**20EC2203 – ELECTROMAGNETIC FIELDS & WAVES**

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| **Course category:** | Program core | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 0 - 0 |
| **Prerequisite:** | Basic concepts of coordinate system & fundamentals of electricity & magnetism | **Sessional Evaluation :**  **External Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course**  **Objectives** | Students undergoing this course are expected to understand: | |
| 1. Co-ordinate systems, Vector calculus. 2. Electrostatics, Coulomb’s law, Mathematical analysis of Gauss’s law. 3. Behaviour of conductors with regard to Current, Current Density, Resistance. Understand the significance of Ohm’s law for EM fields. 4. Magnetic Static Fields and various laws applicable to magnetic fields. 5. Dipole Moment of materials, Boundary conditions governing Magnetic interfaces and study about energy stored in Magnetic Fields. 6. Maxwell’s equations in different forms and their applications to EM fields, Uniform plane wave propagation. | |
| **Course Outcomes** | Upon successful completion of the course , the students will be able to: | |
| CO1 | Know the conversions of one co-ordinate system to other forms. |
| CO2 | Remember Gauss Law, Coulomb’s law to find fields and potentials for a various situations. |
| CO3 | Derive the Continuity equation and give the importance of current density. |
| CO4 | Understand Biot-Savart’s Law and Ampere’s Circuital law and apply to solve problems on these. |
| CO5 | Acquire the knowledge of Dipole moment, Boundary conditions of Magnetic Fields |
| CO6 | Know the Maxwell’s equation in differential and integral forms, Faraday’s law, Uniform plane wave propagation |
| **Course**  **Content**  **Course**  **Content** | **UNIT-I**  **REVIEW OF COORDINATE SYSTEMS:** Introduction to coordinate systems, Cartesian, Cylindrical and Spherical coordinate systems, Vector transformations, Vector calculus.  **UNIT-II**  **ELECTROSTATIC FIELDS:** Coulomb’s Law, Electric Field Intensity, Electric Flux Density –Gauss’s Law, Gauss’s law in point form, Electric Potential, Potential Gradient and Energy Stored in Electric Field.  **UNIT-III**  **CONDUCTORS AND DIELECTRICS:** Current and Current Density- Continuity Equation-Conductors-Ohms Law, Resistance, power dissipation and Joules law. Dielectrics: Dipole Moment-Polarization-bound Charge Densities-Boundary Conditions, Capacitance.  **UNIT-IV**  **MAGNETOSTATIC FIELDS:** Ampere’s force law, Biot-Savart’s Law, Lorentz force law, Ampere’s circuital law in point form, Magnetic Vector Potential.  **UNIT-V**  **MAGNETIC FIELD IN MATERIALS:** Dipole Moment, Magnetization and bound current densities, Boundary Conditions, Inductance, Energy Stored in Magnetic Field.  **UNIT-VI**  **MAXWELL’S EQUATIONS:** Faraday’s law, Motional and transformer induced EMFs, Faraday’s law in point form, Displacement current, Maxwell’s equations in differential and integral forms, Poynting theorem, Wave Equation – Uniform Plane Waves in Lossless Media and in Lossy Media. | |
| **Text Books and Reference Books** | **TEXT BOOKS:**   1. Matthew N.O.Sadiku: “Elements of Engineering Electromagnetics” Oxford University Press, 4th edition, 2007. 2. E.C. Jordan & K.G. Balmain “Electromagnetic Waves and Radiating Systems.” Pearson Education/PHI 4th edition 2006.   **REFERENCES:**   1. NarayanaRao, N: “Elements of Engineering Electromagnetics” 6th edition, Pearson Education, New Delhi, 2006. 2. G.S.N. Raju, Electromagnetic Field Theory & Transmission Lines, Pearson Education, 2006. | |
| **E-Resources** | 1. https://nptel.ac.in/courses 2. https://iete-elan.ac.in 3. https://freevideolectures.com/university/iit | |

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| Contribution of Course Outcomes towards achievement of Program Outcomes (3-High, 2-Medium, 1-Low) | | | | | | | | | | | | | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | 2 | 2 | 1 | - | - | 1 | - | 2 | - | 2 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | 1 | - | - | 1 | - | 2 | - | 2 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 1 | 1 | - | - | 1 | - | 2 | - | 2 | 3 | 3 |
| CO4 | 3 | 3 | 2 | 2 | 1 | - | - | 1 | - | 2 | - | 2 | 3 | 2 |
| CO5 | 3 | 3 | 2 | 2 | 1 | - | - | 1 | - | 2 | - | 2 | 3 | - |
| CO6 | 3 | 3 | 2 | 2 | 1 | - | - | 1 | - | 2 | - | 2 | 3 | 2 |