadvantages & Challenges -Types of Machine Learning Problems – Mathematical Foundations - Linear Algebra & Analytical Geometry -Probability and Statistics- Bayesian Conditional Probability -Vector Calculus & Optimization - Decision Theory - Information theory

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Why is machine learning needed in modern applications?	1	1	2
2.	Explain how machine learning improves decision-making in industries	1	2	2
3.	How did the development of neural networks impact machine learning?	1	2	2
4.	Differentiate between artificial intelligence and machine learning	1	2	2
5.	What are the three main types of machine learning?	1	1	2
6.	What is the significance of eigenvalues in machine learning?	1	1	2
7.	State Bayes' theorem	1	1	2
8.	Define decision theory in the context of machine learning.	1	1	2
	PART B			
1.	Explain the historical evolution of machine learning, highlighting major milestones and breakthroughs.	1	3	16
2.	Evaluate the role of machine learning in different domains such as healthcare, finance, and robotics. Discuss its significance in improving decision-making	1	5	16
3.	Evaluate the importance of Bayesian probability in machine learning. Discuss its application in real-world problems.	1	5	16
4.	Explain the concept of decision theory in machine learning. How does it help in making optimal decisions under uncertainty?	1	3	16

UNIT II

SUPERVISED LEARNING

Introduction-Discriminative and Generative Models -Linear Regression - Least Squares - Under-fitting / Overfitting -Cross-Validation – Lasso Regression- Classification - Logistic Regression- Gradient Linear Models -Support Vector Machines –Kernel Methods -Instance based Methods - K-Nearest Neighbors - Tree based Methods –Decision Trees –ID3 – CART - Ensemble Methods –Random Forest - Evaluation of Classification Algorithms

Q.No	Question	CO	BTL	Marks
	PART A			
1.	How does machine learning differ from traditional programming?	2	2	2
2.	Define discriminative and generative models.	2	1	2
3.	What is the equation of a simple linear regression model?	2	1	2
4.	Why is the least squares method used in regression models?	2	2	2
5.	How does regularization help in reducing overfitting?	2	1	2
6.	What is cross-validation in machine learning?	2	1	2
7.	Why is k-fold cross-validation preferred over simple train-test splitting?	2	2	2
8.	How does Lasso regression perform feature selection?	2	2	2
	PART B			
1.	Explain the fundamental concepts of machine learning. How does it differ from traditional programming, and what are its major components?	2	5	16
2.	Derive the equation of linear regression and explain how it can be used for predictive modeling. Provide an example with calculations.	2	5	16
3.	Explain the least squares method in regression. How does it minimize error, and why is it widely used in machine learning?	2	5	16
4.	Explain the concept of kernel trick in machine learning. How do kernel methods enhance the performance of SVM?	2	5	16

UNIT III

UNSUPERVISED LEARNING AND REINFORCEMENT LEARNING

Introduction - Clustering Algorithms -K – Means – Hierarchical Clustering - Cluster Validity - Dimensionality Reduction –Principal Component Analysis – Recommendation Systems - EM algorithm. Reinforcement Learning – Elements -Model based Learning – Temporal Difference Learning

Q.No	Question	CO	BTL	Marks
	PART A			
1.	How does machine learning differ from deep learning?	3	2	2
2.	What is clustering in machine learning?	3	1	2
3.	What is the objective of the K-Means clustering algorithm?	3	1	2
4.	What are the two types of hierarchical clustering?	3	1	2
5.	Why is dimensionality reduction important in machine learning?	3	2	2
6.	What is the goal of the Expectation-Maximization(EM) Algorithm	3	1	2
7.	Name the key elements of reinforcement learning.	3	1	2
8.	Define Temporal Difference (TD) learning.	3	1	2
	PART B			
1.	Discuss different clustering techniques used in machine learning.	3	4	16
2.	Explain the working of the K-Means clustering algorithm with a step-by-step example. Discuss its limitations and possible improvements.	3	3	16
3.	Explain the concept of cluster validity and discuss various methods used to evaluate the quality of clustering algorithms	3	4	16
4.	Derive the mathematical formulation of PCA and explain how it reduces dimensionality while retaining important features.	3	5	16

