Question Banks

Two Mark Questions

1. Identify the primary enabling factors that contribute to the success of the Internet of Things (IoT).
2. Compare and contrast the Internet of Things (IoT) with the Industrial Internet of Things (I-IoT).
3. Explain how the integration of Cyber-Physical Systems (CPS) within the Industrial Internet of Things (IIoT) corresponds to the various layers of the Automation Pyramid.
4. Outline the key steps involved in both the physical and logical design phases of an Industrial Internet of Things (I-IoT) system.
5. Discuss the significance of the MQTT protocol in facilitating communication within I-IoT systems.
6. Differentiate between Fieldbus and Modbus as industrial automation protocols, highlighting their key characteristics and use cases.
7. Explain the role of data virtualization within Industrial IoT (I-IoT) platforms and its importance for data management.
8. Differentiate between Edge Data Analytics and Cloud Data Analytics in the context of industrial applications, focusing on their benefits and limitations.
9. Summarize the advantages of 5G technologies in enhancing IoT applications within industrial automation.
10. Describe a real-world case study that showcases the application of autonomous robots in the field of industrial automation, including the technologies used and the outcomes achieved.
11. Identify and diagram the key components of an automated industrial system, highlighting their functions and interactions.
12. Enumerate the software tools used for automating and managing various processes within a production support system, detailing their specific purposes.
13. What is operational technology (OT), and in what ways does it enhance the efficiency of processes within the Computer-Integrated Manufacturing (CIM) framework
14. Discuss the role of IoT protocols in shaping the physical architecture of IoT systems.
15. Describe the process steps involved in designing an IoT system
16. Why is PROFINET a preferred choice in industrial automation applications?
17. What capabilities does data virtualization offer in an industrial context?
18. Explain what edge computing entails regarding data processing and computational resources.
19. Mention two critical requirements for mobile network technologies to effectively support IoT devices in industrial automation settings.
20. Provide examples of cross-platform operating systems that are available in the current market.
21. Explain the significance of IoT protocols in the context of physical system design.
22. Outline the methodological steps involved in designing an IoT system.
23. What are the reasons for the widespread use of PROFINET in industrial automation systems?
24. Discuss the primary advantages provided by data virtualization in industrial applications.

25. Clarify what edge computing encompasses in terms of data management and computational capabilities.
26. List two essential criteria that mobile network technologies must meet to effectively support IoT devices in industrial settings.
27. Identify some of the cross-platform operating systems that are currently offered in the market.
28. How does fog computing enhance data management in IoT applications compared to traditional cloud computing?
29. In what way does edge computing contribute to real-time decision-making in industrial IoT systems?
30. How does 5G enhance the performance of IoT devices in industrial applications, specifically regarding connectivity and data transmission?

Essay Questions:

1. Discuss the levels and structure of the Computer-Integrated Manufacturing (CIM) pyramid. Examine how integrating the CIM pyramid with automation systems helps optimize production scheduling and supports real-time adjustments in a smart factory setup. Also, Compare the traditional use of the CIM pyramid with its modern application in Industrial IoT (I-IoT) environments.

2. Identify and provide examples of continuous processes used in industrial operations. Explain one specific continuous process in detail, including its significance, the characteristics of its input and output, and the technologies employed for monitoring and controlling the process.

3. Outline and explain the key IoT layers involved in developing a smart agriculture system, particularly for soil moisture sensing and crop health monitoring. Demonstrate how each layer is applied to improve the effectiveness and productivity of agricultural systems.

4. Analyze the different levels of IoT deployment within an IoT architecture. Discuss the importance of each level in smart manufacturing, identifying and explaining the IoT levels involved in building a smart factory, including applications such as equipment monitoring and predictive maintenance.

5. Evaluate the design methodology of Industrial IoT (I-IoT) systems and explain the communication models and APIs used in industrial scenarios. Discuss the importance of industrial communication protocols and automation networks in enhancing the effectiveness of I-IoT frameworks.

6. Discuss the importance of each level in smart manufacturing, identifying and explaining the IoT levels involved in building a smart factory, including applications such as equipment monitoring and predictive maintenance.

