SILVER OAK UNIVERSITY

Silver Oak Institute of Science

Bachelor of Science Physics

Course Name: Fundamentals of Electromagnetism

Course Code: 2050253203

Semester: 3rd

Prerequisite:

1. Basic understanding of Electricity and magnetism concept.

Course Objectives:

1. Understand magnetism fundamentals: magnetic fields, Biot-Savart's Law, Ampere's Circuital Law, magnetic properties, forces, and torques on current elements.
2. Explore magnetic properties of matter, including magnetization, susceptibility, BH curves, electromagnetic induction principles, and Maxwell's equations.
3. Analyze time-varying fields and Maxwell's equations, covering Faraday's Law, displacement current, dielectric properties, and Gauss' Law in dielectrics.

Teaching Scheme:

Teaching Scheme				
L	T	P	Contact Hours	Credit
4	0	0	4	4

Contents:

Unit	Topics	Teaching Hours	% Weightage
1	**Magnetic Field:** Magnetic force between current elements and definition of Magnetic Field B. Biot-Savart's Law and its simple applications: straight wire and circular loop. Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole).Ampere's Circuital Law and its application to (1) Solenoid and (2) Toroid. Properties of B: curl and divergence. Vector Potential. Magnetic Force on (1) point charge (2) current carrying wire (3) between current elements. Torque on a current loop in a uniform Magnetic Field.	14	25
2	**Magnetic Properties of Matter:** Magnetization vector (M). Magnetic Intensity (H). Magnetic Susceptibility and permeability. Relation between B, H, M. Ferromagnetism.BH curve and hysteresis. Electromagnetic Induction: Faraday's Law. Lenz's Law. Self-Inductance and Mutual Inductance. Reciprocity Theorem. Energy stored in a Magnetic Field. Introduction to Maxwell's Equations. Charge Conservation and Displacement current.	14	25
3	**Time Varying Fields and Maxwell's Equations:** Faraday's Law, Displacement Current, Maxwell's Equations in Point Form, Maxwell's Equations in Integral Form, The Retarded Potentials	14	25
4	**Dielectric Properties of Matter:** Electric Field in matter. Polarization, Polarization Charges. Electrical Susceptibility and Dielectric Constant. Capacitor (parallel plate, spherical, cylindrical) filled with dielectric. Displacement vector D. Relations between E, P and D. Gauss' Law in dielectrics.	14	25

Course Outcomes:

Sr. No.	CO Statement	Unit
CO-1	Define and explain the laws of magnetic field, and properties of the magnetic field such as curl, divergence, and vector potential.	1
CO-2	Interpret the magnetic properties of matter.	2
CO-3	Apply electromagnetic laws to analyze electromagnetic induction phenomena and energy storage in magnetic fields.	3
CO-4	Analyze time-varying fields using Maxwell's Equations, and explain Maxwell's Equations in both point and integral forms.	4

Teaching & Learning Methodology:

1. Conceptual Learning
2. Cooperative based Learning
3. Competency based Learning
4. Problem - based Learning

Books Recommended:-

1. Griffiths, D.J., "Introduction to Electrodynamics", Be**njamin Cummings**
2. Feynman, R.P., Leighton, R.B., Sands, M., "Feynman Lectures Vol.2", Pearson Education
3. Hayt, W., "Engineering Electromagnetics", Seventh Edition, McGraw Hill Education
4. Sadiku, M.N.O., "Elements of Electromagnetics", Oxford University Press
5. Shevgaonkar, R.K., "Electromagnetic Waves", Tata McGraw Hill India
6. Pramanik, A., "Electromagnetism-Problems with Solution", Prentice Hall India
7. Ramo, S., Whinnery, J., "Electromagnetic Fields and Waves", Wiley India
8. Narayana Rao, N., "Engineering Electromagnetics", 3rd Edn., Prentice Hall
9. Jordan, E.C., Balmain, K.G., "Electromagnetic Waves & Radiating Systems", Prentice Hall India.

List of Open-Source Software/learning website:

1. http://silveroakuni.ac.in/video-lecture

CO-PO-PSO Matrix:

CO. No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO-1	3	1	1	1	1	3	2	1	2	1	2	1	2
CO-2	3	2	1	2	2	1	1	2	1	2	2	1	1
CO-3	3	2	1	2	2	1	2	2	1	2	2	1	2
CO-4	3	2	1	1	2	1	1	1	2	2	2	1	1