Course Number & Title: **PH111xH: Introductory Classical Mechanics**
L-T-P-C: 2-1-0-3
Course Content/ Syllabus: **Kinematics**: Position, velocity, acceleration vectors in rectilinear, plane polar, cylindrical and spherical polar coordinate systems. **Laws of Mechanics**: Newton's laws of motion, dynamics using polar coordinates; forces and equations of motion, simple harmonic motion. **Momentum and Energy**: System of particles, center of mass, center of mass coordinates, conservation of momentum; Work-energy theorem, conservation laws; non-conservative forces. **Angular Momentum**: Angular momentum about fixed axis of rotation, dynamics of fixed axis rotation, work-energy theorem and rotational motion. **Motion in non-inertial frame**: Galileo-Newton law of inertia, motion of an object in a linearly accelerated frame of reference; motion of an object in a rotating frame of reference. ***Oscillations:*** *Small oscillations in a bound system, stability, normal modes, damped oscillations, driven damped oscillations, resonance.*
Books
Texts:

1.	D. Kleppner and R. Kolenkow, *An Introduction to Mechanics*, 2nd Ed. Cambridge University Press (2014).
2.	Charles Kittel, Walter D. Knight, Malvin A. Ruderman, A. Carl Helmholz, Burton J. Moyer, *Mechanics (Berkeley Physics Course, Vol. 1)*, McGraw-Hill Book Company (1973)
3.	John Taylor, *Classical mechanics*, (University Science Books, 2005).

NB: x is digit between (0-9)

Week No	Topics: Subtopics	Tentative number of Lectures (in hours)
1	**Kinematics**: Position, velocity, acceleration vectors in rectilinear, plane polar, cylindrical and spherical polar coordinate systems.	3
2	**Laws of Mechanics**: Newton's laws of motion, dynamics using polar coordinates; forces and equations of motion, simple harmonic motion.	2
3	**Momentum and Energy**: System of particles, center of mass, center of mass coordinates, conservation of momentum; Work-	2

	energy theorem, conservation laws; non-conservative forces.	
4	**Angular Momentum**: Angular momentum about fixed axis of rotation, dynamics of fixed axis rotation, work-energy theorem and rotational motion.	3
5	**Motion in non-inertial frame**: Galileo-Newton law of inertia, motion of an object in a linearly accelerated frame of reference; motion of an object in a rotating frame of reference.	2
6	**Oscillations:** Small oscillations in a bound system, stability, normal modes, damped oscillations, driven damped oscillations, resonance	2
	Total Number of Lectures =	14

Course Number & Title: **PH131xH: Modern Physics**

L-T-P-C: 2-1-0-3

Course Content/ Syllabus:

Theory of Relativity: Postulates of special theory of relativity; The Michelson-Morley experiment; Time dilation; Doppler effect; Length contraction; Velocity addition; Mass and energy; Energy and Momentum;.

Particle properties of waves: Electromagnetic waves; Blackbody radiation; Photoelectric effect; X-rays; X-ray diffraction; Compton effect; Pair production;.

Wave properties of particles: De Broglie waves; Describing a matter wave; Phase and Group velocities; Particle diffraction; Particle in a box; Uncertainty principle; Concept of wave function.
Structure of Atom: Rutherford scattering; Bohr's Atomic model; Energy levels and spectra; Correspondence principle; Nuclear mass effect on spectral lines; Sommerfeld's model, Atomic excitation; Basic mechanism of Laser.

Books

Texts:

1. Arthur Beiser, *Concepts of Modern Physics*, McGraw Hill, Eigth Ed. (2024).

References:

1. Robert Eisberg and Robert Resnick, *Quantum Physics*, Wiley India Private Ltd. (2006).
2. J.R. Taylor, C.D. Zafiratos and M.A. Dubson, Modern Physics: For Scientists and Engineers, PHI Learning Pvt. Ltd,2nd Ed. (2009).
3. R. Resnick, *Introduction to Special Relativity*, John Wiley, Singapore (2000).

