INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

WIRELESS COMMUNICATIONS AND NETWORKS								
VIII Semester: ECE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
AECD65	**Elective**	3	-	-	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Analog and Digital Communications								

I. COURSE OVERVIEW:

This course is intended to provide an overview of transmitting information from one point to another without using any connection like wires, cables or any physical medium. It covers the fundamentals of cellular communications, radio propagation, equalization, diversity and wireless networks. It focuses on performance analysis and design of a wireless communication system such as mobile telephone, satellite communication, TV and radio transmissions.

II. COURSES OBJECTIVES:

The students will try to learn

I. The concepts of frequency reuse, handoff, multipath channels and multiple access techniques used in wireless communication systems.
II. The process of fading mechanism, types of equalizers and diversity techniques.
III. The wireless network standards together with network protocols.

III. COURSE OUTCOMES:

At the end of the course students should be able to:

CO 1 Demonstrate the functioning of a cellular system for implementing technical challenges.
CO 2 Summarize the propagation mechanisms and radio wave propagation to know the behavior of radio waves.
CO 3 Apply the channel path loss models for the reduction in power density (attenuation) of an electromagnetic wave.
CO 4 Identify the multiple access schemes and techniques for providing multiple users on a single channel.
CO 5 Analyze the process of equalization and diversity schemes carried out in mobile devicesfor reduced distortion of received signals.
CO 6 Classify the types of wireless local area networks and networking standards for implementing the network of computing devices.

IV. COURSE CONTENT:

MODULE-I: THE CELLULAR CONCEPT SYSTEM DESIGN FUNDAMENTALS (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.

MODULE-II: MOBILE RADIO PROPAGATION-LARGE-SCALE PATH LOSS (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 modeling.

MODULE-III: MOBILE RADIO PROPAGATION- SMALL -SCALE PATH LOSS (09)

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 model for flat fading, spectral shape due to Doppler spread in Clarke model, simulation of Clarke and Gans Fading model, level crossing and fading statistics, two-ray Rayleigh fading model.

MODULE-IV: EQUALIZATION AND DIVERSITY (10)

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.

MODULE –V: WIRELESS NETWORKS (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 nstandards, IEEE 802.16 and its enhancements, wireless PANs, Hipper LAN, WLL.

V. TEXT BOOKS:

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

VI. 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.
5. Jochen Schiller, "Mobile Communication", Pearson Education, 2nd Edition, 2003.

VII. ELECTRONICS RESOURCES:

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
4. https://www.oreilly.com/library/view/wireless-communications-principles/0130422320/
5. https://groups.google.com/forum/#!topic/kluecm2010-2014/7Q5gRhqh51g
6. NPTEL :: Fundamentals of Wireless Communication.

VIII. MATERIALS ONLINE

11. Course template
12. Tutorial question bank
13. Definition and terminology
14. Tech-talk topics
15. Assignments
16. Model question paper - I
17. Model question paper - II
18. Lecture notes
19. Early learning readiness videos (ELRV)
20. Power point presentations