ADAPTIVE & SMART ANTENNAS

17ECMC1T3 **Credits: 4**

Lecture: 4 periods/week **Internal assessment:40 marks**

Semester end examination: 60 marks

Prerequisites: Antennas & Propagation

Course Objectives:

- To Familiarize with smart and adaptive antennas
- To study about the different adaptive algorithms for the antenna
- To integrate smart antenna technology with overall communication system design.
- To analyze the effect of mutual coupling and to study the space time

Course Outcomes:

The students will be able to

- Understand the concepts of smart antenna and adaptive antennas
- Learn different adaptive algorithms for the smart antennas
- Understand the direction of arrival estimation methods to combat fading in mobile communication.
- Learn the time-space processing of the antennas.

UNIT-I

Smart Antennas: Introduction, Need for Smart Antennas, Overview, Smart Antenna Configurations, Space Division Multiple Access (SDMA), Architecture of a Smart Antenna System,Benefits and Drawbacks, BasicPrinciples, Mutual Coupling Effects

DOA Estimation Fundamentals: Introduction, Array Response Vector, Received Signal Model, Subspace-Based Data Model, Signal Autocovariance Matrices, Conventional DOA Estimation Methods, Subspace Approach to DOA Estimation: MUSIC Algorithm, ESPRIT Algorithm.Uniqueness of DOA Estimates.

UNIT-II

Beamforming Fundamentals:Classical Beamformer, Statistically Optimum Beamforming Weight Vectors- Maximum SNR Beamformer, Multiple Sidelobe Canceller and the MaximumSINR Beamformer, Minimum Mean Square Error (MMSE), Direct Matrix Inversion (DMI), Linearly Constrained Minimum Variance (LCMV).Adaptive Algorithms for Beamforming- Least Mean-Square (LMS) Algorithm, Recursive Least-Squares (RLS) Algorithm, Constant-Modulus (CM) Algorithm, Affine-Projection (AP) Algorithm, Quasi-Newton (QN) Algorithm.

UNIT-III

Integration and Simulation of Smart Antennas:Overview, AntennaDesign, MutualCoupling, Adaptive Signal Processing Algorithms, Trellis-Coded Modulation (TCM) for Adaptive Arrays, Smart Antenna Systems for Mobile Ad Hoc NETworks(MANETs).

UNIT-IV

Space–Time Processing: Introduction, Discrete Space–Time Channel and Signal Models, Space–TimeBeamforming, Intersymbol and Co-Channel Suppression, Space–Time Processing for DS-CDMA, Capacity and Data Rates in MIMO Systems.

Text Books:

1. C. A. Balanis& P. I. Ioannides, "Introduction to smart antennas" Morgan & Claypool Publishers, 2007.

Reference Books:

1. S. Chandran, Adaptive antenna arrays, trends and applications, Springer, 2009.