**20EE2101-ELECTROMAGNETIC FIELDS**

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| **Course Category:** | Professional core | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture-Tutorial-Practical:** | 3-0-0 |
| **Pre-requisite:** | Knowledge of vector analysis, co-ordinate system, vector calculus, differentiation of scalars and vectors. | **Sessional Evaluation:**  **External Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Objectives:** | Students undergoing this course are expected to learn : | |
| 1. The Electrostatics and Magneto statics concepts.  2. Calculate electric field and potential using 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 | Demonstrate 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”,byK.A.Gangadhar& PM RamanathanKhannaPublishersNew Delhi, 2005, 5th Edition.   **REFERENCE BOOKS:**   1. “Electromagnetics”, by Joseph A.Edminister, McGraw-Hill 4th Edition, 2014. 2. “Electromagnetic waves & Radiating system”, by Edward C.Jordan and keithG.Balmain, Prentics-Hall of India Pvt.Ltd. 3. “Engineering electromagnetics:Theory and Problems and Applications”, by J.P Tewari, Khanna Publishers,2003. | |
| **e-Resources:** | http://nptel.ac.in/courses  http://iete-elan.ac.in  http://freevideolectures.com/university/iitm | |