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May 2024

B. Tech. (ECE) (Sixth Semester)

Introduction to Wireless Sensor Networks

(ECEL-609)

Time : 3 *Hours*] [*Maximum Marks :* 75

Note : It is compulsory to answer all the questions (1.5 marks each) of Part A in short. Answer any *four* questions from Part B in detail. Different sub-parts of a question are to be attempted adjacent to each other.

Part A

1. (a) What are some unique constraints and challenges associated with Sensor Networks ? **1.5**

(b) What is a key advantage of Sensor Networks ? **1.5**

(c) Name one common issue faced in Wireless Sensor Networks (WSNs). **1.5**

(d) What distinguishes Mobile Ad-hoc Networks (MANETs) from Wireless Sensor Networks (WSNs) ? **1.5**

(e) What are S-MAC and E-MAC ? **1.5**

(f) What is the IEEE 802.15.4 standard used for ? **1.5**

(g) What is ZigBee ? **1.5**

(h) What is a dissemination protocol used for in a large sensor network ? **1.5**

(i) Name one security protocol commonly used in sensor networks. **1.5**

(j) What is the primary function of a gateway in a Wireless Sensor Network (WSN) ? **1.5**

Part B

2. (a) Explain in detail the unique constraints and challenges faced by Sensor Networks in terms of energy efficiency, data accuracy, and scalability and discuss potential strategies to mitigate these challenges. **7.5**

(b) Describe various types of wireless sensor networks, including their architectures, communication protocols, and deployment scenarios, and analyze how each type addresses specific application requirements and environmental conditions. **7.5**

3. (a) Identify and elaborate on the major issues and challenges encountered in Wireless Sensor Networks (WSNs), such as energy efficiency, data accuracy, security, and scalability, and propose potential solutions or mitigation strategies for each challenge. **7.5**

(b) Compare and contrast Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks (WSNs) in terms of their architectures, communication models, and deployment scenarios, highlighting key similarities and differences. **7.5**

4. (a) Explain the classification of MAC protocols used in wireless networks, including contention-based, contention-free, and hybrid approaches and discuss the advantages and disadvantages of each. **7.5**

(b) Describe the S-MAC (Sensor-MAC) protocol, including its key features, operation principles, and how it addresses energy efficiency and latency concerns in Wireless Sensor Networks (WSNs). **7.5**

5. (a) Discuss the E-MAC (Energy-Efficient MAC) protocol, outlining its design objectives, mechanisms for energy conservation and its potential applications in wireless communication systems. **7.5**

(b) Discuss the concept of data dissemination in large sensor networks, including the challenges involved in efficiently distributing data across the network and strategies employed to address these challenges while ensuring data reliability and scalability. **7.5**

6. (a) Explain the role of data gathering and data fusion in sensor networks, detailing the process of collecting data from distributed sensors, aggregating it, and extracting meaningful information to support various applications such as environmental monitoring, surveillance, and infrastructure management. Additionally, discuss the challenges and techniques for enhancing data accuracy and reliability in these processes. **7.5**

(b) Discuss the design principles for Wireless Sensor Networks (WSNs), including considerations such as energy efficienc

scalability, reliability and adaptability to dynamic environmental conditions. Explain how these principles influence the architecture and operation of WSNs. **7.5**

7. (a) Explain the concept of gateways in WSNs, detailing their role in bridging WSNs with external networks such as the internet. Discuss the need for gateways in enabling seamless communication between WSNs and the broader information infrastructure and describe the challenges and solutions associated with gateway implementation in WSNs. **10**

(b) A slotted ALOHA network transmit 200 bits on a shared channel of 200 Kbps. Calculate the throughput if all the systems together produce 1000 frames/sec **5**