UNIT IV

PROBABILISTIC METHODS FOR LEARNING

Introduction -Naïve Bayes Algorithm -Maximum Likelihood -Maximum Apriori -Bayesian Belief Networks -Probabilistic Modelling of Problems -Inference in Bayesian Belief Networks – Probability Density Estimation - Sequence Models – Markov Models – Hidden Markov Models

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is Bayesian learning in machine learning?	4	1	2
2.	What is the assumption behind the Naïve Bayes classifier?	4	1	2
3.	What is the key difference between MLE and MAP estimation?	4	1	2
4.	What is a Bayesian Belief Network?	4	1	2
5.	How does Kernel Density Estimation (KDE) help in estimating probability distributions?	4	2	2
6.	What is the Markov property in Markov models?	4	1	2
7.	Define a Hidden Markov Model (HMM).	4	1	2
8.	What are sequence models in machine learning?	4	1	2
	PART B			
1.	Derive the mathematical formulation of the Naïve Bayes classifier and explain how it is used in classification problems. Provide an example with calculations.	4	3	16
2.	Explain the concept of Maximum Likelihood Estimation (MLE). Derive the likelihood function and discuss its role in parameter estimation.	4	4	16
3.	Explain Bayesian Belief Networks (BBN) with an example. How do they represent probabilistic dependencies among variables?	4	4	16
4.	Design a probabilistic model for a real-world problem using Bayesian techniques. Explain the modeling process step by step.	4	6	16

UNIT V

NEURAL NETWORKS AND DEEP LEARNING

Neural Networks – Biological Motivation- Perceptron – Multi-layer Perceptron – Feed Forward Network – Back Propagation-Activation and Loss Functions- Limitations of Machine Learning – Deep Learning– Convolution Neural Networks – Recurrent Neural Networks – Use cases

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is the biological inspiration behind artificial neural networks?	5	1	2
2.	Define a perceptron in neural networks.	5	1	2
3.	What are the limitations of a perceptron in solving non-linear problems?	5	2	2
4.	What is a Multi-Layer Perceptron (MLP)?	5	1	2
5.	What is the purpose of backpropagation in neural networks?	5	1	2
6.	What is the role of a loss function in a neural network?	5	2	2
7.	Why do machine learning models require a large amount of data?	5	2	2
8.	Define deep learning.	5	1	2
	PART B			
1.	Explain the biological inspiration behind artificial neural networks. How do artificial neurons model the working of the human brain?	5	2	16
2.	Describe the architecture of a Multi-Layer Perceptron (MLP). Explain how it overcomes the drawbacks of a single-layer perceptron in solving complex problems.	5	4	16
3.	Derive the backpropagation algorithm and explain its role in training neural networks. Discuss how gradient descent is used to optimize the network.	5	5	16
4.	Discuss the major limitations of traditional machine learning models. How does deep learning help in overcoming these limitations?	5	4	16

-----END----

24CSPPE209
HIGH PERFORMANCE COMPUTING FOR BIG DATA

UNIT I

INTRODUCTION

The Emerging IT Trends- IOT/IOE-Apache Hadoop for big data analytics-Big data into big insights and actions – Emergence of BDA discipline – strategic implications of big data – BDA Challenges – HPC paradigms – Cluster computing – Grid Computing – Cloud computing – Heterogeneous computing – Mainframes for HPC - Supercomputing for BDA – Appliances for BDA.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define Big Data.	1	1	2
2.	Define IOE.	1	1	2
3.	Distinguish Cluster and Grid Computing.	1	2	2
4.	Write the applications of BDA.	1	1	2
5.	Define Apache Hadoop and its role in big data analytics.	1	1	2
6.	How does Big Data Analytics (BDA) provide strategic business insights?	1	2	2
7.	How does heterogeneous computing enhance high-performance computing (HPC)?	1	2	2
8.	What is cluster computing?	1	1	2
	PART B			
1.	Explain working of the following phases of Map Reduce with one common example (i) Map Phase, (ii) Shuffle and sort phase, and (iii) Reducer Phase	1	3	16
2.	Illustrate in detail about grid computing and Cluster computing.	1	5	16
3.	Explain in detail about the main frames of HPC with suitable example.	1	5	16
4.	Write in detail about the real time applications of Big data Analytics.	1	3	16

