Engineering Physics I
EG 1104 SH

Year: I **Total: 8 hours /week**
Semester: I **Lecture: 4 hour/week**
Tutorial: 2 hours/week
Practical: hours/week
Lab: 2 hours/week

Course Description

This course in physics is designed to provide students with an understanding of the scientific laws of our physical world, and how physics contributes to life's activities in modern society. The course emphasizes both quantitative and qualitative aspects of physics, involving mathematical models and equations. The application of physics to social and environmental situations is well illustrated.

The practical component of this course is designed to supplement learning through the application of learned theory. The students will handle simple apparatus to do simple measurements, demonstrate simple electrical circuits, and apply their knowledge of physics to real life examples.

Course Objectives

On completion of the course the student will be able to:

- Sustain interest in physics and its applications related to everyday experiences of their life
- Identify the social, economic, environmental and other implications of physics
- Describe physics as a coherent and developing framework of knowledge based on fundamental theories ofthe structures and processes of the physical world
- Demonstrate the skills of experimenting, observing, interpreting data and evaluating evidence to formulate generalizations and models
- Apply knowledge of physical principles to familiar and unfamiliar situations
- Apply facts, vocabulary and conventions to unit measurements and common measuring instruments
- Explain the definitions, laws, concepts, theories and models presented in this course.
- Describe the applications and implications of physical facts and principles.
- Explain the basic concept of Physics relevant to problems for the understanding
- and practicing related in engineering works.

Course content

Unit 1: Mechanics **[22 Hrs.]**

Sub-Unit 1.1: Units and Measurement **[2 Hrs.]**

- Physical concept of mass, length and time.
- Various systems of units and their conversion
- Derived units in terms of fundamental units.
- Precise and accurate measurement
- Dimensional formula for various physical quantities.
- Applications of dimensional equations.
- Simple Numerical Problems

Sub-unit 1.2: Scalars and Vectors **[3 Hrs.]**

- Scalars and vectors with examples.
- Resolution of a vector.

- Triangle and parallelogram law of vectors
- Multiplication of vectors
- Simple Numerical Problems

Sub unit 1.3: Kinematics **[2 Hrs.]**

- Revision of equations of motion
- Projectile motion
- Concepts of relative velocity
- Simple Numerical Problems

Sub-unit 1.4: Newton's Laws of motion **[2 Hrs.]**

- Newton's first, second and third laws of motion.
- Principle of conservation of linear momentum.
- Applications of inertia and impulse.
- Laws of solid friction, angle of friction and angle of repose
- Simple Numerical Problems

Sub unit1.5: Uniform circular Motion **[3 Hrs.]**

- Angular displacement and velocity
- Derivation of the relation $v = \omega r$.
- Vector nature of velocity and change thedirection of velocity in circular motion.
- Derivation of centripetal acceleration and force.
- Motion of a body in a vertical circle.
- Motion of cyclist and motion of vehicle in banked road
- Simple numerical problems

Sub-unit 1.6: Work, Energy and power **[3 Hrs.]**

- Definition and units of work, energy and power and its meaning in Physics
- Potential and kinetic energy.
- Work energy theorem.
- Conservation of energy i.e. change of KE into PEgiving example of freely falling body.
- Transformation of energy into different forms.
- Conservative and non-conservative forces.
- Simple numerical problems.

Sub-unit 1.7: Gravity and Gravitation **[3 Hrs.]**

- Newton's law of gravitation.
- Acceleration due to gravity and its variation due to height, depth and latitude
- Motion of satellites: Escape velocity, orbital velocity, geostationary satellite
- Weightlessness condition in a lift
- Simple numerical problems

Sub unit 1.8: Simple Harmonic Motion **[2 Hrs.]**

- Simple harmonic motion and its characteristics
- Time period, frequency, amplitude of simple harmonic motion
- Speed and acceleration in simple harmonic motion
- Energy of simple harmonic motion
- Simple pendulum and its time period
- Simple numerical problems

Sub unit 1.9: Rotation of Rigid bodies **[2 Hrs.]**

- Forces in equilibrium, center of gravity, center of mass
- Torque, work done by torque, couple
- Moment of inertia

- Angular momentum and its conservation
- Simple numerical problems

Unit 2: Heat and Thermodynamics [18 Hrs.]

Sub unit 2.1: Heat phenomena and Quantity of heat [3 Hrs.]

- Concepts of temperature and thermal equilibrium
- Different scales of temperature and their relations
- Quantity of heat gain and heat loss
- Specific heat capacity and its determination by method of mixture
- Newton's laws of cooling and its explanation
- Simple Numerical Problems

Sub unit 2.2: Change of Phase and Hygrometry [2 Hrs.]

- States of matter, fusion, vaporization, evaporation and boiling
- Determination of specific latent heat of fusion and vaporization
- Saturated and unsaturated vapors
- Variation of melting and boiling points with pressure
- Triple point, dew point and humidity
- Simple Numerical Problem

Sub unit 2.3: Thermal Expansion [3 Hrs.]