Sl. No.(or week No. or Module no.)	Topics: Subtopics	Tentative number of Lectures (in hours)
1	**Theory of Relativity:** Postulates of special theory of relativity; The Michelson-Morley experiment; Time dilation; Doppler effect; Length contraction; Velocity addition; Mass and energy; Energy and Momentum	6
2	**Particle properties of waves**: Electromagnetic waves; Blackbody radiation; Photoelectric effect; X-rays; X-ray diffraction; Compton effect; Pair production	2
3	**Wave properties of particles:** De Broglie waves; Describing a matter wave; Phase and Group velocities; Particle diffraction; Particle in a box; Uncertainty principle; Concept of wave function.	3
4	**Structure of Atom**: Rutherford scattering; Bohr's Atomic model; Energy levels and spectra; Correspondence principle; Nuclear mass effect on spectral lines; Sommerfeld's model, Atomic excitation; Basic mechanism of Laser.	3
	Total Number of Lectures =	14

Course Number & Title: **PH121xH Introductory electromagnetics**
L-T-P-C: 2-1-0-3
Course Content/ Syllabus: **Electrostatics:** Gradient, divergence, and curl in curvilinear coordinates; Gauss law in integral form (review) and differential form, calculation of Divergence of E; Curl of E, Scalar potential, potential due to charges and Laplace/Poisson equation; Statements of Uniqueness theorems, boundary value problems and method of images; Dielectrics, Polarization, bound charges (review) and boundary conditions. **Magnetism:** Review of Biot-Savart's law, Lorentz Force. Divergence and curl of magnetic field, vector potential, and forces on magnetic dipoles**;** Magnetic materials and magnetic fields in the matter (magnetostatic case), bound currents **Steady currents 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.
Books (In case of compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References" The books should be compatible to the syllabus.
Texts:

1.		*Purcell, Edward M. Electricity and magnetism. Cambridge university press, 2013*
2.		Griffiths, David J. *Introduction to electrodynamics.* Cambridge University Press, 2023.
References:		
1		Verma, H.C. *Classical Electromagnetism*, Bharati Bhawan,2022.
2		Feynman, Richard P. *The Feynman Lectures on Physics*, Volume 2, Pearson, 2013.

Sl. No.(or week No. or Module no.)	Topics: Subtopics	Tentative number of Lectures (in hours)
1	**Electrostatics:** , Gradient, divergence, and curl in curvilinear coordinates; Gauss law in integral form (review) and differential form, calculation of Divergence of E; Curl of E, Scalar potential, potential due to charges and Laplace/Poisson equation; Statements of Uniqueness theorems, boundary value problems and method of images; Dielectrics, Polarization, bound charges (review) and boundary conditions.	7
2	**Magnetism:** Review of Biot-Savart's law, Lorentz Force. Divergence and curl of magnetic field, vector potential, and forces on magnetic dipoles**;** Magnetic materials and magnetic fields in the matter (magnetostatic case), bound currents	4
3	**Steady currents 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	3
	Total Number of Lectures =	14

Course Number & Title: **PH141xH: Introductory Quantum Mechanics**

L-T-P-C: 2-1-0-3

Course Content/ Syllabus:

Experimental Basis of Quantum Mechanics: Double slit experiment and Stern-Gerlach experiment (basic ideas); De Broglie's hypothesis (matter wave dual nature); Wave-particle duality

Postulates of Quantum Mechanics: Wave function and wave packets; Position and momentum operators, Uncertainty principle, Commutators; Schrödinger equation, Probabilities, probability current densities, wave function normalization; Expectation values, eigenvalues and eigenfunctions.

Applications of Schrödinger Equation: Infinite potential well, energy quantization; Finite square well, potential step and potential barrier, quantum tunnelling; Harmonic Oscillator, energy eigenvalues and eigenfunctions.	
Books	
Texts:	
1.	R. Eisberg and R. Resnick, *Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles*, 2nd Ed. Wiley, 2006.
2.	David J. Griffiths, *Introduction to Quantum Mechanics*, 3rd Edition, 2018.
References:	
1	Ajit Kumar, *Fundamentals of Quantum Mechanics*, Cambridge university press, 2018.

Sl. No.(or week No. or Module no.)	Topics: Subtopics	Number of Lectures (in hours)
1	**Experimental Basis of Quantum Mechanics:** Double slit experiment and Stern-Gerlach experiment (basic ideas); De Broglie's hypothesis (matter wave dual nature); Wave-particle duality	2
2	**Postulates of Quantum Mechanics**: Wave function and wave packets; Position and momentum operators, Uncertainty principle, Commutators; Schrödinger equation, Probabilities, probability current densities, wave function normalization; Expectation values, eigenvalues and eigenfunctions.	7
3	**Applications of Schrödinger Equation**: Infinite potential well, energy quantization; Finite square well, potential step and potential barrier, quantum tunnelling; Harmonic Oscillator, energy eigenvalues and eigenfunctions	5
	Total Number of Lectures =	14

Course Number & Title: **PH110xL/PH120xL: Physics Lab**	
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. C*ontemporary 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).