

## IV B.Tech II Semester

## 15AEC83 - WIRELESS COMMUNICATIONS

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**Course Objectives:**

1. To understand basics of Wireless Communications and its evolution process.
2. To learn about the mechanism of radio mobile propagation and its effects.
3. To understand various types of diversity and equalization techniques to counter balance the effects of Wireless Channel.
4. To Study about importance of Wireless Networking and multiple access techniques in the present day mobile communications
5. To design and analyze mobile systems using OFDM technology for mitigating the ISI effects at higher data rates.

**UNIT – 1**

Introduction to Wireless Communication Systems & Cellular Concept:

Evolution of Mobile Radio Communication Systems, Examples of Wireless Communication Systems, 1G, 2G, 2.5G, and 3G Wireless Cellular Networks and Standards, Frequency Reuse Concept, Channel Assignment Strategies, Interference and System Capacity, Trunking and Grade of Service, Improving Coverage and Capacity in Cellular Systems, Problem Solving.

**UNIT - 2**

Mobile Radio Propagation:

**Large Scale Path Loss:** Introduction, Free Space Propagation Model, *Propagation Mechanisms* – Reflection, Diffraction, and Scattering, Practical Budget Design using Path Loss Models, Outdoor Propagation Models, Indoor Propagation Models.

**Small Scale Fading and Multipath:** Small Scale Multipath Propagation, Impulse Response Model of a Multipath Channel, Small Scale Multipath Measurements, Parameters of Mobile Channels, Types of Small Scale Fading (all variations), *Statistical Models* – Clarke's Model for Flat Fading, Jake's Model, Level Crossing Rate, Simulation of Clarke's/Jake's Model, Two Ray Rayleigh Fading Model, Problem Solving.

**UNIT -3**

Equalization & Diversity Techniques:

**Equalization:** Survey of Equalization Techniques, Linear and Non-linear Equalizers – Linear Transversal Equalizer, Decision Feedback Equalizer (DFE), Algorithms for Adaptive Equalization – Zero Forcing, LMS, RLS, Fractionally Spaced Equalizers.

**Diversity Techniques:** Realization of Independent Fading Paths, *Receiver Diversity* – System Model, Selection Combining, Threshold Combining, Maximal Ratio Combining, Rake receiver, Equal Gain Combining, *Transmit Diversity*–Channel known at Transmitter, Channel unknown at Transmitter – the Alamouti Scheme, analysis.

**UNIT - 4**

Multiple Access Techniques & Networking:

**Introduction to Multiple Access:** FDMA, TDMA, CDMA, SDMA, Packet Radio, Capacity of Cellular Systems, Problem Solving.

**Introduction to Wireless Networking:** Introduction to Wireless Networks, Differences between Wireless and Fixed Telephone Networks, Development of Wireless Networks, Traffic Routing in Wireless Networks, Wireless Data Services, Common Channel Signaling.

**UNIT - 5**

Multicarrier Modulation:

Data Transmission using Multiple Carriers, Multicarrier Modulation with Overlapping Subchannels, Discrete Implementation of Multicarrier Modulation, The Cyclic Prefix, Orthogonal Frequency Division Multiplexing (OFDM), Matrix Representation of OFDM, Vector Coding, Challenges in Multicarrier Systems, Problem Solving.

**Course Outcomes:** After completion of this course the students will be able to

- a. Understand basics of Wireless Communications and its evolution process.
- b. Know about the mechanism of radio mobile propagation and its effects.
- c. Apply various types of diversity and equalization techniques to counter balance the effects of Wireless Channel.
- d. Recognize the importance of Wireless Networking and multiple access techniques in the present day mobile communications
- e. Analyze and design mobile systems using OFDM technology for mitigating the ISI effects at higher data rates.

**TEXT BOOKS:**

1. Aditya K Jagannatham, "Principles of Modern Wireless Communications Systems," 1<sup>st</sup> Edition, McGraw Hill, 2015.
2. T. S. Rappaport, "Wireless Communications, Principles and Practice," 2<sup>nd</sup> Edition, Prentice Hall, 2002.

**REFERENCES:**

1. Andrea Goldsmith, "Wireless Communications," Cambridge University Press, 2005.
2. David Tse, Pramod Viswanath, "Fundamentals of Wireless Communications," Cambridge University Press, 2006.