

GUJARAT TECHNOLOGICAL UNIVERSITY

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

WIRELESS COMMUNICATION NETWORKS

SUBJECT CODE: 2712701

SEMESTER: I

Type of course: Core

Prerequisite: Introduction to Computer Networks, Probability Theory

Rationale: PG Students of Wireless Communication System and Networks needs to possess good understanding of the wireless communication networks. They should understand types of speech coding, channel coding and modulation techniques used for wireless communication. This subject aims to teach wireless personal area network, local area network and wide area network.

Teaching and Examination Scheme:

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

Content:

Sr. No.	Contents	Total Hrs.	% Weightage
1	An Overview of Wireless Systems: Introduction, First- and Second-Generation Cellular Systems, Cellular Communications from 1G to 3G, Road Map for Higher Data Rate Capability in 3G, Wireless 4G Systems, Future Wireless Networks, Standardization Activities for Cellular systems, Concept on Tele traffic Engineering	4	10
2	Architecture of a Wireless Wide-Area Network: Introduction, WWAN Subsystem Entities, Logical Channels, Channel and Frame Structure, Basic Signal Characteristics, Speech Processing, Power Levels in Mobile Station, GSM Public Land Mobile Network Services	5	12
3	Speech Coding, Channel Coding and Modulation Schemes: Introduction, Speech Coding, Speech Codecs in European Systems, CELP Speech Codec, Enhanced Variable Rate Codec, Channel Coding, Introduction to Modulation, Phase Shift Keying, Quadrature Amplitude Modulation, M-ary Frequency Shift Keying, Modulation Selection, Synchronization, Equalization	6	14
4	Mobile Network and Transport Layer Introduction, Concept of the Transmission Control Protocol/ Internet Protocol, Suite in Internet, Network Layer in the Internet,	5	12

	TCP/IP Suite, Transmission Control Protocol, Mobile IP (MIP) and Session Initiation Protocol (SIP), Internet Reference Model		
5	Planning and Design of Wide-Area Wireless Networks Introduction, Planning and Design of a Wireless Network, Radio Design for a Cellular Network, Receiver Sensitivity and Link Budget, cdma2000 1X EV-DO, High-Speed Downlink Packet Access, I_{ub} Interface Dimensioning, Radio Network Controller Dimensioning.	4	14
6	Wireless Application Protocol Introduction, WAP and the World Wide Web (WWW), Introduction to Wireless Application Protocol, The WAP Programming Model, WAP Architecture, Traditional WAP Networking Environment, WAP Advantages and Disadvantages, Applications of WAP, imode, imode versus WAP.	6	13
7	Wireless Personal Area Network: Bluetooth, Low Rate and High Rate Introduction, The Wireless Personal Area Network, Bluetooth (IEEE 802.15.1), Definitions of the Terms Used in Bluetooth, Bluetooth Protocol Stack, Bluetooth Link Types, Bluetooth Security, Network Connection Establishment in Bluetooth, Error Correction in Bluetooth, Network Topology in Bluetooth, Bluetooth Usage Models, Bluetooth Applications, WAP and Bluetooth, ZigBee Technology, IEEE 802.15.4 LR-WPAN Device Architecture, IEEE 802.15.3a — Ultra WideBand, Radio Frequency Identification	5	13
8	Wireless Local Area Networks: Introduction, WLAN Equipment, WLAN Topologies, WLAN Technologies, IEEE 802.11 WLAN, Joining an Existing Basic Service Set, Security of IEEE 802.11 Systems, Power Management, IEEE 802.11b — High Rate DSSS, IEEE 802.11n, Other WLAN Standards, Performance of a Bluetooth Piconet in the Presence of IEEE 802.11 WLANs, Interference between Bluetooth and IEEE 802.11, IEEE 802.16, World Interoperability for MicroAccess, Inc. (WiMAX)	5	13

Reference Books:

1. Wireless Communication and Networking By Vijay Garg. Morgan Kaufman Publication
2. Wireless Communication By Andre Goldsmith. Cambridge university Press

Course Outcome:

After successful completion of the course, students will be able to:

1. Appreciate and use common mobile and personal communications terminology and IEEE standards.
2. Understand fundamental, characteristics, problem, architectures and consequences of all wireless communication system
3. Understand speech coding, channel coding and different modulation techniques used in wireless communication with their significance.
4. Elaborate different types of Personal area Network, Local area Network, and Wide Area Network with all protocols used with them.
5. Plan and design wide area wireless networks
6. Appraise the advantages, disadvantages and behavior of different mobile communications systems and techniques.

7. Assess the behavior of protocols (IEEE standards) and architectures and used in current wireless networks.
8. Conduct experiments using simulation tools to analyze the performance of wireless communication systems and interpret results and formulate conclusions and produce documentation.

List of Experiments:

1. To observe the BER performance of DS-CDMA using mixed codes in multipath channel using RAKE receiver for single user case.
2. Measurement of performance of Analog Modulators (AM, FM, or PM) using Vector Signal Analyzer
3. Measurement of performance of I/Q (digital) Modulators (PSK, FSK, or QAM) using Vector Signal Analyzer.
4. To compare Different modulation techniques used in wireless communication using MATLAB/SCILAB
5. To write wml scripts for sms formation.
6. To write and execute MATLAB/SCILAB code for Speech coding
7. Packet capturing and analysis through Internet packet capturing tool –Ethereal/Wireshark
8. Network Simulator-‘ns-2’: Installation, Scripting & Simulation demonstration
9. Performance based comparison and evaluation of various TCP versions using network simulator
10. Introduction to gns-3 simulator

Open Ended Problems

Major Equipment:

Following equipments are preferred in Wireless Communication Laboratory

- [1] Network Analyzer
- [2] EMC Analyzer
- [3] Noise Figure Analyzer
- [4] RF Logic Analyzer
- [5] Spectrum Analyzer

Software requirement:

Ethereal (Windows) / Wireshark (Linux)

Ns-2 simulator (Windows / Linux)

Gns-3 simulator (Windows / Linux)

List of Open Source Software/learning website:

[1] Learning website: www.nptel.ac.in

[2] Link for e-Book

<http://books.google.co.in/books?id=UE2wEc9NfB8C&printsec=frontcover&dq=recent+book+on+wireless+communication+network&hl=en&sa=X&ei=tvkU4jMDIH08AX8hIHQDQ&ved=0CBwQ6AEwAA#v=onepage&q=recent%20book%20on%20wireless%20communication%20network&f=false>