

<b>6<sup>th</sup> Semester</b>	<b>Antenna Engineering</b>	<b>L-T-P 3-0-0</b>	<b>3 Credits</b>
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**Module-I: (10 Hours)**

Principles of Radiation, Retarded Vector Magnetic Potential. Radiation field from Current element. Radiation Resistance, Current Distribution, on a thin Wire. Half wave dipole and Quarter wave monopole. Two-element array. Principle of Pattern Multiplication. Linear Array. Broadside and end fire patterns. Antenna Gain, effective length of an antenna. Input Impedance. Balun.

**Module-II: (10 Hours)**

Folded Dipole, Yagi Antenna. Frequency Independent Antenna. Log Periodic Dipole array. Secondary Sources and Aperture Antennas . Magnetic Current. Principles of Images. The Equivalence Theorem. Radiation from Huygen's Sources. Radiation from open end of a Co-axial line. Aperture in an absorbing screen. Radiation through an aperture in a perfectly conducting screen. Babinet's Principle– Complementary Screen. A thin slot in an infinite Screen. Slot antenna on a rectangular wave guide wall.

**Module-III: (8 Hours)**

Horn Antennas – Pyramidal & Sectoral Horn. Radiation Pattern and Gain of horn antenna. Parabolic Reflector Antenna Principle, analysis, Radiation Pattern and Gain. Principles of Casse grain Antenna. Inducted EMF method of Calculating Input Impedance of wire antenna. Mutual Impedance between two dipoles.

**Module IV (8 Hours)**

Microstrip Antenna – Basic Characteristics, Rectangular Patch, Circular Patch, Microstrip Array Antenna. Electronic Scanning Antenna- Phase Scanning, Frequency Scanning and Beam switching Antenna Measurements – Radiation Pattern, Gain and Input Impedance. 5G Antenna

**Books:**

- [1] Electromagnetic Wave and Radiating Systems by E. C Jordan and K. G. Balmain, 2nd Edition , PHI. Ch. 10,11,12,13,14 and 15.
- [2] Antennas Theory - Analysis and Design By C Balanis, 2nd Edition, John Willey & Sons. Selected portion Ch. 11,12,13, 15 and 16.
- [3] Antenna Engineering by J. D. Krauss.
- [4] Antenna Engineering by W. L. Weeks
- [5] Antennas and Wave Propagation by G. S. N. Raju, Pearson Education.
- [6] Antenna & Wave Propagation by R.E. Collins.

**Digital Learning Resources:**

Course Name: Antennas  
 Course Link: <https://nptel.ac.in/courses/108/101/108101092/>  
 Course Instructor: Prof. Girish Kumar, IIT, Bombay

Course Name: Analysis and Design Principles of Microwave Antennas  
 Course Link: <https://nptel.ac.in/courses/108/105/108105114/>  
 Course Instructor: Dr. Amitabha Bhattacharya, IIT Kharagpur