ELECTROMAGNETIC THEORY

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INTENDED AUDIENCE : The course is an integral part of EE curriculum. Students after completing this course can take up courses in Microwave Engg, Optics, Antennas etc.,

INDUSTRIES APPLICABLE TO : This is a undergraduate core course required as a foundation to other courses in Microwave, Optical, and Antenna engineering.

COURSE OUTLINE :

Electromagnetic theory is a core course in Electrical Engineering curriculum. The course covers static and dynamic electric and magnetic fields and their interaction. Major topics include Electromagnetic Waves, Transmission Lines, Waveguides, and Antenna fundamentals. In addition, quasi-static analysis and numerical methods are also discussed. Successful completion of the course will allow students to take up Microwave Engg, Antennas, and Optics for future studies.

ABOUT INSTRUCTOR :

Prof. Pradeep Kumar K. obtained his PhD from IIT Madras specializing in quantum cryptography. He joined the Department of Electrical Engineering at IIT Kanpur in 2009. He is also associated with the Centre for Lasers & Photonics. At IIT Kanpur he and his students work in the fields of quantum key distribution, nonlinear fiber optics for signal processing, mitigation of linear and nonlinear impairments in coherent optical communications, mode locked fiber lasers and chaos, fiber-optic sensors for undersea applications, and fiber-optic modeling. He is also actively involved in the LIGO-India effort under IndiGO umbrella. His lab develops single-photon detectors, single- and subcarrier RF transceivers, and is currently working on true random number generators. He has published over 40 papers in peer reviewed journals and conferences. He also holds three patents (one granted and two pending). His MOOC courses on NPTEL has been very popular with more than 15000 enrollments from across the country.

COURSE PLAN :

Week 1 : Coulomb's law and electric fields

Week 2 : Gauss's law, potential and energy, conductors and dielectrics

Week 3 : Laplace and Poisson equations, solution methods, and capacitance

Week 4 : Biot-Savart and Ampere's laws, inductance calculation

Week 5 : Magnetic materials, Faraday's law and quasi-static analysis

Week 6 : Maxwell equations and uniform plane waves

Week 7 : Wave propagation in dielectrics and conductors, skin effect, normal incidence

Week 8 : Oblique incidence, Snell's law, and total internal reflection

Week 9 : Transmission lines, Smith chart, impedance matching

Week 10 : Transients and pulse propagation on transmission line

Week 11 : Waveguides: Metallic and Dielectric

Week 12 : Antenna fundamentals