

Course Title	Embedded Wireless Sensor Networks	
Course Code	EM203	
Course Credit	Lecture	: 4
	Practical	: 1
	Tutorial	: 0
	Total	: 5
Course Objective		
<p>The objective of the course is to:</p> <ul style="list-style-type: none"> To make the student understand and apply the theory behind wireless sensor networks. To impart students with wireless sensor network fundamentals. 		
Detailed Syllabus		
Sr. No.	Name of chapter & Details	Hours Allotted
SECTION - I		
1	Introduction: Challenges and Hurdles in Sensor network design, Radio-frequency identification (RFID)	4
2	Applications of Sensor Networks :Disaster relief applications, Environment control and biodiversity mapping, Intelligent buildings Facility management, Machine surveillance and preventive maintenance, Precision agriculture Medicine and health care, Telematics, Logistics	4
3	Single-node architecture: Hardware components, Energy consumption of sensor nodes, Operating systems and execution environments, Physical layer and transceiver design considerations in WSNs	4
4	Network architecture: Sensor network scenarios - single hop and multi hop, network, multiple sink/sources, Optimization goals and figures of merit - QoS, energy efficiency, scalability, robustness, Design principles for WSNs, Service interfaces of WSNs, Gateway concepts	6
5	Time synchronization, Localization and positioning: 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	6

SECTION – II		
6	Topology control: Aspects of topology-control algorithms, Controlling topology in flat networks and Hierarchical networks, Hierarchical networks by clustering, Hierarchical topologies and power control	4
7	Link-layer protocols: Error control, Framing, Link management	2
8	Medium Access Control :Fundamentals of MAC Protocols, Types of MAC protocols - Schedule-Based and Random Access- Based Protocols, Case Study- Sensor-MAC	4
9	Routing : Problems in routing, Gossiping and agent-based unicast forwarding, Energy-efficient unicast, broadcast and multicast techniques, Geographic routing, Mobility support	4
10	Transport layer and quality of service: Coverage and deployment, Reliable data transport, Single packet delivery, Block delivery, Congestion control and rate control	5
11	Operating system for Sensor Nodes : Embedded operating systems, Programming paradigms and application programming interfaces, Structure of operating system and protocol stack, Case Study: TinyOS and nesC	5

Instructional Method and Pedagogy:

- Lectures will be conducted with the aid of multi-media projector, black board, Transperencies etc.
- Assignments and Exercise will be given to the students for each unit/topic and will be evaluated at regular interval.
- Surprise tests/Quizzes/Seminar/Tutorials will be conducted.

Students Learning Outcomes:

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

- Learn existing applications of wireless sensor actuator networks
- Learn distributed computing and network protocol design and will learn to apply these principles in the context of wireless sensor networks
- Learn the various hardware, software platforms that exist for sensor networks
- Overview of the various network level protocols for MAC, routing, time synchronization, aggregation, consensus and distributed tracking
- Learn to program sensor network platforms using TinyOS, C and Java and will get an opportunity to have hands on training in developing applications on wireless motes, smart phones and other embedded platforms

Reference Books:

1. Protocols and architectures for wireless sensor networks, Holger Karl, Andreas Willig, John Wiley & Sons
2. Wireless sensor networks, Technology, protocols, and applications by Kazem Sohraby, Daniel Minoli, Taieb Znati, John Wiley Publications
3. Wireless Sensor Networks, Signal Processing and Communications Perspectives by Ananthram Swami, Qing Zhao, Yao-Win Hong, Lang Tong, John Wiley Publications
4. Wireless Sensor Networks By C. S. Raghavendra, Krishna M. Sivalingam, Taieb Znati, Kluwer Academic Publishers
5. Networking Wireless Sensors by Bhaskar Krishnamachari, Cambridge University Press