PHYSICS

Course Structure

Units	Topics	Marks
I	**Electrostatics**	
Chapter 1	Electric Charges and Fields	
Chapter 2	Electrostatic Potential and Capacitance	15
II	**Current Electricity**	
Chapter 3	Current Electricity	
III	**Magnetic Effect of Current & Magnetism**	
Chapter 4	Moving Charges and Magnetism	
Chapter 5	Magnetism and Matter	16
IV	**Electromagnetic Induction & Alternating Current**	
Chapter 6	Electromagnetic Induction	
Chapter 7	Alternating Current	
V	**Electromagnetic Waves**	
Chapter 8	Electromagnetic Waves	
VI	**Optics**	17
Chapter 9	Ray Optics and Optical Instruments	
Chapter 10	Wave Optics	
VII	**Dual Nature of Matter**	
Chapter 11	Dual Nature of Radiation and Matter	
VIII	**Atoms & Nuclei**	10
Chapter 12	Atoms	
Chapter 13	Nuclei	
IX	**Electronic Devices**	
Chapter 14	Semiconductor Electronics	12
X	**Communication Systems**	

Chapter 15	Communication Systems	
XI	**Practical Work**	30
Total		**100**

Course Syllabus

Unit I: Electrostatics

Chapter 1: Electric Charges and Fields

- ➢ Electric Charges:
    - • Conservation of charge
    - • Coulomb's law-force between two point charges
    - • Forces between multiple charges
    - • Superposition principle
    - • Continuous charge distribution
- ➢ Electric field, electric field due to a point charge, electric field lines, electric dipole, electric field due to a dipole, torque on a dipole in uniform electric field.
- ➢ Electric flux, statement of Gauss's theorem and its applications to find field due to infinitely long straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell (field inside and outside).

Chapter-2: Electrostatic Potential and Capacitance

- ➢ Electric potential, potential difference, electric potential due to a point charge, a dipole and system of charges
- ➢ Equipotential surfaces, electrical potential energy of a system of two point charges and of electric dipole in an electrostatic field
- ➢ Conductors and insulators, free charges and bound charges inside a conductor
- ➢ Dielectrics and electric polarisation, capacitors and capacitance, combination of capacitors in series and in parallel, capacitance of a parallel plate capacitor

with and without dielectric medium between the plates, energy stored in a capacitor.

Unit II: Current Electricity

Chapter 3: Current Electricity

- Electric current, flow of electric charges in a metallic conductor, drift velocity, mobility and their relation with electric current
- Ohm's law, electrical resistance, V-I characteristics (linear and non-linear), electrical energy and power, electrical resistivity and conductivity
- Carbon resistors, colour code for carbon resistors; series and parallel combinations of resistors; temperature dependence of resistance
- Internal resistance of a cell, potential difference and EMF of a cell, combination of cells in series and in parallel
- Kirchhoff's laws and simple applications
- Wheatstone bridge, metre bridge
- Potentiometer:
  - Principle and its applications to measure potential difference and for comparing EMF of two cells
  - Measurement of internal resistance of a cell

Unit III: Magnetic Effects of Current and Magnetism

Chapter 4: Moving Charges and Magnetism

- Concept of magnetic field:
  - Oersted's experiment
- Biot - Savart law and its application to current carrying circular loop
- Ampere's law and its applications to infinitely long straight wire
- Straight and toroidal solenoids
- Force on a moving charge in uniform magnetic and electric fields

- Cyclotron
- Force on a current-carrying conductor in a uniform magnetic field
- Force between two parallel current-carrying conductors-definition of ampere
- Torque experienced by a current loop in uniform magnetic field; moving coil galvanometer-its current sensitivity and conversion to ammeter and voltmeter.

Chapter 5: Magnetism and Matter

- Current loop as a magnetic dipole and its magnetic dipole moment
- Magnetic dipole moment of a revolving electron
- Magnetic field intensity due to a magnetic dipole (bar magnet) along its axis and perpendicular to its axis
- Torque on a magnetic dipole (bar magnet) in a uniform magnetic field:
  - Bar magnet as an equivalent solenoid
  - Magnetic field lines
  - Earth's magnetic field
  - Magnetic elements
- Para-, dia- and ferro - magnetic substances, with examples
- Electromagnets and factors affecting their strengths
- Permanent magnets

Unit IV: Electromagnetic Induction and Alternating Currents

Chapter 6: Electromagnetic Induction

- Electromagnetic induction:
  - Faraday's laws
  - Induced EMF and current
  - Lenz's Law
  - Eddy currents
- Self and mutual induction.

