

Course Type	Course Code	Name of the Course	L	T	P	Credits
DE	NECD545	Smart Antennas	3	0	0	3

Course Objective

To enable the students to study the Types of Smart Antenna Systems, what are the benefits of smart antenna technology and gain an understanding and experience with smart antenna environments and implementation.

Learning Outcomes

At the end of this module, students are expected to be able to

- Compare the performances of digital radio receivers and software radios.
- Study the CDMA spatial processors to analyze the multi-cell systems.
- Analyze the channel models for smart antenna systems.
- Evaluate the requirements for the design and implementation of smart antenna systems.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Introduction to Smart Antennas, Need for Smart Antennas, Smart Antenna Configurations, Switched-Beam Antennas, Adaptive Antenna Approach, Space Division Multiple Access (SDMA), Architecture of a Smart Antenna System, Receiver, Transmitter, Benefits and Drawbacks, Mutual Coupling Effects..	10	Students will be able to understand the basics of smart antennas
2	DOA Estimation Fundamentals, Introduction to Array Response Vector, Received Signal Model, The Subspace Based Data Model, Signal Auto-covariance Matrices, Conventional DOA Estimation Methods: Conventional Beam forming Method, Capon's Minimum Variance Method, and Subspace Approach to DOA Estimation, The MUSIC Algorithm, The ESPRIT, Algorithm, and Uniqueness of DOA Estimates.	10	Students will understand the DOA estimation and its algorithms
3	Beam forming Fundamentals, The Classical Beam former-Statistically Optimum Beam forming Weight Vectors, The Maximum SNR Beam former, The Multiple Side lobe Canceller and the Maximum, SINR Beam former-Minimum Mean Square Error (MMSE), Direct Matrix Inversion, (DMI), Linearly Constrained Minimum Variance (LCMV), Adaptive Algorithms for Beam forming.	10	Students will understand the beam forming and its applications
4	Space-Time Processing: Introduction, Discrete Space-Time Channel and Signal Models, Space-Time, Beam forming, Inter symbol and Co-Channel Suppression, ISI Suppression, CCI, Suppression, Data Rates in MIMO Systems, MIMO in Wireless Local Area Networks, Mobile Stations' Smart Antennas, Combining Techniques, RAKE	12	Students will understand the space-time processing and its applications
Total		42	

Text Book:

1. Introduction to Smart Antennas, By C. A. Balanis & P. I. Ioannides, Morgan & Claypool Publication, 2007.

Reference Books:

1. Smart Antennas for Wireless Communications IS-95 and Third Generation CDMA Applications, By J. C. Liberti Jr., T. S Rappaport, PTR – PH publishers, 1999.
2. Smart Antennas, By Lal Chand Godara, CRC Press, 1st edition, 2004.
3. Smart Antennas Adaptive Arrays Algorithms and Wireless Position Location, By T.S. Rappaport, IEEE Press, PTR – PH publishers, 1998.