

Unit 1: Embedded Systems

Low Level of Difficulty: 20%

1. What are the advantages of using Raspberry Pi in IoT applications?
2. Compare Arduino and Raspberry Pi in terms of power consumption and processing capabilities.
3. What are the key steps involved in setting up an IoT board?
4. Define the role of sensors and actuators in IoT.
5. Explain the working of an ultrasonic sensor.
6. What are the limitations of using Bluetooth over Wi-Fi in IoT applications?
7. Explain the difference between Bluetooth and Wi-Fi.
8. Describe how a relay module is used in IoT projects.

Moderate Level of Difficulty : 60%

1. Explain the process of connecting a temperature sensor to NodeMCU/Raspberry Pi and reading data.
2. Describe the key components required for designing a smart home application using NodeMCU/Raspberry Pi and sensors.
3. Summarize the working of a motion detection system using a PIR sensor and Raspberry Pi.
4. Explain the concept behind a water level monitoring system using an IoT board.
5. Describe how an LDR and actuators can be used to implement a smart lighting system.
6. Explain the steps involved in setting up a Bluetooth-based home automation system using Arduino Uno/NodeMCU.
7. Discuss the role of cloud computing in IoT-based applications.
8. Explain the working of a voice-operated home automation system using NodeMCU/Raspberry Pi.
9. Describe how an ultrasonic sensor and a microcontroller (NodeMCU/Raspberry Pi) can be used to measure distance and trigger an alert when an object crosses a predefined threshold.
10. Compare the features of Raspberry Pi and Arduino.
11. Describe the role of GPIO pins in an IoT board.
12. Describe the process of uploading a program to an Arduino board.
13. How does a PIR motion sensor detect movement?
14. How does an ultrasonic sensor measure distance in an IoT project?
15. What is the purpose of using a relay module with an IoT board?
16. Why is Wi-Fi preferred over Bluetooth for IoT communication?
17. Compare the power consumption of Bluetooth and Wi-Fi in IoT applications.
18. What are the advantages of using cloud-based communication in IoT systems?

Higher Order Thinking Skills (HOTS): 20%

1. Design an IoT communication framework for disaster management.
2. Evaluate the suitability of different IoT boards for a smart healthcare monitoring system. What parameters would you consider while selecting the board?
3. Propose an IoT deployment strategy for a smart agriculture system that optimizes power consumption, data storage, and sensor integration.
4. Develop an advanced IoT-based home automation system that integrates multiple sensors and actuators for energy-efficient smart home control.
5. How can real-time data analytics improve the performance of an IoT-based air quality monitoring system?

Unit 2: Wireless Sensor Networks

Low Level of Difficulty

1. Explain the difference between wired and wireless communication with examples.
2. Describe the main components of a Wireless Sensor Network (WSN) node and their functions.
3. Compare and contrast Zigbee and Bluetooth Low Energy (BLE) in terms of power consumption, range, and applications.
4. What are the different types of WSNs? Describe any two with suitable applications.
5. Explain the importance of IEEE 802.15.4 in wireless sensor networks.
6. Draw and explain the architecture of a Wireless Sensor Network (WSN).
7. How does LoRa enable long-range communication in IoT applications? Explain with an example.
8. Describe the major components of a WSN node and their functions.
9. What are the key challenges in designing a Wireless Sensor Network?

