



## Syllabus

For 2<sup>nd</sup> Semester Courses in PHYSICS  
(Academic Year 2016 - 2017 onwards)

### Contents

Theory Syllabus for Courses:

**S.PHY.2.01 - Electricity and Magnetism**

**S.PHY.2.02 - Optics**

Practical Syllabus for Course:

**S. PHY.2. PR**

## F.Y. B.Sc. PHYSICS

Course: S.PHY.2.01

### Title: Electricity and Magnetism

#### Learning Objectives:

To study the fundamentals of Electricity and Magnetism

Number of lectures: 45

#### Unit I: ELECTROSTATICS

[15 lectures]

**Charges and fields :** Electric Charge, Conservation of Charge Quantization of Charge, Coulomb's Law, Energy of a System of Charges, Electrical Energy in a Crystal Lattice, The Electric Field, Charge Distributions, Flux, Gauss's Law , Field of a Spherical Charge Distribution, Field of a Line Charge, Field of an Infinite Flat Sheet of Charge, The Force on a Layer of Charge, Energy Associated with the Electric Field, Problems

**The electric potential:** Line Integral of the Electric Field, Potential Difference and the Potential Function, Gradient of a Scalar Function, Derivation of the Field from the Potential, Potential of a Charge Distribution, Potential of Two Point Charges, Potential of a Long Charged Wire, Uniformly Charged Disk, Divergence of a Vector Function, Gauss's Theorem and the Differential Form of Gauss's Law, The Divergence in Cartesian Coordinates, The Laplacian, Laplace's, Distinguishing the Physics from the Mathematics, The Curl of a Vector Function, Stokes' Theorem, The Curl in Cartesian Coordinates, The Physical Meaning of the Curl, Problems

#### Unit-II: Capacitors, Electric current and magnetic field [15lectures]

**Electric Field around conductors:** Conductors and Insulators, Conductors in the Electrostatic, The General Electrostatic Problem; ,Uniqueness Theorem, Some Simple Systems of Conductor, Capacitance and Capacitors, Potentials and Charges on Several, Energy Stored in a Capacitor, Other Views of the Boundary-Value Problem, Problems

**Electric current:** Electric Current and Current Density, Steady Currents and Charge Conservation, Electrical Conductivity and Ohm's Law, The Physics of Electrical Conduction, Conduction in Metals, Semiconductors Circuits and Circuit Elements, Energy Dissipation in Current, Electromotive Force and the Voltaic Cell, Networks with Voltage Sources, Variable Currents in Capacitors and Resistors, Problems

**The Magnetic field:** Definition of the Magnetic Field, Some Properties of the Magnetic Field, Vector Potential, Field of Any Current-Carrying Wire, Fields of Rings and Coils, Change in B at a Current Sheet, How the Fields Transform, Rowland's Experiment, Electric Conduction in a Magnetic Field: The Hall Effect, Problems

#### Unit III: EMI and AC circuits

[15 lectures]

**Electro-Magnetic Induction:** Faraday's Discovery, A Conducting Rod Moving through a Uniform, Magnetic Field, A Loop Moving through a Non uniform, Magnetic Field , A Stationary Loop with the Field Sources Moving, A Universal Law of Induction, Mutual Inductance, A Reciprocity Theorem, Self-inductance , A Circuit Containing Self-inductance , Energy Stored in the Magnetic Field , Problems,

**Alternating Current circuit:** A Resonant circuit, Alternating Current, Alternating-Current Networks, Admittance and Impedance, Power and Energy in Alternating-Current Circuits, Problems

#### References:

Electricity and Magnetis - EDWARD M. PURCELL, CAMBRIDGE UNIVERSITY PRESS  
University Physics, Sears & Zemansky, Young and Freedman, Pearson

## **F.Y. B.Sc.: PHYSICS**

## **Course: S.PHY.2.02**

### **Title: Optics**

**Learning Objectives:** To acquire knowledge of fundamental optics.

Number of lectures: 45

#### **UNIT 1: Nature of Light (15 Lectures)**

##### **ELECTROMAGNETIC WAVES:**

Maxwell's Equations and Electromagnetic Waves Plane Electromagnetic Waves, and the Speed of Light, Sinusoidal Electromagnetic Waves, Energy and Momentum in Electromagnetic Waves, Standing Electromagnetic Waves, Questions/Exercises/Problems

##### **THE NATURE AND PROPAGATION OF LIGHT**

The Nature of Light, Reflection and Refraction, Total Internal Reflection, Dispersion, Polarization, Scattering of Light, Huygens's Principle, Questions/Exercises/Problems

#### **UNIT 2: Light Phenomenon (15 Lectures)**

##### **GEOMETRIC OPTICS**

Reflection and Refraction at a Plane Surface, Reflection at a Spherical Surface, Refraction at a Spherical Surface, Thin Lenses, Cameras, The Eye, The Magnifier, Microscopes and Telescopes, Questions/Exercises/Problems

##### **INTERFERENCE**

Interference and Coherent Sources, Two-Source Interference of Light, Intensity in Interference Patterns, Interference in Thin, the Michelson Interferometer, Questions/Exercises/Problems

#### **UNIT 3: Light Phenomenon (15 Lectures)**

##### **Diffraction**

Fresnel and Fraunhofer Diffraction, Diffraction from a Single, Intensity in the Single-Slit Pattern, Multiple Slits, The Diffraction Grating, X-Ray Diffraction, Circular Apertures and Resolving Power, Holography, Questions/Exercises/Problems

##### **Photons**

Light Absorbed as Photons: The Photoelectric Effect, Light Emitted as Photons: X-Ray Production, Light Scattered as Photons: Compton Scattering and Pair Production, Wave-Particle Duality, Probability and Uncertainty, Questions/Exercises/Problems

##### **List Of Recommended Reference Books**

University Physics, Sears & Zemansky: Young and Freedman, Pearson  
Fundamentals of Physics: Halliday and Resnick

## F.Y.B.Sc. PHYSICS

## COURSE : S.PHY.2.PR

**The experiment will be from the following groups**

### **Group I**

1. Static Electricity (Demo).
2. Capacitor designing and measurement of capacitance with DMM.
3. Inductor designing and measurement of inductance with DMM.
4. Mutual induction.
5. Helmholtz Coil.
6. Capacitor charging.
7. Determination of internal resistance and pure “L” by LR circuit.
8. Determination of internal resistance and pure “C” by CR circuit.
9. Change in reactance of L or C with frequency of input signal.
10. LCR resonance.
11. Study of voltage divider and current divider circuits.
12. Determination of specific resistance of a conductor.

### **Group II**

1. Mirrors.
2. Single lens: Real images and virtual images.
3. Combination of lens to design telescope and microscope.
4. Lens aberration: Spherical/ Chromatic.
5. Total internal reflection.
6. Study of prisms.
7. Wedge shaped film.
8. Newton's ring.
9. Study of spectra of different sources.
10. Transmission and reflection grating to find refractive index of liquid using Laser.
11. Brewster's law.

### **REFERENCES:**

1. Advanced Practical Physics – Worsnop & Flint
  2. Advanced course in Practical Physics D. Chattopadhyaya , P.C. Rakshit& B. Saha
  3. B. Sc. Practical Physics –C. L. Arora
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