UNIT II

NETWORK & SOFTWARE INFRASTRUCTURE FOR HIGH PERFORMANCE BDA

Design of Network Infrastructure for high performance BDA – Network Virtualization – Software Defined Networking – Network Functions Virtualization – WAN optimization for transfer of big data – started with SANs- storage infrastructure requirements for storing big data – FC SAN – IP SAN – NAS – GFS – Panasas – Luster file system – Introduction to cloud storage.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Write short notes on Network Functions Virtualization	2	2	2
2.	Define SAN. List out some advantages of SAN.	2	1	2
3.	Differentiate FC SAN and IP SAN	2	1	2
4.	What is Luster file System?	2	2	2
5.	What is the role of WAN optimization in big data transfer?	2	1	2
6.	How does NAS differ from SAN in big data storage?	2	1	2
7.	Compare GFS and Panasas in terms of big data storage performance.	2	2	2
8.	How does Luster File System enhance high-performance data storage?	2	2	2
	PART B			
1.	Discuss about the storage infrastructure requirements for storing big data.	2	4	16
2.	Generalize the following in detail. (i) Google Bigtable Datastore (ii) Mobile Me.	2	5	16
3.	Explain about the Network function virtualization for high performance for big data	2	5	16
4.	Find the different file systems used in cloud environment and Explain in detail about the file systems used GFS and Amazon S3	2	5	16

UNIT III

REAL TIME ANALYTICS USING HIGH PERFORMANCE COMPUTING

Technologies that support Real time analytics – MOA: Massive online analysis – GPFS: General parallel file system – Client case studies – Key distinctions – Machine data analytics – operational analytics – HPC Architecture models – In Database analytics – In memory analytics

Q.No	Question	CO	BTL	Marks
	PART A			
1.	State Massive Online Analysis.	3	2	2
2.	Outline the challenges in implementing HPC Architecture	3	2	2
3.	What is real-time analytics?	3	1	2
4.	What is GPFS (General Parallel File System)?	3	1	2
5.	Define In-Database Analytics	3	1	2
6.	Give an example of a real-world application of in-memory analytics.	3	2	2
7.	What are the key distinctions between traditional analytics and real-time analytics?	3	1	2
8.	How does HPC architecture support real-time analytics?	3	2	2
	PART B			
1.	You are required to make a case study on STOCK MARKET PREDICTION with following requirements: (i) Briefly introduce about Stock market and its prediction (ii) The Solution Path of the stock Market Perdition. (iii) Do the Empirical Study of the Stock Market Prediction.	3	4	16
2.	Discuss in detail about (i)Tabulate the short notes on GPFS (ii)Compare and contrast- In Database analytics–In memory analytics.	3	3	16
3.	Describe Massive Online Analysis (MOA) and its role in real-time big data processing. How does it compare with traditional analytics models?	3	4	16
4.	Explain High-Performance Computing (HPC) architecture models and their role in real-time analytics. Discuss how they help in processing big data efficiently.	3	5	16

UNIT IV

SECURITY AND TECHNOLOGIES

Security, Privacy and Trust for user – generated content: The challenges and solutions – Role of real time big data processing in the IoT – End to End Security Framework for big sensing data streams – Clustering in big data.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What are the key challenges in ensuring security for user-generated content?	4	1	2
2.	Define real-time big data processing.	4	1	2
3.	What is an end-to-end security framework?	4	1	2
4.	What is clustering in big data	4	1	2
5.	Give an example of a security solution for protecting big data streams.	4	2	2
6.	How is clustering used for analyzing big data in IoT?	4	1	2
7.	Compare different security challenges in user-generated content.	4	2	2
8.	What are the advantages and disadvantages of clustering in big data?	4	1	2
	PART B			
1.	Discuss the security, privacy, and trust issues related to user-generated content. What are the key challenges and solutions in managing secure content?	4	4	16
2.	Provide examples of IoT applications using real-time data processing.	4	3	16
3.	Explain the importance of security in data streams and discuss the techniques used to secure data from collection to storage and analysis	4	5	16
4.	Explain the risks and threats associated with big data analytics. How do organizations address these challenges in real-time big data applications?	4	5	16

