**19EE2202-ELECTROMAGNETIC FIELDS**

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| **Course Category:** | Professional core | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture-Tutorial-Practical:** | 2-1-0 |
| **Pre-requisite:** | Knowledge of vector analysis, co-ordinate system, vector calculus, differentiation of scalars and vectors. | **Sessional Evaluation:****External Exam Evaluation:****Total Marks:** | 4060100 |

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| **Course Objectives:** | Students undergoing this course are expected to learn : |
| 1. The Electrostatics and Magneto statics concepts. 2. The Gauss’s law.3. The boundary conditions of dielectrics.4. The Maxwell’s equations and EM wave Characteristics .5. The magnetic forces and torque produced by currents in magnetic field.6. The time varying fields and ability to calculate the induced EMF. |
| **Course Outcomes:** | After completing the course the student will be able to |
| CO1 | Determine electric force and electric field intensity. |
| CO2 | Calculate electric field and potential using Gauss’s law. |
| CO3 | Analyse current densities and boundary conditions of dielectrics. |
| CO4 | Find magnetic field intensity due to current, the application of ampere’s law and the Maxwell’s second and third equations. |
| CO5 | Estimate the magnetic forces and torque produced by currents in magnetic field. |
| CO6 | Gain knowledge on time varying fields and ability to calculate the induced EMF. |
| **Course Content:** | **UNIT – I****Electrostatic Fields-I:** Vector Analysis-Cartesian-Cylindrical-Spherical Co-Ordinate systems, Coulomb’s law, Electric field Intensity(EFI)– EFI due to a infinite line charge- infinite sheet of charge-circular disc charge-Circular ring of charge, Electric flux density.**UNIT – II****Electrostatic Fields-II:** Gauss’s law-Gauss’s law in point form, Application of Gauss’s Law-point charge-infinite line charge-co axial cable-infinite sheet of charge-spherical shell of charge-uniformly charged sphere, Laplace’s and Poisson’s equations, Electrostatic potential, Potential gradient, Energy stored in Electric field, Capacitance-– Capacitance of parallel plates – Coaxial Capacitor - Spherical Capacitor – Composite parallel plate capacitor.**UNIT-III****Conductors and Dielectrics:** Current and current density, Conductors – properties of conductor- Ohm’s Law-Resistance-Power dissipation - Joule’s Law, Dielectrics- Properties of Dielectrics - Polarization –mathematical expression for polarization- Dipole Moment, Torque on an Electric dipole in an electric field, , Boundary conditions-Conductor and Dielectric – Dielectric and Dielectric boundary conditions, Continuity equation.**UNIT – IV****Magneto Static Fields:** Static magnetic fields – Biot-Savart’s law – Magnetic field intensity (MFI) – MFI due to a straight current carrying filament –center of the circular conductor-circular loop, Ampere’s circuital law, Ampere’s circuital law in point form, Applications of Ampere’s circuital law- MFI due to infinite straight long conductor- MFI due to co axial cable- MFI due to infinite sheet of current, Magnetic vector potential, Lorentz force law.**UNIT – V****Magnetic Field in Materials:** Dipole moment, Torque, Boundary conditions, Magnetic circuits, Inductance- Solenoid- Toroid- Co axial cable, Energy stored in Magnetic field.**UNIT –VI****Maxwell’s Equations:** Faraday’s law-Motional and transformer induced E.M.F., Maxwell’s equations, Faraday’s law, Faraday’s law in point form, Displacement current, Wave equation and its general solution for free space conditions. |
| **Text Books** **&** **Reference Books:** | **TEXT BOOKS:**1. “Engineering Electromagnetics”, by William H. Hayt & John. A. Buck Mc.Graw-Hill Companies, 7th Editon.2006 .
2. “Electromagnetic Fields”, by Sadiku, Oxford Publications, 3rd Editon.2007.
3. “Field Theory”, by K.A.Gangadhar & PM Ramanathan Khanna PublishersNew Delhi, 2005, 5th Edition.

**REFERENCE BOOKS:**1. “Electromagnetics”, by Joseph A.Edminister, Mc Graw-Hill 4th Edition, 2014.
2. “Electromagnetic waves & Radiating system”, by Edward C.Jordan and keith G.Balmain, Prentics-Hall of India Pvt.Ltd.
3. “Engineering electromagnetics:Theory and Problems and Applications”, by J.P Tewari, Khanna Publishers,2003.
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| **e-Resources:** | http://nptel.ac.in/courseshttp://iete-elan.ac.inhttp://freevideolectures.com/university/iitm |