Course Number & Title: **PH1100L: General Physics Lab-1**	
L-T-P-C: 0-0-3-3	
Course Content/ Syllabus: List of Experiments: Determination of g by Compound pendulum, Surface tension of a liquid by Jaeger's Method, Magnetic field along the axis of a coil, Resonance and Q factor of a LCR circuit, Hall Effect in an extrinsic semiconductor, Newton's ring, Plane Transmission Grating, Linear Air track, Error analysis.	
Books	
Texts:	
1.	Taylor, John R. *"Error analysis."* Univ. Science Books, Sausalito, California 20 (1997).
2.	Ghatak, Ajoy. *Contemporary Optics.* Springer Science & Business Media, 2012
3.	Mahajan, A. and Rangawala, A. *Electricity and Magnetism*. Mc. Gras Hill (2017).
4.	Mathur D.S. *Elements of Properties of Matter.* S. Chand (2010).

Course Number & Title: **PH 1130: Classical Mechanics**
L-T-P-C: 2-1-0-6
Course Content/ Syllabus: **Review of kinematics**: Position, velocity, acceleration vectors in rectilinear, plane polar, cylindrical and spherical polar coordinate systems. Review of Newtonian mechanics in rectilinear coordinate system; Motion in plane polar coordinates; forces and equations of motion, simple harmonic motion. System of particles, center of mass, center of mass coordinates, conservation of momentum; Work-energy theorem, conservation laws; non-conservative forces. **Rigid body dynamics**: Angular momentum and fixed axis of rotation; dynamics of fixed axis rotation, work-energy theorem and rotational motion; Moment of Inertia tensor; Euler angles; Euler equations. **Lagrangian and Hamiltonian mechanics:** Degrees of freedom, Constraints and constraint forces, D'Alembert's principle, Generalized coordinates, Principle of least action; Lagrange's equations of motion, Generalized momentum, Ignorable coordinates; symmetry and conservation theorems; Concept of phase space, Hamilton's equations of motion and applications, Poisson Brackets. **Central Force problem**: Central force as a one-body problem; planetary motion; Equation of orbit. **Oscillations:** Small oscillations in a bound system, stability, normal modes, damped oscillations, driven damped oscillations, resonance. **Special Theory of Relativity**:

Postulates of special theory of relativity; Lorentz transformation; Time dilation; Doppler effect; Length contraction; Twin paradox; Relativistic addition of velocities; Mass and energy; Energy Momentum relationships.	
Books	
Texts:	
1.	John Taylor, *Classical mechanics* (University Science Books, 2005)
2.	D. Kleppner and R. Kolenkow, *An Introduction to Mechanics*, 2nd Ed. Cambride University Press (2014).
References:	
1	Resnick, Robert. *Introduction to special relativity*. John Wiley & Sons, 1991.
2	Goldstein H. *Classical mechanics*. Pearson Education India; 2011
3 4	L.D. Landau and E.M. Lifshitz, *Mechanics*, Elsevier (2005). Takwale R and Puranik P, *Introduction to Classical Mechanics*, (McGraw Hill Education, 1st Ed., 2017).

Sl. No.(or week No. or Module no.)	Topics: Subtopics	Tentative number of Lectures (in hours)
1	**Review of kinematics**: Position, velocity, acceleration vectors in rectilinear, plane polar, cylindrical and spherical polar coordinate systems. Review of Newtonian mechanics in rectilinear coordinate system; Motion in plane polar coordinates; forces and equations of motion, simple harmonic motion. System of particles, center of mass, center of mass coordinates, conservation of momentum; Work-energy theorem, conservation laws; non-conservative forces.	3
2	**Rigid body dynamics**: Angular momentum and fixed axis of rotation; dynamics of fixed axis rotation, work-energy theorem and rotational motion; Moment of Inertia tensor; Euler angles; Euler equations	3
3	**Lagrangian and Hamiltonian mechanics:** Degrees of freedom, Constraints and constraint forces, D'Alembert's principle, Generalized coordinates, Principle of least action; Lagrange's equations of motion, Generalized momentum, Ignorable coordinates; symmetry and conservation theorems; Concept of phase space, Hamilton's equations of motion and applications,	11

