

WIRELESS MIMO COMMUNICATIONS

17ECMC2T5A

Credits: 4

Lecture: 4 periods/week

Internal assessment: 40 marks

Semester end examination: 60 marks

---

**Prerequisites:** Signals & Systems, Digital Signal Processing, Digital Communications

**Course Objectives:**

- To understand the basic concept of fading channels, their Probability of Error/Outage Probability and Different Diversity Technique.
- To impart the knowledge about MIMO Channel Modeling, Capacity and Orthogonal Space Time Block Coding.
- To design basic MIMO communication systems, Space-time block codes, Space-time trellis codes, MIMO systems for frequency-selective (FS) fading channels, Turbo codes and iterative decoding for MIMO systems.
- To understand comprehensive coverage of coding techniques for multiple-input, multiple-output (MIMO) communication systems.

**Learning Outcomes:**

Student will be able to

- Understand the fading channels and calculate Error Probability and Outage Probability.
- Model a MIMO Channel and find its capacity.
- Articulate basic equalization schemes commonly used in wireless system.
- Analyze multiple antenna systems and techniques such as space time codes and singular value decomposition

**UNIT I**

**Fading channels and diversity techniques:** Wireless channels – Error/Outage probability over fading channels – Diversity techniques – Channel coding as a means of time diversity – Multiple antennas in wireless communications.

**UNIT II**

**Capacity And Information Rates Of MIMO Channels:** Capacity and Information rates of noisy, AWGN and fading channels – Capacity of MIMO channels  
– Capacity of non-coherent MIMO channels – Constrained signaling for MIMO communications.

**UNIT III**

**Space-Time Block and Trellis Codes:** Transmit diversity with two antennas: The Alamouti scheme – Orthogonal and Quasi-orthogonal space-time block codes – Linear dispersion codes – Generic space-time trellis codes – Basic space-time code design principles – Representation of space-time trellis codes for PSK constellation – Performance analysis for space-time trellis codes – Comparison of space-time block and trellis codes.

**UNIT IV**

**Concatenated Codes, Iterative Decoding:** Development of concatenated codes – Concatenated codes for AWGN and MIMO channels – Turbo coded modulation for MIMO channels – Concatenated space-time block coding.

**Text Books:**

1. Tolga M. Duman and Ali Ghayeb, “Coding for MIMO Communication systems”, John Wiley & Sons, West Sussex, England, 2007.
2. A.B. Gershman and N.D. Sidiropoulos, “Space-time processing for MIMO communications”, Wiley, Hoboken, NJ, USA, 2005.

**References :**

1. E.G. Larsson and P. Stoica, “Space-time block coding for Wireless communications”, Cambridge University Press, 2003.
2. M. Janakiraman, “Space-time codes and MIMO systems”, Artech House, 2004.
3. H. Jafarkhani, “Space-time coding: Theory & Practice”, Cambridge University Press, 2005.