ECE3071: ANTENNA ENGINEERING

Programme: B. Tech. (ECE & CCE)	Year: 3rd	Semester: V/VI
Course: Program Elective	Credits: 3	Hours: 40

Course Context and Overview (~100 words): The objective of the course is to provide students with an in-depth understanding of fundamental principles using which commonly used antennas are analyzed.

Prerequisites Courses: Engineering Electromagnetics (ECE0332)

Course outcomes (COs):

On completion of this course, the students will have the ability to:
CO1: should be able to derive the mathematical expressions for radiated field for dipole and monopole antennas.
CO2: should be able to conceptually understand and calculate the performance parameters of dipole and monopole antennas.
CO3: should be able to analyze linear arrays.
CO4: should be able to analyze commonly used aperture antennas and broadband antennas.
CO5: should be able to analyze commonly used microstrip antennas.

Course Topics:

Proposed Curriculum (Separated into 4-5 (not more than that) units each corresponding to approximately 10 contact hours):

UNIT I (8 lectures) : Radiation Fundamentals: Physical concept of radiation, mathematical expressions for radiated field for Herzian dipole, short dipole/monopole, and dipole/monopole of arbitrary length, near-field and far-field, radiation integrals.

UNIT II (8 lectures) : Antenna Performance Parameters: Radiation pattern, effective length, gain, directivity, effective aperture, polarization, input impedance, efficiency, antenna feeds, LOS propagation, Friis transmission equation, the concept of noise temperature and G/T ratio, propagation through ionospheric layers.

UNIT III (8 lectures): Antenna Arrays: Analysis of uniformly-spaced linear arrays with uniform and non-uniform excitation, introduction to planar arrays.

UNIT IV (8 lectures): Aperture Antennas and Broadband Antennas: Huygen's principle, Babinet's principle, slot antennas, rectangular and circular loop antennas, sectoral and pyramidal horns, parabolic reflector and Cassegrain antennas, log periodic and Yagi antennas, helical antennas, spiral antennas.

UNIT V (8 lectures): Microstrip Antennas and Smart Antennas: Basic characteristics (resonant frequency, input impedance, feed technique, radiation pattern, etc.) of microstrip antennas, methods of analysis, design of rectangular and circular patch antennas, design of printed dipoles. Concepts behind and benefits of smart antennas, fixed-weight beam-forming basics, adaptive beam-forming, fractal antennas and body-centric antennas.

Suggested Readings: (APA Style/ IEEE format)

Text Books:

1. Edward C. Jordan and Keith G. Balmain, "*Electromagnetic Waves and Radiating Systems"*, Second Edition, PHI Learning Private Limited, New Delhi, 2011.
2. John D. Kraus, Ronald J. Mathefka, and Ahmad S. Khan, "*Antennas and wave Propagation"*, Fourth Edition, Tata McGraw-Hill Education, 2006.
3. R.S. Elliot, Revised Edition, "*Antenna Theory and Design"*, Wiley-IEEE Press, 2003.

Reference Books:

URL for the course (optional):

Grading Policy (With Weightage)

- Mid Semester Exam: 25%
- End Semester Exam: 50%
- Continuous evaluation (Quizzes, etc.): 25%

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Instructor(s) names: