

## **CU5095 SPACE TIME WIRELESS COMMUNICATION**

### DETAILED SYLLABUS

#### **OBJECTIVES**

- To acquire the knowledge on various modulation and coding schemes for space-time Wireless Communications.
- To understand transmission and decoding techniques associated with Wireless Communications.
- To understand multiple-antenna systems such as multiple-input multiple-output (MIMO) and Space-Time Codes.

#### **UNIT I MULTIPLE ANTENNA PROPAGATION AND ST CHANNEL CHARACTERIZATION**

Wireless channel, Scattering model in macrocells, Channel as a ST random field, Scattering functions, Polarization and field diverse channels, Antenna array topology, Degenerate channels, reciprocity and its implications, Channel definitions, Physical scattering model, Extended channel models, Channel measurements, sampled signal model, ST multiuser and ST interference channels, ST channel estimation.

#### **UNIT II CAPACITY OF MULTIPLE ANTENNA CHANNELS**

Capacity of frequency flat deterministic MIMO channel: Channel unknown to the transmitter, Channel known to the transmitter, capacity of random MIMO channels, Influence of rician fading, fading correlation, XPD and degeneracy on MIMO capacity, Capacity of frequency selective MIMO channels.

#### **UNIT III SPATIAL DIVERSITY**

Diversity gain, Receive antenna diversity, Transmit antenna diversity, Diversity order and channel variability, Diversity performance in extended channels, Combined space and path diversity, Indirect transmit diversity, Diversity of a space-time- frequency selective fading channel.

#### **UNIT IV MULTIPLE ANTENNA CODING AND RECEIVERS**

Coding and interleaving architecture, ST coding for frequency flat channels, ST coding for frequency selective channels, Receivers (SISO, SIMO, MIMO), Iterative MIMO receivers, Exploiting channel knowledge at the transmitter: linear pre-filtering, optimal pre-filtering for maximum rate, optimal pre-filtering for error rate minimization, selection at the transmitter, Exploiting imperfect channel knowledge.

## **UNIT V ST OFDM, SPREAD SPECTRUM AND MIMO MULTIUSER DETECTION**

SISO-OFDM modulation, MIMO-OFDM modulation, Signaling and receivers for MIMO OFDM, SISO-SS modulation, MIMO-SS modulation, Signaling and receivers for MIMO- SS. MIMOMAC, MIMO-BC, Outage performance for MIMO-MU, MIMO-MU with OFDM, CDMA and multiple antennas.

### **REFERENCES**

1. Andre Viterbi " Principles of Spread Spectrum Techniques" Addison Wesley 1995
2. Jafarkhani, Hamid. Space-time coding: Theory and Practice. Cambridge University Press, 2005.
3. Paulraj, Rohit Nabar, Dhananjay Gore., "Introduction to Space Time Wireless Communication Systems", Cambridge University Press, 2003
4. Sergio Verdu " Multi User Detection" Cambridge University Press, 1998