First-year Physics course for B. Tech

Course Number	**PH1101/PH1201**
Course Credit	3-1-3-5.5
Course Title	Physics
Learning Mode	Lectures and Tutorials
Learning Objectives	Complies with Program Goals 1 and 2
Course Description	This course deals with fundamentals in Classical mechanics, Waves and Oscillations and Quantum Mechanics. As a prerequisite, the mathematical preliminaries such as coordinate systems, vector calculus etc will be discussed in the beginning.
Course Outline	Orthogonal coordinate systems (Plane polar, Spherical, Cylindrical), concept of generalised coordinates, generalised velocity and phase space for a mechanical system, Introduction to vector operators, Gradient, divergence, curl and Laplacian in different co-ordinate systems. Central force problem and its applications. Rigid body rotation, vector nature of angular velocity, Finding the principal axes, Euler's equations; Gyroscopic motion and its application; Accelerated frame of reference, Fictitious forces. Potential energy and concept of equilibrium, Lennard-Jones and double-well potentials, Small oscillations, Harmonic oscillator, damped and forced oscillations, resonance and its different examples, oscillator states in phase space, coupled oscillations, normal modes, longitudinal and transverse waves, wave equation, plane waves, examples two- and three-dimensional waves. Michelson-Morley experiment, Lorentz transformation, Postulates of special theory of relativity, Time dilation and length contraction, Applications of special theory of relativity. **List of Experiments** Experiments in Broad Day light: Decay of Current in A Capacitive Circuit, Q-Factor of an LCR Circuit, Use of Hall probe for magnetic field measurement 'g' by different pendulums Surface Tension of Water by Method of Capillary Ascent (Marangoni effect) Normal modes (double pendulum; two pendulums connected by light spring; spring mass system) Speed of Sound in Air (design of experiments) Experiments in Darkroom:

	Speed of Light in Glass, Determination of e/m, Interference of Light: Newton's Ring, Determination of Planck's constant by Photoelectric Effect, Diffraction of light using single slit, grating and a thin wire (design of experiments)
Learning Outcome	Complies with PLO 1a, 2a, 3a The lab part of this course trains by practical laboratory sessions: 1. Skill development. 2. Students get know the basics of measurement by instrument, accuracy & precision of data, data analysis skill and error handling. Students get to know how various laws of classical and quantum physics plays important role in shaping and explaining various natural phenomena.
Assessment Method	Quiz, Assignments and Exams
Suggested Readings:	**Textbooks:** 1. Engineering Mechanics, M. K. Harbola, 2nd ed., Cengage, 2012 2. D. Kleppner and R. J. Kolenkow, An introduction to Mechanics, Tata McGraw-Hill, New Delhi, 2000. 3. I. G. Main, Oscillations and Waves 4. H. G. Pain, The Physics of Vibrations and Waves, 1968 5. Frank S. Crawford, Berkeley Physics Course Vol 3: Waves and Oscillations, McGraw Hill, 1966. **References:** 1. R. P. Feynman, R. B. Leighton and M. Sands, The Feynman Lecture in Physics, Vol I, Narosa Publishing House, New Delhi, 2009. 2. David Morin, Introduction to Classical Mechanics, Cambridge University Press, NY, 2007. 3. P. C. Deshmukh, Foundations of Classical Mechanics, Cambridge University Press, 2019