UNIT V

EMERGING BIG DATA APPLICATIONS

Deep learning Accelerators – Accelerators for clustering applications in machine learning - Accelerators for classification algorithms in machine learning – Accelerators for Big data Genome Sequencing

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What are deep learning accelerators?	5	1	2
2.	Define clustering in machine learning.	5	1	2
3.	What is a classification algorithm in machine learning?	5	2	2
4.	What is genome sequencing in big data analytics?	5	1	2
5.	Compare CPUs, GPUs, and TPUs in deep learning acceleration.	5	2	2
6.	What are the challenges in accelerating big data genome sequencing?	5	1	2
7.	How can TPUs improve deep learning performance?	5	2	2
8.	How do accelerators enhance clustering applications?	5	1	2
	PART B			
1.	Explain deep learning accelerators and their role in high-performance computing. Compare different accelerators such as GPUs, TPUs, and FPGAs used in deep learning.	5	2	16
2.	Discuss the role of accelerators in clustering applications in machine learning. How do they improve the efficiency of clustering algorithms?	5	4	16
3.	Explain the use of accelerators in classification algorithms. Discuss different accelerators and their impact on the accuracy and speed of classification tasks.	5	5	16
4.	Compare different accelerators used for machine learning applications, including clustering, classification, and genome sequencing. Discuss their advantages and limitations	5	4	16

-----END----

24CSPPE204

WIRELESS COMMUNICATIONS

UNIT I
CELLULAR CONCEPTS

Frequency Reuse – Channel Assignment Strategies – Handoff Strategies – Interference and system capacity- Co-Channel Interference- Adjacent Channel Interference – Trunking and Grade of service – Improving coverage & capacity in cellular systems-Cell Splitting-Sectoring- Repeaters for Range Extension-Microcell Zone Concept.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define frequency reuse in cellular systems.	1	1	2
2.	What is co-channel interference?	1	1	2
3.	Differentiate between co-channel and adjacent channel interference.	1	2	2
4.	Explain the concept of handoff in cellular communication.	1	2	2
5.	What is trunking in cellular networks?	1	1	2
6.	Define cell splitting and its significance.	1	1	2
7.	Describe the purpose of sectoring in cellular systems.	1	2	2
8.	How do repeaters help in range extension?	1	2	2
	PART B			
1.	Explain frequency reuse and channel assignment strategies in detail. Discuss the factors affecting frequency reuse patterns.	1	4	16
2.	Describe various handoff strategies used in cellular networks. Compare different handoff techniques and explain their significance.	1	4	16
3.	Analyze the impact of interference on system capacity. Explain co-channel and adjacent channel interference with solutions to minimize them.	1	5	16
4.	Suggest different techniques to improve coverage and capacity in cellular systems. Discuss cell splitting, sectoring, and the microcell zone concept.	1	5	16

UNIT II

THE WIRELESS CHANNEL

Overview of wireless systems – Physical modeling for wireless channels – Time and Frequency coherence – Statistical channel models – Capacity of wireless Channel- Capacity of Flat Fading Channel – Channel Side Information at Receiver – Channel Side Information at Transmitter and Receiver –Capacity comparisons – Capacity of Frequency Selective Fading channels.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What are the key characteristics of wireless systems?	2	1	2
2.	Define time coherence and frequency coherence in wireless channels.	2	1	2
3.	What is a statistical channel model?	2	1	2
4.	Differentiate between flat fading and frequency selective fading.	2	2	2
5.	Explain the concept of channel capacity in wireless communication.	2	2	2
6.	What is channel side information at the receiver?	2	1	2
7.	Compare the capacity of flat fading and frequency selective fading channels.	2	2	2
8.	Why is channel side information at the transmitter important?	2	2	2
	PART B			
1.	Explain physical modeling for wireless channels. Discuss how wireless channels are affected by time and frequency coherence.	2	4	16
2.	Describe statistical channel models. Compare different types of statistical models used for wireless communication.	2	4	16
3.	Analyze the capacity of a flat fading channel. Explain how channel side information at the transmitter and receiver affects channel capacity.	2	6	16
4.	Compare the capacity of flat fading and frequency selective fading channels. Suggest methods to improve the performance of frequency-selective fading channels.	2	6	16

