# COURSE OUTLINE FOR ELECTROMAGNETISM AND MODERN PHYSICS

**ELECTRIC CHARGE AND ELECTRIC FIELD**

Electric Charge, Electric Charge and structure of Matter, Induced Charges, Continuous Charge distribution, Motion of Charged Particle in an Electric Field

**CAPACITANCE AND DIELECTRIC**

Definition of Capacitor and Capacitance, Factors that affect the capacitance of a Capacitor, Types of capacitors, Determination of capacitance of a capacitor, capacitors in series and in parallel, Energy stored in a capacitor, dielectrics, molecular view of a dielectric, uses of capacitors.

**ALTERNATING CURRENT CIRCUIT**

AC circuits containing single elements, RMS qualities, R-L-C Circuits, Resonance in R-L-C circuits

**WAVES AND PARTICLES**

Photoelectric effect, Compton effect, Wave-Particle Duality, Uncertainty principle.

**SOURCES OF MAGNETIC FIELDS**

The Biot-Savart Law, Magnetic field due to current loop, Magnetic field along the circular current loop, magnetic field on the axis of a long solenoid, magnetic field in toroid, Ampere's law.

**ELECTROMAGNETIC INDUCTION**

Concept of Induced EMF, Faraday's Law of induction and Lenz's Law, Motional EMF's, Induced Electric Fields, Betatron-particle accelerator by induced electric field, Transformers, Artificial External pacemakers.

**INDUCTANCE AND ENERGY STORAGE IN MAGNETIC FIELDS**

Mutual Inductance, Self-Inductance, Energy stored in a magnetic field, Magnetic Properties of matter

**MAGNETIC PROPERTIES OF MATTER**

Properties of magnetic materials, diamagnetism, Paramagnetism, Ferromagnetism and its type, the magnetization curve, Curie Temperature.

**GAUSS' LAW**

Statement of Gauss law and some applications, Electric Flux and charge in Conductor.

**ELECTRIC POTENTIAL**

Electric Potential difference, Electric potential due to single point charge, electric potential due to continuous charge distribution, Equipotential surfaces, charge sharing and dielectric breakdown, Electrostatic potential Energy.

**MAGNETISM**

Magnets and Magnetic fields, Electric Current as source of magnetism, magnetic forces on wire carrying currents, forces on moving electrical charges in a magnetic field, Hall Effect, Cyclotrons, Torque on current loop, Galvanometers and Motors, The earth magnetism, magnetic flus pattern in the Earth's field.

**MAXWELL'S QUATIONS AND ELECTROMAGNETIC WAVES**

Maxwell's Equation, The Physical basis for Maxwell's equations, the electromagnetic spectrum.

**ELECTRIC CURRENT**

The Electric Cell and batteries, cells in series and in parallel, resistance and resistors, factors affecting the resistance of a resistor, Electric Power, Superconductivity.

**DC CIRCUITS AND INSTRUMENTS**

Resistors in series and in parallel, Kirchhoff's laws (KCL and KVL), the Potentiometer, R-C circuits, Electrostatics Voltmeter, Cathode Ray Oscilloscope (CRO), the digital voltmeter.
Semiconductors, The junction diode, Bipolar junction Transistors and its applications.

**ATOMIC PHYSICS**

Charge and mass of Electron, Atomic Structure, the Bohr Theory, Spectophotometry, X-ray.

**NUCLEAR PHYSICS**

Nuclear masses, constituent and binding of the nucleus, Radioactivity
Nuclear Reactions-Fussion and Fission, Elementary particles, the forces of nature.