

Year & Sem: P2S2	Course Code: P223	Course Name: Physics	No. of Credits: 4	L-T-P: 2-2-1
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Syllabus

UNIT-1: ELECTRIC CHARGE, FIELD AND POTENTIAL

Charge and electric force (Coulomb's law) - Triboelectric effect and charge, Coulomb's Law, Conductors and Insulators, Conservation of Charge. **Electric field**- Electric field definition, Electric field direction, Magnitude of electric field created by a charge, Net electric field from multiple charges in 1D, Net electric field from multiple charges in 2D, Electric field, Proof: Field from infinite plate (part 1), Proof: Field from infinite plate (part 2). **Electric potential energy, electric potential, and voltage**- Electric potential energy, Electric potential energy (part 2-- involves calculus), Voltage, Electric potential energy of charges, Electric potential at a point in space, Electric potential charge configuration.

UNIT-2: CIRCUITS

Ohm's law and circuits with resistors- Basic electrical quantities: current, voltage, power, Introduction to circuits and Ohm's law, Resistors in series, Resistors in parallel, Example: Analyzing a more complex resistor circuit, Analyzing a resistor circuit with two batteries, Resistivity and conductivity, Kirchhoff's laws, Kirchhoff's current law, Kirchhoff's voltage law, Electric power, Voltmeters and Ammeters, Electrolytic conductivity. **Circuits with capacitors** - Capacitors and capacitance, Capacitance, Energy of a capacitor, Capacitors in series, Capacitors in parallel, Dielectrics in capacitor.

UNIT-3: MAGNETIC FORCES,

Magnets and Magnetic Force- Introduction to magnetism, What is magnetic force, Magnetic force on a charge, Cross product 1, Cross product 2, Magnetic force on a proton example (part 1), Magnetic force on a proton example (part 2), Magnetic force on a current carrying wire.

UNIT-4: MAGNETIC FIELDS AND FARADAY'S LAW

Magnetic field created by a current- What are magnetic fields, Magnetic field created by a current carrying wire, Magnetic force between two currents going in the same direction, Magnetic force between two currents going in opposite directions, Induced current in a wire. **Electric motors**- Electric motors (part 1), Electric motors (part 2), Electric motors (part 3), The dot product, Dot vs. cross product, Calculating dot and cross products with unit vector notation. **Magnetic flux and Faraday's law**- What is magnetic flux, Flux and magnetic flux, Faraday's Law Introduction, Lenz's Law, What is Faraday's law, Faraday's Law example, Emf induced in rod traveling through magnetic field, Faraday's Law for generating electricity. Einstein velocity addition formula derivation, Applying Einstein velocity addition, Finding an in-between frame of reference, Calculating neutral velocity, Time dilation.

UNIT-5: QUANTUM PHYSICS

Photons- Photon Energy, Photon Momentum, Photoelectric effect, Photoelectric effect. **Atoms and electrons**- De Broglie wavelength, Quantum Wave function, Atomic Energy Levels, Bohr model radii (derivation using physics), Bohr model radii, Bohr model energy levels (derivation using physics), Bohr model energy levels, Absorption and emission, Emission spectrum of hydrogen, Bohr's model of hydrogen. **Quantum numbers and orbitals**- The quantum mechanical model of the atom, Heisenberg uncertainty principle,

Quantum numbers, Quantum numbers for the first four shells. **Nuclei-** Mass defect and binding energy, Nuclear stability and nuclear equations, Types of decay, Writing nuclear equations for alpha, beta, and gamma decay, Half-life and carbon dating, Half-life plot, Exponential decay formula proof (can skip, involves calculus), Introduction to exponential decay, More exponential decay examples, Exponential decay and semi-log plots.

UNIT-6: INTRODUCTION TO SEMICONDUCTORS AND BASIC ELECTRONICS

Intrinsic and Extrinsic semiconductors- Intrinsic semiconductors, extrinsic semiconductors, n-type and p-type semiconductors. **Junction Diode-** p-n junction diode, forward bias, reverse bias, voltage-current (V-I) characteristics, junction diode as rectifier, half wave rectifier and full wave rectifier, Zener diode, Zener diode as voltage regulator. **Transistors-**p-n-p transistor, n-p-n transistor, transistor configurations, transistor characteristics, transistor as amplifier. **Logic Gates-** AND gate, OR gate, NOT gate, NOR gate, NAND gate.

Practicals:

1. Magnetic lines of force,
2. Verification of Ohm's Law,
3. Meter bridge,
4. P-N Junction Diode.
5. Newton's Rings

References:

1. www.khanacademy.org
2. www.wikipedia.com
3. University Physics with Modern Physics (Hugh D. Young, Roger A. Freedman and A. Lewis Ford)
4. Fundamentals of Physics by H. C. Verma.
5. Principles of Physics by Halliday, Resnick and Walker