

Advanced Wireless and Mobile Communication

(Elective Subject)

Course Code:	10M11EC212	Semester:	2 rd Sem. M. Tech (ECE) 8 th Sem. B. Tech (ECE)
Credits:	3	Contact Hours:	L-3, T-0,P-0

Course Objectives

1. To make students familiar with fundamentals of mobile communication systems.
2. To identify the limitations of 2G and 2.5G wireless mobile communication and the design of 3G and beyond mobile communication systems.
3. To understand the fading and shadowing concept in wireless communication system.
4. To understand the multicarrier and multi-antenna advantages in wireless communication.
5. To become familiar with the diversity and equalization concepts in wireless channel.

Course Outcomes

Upon successful completion of this course the students will have developed following skills/abilities

1. Understanding of various generations of mobile communication technologies.
2. Concept of cellular communication technology.
3. Basics of wireless communication.
4. Knowledge of GSM mobile communication standard, its architecture, logical channels, advantages and limitations.
5. Knowledge of 3G and 4G mobile standards and their architectures.
6. The difference among the different generations of mobile standards.
7. Concept of multicarrier communication systems.
8. Multiple antenna concept in wireless communication to combat fading and to increase the channel capacity.

Course Contents

Unit	Topics	References	Lectures
1.	Introduction to Wireless Communication System: Evolution of Mobile Radio Communications, Cellular Phone Standards: 1G, 2G, 2.5G and 3G, FDD, TDD, FDMA, TDMA, CDMA, Cellular Telephone Systems, How a Cellular Telephone Call is Made.	T S Rappaport	2
2.	The cellular Concept – System Design Fundamentals: Introduction, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Interference and System Capacity: co-channel interference, adjacent channel interference, Trunking and Grade of Services, Improving Coverage & Capacity in Cellular System: cell splitting, sectoring and microcell concept.	T S Rappaport	4
3.	Mobile Radio Propagation-Path Loss & Shadowing: Radio Wave Propagation, Transmit and Receive Signal Models, Free Space Path Loss, Indoor and	T S Rappaport, A. Goldsmith	7

	Outdoor Propagation Models, Combined Path Loss & Shadowing, Outage Probability under Path Loss & Shadowing.		
4.	Mobile Radio Propagation-Small Scale Fading and Multipath: Small Scale Multipath Propagation, Factors affecting Small Scale Fading, Doppler Shift, Impulse Response Model of a Multipath Channel, Parameters of Mobile Multipath Channel, Types of Small Scale Fading: flat fading, frequency selective fading, slow fading and fast fading, Capacity of AWGN, Flat Fading and Frequency Selective Channels.	T S Rappaport, A. Goldsmith	7
5.	Diversity & Equalization: Diversity System Model, Receiver Diversity: selection diversity, feedback diversity, maximal ratio combining, equal gain combining, Equalizers, Types of Equalizers: linear equalizers, non-linear equalizers.	T S Rappaport, A. Goldsmith	7
6.	GSM System Architecture: GSM Channel Types, Traffic Channel, Control Channel, Frame Structure for GSM, Authentication Mechanism in GSM.	T S Rappaport, A. Goldsmith, J. Schiller, J. Tisal	4
7.	Introduction to OFDM and MIMO wireless communication: Introduction to OFDM, OFDM Block Diagram, MIMO Wireless Communication, Benefits of MIMO Technology, MIMO OFDM Building Block, STBC: Alamouti code, Capacity Comparisons of SISO, SIMO, MISO, and MIMO.	D.Tse & P. Viswanath, E. Biglieri	5
8.	3G and 4G Networks Architecture: UMTS Network Architecture, UMTS Radio Interface, UTRAN, Handover, LTE Network Architecture, Air Interface and Radio Network, LTE Advanced, 802.16 WiMAX: Network architecture, Air Interface and Radio Network, Basic procedures.	J. Schiller, M. Sauter, S. G. Glisic	6
Total Number of Lectures			42

Evaluation Scheme

1. Test 1 :15 marks
2. Test 2 : 25 marks
3. Test 3 : 35 marks
4. **Internal Assessment** : 25 marks
 - 10 Marks : Class performance, Tutorials & Assignments
 - 10 Marks : Quizzes
 - 5 marks : Attendance

Reference Books

1. T. S. Rappaport: Wireless Communications, PHI, 2002.
2. Jochen Schiller : Mobile Communication , Pearson.
3. Raymond Steel : GSM, cdma one and cdma 2000, Wiley.
4. Andrea Goldsmith : Wireless Communications , Cambridge University Press.
5. Jochim Tisal : GSM Network: GPRS evolution one step towards UMTS , John Wiley & Sons.
6. David Tse & Pramod Viswanath: Fundamentals of Wireless Communication , Cambridge University Press.
7. Ezio Biglieri : MIMO Wireless Communications, Cambridge University Press.
8. Martin Sauter: Beyond 3G Bringing Networks, Terminals and the Web Together , John Wiley & Sons.
9. Savo G. Glisic: Advanced Wireless Communications, John Wiley & Sons