GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS & COMMUNICATION (WIRELESS COMMUNICATION TECHNOLOGY) (44)
ADVANCE WIRELESS COMMUNICATION
SUBJECT CODE: 2714407
SEMESTER: I

Type of course: Core

Prerequisite: Introduction to Computer Networks, Probability Theory

Rationale: 3G-4G Mobile communication subject deals with the latest technology of collecting and sharing information at the highest speed with full accuracy. The goal of subject is to inspire them for further research for next generation wireless communication technology.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks		Practical Marks				
				ESE (E)	PA (M)	PA (V)		PA (I)		
						ESE	OEP	PA	RP	
4	2#	2	6	70	30	20	10	10	10	150

Content:

Sr. No.	Contents	Total Hrs.	% Weightage
1	Wireless Communications and Diversity 1. Fast Fading Wireless Channel Modeling 2. Rayleigh/Ricean Fading Channels 3. BER Performance in Fading Channels 4. Diversity modeling for Wireless Communications 5. BER Performance Improvement with diversity 6. Types of Diversity – Frequency, Time, Space		
2	Broadband Wireless Channel Modeling 1. WSSUS Channel Modeling, RMS Delay Spread 2. Doppler Fading, Jakes Model, Autocorrelation 3. Jakes Spectrum 4. Impact of Doppler Fading		
3	Cellular Communications 1. Introduction to Cellular Communications 2. Frequency reuse 3. Multiple Access Technologies 4. Cellular Processes - Call Setup, Handover etc. 5. Teletraffic Theory		
4	CDMA 1. Introduction to CDMA 2. Walsh codes, Variable tree OVSF 3. PN Sequences		

	4. Multipath diversity, RAKE Receiver 5. CDMA Receiver Synchronization		
5	OFDM 1. Introduction to OFDM 2. Multicarrier Modulation and Cyclic Prefix 3. Channel model and SNR performance 4. OFDM Issues – PAPR 5. Frequency and Timing Offset Issues		
6	MIMO 1. Introduction to MIMO, MIMO Channel Capacity 2. SVD and Eigenmodes of the MIMO Channel 3. MIMO Spatial Multiplexing – BLAST 4. MIMO Diversity – Alamouti, OSTBC, MRT 5. MIMO - OFDM.		
7	UWB (Ultra wide Band) 1. UWB Definition and Features 2. UWB Wireless Channels 3. UWB Data Modulation 4. Uniform Pulse Train 5. Bit-Error Rate Performance of UWB		
8	3G and 4G Wireless Standards 1. GSM 2. GPRS 3. WCDMA 4. LTE 5. Wi-MAX		

Reference Books:

1. Fundamentals of Wireless Communication By. David Tse and Pramod Viswanath, Cambridge University Press
2. Advanced Wireless Communications-4G By. Savo G Glisic John Wiley & Sons Publication
3. Wireless Communication and Networking By Vijay Garg. Morgan Kaufman Publication
4. Wireless Communication By Andre Goldsmith. Cambridge university Press.

Course Outcome:

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

1. Appreciate improvement of performance due to diversity
2. Understand and simulate wireless channel modeling
3. Describe current and future cellular mobile communication systems (GSM, IS95, WCDMA, etc)
4. Learn 3G and 4G Major Technical Standards
5. Grasp the characteristics of the OFDM
6. Learn CDMA coding techniques
7. Understand multiple-antenna systems such as multiple-input multiple-output (MIMO)
8. Understand Ultra wide band technology
9. Do analysis of 3G and 4G systems using simulations
10. Perform experiments on CDMA Kit

List of Experiments:

01) Wireless channel modeling and diversity using MATLAB

02) Analysis of broadband wireless channel modeling using MATLAB

03) Analysis of Spread Spectrum communication technique using MATLAB

04) Analysis of CDMA using MATLAB

05) GOLD sequence characteristic, Acquisition and tracking of GOLD sequence using CDMA

    trainer kit

06) Perform following experiments using CDMA trainer kit

    a-Spread spectrum and despread spectrum experiment

    b-Carrier extraction experiment

07) Perform following experiments using CDMA trainer kit

    a-PSK modulation and demodulation experiment

    b-Bit synchronization extraction experiment

    c-Frame synchronization extraction experiment

    d-Error correction encoding experiment

08) CDMA mobile communication system using CDMA trainer kit

09) Analysis of 3G network using 3G UMTS Communications Network Lab

10) Analysis of 4G network using 4G LTE Communications Network Lab

11) Analysis of MIMO Diversity using MATLAB

12) Analysis of UWB system using MATLAB

13) To perform an experiment for Voice and data quality testing for 3G

(Minimum TEN experiments depending on availability of Lab facilities)

Open Ended Problems

Major Equipments required in the laboratory:

    [1] CDMA Trainer Kit

    [2] Network Analyzer

    [2] EMC Analyzer

    [3] Noise Figure Analyzer

    [4] RF Logic Analyzer

    [5] Spectrum Analyzer

Software requirement for the laboratory:

- MATLAB or SCILAB
- End-to-End Communications Network Lab (EE-CNL) PC based simulator for simulation of 3G and 4G networks MAPS™.

Learning website: www.nptel.ac.in