Moderate Level of Difficulty

1. Compare fiber optic communication with twisted pair communication in terms of speed, reliability, and use cases.
2. Explain the role of frequency bands in wireless communication and how they affect transmission performance.
3. Define Wireless Sensor Network (WSN) and explain its significance in modern communication systems.
4. Differentiate between static and mobile WSN nodes with examples.
5. Explain the role of energy efficiency in WSNs and methods to optimize power consumption.
6. Explain the role of a microcontroller in a WSN node and its interaction with other components.
7. How does a transceiver work in a sensor node? Discuss its importance in wireless communication.
8. What is the function of the sensing unit in a WSN node? Give an example of a sensor used in environmental monitoring.
9. Draw and explain the general architecture of a Wireless Sensor Network.
10. Describe the different layers of a WSN architecture and their respective functions.
11. How does data aggregation improve the efficiency of WSNs? Provide an example.
12. Explain the significance of self-organizing capabilities in WSNs.
13. Differentiate between terrestrial WSN and underground WSN with suitable applications.
14. What are the key challenges in implementing underwater WSNs?
15. How does a multimedia WSN differ from a traditional WSN? Discuss its applications.
16. Compare mobile WSNs and static WSNs in terms of deployment and data transmission.
17. Explain the role of IEEE 802.15.4 in WSNs and its significance in low-power applications.
18. Compare Zigbee and Bluetooth Low Energy (BLE) in terms of communication range, power consumption, and data rate.
19. How does LoRa enable long-range communication with low power consumption? Explain its working principle.

20. What is the significance of the Low-Rate Wireless Personal Area Network (LR-WPAN) in IoT and WSN applications?

Higher-Order Thinking Questions

1. Analyze the impact of interference on wireless communication systems and suggest techniques to mitigate it.
2. How does energy harvesting improve the sustainability of WSN nodes? Evaluate its feasibility for real-world applications.
3. Evaluate the trade-offs between range, data rate, and power consumption in Zigbee, BLE, and LoRa protocols.
4. What are the major security threats in WSNs? Critically assess existing countermeasures and suggest improvements.
5. Evaluate the performance of LoRa in smart agriculture applications and discuss potential challenges in deployment.
6. What are the limitations of IEEE 802.15.4 for high-speed applications? Suggest modifications to improve its efficiency.
7. Discuss the ethical implications of deploying WSNs in urban surveillance. How can privacy concerns be addressed?
8. How does the scalability of a WSN affect its reliability? Analyze different methods for improving large-scale deployment.
9. Assess the role of Artificial Intelligence (AI) in improving the efficiency of WSNs. Provide real-world use cases.
10. Analyze the role of WSNs in Industry 4.0 and discuss their impact on automation and smart manufacturing.
11. Critically examine the differences between WSNs and traditional ad-hoc networks. Under what circumstances is one preferable over the other?
12. Design a smart city WSN infrastructure for real-time air quality monitoring. Include communication protocols, topology, and power management strategies.
13. Design an intelligent WSN-based healthcare monitoring system for remote patient monitoring. Specify hardware and communication protocols.
14. Develop an IoT-based WSN framework for waste management in a smart city and analyze its feasibility.
15. Design a self-healing WSN architecture for military surveillance applications. Include redundancy techniques for reliability.

Unit 3: Cloud Computing

Low Level of Difficulty: 20%

1. What is cloud computing, and how does it differ from traditional computing?
2. Explain the basic architecture of cloud computing with a diagram.
3. Define Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) with examples.
4. What is virtualization in cloud computing, and why is it important?
5. How does distributed computing differ from cloud computing?
6. What are the main characteristics of cloud computing?

Moderate Level of Difficulty : 60%

1. Differentiate between public, private, and hybrid cloud models with examples.
2. Compare scalability and elasticity in cloud computing.
3. What are the key characteristics of cloud computing? Describe each briefly.
4. How does cloud computing provide cost efficiency to businesses?
5. What are the key challenges in implementing cloud computing?
6. How does cloud computing ensure data security and privacy?
7. Explain the difference between IaaS, PaaS, and SaaS with suitable examples.
8. Why is Platform as a Service (PaaS) preferred for software developers?
9. Describe the major advantages of Infrastructure as a Service (IaaS).
10. Identify real-world applications that use SaaS and explain their benefits.
11. How do organizations decide between private cloud and public cloud for their needs?
12. What are the main limitations of IaaS and how can they be overcome?
13. What are the main services provided by Amazon Web Services (AWS)?
14. Describe the security measures provided by Google Cloud Platform (GCP).
15. Explain the need for distributed computing in modern applications.
16. Compare distributed computing with cloud computing based on scalability.
17. Explain the concept of edge computing and how it relates to distributed computing.
18. How does a distributed database system differ from a centralized database system?

