



# ELECTROMAGNETIC WAVES IN GUIDED AND WIRELESS MEDIA

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**INTENDED AUDIENCE** : Undergraduate students and first year graduate students

**PRE-REQUISITES** : Vector analysis, Electrostatics, and Magnetostatics

**INDUSTRIES APPLICABLE TO** : Of interest to all companies that deal with electromagnetic waves and wireless communications. In addition, DRDO, ISRO, etc will value the course.

## COURSE OUTLINE :

A thorough understanding of propagation and radiation of electromagnetic waves in both wired and wireless media is important in many fields such as microwave and RF engineering, antennas, wireless communications, and fiber-optics. In this course, we discuss guided electromagnetic wave propagation in transmission lines and metallic waveguides, light propagation in optical waveguides, fibers, and free-space. In the final part of the course, we cover basic concepts of antennas and channel models for wireless communications. Pre-requisites include familiarity with vector analysis and vector calculus, electrostatics, and magnetostatics. Assignments include both conceptual and computational problems.

## ABOUT INSTRUCTOR :

Dr. K Pradeep Kumar is currently an Associate Professor in the Department of Electrical Engineering at IIT Kanpur. His research interests include Quantum key distribution, optical communications, and nonlinear fiber optics. He has taught several popular NPTEL courses on Electromagnetics and Fiber-Optics. Dr. 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 01** : Transmission lines

**Week 02** : Applications of transmission lines

**Week 03** : EM waves in free-space

**Week 04** : Diffraction of EM waves

**Week 05** : Guided waves in metallic waveguides

**Week 06** : Guided waves in dielectric waveguides

**Week 07** : Fundamentals of radiation

**Week 08** : Wireless channel modeling