Name of the Department/Centre: Physics

Course Type (Please tick appropriate box):

Major	X	Discipline Specific Core		Ability Enhancement	
Minor		Multidisciplinary		Skill Enhancement	
Value Added		Any other			

Semester - II

Course Title – Electricity Magnetism I

Course Type – Major (Core)

Maximum Marks: 100

Course Code - 24-PHY-C-151

Course Level – 100

Total Credits – 3

Classes /week – 3

Prerequisite – Mathematical Physics I

Course Advisor's Name :

Course Advisor's Email :

Expected Learning Outcome –

After completing this course, the students will be able to -
1. Apply mathematical techniques to solve problems in electromagnetism.
2. Analyze and interpret physical phenomena using vector calculus.
3. Demonstrate understanding of fundamental laws and principles in electromagnetism.
4. Apply theoretical knowledge to solve practical problems.
5. Develop problem-solving skills using analytical and numerical methods

Reference Books:

1. Introduction to Electrodynamics : D.J. Griffiths
2. Electricity and Magnetism : A.S. Mahajan and A.A. Rangwala
3. Electricity and Magnetism : Berkeley Physics Course ed. E.M. Purcell
4. Physics (Vol. 2) : Halliday and Resnick
5. Feynman Lectures in Physics (Vol II)

Course Syllabus

Unit I: Vector Analysis

Vector Algebra, Triple products, Differential calculus, gradient, divergence and curl, Product rules, Vector identities, Line, surface and volume integrals, Fundamental theorems, curvilinear coordinates, Helmoholz theorm.

Unit II: Electrostatics

Coulomb's law, Electric field, Continuous charge distribution, Divergence of Electric field, Electric flux. Gauss' Law with applications, Curl of Electric field, Electrostatic potential,. Conservative nature of Electrostatic Field, Laplace's and Poisson equations, Work and energy, Conductors, Surface charge and force on a conductor. Capacitors, Uniqueness Theorems, Boundary conditions, Method of images and application, Separation of variables. Problems.

Unit III: Magnetostatics

Magnetic effect of steady current, Equation of continuity and steady current, Lorentz force and concept of magnetic induction, force on linear current element, Biot-Savart law and its simple applications: straight wire and circular loop, Ampere's Circuital Law and its application to (1) Solenoid and (2) Toroid. Divergence and curl of magnetic field, Vector potential. Boundary conditions, Problems.

Unit IV: Faraday's law

Electromagnetic induction: Integral and differential forms. Induced electric field and emf. Mutual and self-inductance. Transformers. Magnetic field energy.
Electromotive Force, Motional e.m.f.-simple problems, Electromagnetic induction, Faraday's Law. Lenz's Law. Self Inductance and Mutual Inductance. Reciprocity Theorem. Calculation of self and mutual inductance in simple cases, Energy stored in a Magnetic Field. Charge Conservation and Displacement current. Introduction to Maxwell's Equations.

Name of the Department/Centre: Physics

Course Type (Please tick appropriate box):

Major	X	Discipline Specific Core		Ability Enhancement	
Minor		Multidisciplinary		Skill Enhancement	
Value Added		Any other			

Semester - II

Course Title – Thermal Physics

Course Type – Major (Core)

Maximum Marks: 100

Course Code - 24-PHY-C-152

Course Level – 100

Total Credits – 3

Classes /week – 3

Prerequisite – Physics in class XII

Course Advisor's Name :

Course Advisor's Email :

Expected Learning Outcome –

After completing this course, the students will be able to -
1. Apply kinetic theory and thermodynamic principles to explain physical phenomena.
2. Analyze and interpret data related to gas behavior and thermodynamic processes.
3. Demonstrate understanding of fundamental laws and equations governing thermodynamics.
4. Apply mathematical models to solve problems in thermodynamics.
5. Develop problem-solving skills using analytical and numerical methods.

Reference Books:

1. A Text book of heat: M. N Saha and B.N Srivastava
2. Heat and Thermodynamics: Zemansky, Richard Dittman .
3. Thermal Physics : Garg, Bansal and Ghosh .
4. Thermodynamics, Kinetic Theory and Statistical Thermodynamics: Sears, Salinger

Course Syllabus

Unit I: Kinetic theory of gases

Basic postulates of kinetic theory, Pressure of an ideal gas, Maxwell-Boltzmann Law of Distribution of velocities and energy of an Ideal Gas. Mean, RMS and Most Probable Speeds. Degrees of Freedom. Law of Equipartition of Energy and its applications, Specific heats of Gases Mean Free Path, Collision Probability, Distribution of Mean Free Paths,

Unit II: Ideal and Real gases

Transport Phenomenon in Ideal Gases: (1) Viscosity, (2) Thermal Conductivity and (3) Diffusion. Brownian Motion and its Significance. Behavior of Real Gases: Deviations from the Ideal Gas Equation. The Virial Equation. Andrew's Experiments on CO2 Gas. Critical Constants. Continuity of Liquid and Gaseous State. Vapour and Gas. Boyle Temperature. Van der Waal's Equation of State for Real Gases. Values of Critical Constants. Law of Corresponding States. Joule-Thomson Effect for Real and Van der Waal Gases.

Unit III: Thermodynamics

Thermodynamic Variables, Thermodynamic Equilibrium, Zeroth Law of Thermodynamics, Concept of Temperature, Work and Heat, State Functions, Internal Energy, First Law of Thermodynamics, General Relation between Cp and Cv, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Co-efficient. Reversible and Irreversible process, Conversion of Work and Heat. Heat Engines. Carnot's Cycle, Carnot engine and efficiency, Refrigerator and coefficient of performance, 2nd Law of Thermodynamics: Kelvin-Planck and Clausius Statements, Carnot's Theorem. Thermodynamic Scale of Temperature

Unit IV: Entropy, Thermodynamic Potentials and Maxwell's relations

Entropy, Clausius Theorem, Clausius Inequality, Entropy of a perfect gas. Principle of Increase of Entropy. Entropy Changes in Reversible and Irreversible processes. Entropy of the Universe. Temperature–Entropy diagrams for Carnot's Cycle, Third Law of Thermodynamics. Unattainability of Absolute Zero, Thermodynamic Potentials : Enthalpy, Helmholtz Free Energy, Gibbs Free Energy: Properties and applications, First and second order Phase Transitions, Clausius-Clapeyron Equation and Ehrenfest criterion. Maxwell's Thermodynamic Relations - Derivations and applications of Maxwell's Relations such as Clausius-Clapeyron Equation, Cp-Cv, TdS Equations, Joule-Kelvin coefficient for Ideal and Van der Waal Gases, Energy equations, Change of Temperature during Adiabatic Process.