

NIRMA UNIVERSITY
School of Technology, Institute of Technology
B.Tech. Electronics & Communication Engineering
Semester - VII
Department Elective IV

L	T	P	C
3	-	2	4

Course Code	2ECDE64
Course Title	Wireless Sensor Networks

Course Outcomes (COs):

At the end of the course, the students will be able to

1. comprehend the principles, features, network architecture, and applications of the wireless sensor network.
2. select a suitable type of sensor, hardware platform, communication protocol, energy harvesting technique, and security protocol for a given application.
3. evaluate the performance of Sensor-MAC, Zebra-MAC Medium Access Control protocols for given wireless sensor networks for power consumption, fairness, channel utilization, and control packet overhead.
4. analyse the performance of Congestion Detection and Avoidance, Event-to-Sink Reliable Transport Control and Pump Slowly Fetch quickly protocols for a given wireless sensor network for reliability, congestion control and control packet overhead parameters.

Syllabus

Teaching Hours: 45

UNIT I: Introduction and Overview of Wireless Sensor Networks **03**

Evolution, Challenges in Sensor network design, Applications of Sensor Networks in Science, Engineering and Societal Domain

UNIT II: Single-node Architecture **04**

Type of sensors for various applications, Hardware components, Energy management of sensor nodes, Examples of sensor nodes

UNIT III: Network Architecture **04**

Sensor network scenarios: single-hop and multi-hop, network, multiple sink/sources, optimization goals and figures of merit, Design principles for sensor networks

UNIT IV: Wireless Communication and Network Standards **06**

Wireless channel and communication fundamentals for wireless sensor network, transceiver design considerations, Wireless standards- IEEE 802.11, Zigbee, Bluetooth

UNIT V: Medium Access Control Protocols for Wireless Sensor Networks **06**

Fundamentals of MAC Protocols, Types of MAC protocols - Schedule-Based and Random Access-Based Protocols, Case Study- Sensor-MAC, Zebra-MAC

UNIT VI: Routing Protocols for Wireless Sensor Networks **06**

Routing Challenges and Design Issues, Routing Strategies - Flooding and Its Variants, LEACH, Directed diffusion, Geographical routing, SPIN

UNIT VII: Transport Control Protocols for Wireless Sensor Networks **05**

Feasibility of Using TCP or UDP for WSNs, Examples of Existing Transport Control Protocols- Congestion Detection and Avoidance (CODA), Event-to-Sink Reliable Transport (ESRT), Pump Slowly Fetch quickly (PSFQ)

UNIT VIII: Time Synchronization, Localization, and Positioning **06**

Time synchronization problem, Protocols based on sender/receiver synchronization, Protocols based on receiver/receiver synchronization, Properties of localization and positioning procedures, Singlehop and Multi-hop localization.

UNIT IX: Operating System for Sensor Nodes **05**

Embedded operating systems, programming paradigms, and application programming interfaces,

Structure of operating system, and protocol stack

Laboratory Work:

Laboratory work will be based on the above syllabus with a minimum of 10 experiments to be incorporated.

Self-Study:

The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings:

1. Holger Karl, Andreas Willig, John, Protocols, and Architectures for Wireless Sensor Networks, Wiley Publications.
2. Kazem Sohraby, Daniel Minoli, Taieb Znati, John, Wireless Sensor Networks, Technology, Protocols, and Applications, Wiley Publications.
3. Edgar H. Callaway, Wireless Sensor Networks, Architectures and Protocols, CRC Press.

L = Lecture, T = Tutorial, P = Practical, C = Credit