

NIRMA UNIVERSITY
SCHOOL OF TECHNOLOGY, INSTITUTE OF TECHNOLOGY
B. Tech. Electronics and Communication Engineering

OPEN ELECTIVE

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Course Code	
Course Name	Wireless Sensor Network

Course Learning Outcomes (CLOs):

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

1. Design a wireless sensor network for given sensor data using microcontroller, transceiver, middleware and operating system.
2. Evaluate the performance of schedule based and random Medium Access Control protocols for power consumption, fairness, channel utilization and control packet overhead.
3. Evaluate the performance of Geographic routing protocols for power consumption, scalability and latency parameters.
4. Evaluate the performance of transport control protocols for congestion detection and avoidance, reliability and control packet overhead parameters.

Syllabus:

Teaching Hours: 45

UNIT I : Introduction

05

Wireless Networks, 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 : Wireless Transmission Technology and Systems

06

Bluetooth; IEEE 802.11a/b/g/n series of wireless LANs; ZigBee; Radio-frequency identification (RFID).

UNIT III : Sensor-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 IV : Medium Access Control Protocols for Wireless Sensor Networks

06

Fundamentals of MAC Protocols, Performance Requirements, Types of MAC protocols - Schedule-Based and Random Access-Based Protocols, Sensor-MAC, Zebra-MAC.

UNIT V : Routing Protocols for Wireless Sensor Networks

06

Fundamentals of Routing Protocols, Performance Requirements, Routing Strategies in Wireless Sensor Networks - Flooding and its variants, LEACH, Power-Efficient Gathering in Sensor Information Systems, Directed diffusion, Geographical routing.

UNIT VI : Transport Control Protocols for Wireless Sensor Networks

06

Traditional Transport Control Protocols-TCP, UDP; Feasibility of Using TCP or UDP for WSNs, Transport Protocol Design Issues, Existing Transport Control Protocols- CODA (Congestion Detection and Avoidance), ESRT (Event-to-Sink Reliable Transport) Performance of Transport Control Protocols.

UNIT VII : Middleware for Wireless Sensor Networks

06

WSN Middleware Principles, Middleware Architecture, Existing Middleware-MiLAN (Middleware Linking Applications and Networks), IrisNet (Internet-Scale Resource-Intensive Sensor Networks Services).

UNIT VIII : Time Synchronization and Localization

05

Time synchronization protocols based on sender/receiver synchronization,

Localization approaches- proximity, trilateration and triangulation.

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.

Assignments:

The students will be given 8-10 programming/simulation/projects/assignments based on the above syllabus as mentioned below:

- i. Hardware Design of Sensor Node
- ii. Block-level design of Wireless Sensor Network
- iii. Numerical problems related to Time Synchronization
- iv. Numerical problems related to Localization
- v. Numerical problems related to Medium Access Control Mechanism
- vi. Numerical problems related to Routing Mechanism
- vii. Numerical problems related to Transport layer protocols
- viii. Numerical problems related to Bluetooth Standard
- ix. Numerical problems related to Zigbee Standard

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.

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