



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Internet of Things

Subject Code : ME02062021

Subject Name : Wireless Communication & Sensor Networking

w. e. f. Academic Year:	2024-25
Semester:	2
Category of the Course:	PCC

Prerequisite:	Fundamentals of wireless communication and data communication is necessary. Basics of wireless technologies and Evolution of wireless standards are required.
Rationale:	The course offers good perceptives of wireless communication and sensor network technologies and its challenges. The course provides good knowledge of different wireless sensor network protocols and applications. Topics to be addressed include wireless communication and sensor networking for creating interest in doing research in the area of wireless ad-hoc and sensor.

Course Outcome:

After completion of the Course, Students will be able to:

No	Course Outcomes	RBT Level*
01	Understand the design principles and architecture challenges of Wireless Sensor Networks	UN
02	Apply wireless sensor network technologies and design principles of Wireless Sensor Networking.	AP
03	Implement MAC protocols and routing protocols in Wireless Sensor Networks.	AP
04	Analyse various protocols, positioning and localization techniques in wireless sensor networks.	AN
05	Evaluate various techniques and protocols in Wireless Sensor Networks.	EL

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create



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Teaching and Examination Scheme:

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Practical		
				ESE (E)	PA(M)	ESE (V)	PA (I)	
03	00	02	04	70	30	30	20	150

Course Content:

Sr No	Course Content	No of Hours	% of Weightage
1	UNIT-I: Introduction: Fundamentals of sensor network architecture and its applications, sensor network comparison with Ad Hoc Networks, Sensor node architecture with hardware and software details. Challenges for WSNs , Characteristic requirements, Required mechanisms, Enabling technologies for wireless sensor networks	8	20
2	UNIT-II: Network architecture: Sensor network scenarios ,Types of sources and sinks , Single-hop versus multichip networks , Multiple sinks and sources , Three types of mobility , Optimization goals and figures of merit , Quality of service, Energy efficiency, Scalability Design principles for WSNs, Distributed organization , In-network processing , Adaptive fidelity and accuracy , Data centricity , Exploit location information, Exploit activity patterns, Exploit heterogeneity, Component-based protocol stacks and cross-layer ,optimization, Gateway concepts ; The need for gateways ,WSN to Internet communication , Internet to WSN communication .	9	20
3	UNIT-III: Medium Access Control(MAC) Protocols: Fundamentals of wireless MAC protocols, Requirements and design constraints for wireless MAC protocols, Important classes of MAC protocols, MAC protocols for wireless sensor networks ,Low duty cycle protocols and wakeup concepts, Sparse topology and energy management (STEM), S-MAC ,The mediation device protocol , Further reading ,Contention-based protocols ,CSMA protocols ,PAMAS , Schedule-based protocols, LEACH,SMACS ,Traffic-adaptive medium access protocol (TRAMA),The IEEE 802.15.4 MAC protocol Network	10	22



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	Super frame structure , Data transfer procedures , Slotted CSMA-CA protocol		
4	UNIT IV: Localization and positioning: Properties of localization and positioning procedures, Possible approaches ,Proximity ,Trilateration and triangulation ,Scene analysis Mathematical basics for the lateration problem Solution with three anchors and correct distance values, Single-hop localization, Overlapping connectivity, Approximate point in triangle, Using angle of arrival information, Positioning in multichip environments, Connectivity in a multichip network, Multichip range estimation, Iterative and collaborative multilateration.	9	20
5	UNIT V: Routing protocols : Forwarding and routing , Gossiping and agent-based unicast forwarding ,Randomized forwarding ,Random walks ,Further reading, Energy-efficient unicast, Some example unicast protocols ,Multipath unicast routing ,Broadcast and multicast, Source-based tree protocols , Shared, core-based tree protocols ,Mesh-based protocols Geographic routing, Basics of position-based routing, Geocasting, Mobile nodes, Mobile sinks, Mobile data collectors ,Mobile regions	9	18
TOTAL		45	100

Reference Book:

1. Karl and A. Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, India, 2012.
2. F. Zhao and L. Guibas, "Wireless Sensor Networks: An Information Processing Approach", Morgan Kaufmann, 1st Indian reprint, 2013.
3. YingshuLi, MyT. Thai, Weili Wu, "Wireless sensor Network and Applications", Springer series on signals and communication technology, 2008
4. Toh C K "Ad Hoc Mobile Wireless Networks: Protocols And Systems" by printis hall ,2001

Suggested Course Practical List:

- The practical work will be carried out based on the content covered during the academic sessions.



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List of Laboratory/Learning Resources Required:

- List of Hardware: Wireless Sensor Nwtwork Kit
- List of Software/Open Source Tools/Simulator: Ns-2, CISCO packet tracer
- List of Useful websites/MOOCs
 - Course-related online MOOCs on NPTEL/SWAYAM platform
 - Recent publications in reputed journal/conferences
 - <https://nptel.ac.in/courses/117/104/117104118/>
 - <https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-cs09/>
