ELECTROMAGNETISM

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IISER Bhopal

TYPE OF COURSE : New | Core | UG
COURSE DURATION : 12 weeks (27 Jan' 20 - 17 Apr' 20)
EXAM DATE : 26 Apr 2020

PRE-REQUISITES : Calculus

INTENDED AUDIENCE : BSc first year

COURSE OUTLINE :

In this course students will learn and apply properties of electric and magnetic fields in the presence of static charge and current distributions. They will also understand, analyze, and apply Maxwell's equations that govern the dynamics of electric and magnetic fields.

ABOUT INSTRUCTOR :

Dr. Ganguli finished his Masters and PhD from IIT Bombay, carrying out a significant part of the research work at IACS, Kolkata. He moved to University of Twente, the Netherlands in 2011 and subsequently to Max Planck Institute for Solid State Research, Germany in 2015 for postdoctoral research. He has been working as an Assistant Professor at IISER Bhopal since 2016.

COURSE PLAN :

Week 1**:** Vector algebra, Introduction to vector calculus: gradient, divergence, and curl

Week 2**:** Cylindrical and spherical coordinate systems, line, surface, and volume elements

Week 3**:** Divergence theorem, Stokes theorem, and Dirac Delta function

Week 4**:** Electrostatics: Coulomb's law, Gauss's law: differential and integral forms, application

Week 5**:** Electric potential, Poisson and Laplace equation (no solution), Method of images, Energy of a charge distribution

Week 6**:** Field and potential due to dipole, Polarization in a dielectric, Linear dielectrics, Force on dielectrics

Week 7**:** Motion of charged particles in electric and magnetic fields, Electric currents: line, surface, and volume currents and current densities, Electrical conductivity and Ohm's law, Equation of continuity, Energy dissipation

Week 8**:** Magnetostatics: Biot-Savart law, Divergence and curl of B, Differential and integral form of Ampere's law

Week 9**:** Vector potential, Magnetic dipoles, Magnetization in materials, Dia, para, and ferromagnetism

Week 10**:** Electrodynamics, electromagnetic induction, motional emf and Faraday's law

Week 11**:** Inductance and energy in a magnetic field, the displacement currents, Maxwell's equations

Week 12**:** Electrodynamics within the framework of Maxwell's equations and outlook