Course Title: General Physics I
Course Code: PHYS 101
Credit Hours: 3

Course Description:
This course is prepared to help undergraduate students in developing physical intuition through a comprehensive understanding of fundamental concepts, emphasizing physical concept rather than complicated mathematical treatments. The contents of the course include fundamentals of mechanics, optics, and heat transfer and address the need of engineering and applied sciences.

Course Contents:

MECHANICS

Unit 1: Dynamics of Systems of Particles
Work done by constant and variable forces, Work-energy theorem, conservative and non-conservative forces, force as negative gradient of potential energy, conservation of linear momentum, Center of mass, System of variable mass, particle collision: one dimensional and two dimensional (relation between the scattering angle in CM and L system not required), two-body problem and reduced mass.

Unit 2: Rotational Dynamics
Angular momentum of a single particle and system of particles, Torque, Conservation of angular momentum, Rotation about fixed axis: K. E. of rotation, Moment of inertia and Radius of gyration, Theorem of parallel and perpendicular axes, Calculation of rotational inertia for slender rod, circular disc and solid sphere

Unit 3: Wave and Oscillation
Simple harmonic oscillator, Compound pendulum, loaded spring, Time average of energy, Damped harmonic oscillator, forced vibration and resonance in light damped system

Unit 4: Elasticity
Stress, strain, elastic limit, Elastic and plastic behavior, Types of elasticity, Poisson's ratio, work done per unit volume in stretched wire, Relation between elastic constants (without derivation)

Unit 5: Viscosity
Streamline and turbulent flow, Continuity equation, Bernoulli's principle, Coefficient of viscosity, Newton's formula, Poiseuille's equation for flow of liquid through a tube, Reynold's number

OPTICS

Unit 6: Interference
Monochromatic radiation, Coherent sources, Constructive and destructive interference, Young's double-slit experiment, Intensity distribution, Interference in thin films due to reflected light, Newton's rings

Unit 7: Diffraction
Rectilinear propagation of light, Distinction between Fresnel and Fraunhofer diffraction, Diffraction at single slit and N-slits, Diffraction grating

Unit 8: Polarization
Polarization and transverse nature of light, Double refraction, Polarization by reflection, Brewster's law, Malus' law, Nicol prism as polarizer and analyzer, Optically active substances, Specific rotation

Unit 9: Laser
Properties of laser radiation, the laser process, stimulated and spontaneous emission and population inversion, optical and electrical pumping, Applications of lasers

HEAT

Unit 10: Heat Transfer
Heat flux and thermal conductivity, convection and radiation (Wien's dis- placement law, Rayleigh-Jeans law, limitation of classical law), Planck's law to explain black body radiation, Stefan-Boltzmann law

Experiments:

1. Determination of the value of 'g' by compound pendulum.
2. To determine the Young's modulus of the material of a rectangular bar by the method of bending.
3. To determine the coefficient of viscosity of water by capillary tube method.
4. Determination of thermal conductivity of a bad conductor by Lee's method
5. To determine the wavelength of sodium light by measuring the diameter of Newton's ring.
6. To determine refractive index of sugar solution at different concentrations using a spectrometer.
7. To determine the wavelength of sodium light using a plane diffraction grating
8. Determination of specific rotation of a given sample using a Laurent's half shade polarimeter

References
1. R. Resnick, D. Halliday, *Physics - Part I and Part II*, John Wiley and Sons
2. J. W. Jewett and R. A. Serway, *Physics for Scientists and Engineers*, Cengage Learning
3. W. M. Steen, *Laser Material Processing*, Springer