7. Explain the flexible message format and the three Quality of Service (QoS) levels offered by the MQTT protocol that enable reliable communication. Discuss how the adoption of industrial Ethernet has transformed industrial automation, especially by replacing traditional fieldbus and serial-based communication protocols.

8. Describe the different types of IoT platforms, including those focused on applications, data analytics, and virtualization. Analyze the development of Edge and Fog computing and how these architectures complement Cloud-based systems in industrial automation.
9. Explain the concept of predictive maintenance in industrial automation. Discuss how Machine-to-Machine (M2M) communication enhances the effectiveness of predictive maintenance systems.
10. Examine the use of Software-Defined Networking (SDN) in IoT environments. Analyze how SDN improves the management and orchestration of IoT devices in industrial automation settings.
11. Explain the role of Machine-to-Machine (M2M) communication in I-IoT and assess the support provided by 5G technology in the context of industrial automation. Evaluate how Software-Defined Networking (SDN) and Network Function Virtualization (NFV) contribute to improving the flexibility and scalability of industrial networks.
12. Explore a case study on the use of autonomous robots in industrial automation. Analyze how technologies such as 5G, M2M communication, and Edge computing are integrated, and evaluate both the advantages and challenges these technologies bring to industrial automation.
13. Evaluate how industrial Ethernet is transforming industrial automation by replacing legacy communication protocols such as fieldbus and serial communication.
14. Select one continuous process and explain its importance, input/output characteristics, and the technologies used for real-time monitoring and control.

PART C

1. As part of XYZ consultancy, you are tasked with developing an IoT-based solution for a smart energy management system aimed at optimizing power usage and resource efficiency in a large commercial building through real-time energy monitoring, predictive analytics, and automated control of energy-consuming devices. The system should incorporate multiple IoT layers and technologies to improve energy efficiency and reduce operational costs.

   (a) Design an IoT architecture for the smart energy management system, explaining how various IoT layers work together to enable real-time monitoring of energy consumption and predictive decision-making for optimizing power usage.

   (b) Outline the prototyping process for the smart energy management system and identify the communication protocols used for transmitting energy consumption data from IoT devices to the cloud.

   (c) Evaluate how emerging technologies such as 5G, edge computing, and Cyber-Physical Systems (CPS) can be integrated into the system to enhance energy efficiency, sustainability, and real-time control.

2. You are tasked with designing an IoT-based solution for a smart building management system aimed at enhancing occupant comfort, energy efficiency, and safety through real-time monitoring, automated control, and predictive maintenance. The system should integrate various IoT layers and technologies to optimize building operations and improve user experience.

   (a) Design a comprehensive IoT architecture for the smart building management system, explaining how different deployment levels (sensors, gateways, cloud, and edge computing) collaborate to support real-time monitoring, automation, and control of building systems such as lighting, HVAC, and security.

   (b) Outline the prototyping process and discuss the suitable communication protocol employed for transmitting data between IoT devices, sensors, and the cloud.

   (c) Discuss how advanced technologies like 5G, edge computing, and Cyber-Physical Systems can be integrated into the solution to enhance building efficiency, occupant comfort, and operational sustainability.

3. You are tasked with designing an IoT-based solution for an intelligent oil pipeline inspection system aimed at enhancing safety, detecting leaks, and optimizing maintenance through real-time monitoring, data analytics, and automated inspections. The system should integrate various IoT layers and technologies to improve the overall efficiency of pipeline operations.

   (a) Develop a comprehensive IoT architecture for the oil pipeline inspection system, explaining how different deployment levels (sensors, gateways, cloud, and edge computing) work together to facilitate real-time monitoring, leak detection, and predictive maintenance of the pipelines.

   (b) Outline the prototyping process and identify the communication protocols used for transmitting data from IoT devices to the cloud for analysis and decision-making.

   (c) Discuss how technologies such as fog computing, edge computing, and cloud computing can be integrated into the system to enhance data processing, reduce latency in monitoring, and improve the overall reliability and efficiency of pipeline inspections.