NIRMA UNIVERSITY
SCHOOL OF TECHNOLOGY, INSTITUTE OF TECHNOLOGY
M. Tech. in Electronics and Communication Engineering (Embedded System)
M.Tech. Semester - II
Department Elective II

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Course Code	6EC267ME22
Course Title	Sensor Networks

Course Learning Outcomes (CLOs):

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

1. Design a wireless sensor network for given sensor data using microcontroller, transceiver and operating system.
2. Evaluate the performance of schedule based and random Medium Access Control protocols for a given wireless sensor networks for power consumption, fairness, channel utilization and control packet overhead.
3. Analyze gossiping and agent-based unicast forwarding, energy-efficient unicast, broadcast/ multicast techniques and Geographic routing protocol for power consumption, scalability and latency parameters.
4. Evaluate the performance of transport control protocols for a given wireless sensor network for congestion detection and avoidance, reliability and control packet overhead parameters.

Syllabus: **Teaching Hours:45**

UNIT I: Introduction **04**

Layered operation, Protocol Suites and Standards, OSI Model and TCP/IP Protocol Suite, Adhoc Networks, Comparison of Adhoc and Sensor Networks, Applications of Sensor Networks Challenges and Hurdles in Sensor network design.

UNIT II: Single-node Architecture **05**

Hardware components, Energy consumption of sensor nodes, Operating systems and execution environments, Physical layer and transceiver design considerations in Wireless Sensor Networks.

UNIT III: Network Architecture **06**

Sensor network scenarios - single hop and multi hop, network, multiple sink/sources, Optimization goals and figures of merit – Quality of Service (QoS), energy efficiency, scalability, robustness, design principles for Wireless Sensor Networks, Service interfaces of Wireless Sensor Networks, Gateway concepts.

UNIT IV: 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, Localization approaches- proximity, trilateration and triangulation, Single-hop and Multi hop localization.

UNIT V: Medium Access Control **06**

Fundamentals of MAC Protocols, types of MAC protocols - Schedule-Based and Random Access- Based Protocols, Sensor-MAC, Zebra-MAC.

UNIT VI: **Routing** **06**

Problems in routing, Gossiping and agent-based unicast forwarding, Energy-efficient unicast, broadcast and multicast techniques, Geographic routing.

UNIT VII: Transport Layer and Quality of Service **06**

Coverage and deployment, Reliable data transport, Single packet delivery, Block delivery, Congestion control and rate control, Congestion Detection and Avoidance protocol, Event-to-Sink Reliable Transport protocol.

UNIT VIII: Operating system for Sensor Nodes

Embedded operating systems, Programming paradigms and application programming interfaces, Structure of operating system and protocol stack, Case Study: TinyOS **06**

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

Suggested Readings:

1. Holger Karl, Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, John Wiley.
2. Kazem Sohraby, Daniel Minoli, Taieb Znati, Wireless Sensor Networks: Technology, Protocols, and Applications, John Wiley.
3. Ananthram Swami, Qing Zhao, Yao-Win Hong, Lang Tong, Wireless Sensor Networks, Signal Processing and Communications Perspectives, John Wiley.
4. C. S. Raghavendra, Krishna M. Sivalingam, Taieb Znati, Wireless Sensor Networks, Kluwer Academic.
5. Bhaskar Krishnamachari, Networking Wireless Sensors, Cambridge University Press.