WIRELESS COMMUNICATION AND NETWORKS

VI Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEC524	ELECTIVE	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: -	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand fundamental treatment of wireless communications and the Cellular Concept-
II. System Design, Fundamental concepts like frequency reuse, Radio Wave Propagation Basic Propagation Mechanisms and Diffraction Models..
III. Understand the concept of frequency reuse and be able to apply it in the design of mobile cellular system
IV. Understand the various modulation schemes and multiple access techniques that are used in wireless communications
V. Remember the analytical perspective on the design and analysis of the traditional and emerging wireless networks and discuss the nature of and solution methods to the fundamental problems in wireless networking

COURSE OUTCOMES:

CO 1: Demonstrate their understanding on functioning of wireless communication system and evolution of different wireless communication systems and standards.
CO2: Compare different technologies used for wireless communication systems operations
CO3: Explain the architecture, functioning, protocols capabilities and application of various wire communication networks I/O device with different modules.
C04: Demonstrate an ability explain multiple access techniques for Wireless Communication
CO5: Demonstrate an ability to evaluate design challenges, constraints and security issues associated with Ad-hoc wireless networks.

COURSE LEARNING OUTCOMES (CLOs):

1. Understand the principles and fundamentals of wireless communications.
2. Demonstrate cellular system design concepts in wireless mobile communication networks.
3. Understand the fundamental Radio Wave Propagation Mechanisms.
4. Analyze perspective on Fundamentals of Equalization and Mobile Radio Propagation Multipath Measurements.
5. Analyze various multiple access schemes and techniques used in wireless communication.
6. Discuss the Parameters of Mobile Multipath Channels and Types of Small-Scale Fading-Fading effects.
7. Examine the perspective on Fundamentals of Equalization, Linear Equalizers, Non-linear Equalization.
8. Study and understand the Diversity Techniques and RAKE Receiver in Radio Propagation.
9. Demonstrate wireless local area networks and their specifications in communication system.
10. Understand the analytical perspective on the design and analysis of the traditional and emerging wireless networks
11. Discuss the nature of and solution methods to the fundamental problems in wireless networking.
12. Understand the architecture of the various wireless wide area networks such as GSM, IS-95, GPRS and SMS.
13. Understand the existing and emerging wireless standards in wireless wide area networks
14. Understand the operation of the various wireless wide area networks such as GSM, IS- 95, GPRS and SMS.
15. Examine the emerging techniques OFDM and its importance in the wireless communications

UNIT-I	THE CELLULAR CONCEPT SYSTEM DESIGN FUNDAMENTALS	Classes: 10

Introduction, frequency reuse, channel assignment strategies, handoff strategies; Prioritizing handoffs, practical handoff considerations, interference and system capacity; Co-channel interference and system capacity, channel planning for wireless systems, adjacent channel interference, power control for reducing interference, trunking and grade of service, improving coverage & capacity in cellular systems; Cell splitting, sectoring.

UNIT -II	MOBILE RADIO PROPAGATION	Classes: 09

Large-Scale Path Loss: Introduction to radio wave propagation, free space propagation model, relating power to electric field, the three basic propagation mechanisms; Reflection: Reflection from dielectrics, Brewster angle, reflection from prefect conductors, ground reflection (Two-Ray) mode; Diffraction Fresnel zone geometry, knife- edge diffraction model, multiple knife-edge diffraction, scattering, outdoor propagation models; Longley-Ryce model, Okumura Model, Hata Model, PCS extension to hata Model, Walfisch and Bertoni model, wideband PCS microcell model, indoor propagation models-partition losses (Same Floor), partition losses between floors, log- distance path loss model, ericsson multiple breakpoint model, attenuation factor model, signal penetration into buildings, ray tracing and site specific modelling

UNIT -III	CELLULAR SYSTEM DESIGN FUNDAMENTALS	Classes: 08

Small-scale fading and multipath: Small scale multipath propagation; Factors influencing small scale fading, Doppler shift, impulse response model of a multipath channel; Relationship between bandwidth and received power, small; Scale multipath measurements; Direct RF pulse system, spread spectrum sliding correlator channel sounding, frequency domain channels sounding, parameters of mobile multipath channels; Time dispersion parameters.

Coherence Bandwidth, Doppler spread and coherence time, types of small - Scale fading; Fading effects due to multipath time delay spread, flat fading, frequency selective fading, fading effects due to Doppler Spread -Fast fading, slow fading, statistical models for multipath fading channels; Clarke,,s model for flat fading, spectral shape due to Doppler spread in Clarke,,s model, simulation of Clarke and Gans Fading model, level crossing and fading statistics, two-ray Rayleigh fading model.

UNIT -IV	EQUALIZATION AND DIVERSITY	Classes: 08

Introduction, fundamentals of equalization, training a generic adaptive equalizer, equalizers in a communication receiver, linear equalizers, non-linear equalization; Decision feedback equalization (DFE), maximum likelihood sequence estimation (MLSE) equalizer, algorithms for adaptive equalization; Zero forcing algorithm, least mean square algorithm, recursive least squares algorithm; Diversity techniques; Derivation of selection diversity improvement, derivation of maximal ratio combining improvement, practical space diversity consideration; Selection diversity, feedback or scanning diversity, maximal ratio combining, equal gain combining, polarization diversity, frequency diversity, time diversity, RAKE receiver.

UNIT -V	WIRELESS NETWORKS	Classes: 10

Introduction to wireless networks, advantages and disadvantages of wireless local area networks, WLAN topologies, WLAN standard IEEE 802.11, IEEE 802.11 medium access control, comparison of IEEE 802.11 a,b,g and n standards, IEEE 802.16 and its enhancements, wireless PANs, Hipper LAN, WLL.

Text Books:

1. Theodore .S. Rapport, ―Wireless Communications‖, Pearson Education, 2 nd Edition, 2010.
2. Upen Dalal, "Wireless communication", oxford University press, 2010.
3. Kaveh Pahlvan, Prashant Krishnamurthy, "Principle of wireless networks", A United Approach‖, Pearson Education, 2004.
4. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005.

Reference Books:

1. P.Nicopolitidis, M.S. Obaidat, G.I.Papadimitria, A.S. Pomportsis,"Wireless Networks" John Wiley & sons, 1st Edition, 2003.
2. Vijay K Garg,"Wireless Communications and Networks", Morgan Kaufmann Publishers an Imprint of Elsevier, USA 2009 (Indian Reprint).
3. Mark Ciampa Jorge Olenewa, "wireless communication and Networking", IE, 2009.
4. X.Wang, H.V.Poor ,Wireless communication system, Pearson 2nd Education, 2004.

Web References:

1. http://keshi.ubiwna.org/2017IoTCOMM/Wireless_Communications_&_Networking_Stallings_2nd.
2. https://www.google.com/wirelesscommunicationnetwork.
3. https://www3.nd.edu/~mhaenggi/ee598q/books/stallings_jagadish.pdf

E-Text Books:

1.https://www.oreilly.com/library/view/wireless-communications-principles/0130422320/
2. https://groups.google.com/forum/#!topic/kluecm2010-2014/7Q5gRhqh51g.