## WIRELESS CHANNEL MODELLING

**17ECMC1T5B** **Credits: 4**
**Lecture: 4 periods/week** **Internal assessment: 40 marks**
**Semester end examination: 60 marks**

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**Prerequisites:** Digital and Analog Communications, Electromagnetic Theory, Probability & Random Processes.

**Course Objectives:**

- To understand the fundamentals of free space propagation mechanisms and statistical descriptions
- To study the methods for characterization of wideband wireless channels
- To analyse different models for narrowband and wideband wireless channels
- To learn concepts of channel sounding and antenna aspects in wireless systems

**Course Outcomes:**

After completion of the course, the student will be able to

- describe the wireless propagation mechanisms
- measure the radio channel properties and evaluate propagation conditions for a certain scenario
- develop a model for a specified wireless channel
- apply the concepts of channel sounding and antenna aspects in designing a wireless communication system

**UNIT I**

**Propagation Mechanisms and Statistical Description of Wireless Channels:**Propagation Mechanisms - Free space propagation, reflection and transmission, diffraction, scattering on rough surfaces, wave guiding

Statistical Description of Wireless Channels - The time-invariant two-path model, time-variant two-path model, small-scale fading without line-of-sight, small-scale fading with line-of-sight, Doppler spectra, level crossing rate and random FM, large-scale fading

**UNIT II**

**Wideband Channel Characterizations:** Narrowband vs. wideband systems, system-theoretic description of propagation channels, the WSSUS model, description methods for time dispersion, description methods for angular dispersion

**UNIT III**

**Channel Models**:Narrowband models, wideband models, spatial models, deterministic models, models for ultra wideband channels

**UNIT IV**

**Channel Sounding and Antenna aspects in wireless systems**: Channel Sounding - Time-domain methods, frequency-domain methods, generalizations, spatially resolved methods

Antenna aspects in wireless systems - Requirements for antennas in mobile radio, antennas for mobile stations, antennas for base stations, aspects of multiple antenna systems.

**Textbook**

1. Andreas Molisch, Wireless communications, 2nd Ed, Wiley-IEEE Press, 2009.

**References**

1. T. S. Rappaport , Wireless Communications - Principles and Practice, 2nd Ed. Prentice Hall, 2001.
2. D. Tse and P. Viswanath, Fundamentals of Wireless Communication, Cambridge Univ. Press, 2005.
3. A. Paulraj, R. Nabar, and D. Gore, Introduction to Space-Time Wireless Communications, Cambridge University Press, 2003.
4. J.G. Proakis and Salehi, Digital Communications, 5th Ed., McGraw-Hill, 2008.

**Web Resource**

1. http://www.wiley.com/legacy/wileychi/molisch/secondedition.html