(2½ Hours) [Total Marks: 75]

**Instructions:** (1) All questions are compulsory.
(2) Make suitable assumptions wherever necessary and state the assumptions made.
(3) Numbers to the right indicate marks.
(4) Draw neat labelled diagrams wherever necessary.

**1 : Attempt the following questions(Any 4)** **20 Marks**

a. What are the important features and advantages of using TinyOS in embedded systems and wireless sensor networks?
b. Explain the concept of mobile ad-hoc networks (MANETs) and illustrate their structure with a clear diagram?
c. How is the network architecture of Wireless Sensor Networks (WSNs) structured? Explain the different components involved?
d. What are the primary objectives when optimizing a Wireless Sensor Network, and how do they impact performance?
e. Why are gateways considered essential in the functioning of Wireless Sensor Networks? How do they facilitate communication?
f. What are the major issues and challenges encountered when designing and deploying sensor networks, and how do they affect their efficiency?

**2 : Attempt the following questions(Any 4)** **20 Marks**

a. How do routing strategies operate in Wireless Sensor Networks, and what are the different approaches to optimize data transmission?
b. Explain the SPIN (Sensor Protocols for Information via Negotiation) protocol and its role in sensor networks?
c. How does the process of congestion detection and avoidance function in wireless sensor networks to maintain efficient communication?
d. What is the Low Energy Adaptive Clustering Hierarchy (LEACH) protocol, and what are its strengths and weaknesses in WSNs?
e. Describe the transport control protocols specifically designed for Wireless Sensor Networks?
f. How does the Power-efficient gathering in Sensor Information System (PEGASIS) routing protocol work, and what benefits does it provide in sensor networks?

**3 : Attempt the following questions(Any 4)** **20 Marks**

a. What distinguishes GEO, LEO, and MEO satellite orbits, and how do they differ in terms of coverage and functionality?

b. What are the key characteristics and features of the DECT (Digital Enhanced Cordless Telecommunications) system?

c. In what ways is satellite communication used and what are some of its major applications?

d. What benefits do cellular systems offer, particularly in terms of network performance and user experience?

e. How does signal propagation work with different types of antennas, and how do these antenna types affect the transmission of signals?

f. Explain the system architecture of UMTS (Universal Mobile Telecommunications System) with a detailed diagram, highlighting its key components and functions?

**4 : Attempt the following questions(Any 5)** **15 Marks**

a. Provide a brief overview of the security services offered by GSM and their role in ensuring communication privacy and integrity.

b. Explain the terms : a) Spread Spectrum and b) TETRA technologies.

c. What are the main components of the Sensor MAC (Medium Access Control) protocol, and how do they contribute to the efficient operation of wireless sensor networks?

d. What are the differences between single-hop and multi-hop networks, and how do each of these network types impact data transmission and network efficiency?

e. What are important functions of transceivers in wireless communication systems, and how do they contribute to the overall network performance?

f. What defines an ad-hoc network? Describe its characteristics, and discuss the challenges it faces, especially in the context of Wireless Sensor Networks (WSNs)?

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