GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Electronics & Communication (Communication System Engineering)

Course / Subject Code : ME01005011

Course / Subject Name : Wireless Sensor Networks

w. e. f. Academic Year:	2024-25
Semester:	1st Semester
Category of the Course:	PEC

Prerequisite:	Wireless Communications, Sensors and Transducers
Rationale:	Wireless sensor networks are used in many applications like habitat monitoring or in areas where human interventions is hazardous. Wireless sensor network is an emerging area which utilizes network of sensor nodes which are tiny in size and battery operated. They are required to be used very power efficiently so that network lifetime is optimized and provide reliable communication to the base station. By learning this subject, the students will appreciate the recent trends of wireless sensor networks, their design constraints and challenges.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Design wireless sensor network system for different applications under consideration.	C
02	Understand the hardware details of different types of sensors and select right type of sensor for various applications.	U
03	Understand radio standards and communication protocols to be used for wireless sensor network based systems and applications.	U
04	Use operating systems and programming languages for wireless sensor nodes, performance of wireless sensor networks systems and platforms.	A
05	Handle special issues related to sensors like energy conservation and security challenges.	A

**Revised Bloom's Taxonomy (RBT)*

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Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Introduction and overview of sensor network architecture**: WSN and its applications, sensor network comparison with Ad Hoc Networks, Sensor node architecture with hardware and software details.	9	20
2.	**Hardware**: Examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun SPOT, Software (Operating Systems): tinyOS, MANTIS, Contiki, and RetOS.	9	20
3.	**Programming tools**: C, nesC, Performance comparison of wireless sensor networks simulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet)	9	20
4.	**Overview of sensor network protocols:** (details of at least 2 important protocol per layer): Physical, MAC and routing/ Network layer protocols, node discovery protocols, multi-hop and cluster based protocols, Fundamentals of 802.15.4, Bluetooth, BLE (Bluetooth low energy), UWB.	9	20
5.	**Specialized features**: Energy preservation and efficiency; security challenges; fault tolerance, Issues related to Localization, connectivity and topology, Sensor deployment mechanisms; coverage issues; sensor Web; sensor Grid, Open issues for future research, and Enabling technologies in wireless sensor network.	9	20
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
10	20	20	20	20	10

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. H. Karl and A. Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, India, 2012.
2. C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors, "Wireless Sensor Networks", Springer Overflag, 1st Indian reprint, 2010.
3. F. Zhao and L. Guibas, "Wireless Sensor Networks: An Information Processing Approach", Morgan Kaufmann, 1st Indian reprint, 2013.
4. YingshuLi, MyT. Thai, Weili Wu, "Wireless sensor Network and Applications", Springer series on signals and communication technology, 2008.

(b) Open source software and website:

1. SensorSim/SENS/TOSSIM/TOSSF/GloMoSim
2. https://nptel.ac.in

Suggested Course Practical List: (30 Hours)

1. Wireless test bed for lab usage monitoring
2. A wireless sensor network for monitoring class room occupancy
3. Wireless Sensor network for habitat monitoring
4. Protocol Architectures for Cognitive Networks
5. Study of Mica2/MicaZ and associated interface board

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