NIRMA UNIVERSITY
SCHOOL OF TECHNOLOGY, INSTITUTE OF TECHNOLOGY
Electronics & Communication Engineering

OPEN ELECTIVE

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Course Code	**2ECOE01**
Course Name	**Wireless Sensor Network**

Course Outcomes (COs):

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

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 Synchronisation
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.