	Poisson Brackets.	
4	**Central Force problem**: Central force as a one-body problem; planetary motion; Equation of orbit.	3
5	**Oscillations:** Small oscillations in a bound system, stability, normal modes, damped oscillations, driven damped oscillations, resonance.	3
6	**Special Theory of Relativity**: Postulates of special theory of relativity; Lorentz transformation; Time dilation; Doppler effect; Length contraction; Twin paradox; Relativistic addition of velocities; Mass and energy; Energy Momentum relationships.	5
	Total Number of Lectures =	28

Course Number & Title: **PH1230: Electrodynamics**
L-T-P-C: 3-1-0-8
Course Content/ Syllabus:
Essential mathematical tools: Review of Stokes and Gauss' divergence theorem, Curvilinear coordinates, Gradient, divergence, and curl in curvilinear coordinates; Dirac Delta function. **Electrostatics:** Gauss law in integral and differential forms; Scalar potential, potential due to charge distributions, and Laplace/Poisson equation; Work and energy; Uniqueness theorem, Dirichlet and Neumann boundary conditions; Image charge problems, point charge in front of an infinite grounded conducting plane, point charge in front of a grounded conducting sphere and conducting infinite plane. **Solutions of Laplace Equation:** Separating variables in Cartesian, spherical, and cylindrical coordinates and general solution (Legendre polynomials, Bessel functions). Multipole expansion. **Dielectrics:** Polarization, Surface and volume-bound charges; Gauss' law in dielectrics, Displacement vector ; Boundary value problem with linear dielectric; Image charge problem with dielectric; Forces on dielectrics; Magnetism: Review of Biot-Savart's law, Lorentz Force. vector potential, and forces on magnetic dipoles; Magnetic materials, Bound currents, Boundary value problems. Magnetic field in conductors. **Steady current and electromagnetic fields:** Review of Ohm's law, Faraday's law, Lenz's law, and Electromotive force; Ampere's law and Displacement current; Maxwell's equations in vacuum and media; Gauge

transformation and gauge conditions; Poynting vector and Poynting theorem; Plane waves, Polarization of EM field; Propagation in nonconducting and conducting media. Reflection and refraction with normal and oblique incidence, Fresnel relations, Brewster's angle. **Dipole radiation:** Radiation, dipole radiation from oscillating electric dipole, Retarded potential, Intensity distribution of radiating dipole.

Books	
Texts:	
1.	Griffiths, David J. *Introduction to electrodynamics.* Cambridge University Press, 2023.
2.	Sadiku MN, Kulkarni SV. Principles of electromagnetics. New Delhi, India: oxford university Press; 2015 Sep

Sl. No.(or week No. or Module no.)	Topics: Subtopics	Tentative number of Lectures (in hours)
1	**Essential mathematical tools:** Review of Stokes and Gauss' divergence theorem, Curvilinear coordinates, Gradient, divergence, and curl in curvilinear coordinates; Dirac Delta function.	3
2	**Electrostatics:** Gauss law in integral and differential forms; Scalar potential, potential due to charge distributions, and Laplace/Poisson equation; Work and energy; Uniqueness theorem, Dirichlet and Neumann boundary conditions; Image charge problems, point charge in front of an infinite grounded conducting plane, point charge in front of a grounded conducting sphere and conducting infinite plane	7
3	**Solutions of Laplace Equation:** Separating variables in Cartesian, spherical, and cylindrical coordinates and general solution (Legendre polynomials, Bessel functions). Multipole expansion.	5
4	**Dielectrics:** Polarization, Surface and volume-bound charges; Gauss' law in dielectrics, Displacement vector ; Boundary value problem with linear dielectric; Image	11

	charge problem with dielectric; Forces on dielectrics; Magnetism: Review of Biot-Savart's law, Lorentz Force. vector potential, and forces on magnetic dipoles; Magnetic materials, Bound currents, Boundary value problems. Magnetic field in conductors.	
5	**Steady current and electromagnetic fields:** Review of Ohm's law, Faraday's law, Lenz's law, and Electromotive force; Ampere's law and Displacement current; Maxwell's equations in vacuum and media; Gauge transformation and gauge conditions; Poynting vector and Poynting theorem; Plane waves, Polarization of EM field; Propagation in nonconducting and conducting media.	10
6	Reflection and refraction with normal and oblique incidence, Fresnel relations, Brewster's angle.	4
7	**Dipole radiation:** Radiation, dipole radiation from oscillating electric dipole, Retarded potential, Intensity distribution of radiating dipole	2
	Total Number of Lectures =	42