## Integrated M.Sc. (Physics) (Semester 1) Teaching Schedule

## 060100105: CC1 Electricity and Magnetism

**Course Objectives:** To study the basic concepts of physics and to develop physical intuition, mathematical reasoning and problem solving skills.

Unit	Sub Unit	No. of Lectur e(s)	Topics	Reference Chapter/ Additional Reading	Teaching Methodology to be used
Unit 1	1: Elect	ric Field a	and Electric Potential		
	1	3	Properties of vectors under rotations. Scalar product and its Invariance under rotations. Vector product.	E.M #1	Chalk and Talk
	1	4	Scalar triple product and their interpretation in terms of area and volume respectively. Scalar and Vector fields	E.M #1	
	2	2	Concept of irrotational & rotational vector fields (gradient of scalar field and curl of a vector field), Field equation for <i>E</i> in vacuum.	E.M. #1	
	2	3	Gauss's Law, Energy associated with E field, Poisson's equation, Laplace's equation and Uniqueness theorems. Conductor in electric field	E.M #4	
	2	5	Electric dipole, dipole moment, polarization and charge density, E and D fields, polarizability and susceptibility, Gauss's law in dielectrics, Static boundary conditions in dielectric, energy of fields in the presence of dielectrics.	E.M. #4	
Unit 2	2: Diele	ctric Proj	perties of Matter		
	2	3	Electric Field in matter. Polarization, Polarization Charges. Electrical Susceptibility and Dielectric Constant.	E.M #2	Chalk and Talk
		3	Capacitor (parallel plate, spherical, cylindrical) filled with dielectric. Displacement vector D.	E.M. #9	
		3	Relations between E, P and D.	E.M. #4	

			Gauss' Law in dielectrics.		
Unit-3	3 Magne	tic Field, I	Magnetic properties of Matter and E	Electromagnetic Induction	
3	1	5	Magnetic force between current elements and definition of Magnetic Field. 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	E.M#	Chalk and Talk
3	2	4	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.	E.M#	Chalk and Talk
3	3	4	Magnetization vector (M). Magnetic Intensity(H). Magnetic Susceptibility and permeability. Relation between B, H, M. Ferromagnetism. B-H curve and hysteresis	E.M#	Chalk and Talk
3	4	5	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	E.M#	Chalk and Talk
Unit -	4 Electr	ical Circui	t and Its Applications		
4	1	4	Kirchhoff's laws for AC circuits. Complex Reactance and Impedance. Series LCR Circuit: (1) Resonance, (2) Power Dissipation, (3) Quality Factor, and (4) Band Width. Parallel LCR Circuit.	BPP#	Chalk and Talk
4	2	4	Ideal Constant-voltage and Constant-current Sources. Network Theorems: Thevenin theorem, Norton theorem, Superposition theorem,	BPP#	Chalk and Talk

Reciprocity theorem, Maximum Power Transfer	
theorem. Applications to dc circuits.	

Text Book:

- 1. D.J. Griffiths "Introduction to Electrodynamics", 3rd Edn., 1998, Benjamin Cummings
- 2. D.L. Sehgal, K. L. Chopra, N.K. Sehgal, Electricity and Magnetism, Sultan Chand & Sons.

**Reference Book:** 

- 1. S. Mahajan and Choudhury "Electricity, Magnetism & Electromagnetic Theory", 2012, Tata McGraw.
- 2. Edward M. Purcell "Electricity and Magnetism", 1986 McGraw-Hill Education.
- 3. J.H. Fawkes & J. Yarwood- "Electricity and Magnetism", Vol. I, 1991, Oxford Univ. Press.
- 4. B. L. Theraja, A.K. Theraja "A Textbook of Electrical Technology", Vol. I, S. Chand
- 5. Geeta Sanon- "B.Sc Practical Physics", R.Chand & Co