Chapter 7: Alternating Current

- Alternating currents:
  - Peak and RMS value of alternating current/voltage
  - Reactance and impedance
  - LC oscillations (qualitative treatment only)
  - LCR series circuit
  - Resonance
  - Power in AC circuits
  - Wattless current
- AC generator and transformer

Unit V: Electromagnetic waves

Chapter 8: Electromagnetic Waves

- Basic idea of displacement current, Electromagnetic waves, their characteristics, their transverse nature (qualitative ideas only).
- Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, X-rays, gamma rays) including elementary facts about their uses.

Unit VI: Optics

Chapter 9: Ray Optics and Optical Instruments

- Ray Optics:
  - Reflection of light
  - Spherical mirrors
  - Mirror formula
  - Refraction of light
  - Total internal reflection and its applications
  - Optical fibres
  - Refraction at spherical surfaces

- Lenses
- Thin lens formula
- Lensmaker's formula

➢ Magnification, power of a lens, combination of thin lenses in contact combination of a lens and a mirror

➢ Refraction and dispersion of light through a prism.

➢ Scattering of light - blue colour of sky and reddish appearance of the sun at sunrise and sunset

➢ Optical instruments: Microscopes and astronomical telescopes (reflecting and refracting) and their magnifying powers

Chapter 10: Wave Optics

➢ Wave optics: Wave front and Huygen's principle, reflection and refraction of plane wave at a plane surface using wave fronts

➢ Proof of laws of reflection and refraction using Huygen's principle

➢ Interference Young's double slit experiment and expression for fringe width, coherent sources and sustained interference of light

➢ Diffraction due to a single slit, width of central maximum

➢ Resolving power of microscopes and astronomical telescopes

➢ Polarisation, plane polarised light Brewster's law, uses of plane polarised light and Polaroids

Unit VII: Dual Nature of Matter and Radiation

Chapter 11: Dual Nature of Radiation and Matter

➢ Dual nature of radiation

➢ Photoelectric effect

➢ Hertz and Lenard's observations

➢ Einstein's photoelectric equation-particle nature of light

➢ Matter waves-wave nature of particles, de Broglie relation

> ➢ Davisson-Germer experiment (experimental details should be omitted; only conclusion should be explained).

Unit VIII: Atoms & Nuclei

Chapter 12: Atoms

> ➢ Alpha-particle scattering experiment
> ➢ Rutherford's model of atom
> ➢ Bohr model
> ➢ Energy levels
> ➢ Hydrogen spectrum

Chapter 13: Nuclei

> ➢ Composition and size of:
>   - Nucleus
>   - Atomic masses
>   - Isotopes
>   - Isobars
>   - Isotones
> ➢ Radioactivity alpha, beta and gamma particles/rays and their properties
> ➢ Radioactive decay law
> ➢ Mass-energy relation:
>   - Mass defect
>   - Binding energy per nucleon and its variation with mass number
>   - Nuclear fission
>   - Nuclear fusion

Unit IX: Electronic Devices

Chapter 14: Semiconductor Electronics: Materials, Devices and Simple Circuits

- Energy bands in conductors, semiconductors and insulators (qualitative ideas only)
- Semiconductor diode - I-V characteristics in forward and reverse bias, diode as a rectifier
- Special purpose p-n junction diodes: LED, photodiode, solar cell and Zener diode and their characteristics, Zener diode as a voltage regulator
- Junction transistor, transistor action, characteristics of a transistor and transistor as an amplifier (common emitter configuration), basic idea of analog and digital signals, Logic gates (OR, AND, NOT, NAND and NOR).

Unit X: Communication Systems

Chapter 15: Communication Systems

- Elements of a communication system (block diagram only)
  - Bandwidth of signals (speech, TV and digital data)
  - Bandwidth of transmission medium
- Propagation of electromagnetic waves in the atmosphere, sky and space wave propagation, satellite communication
- Need for modulation, amplitude modulation and frequency modulation, advantages of frequency modulation over amplitude modulation
- Basic ideas about internet, mobile telephony and global positioning system (GPS).

Practical Work

- ➢ Record of at least 15 Experiments to be performed by the students.
- ➢ Record of at least 5 to be demonstrated by the teachers.
- ➢ The Report of the project, to be carried out by the students.