Higher Order Thinking Skills (HOTS): 20%

1. How can businesses implement cloud computing to enhance scalability and resource management? Provide a practical example.
2. What are the common security challenges in cloud computing, and how can businesses apply security best practices to mitigate them?
3. Analyze the key challenges and strategies involved in migrating an organization's on-premises IT infrastructure to a cloud environment.
4. Compare and evaluate the role of edge computing vs. cloud computing in real-time applications. How can they be integrated for optimal performance?
5. Analyze the impact of elasticity vs. scalability on cloud performance. How should organizations decide between the two based on their business needs?

Unit 4 Big Data Analytics

Low Level of Difficulty

1. Define Big Data and explain its importance in modern technology.
2. List and describe the five characteristics (5Vs) of Big Data with examples.
3. Differentiate between structured, unstructured, and semi-structured data with suitable examples.
4. Explain the basic flow of data from acquisition to storage in a Big Data system.
5. What is Hadoop? Briefly describe its components and their roles in handling Big Data.
6. Compare local analytics and cloud analytics. In what scenarios would each be preferable?
7. Explain the role of Data Analytics in business decision-making. Provide a real-world example.
8. How does Hadoop Distributed File System (HDFS) help in storing large datasets efficiently?
9. Discuss the applications of Big Data analytics in healthcare and finance industries.
10. Consider an online retail company. Which type of data analytics (descriptive, diagnostic, predictive, or prescriptive) would be most useful for improving sales? Justify your answer.

Moderate Level of Difficulty

1. Explain the role of Big Data in modern industries. How does it differ from traditional data processing?
2. What are the key challenges in handling Big Data? Discuss how they can be addressed.
3. What is a Data Lake? How is it different from a traditional Data Warehouse?
4. Explain the role of Hadoop in Big Data analytics. Why is it widely used?
5. Describe the architecture of Hadoop and explain the functions of HDFS, MapReduce, and YARN.
6. Discuss the importance of distributed computing in handling Big Data. Provide an example.
7. Explain the step-by-step flow of data in a Big Data pipeline, from acquisition to storage and analysis.
8. What is data preprocessing? Why is it important before performing analytics on Big Data?
9. What is Data Analytics? How does it help organizations make informed decisions?
10. Compare descriptive, diagnostic, predictive, and prescriptive analytics with real-life examples.
11. Explain the concept of Local Analytics. What are its advantages and limitations?
12. Discuss the benefits and challenges of using Cloud Analytics for Big Data applications.
13. How does machine learning enhance Big Data Analytics? Provide an example.
14. Compare the use of SQL-based tools (MySQL, PostgreSQL) and NoSQL tools (MongoDB, Cassandra) in Big Data management.
15. Discuss the importance of Apache Spark in Big Data analytics. How does it improve performance compared to Hadoop MapReduce?
16. What are the key differences between on-premise and cloud-based Big Data solutions?
17. Explain how data visualization tools like Tableau and Power BI help in understanding Big Data.
18. Describe the role of AI and automation in Big Data processing.

Higher-Order Thinking Questions

1. Analyze the impact of data velocity on real-time analytics. How can organizations balance speed and accuracy in decision-making?
2. Assess the role of cloud computing in Big Data storage. How does cloud security impact data privacy and compliance?
3. How can Big Data-driven solution be applied for optimizing traffic management in smart cities. Include data sources, processing methods, and expected outcomes.
4. Create a strategy for implementing data governance and security in a multinational corporation handling massive amounts of customer data.
5. Imagine you are an AI engineer in a hospital. Design a Big Data-based patient monitoring system that predicts health risks and suggests preventive measures.
6. How is Big Data used in healthcare for disease prediction and patient management? Provide examples.
7. Discuss how financial institutions use Big Data for fraud detection and risk assessment.
8. Explain how retailers use customer behavior analysis to improve sales using Big Data Analytics.
9. How is Big Data applied in smart cities for traffic management and energy optimization?
10. Describe a real-world case study where Big Data and analytics helped solve a major industry problem.