

PHASED ARRAYS

17ECMC2T6C

Lecture: 4periods/week

Credits: 4

Internal assessment: 40 marks

Semester end examination: 60 marks

Prerequisites: Antennas**Course Objectives:**

- To study the different array patterns
- To Analyse the characteristics of various array patterns
- To Synthesize various array patterns
- To study the behaviour of different array feed mechanisms and measure the antenna parameters

Course Outcomes:

- Design linear arrays with required sidelobes, beamwidth, bandwidth etc., and determine their directivity
- Formulate the array patterns using Taylor narrow Beam design, Dolph-Chebyshev array, Taylor one-parameter distribution, Bickmore-Spellmire two parameter distribution.
- Synthesize the circular planar arrays like flat plane slot array, Circular Bayliss difference pattern, Two-Dimensional Optimization, Ring sidelobe synthesis
- Apply different feeding mechanisms for resonant and travelling wave arrays, measure sidelobe patterns

UNIT I

Basic Array Characteristics: Uniformly Excited Linear Arrays: Patterns, Beamwidth, Sidelobes, Grating Lobes, Bandwidth, Planar Arrays: Array Coordinates, Beamwidth, Grating Lobes (Rectangular Lattice, Hexagonal Lattice), Beam Steering and Quantization Lobes: Steering Increment, Steering Bandwidth, Time Delay Deployment, Phaser Quantization Lobes, QL Decollimation: Overlapped Sub-Arrays, Directivity: Linear array directivity, Directivity of Arrays of short Dipoles, Directivity of Arrays of Resonant Elements, Planar array directivity.

UNIT II

Linear Array Pattern Synthesis: Introduction: Pattern Formulations, Physics versus Mathematics, Taylor Narrow Beam Design Principles, Dolph-Chebyshev Arrays: Half wave spacing, Spacing less than half wave, Taylor one parameter Distribution: One-parameter design, Bickmore-Spellmire Two parameter distribution, Taylor N-Bar Aperture distribution, Low-sidelobe distributions: Comparison of distributions, Average sidelobe level, Shaped beam synthesis: Woodward-Lawson synthesis, Elliott Synthesis, Thinned Arrays: Parabolic Design, Space Tapering, Minimum Redundancy Arrays.

UNIT III

Planar and Circular Array Pattern Synthesis: Circular Planar Arrays: Flat plane slot array, Hansen One-parameter pattern, Taylor circular n pattern, Circular Bayliss Difference pattern, Difference pattern optimization, Noncircular Apertures: Two-Dimensional Optimization, Ring sidelobe synthesis.

UNIT IV

Array feeds and Measurements: Series feeds: Resonant Arrays- Impedance and bandwidth, Resonant slot array design, Travelling Wave Arrays- Frequency Squint and Single Beam condition, Calculation of element conductance, TW slot array design Frequency scanning, Phaser scanning, Shunt feeds: Corporate feeds, distributed feeds, Measurement of Low-sidelobe patterns, Array diagnostics, Wave guide simulators.

Text books:

1. Phased Array Antennas, R.C.Hansen, Second edition 2009, John Wiley & Sons Publications

Reference Books:

1. Phased Array Antenna Handbook, Second Edition (Artech House Antennas and Propagation Library) 2nd Edition by Robert J. Mailloux.
2. Phased Array Antennas : Floquet Analysis, Synthesis, BFNs and Active Array Systems 1st Edition, Arun K. Bhattacharyya.