UNIT III

PERFORMANCE OF DIGITAL MODULATION OVER WIRELES CHANNELS

Performance of flat fading and frequency selective fading – Impact on digital modulation techniques –- Outage Probability– Average Probability of Error — Combined Outage and Average Error Probability – Doppler Spread – Inter symbol Interference.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define flat fading and frequency selective fading.	3	1	2
2.	What is the impact of fading on digital modulation techniques?	3	2	2
3.	Define outage probability in a wireless channel.	3	1	2
4.	What is the average probability of error in digital communication?	3	1	2
5.	Explain the concept of combined outage and average error probability.	3	2	2
6.	What is Doppler spread, and how does it affect wireless communication?	3	2	2
7.	Define inter-symbol interference (ISI) and its causes.	3	1	2
8.	How does Doppler spread affect the performance of digital modulation?	3	2	2
	PART B			
1.	Explain the performance of digital modulation techniques over flat fading and frequency selective fading channels.	3	4	16
2.	Derive and analyze the outage probability and average probability of error in wireless communication systems.	3	6	16
3.	Discuss the impact of Doppler spread on digital modulation. How does it influence system design?	3	4	16
4.	Evaluate and compare the effects of inter-symbol interference (ISI) and fading on the performance of wireless digital communication. Suggest techniques to mitigate these effects.	3	6	16

UNIT IV

DIVERSITY TECHNIQUES

Realization of Independent Fading Paths – Receiver Diversity – Selection Combining – Threshold Combing – Maximal-Ratio Combining – Equal - Gain Combining – Capacity with Receiver diversity – Transmitter Diversity – Channel known at Transmitter – Channel unknown at Transmitter – The Alamouti Scheme– Transmit & Receive Diversity-MIMO Systems.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is diversity in wireless communication?	4	1	2
2.	Define receiver diversity and its significance.	4	1	2
3.	Differentiate between selection combining and threshold combining.	4	2	2
4.	What is maximal-ratio combining (MRC)?	4	1	2
5.	Compare equal-gain combining and maximal-ratio combining.	4	2	2
6.	What is transmitter diversity?	4	1	2
7.	Explain the Alamouti scheme and its importance.	4	2	2
8.	How does MIMO improve system performance?	4	2	2
	PART B			
1.	Explain the concept of receiver diversity. Compare selection combining, threshold combining, maximal-ratio combining, and equal-gain combining techniques.	4	4	16
2.	Analyze the capacity of a system with receiver diversity. How does it differ when the channel is known or unknown at the transmitter?	4	5	16
3.	Describe the Alamouti scheme in detail. Explain how it achieves transmit and receive diversity.	4	4	16
4.	Compare different MIMO systems and discuss their advantages. How do transmit and receive diversity techniques improve system performance?	4	5	16

UNIT V

MULTICARRIER MODULATION

Data Transmission using Multiple Carriers – Multicarrier Modulation with Overlapping Sub channels – Mitigation of Subcarrier Fading – Discrete Implementation of Multicarrier Modulation – Peak to average Power Ratio- Frequency and Timing offset.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is multicarrier modulation?	5	1	2
2.	Define subcarrier fading.	5	1	2
3.	What is the purpose of using overlapping subchannels in multicarrier modulation?	5	2	2
4.	How does multicarrier modulation mitigate subcarrier fading?	5	2	2
5.	What is peak-to-average power ratio (PAPR)?	5	1	2
6.	Explain the impact of frequency offset in multicarrier systems.	5	2	2
7.	What is the significance of timing offset in multicarrier modulation?	5	1	2
8.	Differentiate between single-carrier and multicarrier modulation techniques.	5	2	2
	PART B			
1.	Explain the concept of data transmission using multiple carriers. How does it improve wireless communication performance?	5	4	16
2.	Describe multicarrier modulation with overlapping subchannels. Discuss its advantages and challenges.	5	4	16
3.	Analyze the impact of peak-to-average power ratio (PAPR) in multicarrier systems. Suggest techniques to mitigate PAPR.	5	6	16
4.	Compare frequency offset and timing offset in multicarrier modulation. Propose methods to minimize their effects.	5	6	16

-----END----