

Modern Antennas (Elective Subject-B.Tech)

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| Course Code: | 13B1WEC832 | Semester: | 8 th sem B.Tech (ECE) |
| Credits: | 3 | Contact Hours: | L-3, T-0, P-0 |

Course Objectives

The main objective of the course is to

1. Learn the mechanism of antenna, antenna performance parameters,
2. Design and analysis of various antennas for different applications
3. Size reduction techniques, Broadbanding and multi band operation techniques in antenna design.

Course Outcomes

After studying this course the students would gain enough knowledge

1. To understand the mechanism of antenna radiation
2. To design and analyze various antennas for specific application.

Course Contents

| Unit | Topics | References (chapter number, page no. etc) | Lectures |
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| 1. | Introduction: antenna types, radiation mechanism, use of potential functions, radiated field, far field, antenna parameters, radiation pattern, directivity, numerical evaluation of directivity, gain, efficiency, impedance, loss resistance, polarization, linear polarization, circular and elliptic polarization, equivalent area, Friss equation. | Balanis: Chapter 1,2,3 | 6 |
| 2. | Dipole Antennas: Potential functions for analysis of radiated fields, Duality theorem, Reciprocity theorem for antennas, Radiation from current element, infinitesimal dipole, finite length dipole, half wave dipole | Balanis: Chapter 4 | 6 |
| 3 | Antenna Arrays: Analysis and Synthesis Review of antenna array basics, Linear arrays, circular array, planar (2D) arrays, sum and difference patterns, Effect of mutual couplings, Phased array antennas, scan principles, Non uniform arrays, Dolph Chebyshev Arrays Binomial Arrays. | Balanis: Chapter 6 | 6 |
| 4 | Broadband and Frequency Independent Antennas Helical antenna: Normal mode and | Balanis: Chapter 10 | 6 |

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| | axial mode helix Spiral antennas, Log Periodic antennas. | | |
| 5 | Aperture Antennas Radiation from an aperture in an infinite ground plane, Radiation from rectangular and circular apertures, Radiation from a slotted rectangular waveguide Horn antennas: E plane and H plane sectoral horns, Pyramidal horn, Conical horn Reflector antennas parabolic reflector, methods of analysis, dual reflector antennas, offset reflector antenna, gain and efficiency calculations, scanning properties and cross polarization Lens antennas and their applications | Balanis: Chapter 12 | 7 |
| 6 | Microstrip Antennas Rectangular patch antenna: cavity and transmission line models, Circular patch antenna Coupling mechanisms, circular polarization, Microstrip arrays, Broadband and Multi band microstrip antennas, Compact Microstrip Antennas. | Balanis: Chapter 14 | 6 |
| 7 | Dielectric Resonator Antennas Introduction, radiation mechanism, advantages of DRA, types of DRA, feeding techniques, design method, modes. | Rajveer: Chapter 1, 2 | 6 |
| Total Number of Lectures | | | 43 |

Evaluation Scheme

1. Test 1 :15 marks
2. Test 2 : 25 marks
3. Test 3 : 35 marks
4. **Internal Assessment** : 25 marks
 - 10 Marks : Class performance, Tutorials & Assignments
 - 10 Marks : Quizzes
 - 5 marks : Attendance

Text Books

1. Antenna Theory Analysis and Design, C. A. Balanis, 3rd Ed, 2005, John Wiley & Sons Inc.
2. Antennas for All Applications, J. D. Kraus and R. J. Marhefka, 3rd Ed., 2002, McGraw-Hill, Inc
3. Rectangular Dielectric Resonator Antennas, Rajveer S. Yaduvanshi Harish Parthasarathy, 1st Ed, 2016, Springer.

Reference Books

1. Antennas and Radiowave Propagation, R. E. Collin, 1985, McGraw-Hill, Inc.
2. Modern Antenna Design, T. A. Milligan, 2nd Ed., 2005, John Wiley & Sons
3. Antenna Arrays, R. L. Haupt, 2010, John Wiley & Sons, Inc.
4. Antenna Theory and Microstrip Antennas, D. G. Fang, 2010, CRC Press