

GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS & COMMUNICATION (WIRELESS COMMUNICATION SYSTEMS & NETWORKS) (27)

WIRELESS ADHOC AND SENSOR NETWORKS

SUBJECT CODE: 2722711

SEMESTER: II

Type of course: Core III

Prerequisite: Basic knowledge of Data & Advanced Communication Networks, Fundamentals of 'C' programming, IP addressing, Routing protocols, IEEE 802.XX standards

Rationale:

- Ad-Hoc networks fundamentals, implementation challenges, and routing, security and applications
- Sensor networks fundamentals, major areas of thrust, energy efficiency, routing, security and applications

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	ESE (V)		PA (I)			
					ESE	OEP	PA	RP		
4	0	2#	5	70	30	20	10	10	10	150

Content:

Sr. No.	Content	Total Hrs	% weightage
1	Introduction to Ad-Hoc networks, Wireless LANs, Wireless PANs, Wireless Mesh Networks, Topology Control in Wireless Ad Hoc Networks, Broadcasting and Activity Scheduling in Ad Hoc Networks, Location Discovery, Mobile Ad Hoc Networks (MANETs): Routing Technology for Dynamic Wireless Networking, Congestion Control in ad hoc wireless networks	7	15
2	Introduction, Routing in Ad Hoc Networks, Broadcasting, Multicasting and Geocasting, Mobile Ad-Hoc Networking with a View of 4G Wireless: Imperatives and Challenges, Off-the-Shelf Enables of Ad Hoc Networks, IEEE 802.11 in Ad Hoc Networks: Protocols, Performance and Open Issues	8	15
3	Media Access Control (MAC) Protocols: Issues in designing MAC protocols, Classifications of MAC protocols, MAC protocols, Cognitive Radio and Networks, TCP over Ad Hoc Networks, Energy-Efficient Communication in Ad Hoc Wireless Networks, Ad Hoc	8	20

	Networks Security, Self-Organized and Cooperative Ad Hoc Networking, Security in Ad Hoc and Sensor Networks		
4	Introduction to Sensor networks, Introduction and Overview of Wireless Sensor Networks: Applications of Wireless Sensor Networks, Examples of Category 1 WSN Applications, Basic Wireless Sensor Technology: Sensor Node Technology, Sensor Taxonomy, WSN Operating Environment, WSN Trends	9	15
5	Sensor Networks Design Considerations, Sensor Networks in Controlled Environment, Wireless Transmission Technology and Systems: Radio Technology Primer, Available Wireless Technologies. Medium Access Control Protocols for Wireless Sensor Networks: Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC Case Study, IEEE 802.15.4 LR-WPANs Standard Case Study.	8	20
	Integrating MANETs, WLANs and Cellular Networks, Networking Sensors: Unique features, Deployment of ad-hoc/sensor network, Sensor tasking and control, Transport layer and security protocols, Applications of Sensor Networks	8	15

Reference Books:

1. Carlos de Morais Cordeiro and Dharma Prakash Agrawal, "Ad Hoc and Sensor Networks : Theory and Applications", Second Edition, World Scientific Publishers, 2011
2. Prasant Mohapatra and Sriramamurthy, "Ad Hoc Networks: Technologies and Protocols", Springer International Edition, 2009
3. Kazem Sohraby, Daniel Minoli, Taieb Znati, "Wireless Sensor Networks", A John Wiley & Sons Inc. Publication, 2007
4. "Adhoc and Sensor Networks" by Stefano Basagni, Silvia Giordano, Ivan Stojmenovic. IEEE Press, A John Wiley & Sons, Inc., Publication 2004.
5. Protocols and Architectures for Wireless Sensor Networks, Holger Karl, Technical University of Berlin, Andreas Willig, University of Potsdam, Wiley, ISBN: 0-470-09510-5, June 2005
6. Wireless Sensor Networks, Cauligi S. Raghavendra, University of Southern California Krishna Sivalingam, University of Maryland Baltimore County, Taieb M. Znati, University of Pittsburg, Springer, ISBN: 1-4020-7883-8, August 2005
7. C. Siva Ram Murthy & B. S. Manoj, "Ad hoc Wireless, Networks – Architecture and Protocols", Prentice Hall, 2004, ISBN – 013-147-023x
8. C. K. Toh, "Ad hoc Mobile Wireless Network", Prentice, Hall, 2002 (ISBN 0-13-007817-4).
9. Charles E. Perkins, Ed., "Ad Hoc Networking", Addison_Wesley, Dec. 2000
10. ALGORITHMS AND PROTOCOLS FOR WIRELESS AND MOBILE AD HOC NETWORKS Edited by Azzedine Boukerche, PhD University of Ottawa Ottawa, Canada
11. Wireless Sensor Network by KazemSohraby, Daniel Minoli, and TaiebZnati Pub: Wiley.
12. Wireless Sensor Networks Signal Processing and Communications by Ananthram Swami, Qing Zhao, Yao-Win Hong, and Lang Tong Pub: John Wiley & Sons.
13. Wireless sensor networks Edited by C. S. Raghavendra Pub: Springer
14. Fundamentals of Sensor Network Programming: Applications and Technology By Sridhar S. Iyengar, NandanParameshwaran, Vir V. Phoha, N. Balakrishnan, Chuka D. Okoye, Wiley
15. Jagannathan Sarangapani, Wireless Ad hoc and Sensor Networks: Protocols, Performance, and Control, CRC Press, 2007.
16. Protocols & Architectures for Wireless Sensor Networks, Wiley, 2005.

Course Outcome:

After learning the course the students should be able to:

1. Students will be able to describe the unique issues in ad-hoc/sensor networks.
2. Students will be able to describe current technology trends for the implementation and deployment of wireless ad-hoc/sensor networks.
3. Students will be able to discuss the challenges in designing MAC, routing and transport protocols for wireless ad-hoc/sensor networks.
4. Students will be able to build and configure a test bed for a sensor network.
5. Students will be able to describe and implement protocols on a sensor test bed network.
6. Students will be able to explain the principles of mobile ad hoc networks (MANETs)
7. Students will be able to explain the principles and characteristics of wireless sensor networks (WSNs).

List of Experiments:

1. Introduction to network simulators used for wireless Ad-Hoc and Sensor Networks.
2. Introduction to TCL scripting: demonstration of one small network simulation script.
3. To study various trace file formats of network simulators.
4. To implement and compare various MAC layer protocols.
5. To implement and compare AODV and DSR routing algorithms in MANET.
6. To implement DSDV routing algorithms in MANET.
7. To implement signal strength based link management routing protocols.
8. To calculate and compare average throughput for various TCP variants.
9. To implement and compare various routing protocols for wireless sensor networks.
10. To study Ethereal / Wireshark software and analyze dump files.
11. Seminar.
12. Mini project based on simulation.

Open Ended Problems:**Major Equipment's:**

Computers, LAN cables, Wi-Fi cards, Simulator, Linux Operating System

List of Open Source Software/learning website:

Ns-2, SENSE simulator and many more are available according to simulation requirements

http://user.informatik.uni-goettingen.de/~sensorlab/Lab_Content

<http://www.isi.edu/nsnam/ns/>

http://en.wikipedia.org/wiki/Network_simulation

<http://www.ita.cs.rpi.edu/>

<https://www.wireshark.org/>

Paper: An Exploratory Study of Experimental Tools for Wireless Sensor Networks

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website