- Coefficients of linear, superficial and cubical expansion of a solid and relation between them
- Real and apparent expansions of liquids and their relation
- Variation of density due to change in temperature
- Simple Numerical Problems

Sub unit 2.4: Transfer of Heat [2 Hrs.]

- Methods of heat transfer
- Thermal conduction, conductivity and determination of thermal conductivity
- Radiation
- Black body and its practical realization
- Stefan's law of black body radiation
- Simple Numerical Problems

Sub unit 2.5: Gas Laws and Kinetic Theory of Gas [3 Hrs.]

- Boyle's law, Charle's law and ideal gas equations
- Universal gas constant, Avogadro's number and Boltzmann's constant
- Volume and pressure coefficients of ideal gas
- Pressure exerted by ideal gas according to kinetic theory
- RMS speed and mean energy of a molecule of an ideal gas
- Simple Numerical Problems

Sub units 2.6: Thermodynamics [5 Hrs.]

- First law of thermodynamics
- Thermodynamic processes: Isothermal, adiabatic, isobaric and isochoric
- Equation of adiabatic process.
- Work done in isothermal and adiabatic process.
- Specific and molar heat capacities at constant pressure and constant volume with their relation
- Second law of thermodynamics, working of ideal engine and refrigerator
- Simple Numerical Problems

Unit 3: Optics **[12 Hrs.]**

Sub unit 3.1: Reflection by plane surface **[2 Hrs.]**

- Laws of reflection
- Deviation produced by plane mirror
- Effect on reflected ray due to rotation of mirror
- Minimum size of mirror to see full image of a person.
- Real and virtual images

Sub unit 3.2: Reflection by spherical surfaces **[2 Hrs.]**

- Reflection by concave and convex mirrors
- Formation of image by concave and convex mirrors
- Derivation of mirror formula for concave and convex mirrors
- Uses of spherical mirrors
- Simple numerical Problems

Sub unit 3.3: Refraction through Plane Surfaces **[3 Hrs.]**

- Laws of refraction of light
- Speed of light in different media
- Principle of reversibility of light
- Lateral Shift
- Real and apparent depths
- Total internal reflection and critical angle
- Simple Numerical Problems

Sub unit 3.4: Refraction through Prism and Lenses **[5 Hrs.]**

- Deviation through prism and minimum deviation
- Refraction through lenses
- Formation of images by lenses
- Lens formula and lens maker's formula
- Combination of two thin lenses
- Power and magnification of lenses
- Uses of lenses in compound microscope and Astronomical telescope
- Simple Numerical Problems

Unit 4: Magnetism **[8 Hrs.]**

Sub unit 4.1: Magnets and magnetic fields **[3 Hrs.]**

- Magnetic poles, magnetic moments, magnetic axis, magnetic meridian, real and effective length of magnet
- Magnetic field, magnetic lines of force, Coulomb's law in magnetism
- Magnetic field intensity on axial and equatorial line due to magnetic poles of bar magnet
- Neutral points and Tangent's law
- Simple Numerical Problems

Sub unit 4.2: Terrestrial Magnetism **[2 Hrs.]**

- Horizontal and vertical components of earth's magnetic field
- Angle of declination and angle of dip
- Total intensity of earth's magnetic fields
- Simple Numerical Problems

Sub unit 4.3: Magnetic Properties of Materials **[3 Hrs.]**

- Molecular and modern theory of magnetism
- Dia, Para and Ferromagnetic materials

- Permeability, susceptibility and intensity of magnetization
- Domain theory of ferromagnetism
- Magnetic Hysteresis

Tutorial:
The instructors should practice the numerical problems of following topics as indicated by credit hours.

S. N.	Units	Sub Units	Credit Hrs.	
1	Mechanics	Units and Measurements	1	13
		Scalars and Vectors	1	
		Kinematics	2	
		Newton's Law of Motion	2	
		Works, Energy and Power		
		Gravity and Gravitation	1	
		Uniform Circular Motions	1	
		Simple Harmonic Motion	2	
		Rotation of Rigid Bodies		
		Heat phenomena and quantity of heat	2	
		Change of State and Hygrometry	1	
2	Heat and Thermo Dynamics	Thermal Expansion	2	10
		Transfer of Heat	2	
		Gas Laws and Kinetic theory of Gas		
		Thermodynamics	1	
		Reflection through Plane Surface	2	
		Reflection through Spherical Surface	2	
		Refraction through Plane Surface	1	
3	Optics	Refraction through prism and lenses	-	4
		Magnet and Magnetic Fields	1	
		Terrestrial Magnetism	1	
		Magnetic properties of Materials	2	
4	Magnetism	Permeability, susceptibility and intensity of magnetization	2	3
		Magnetic Hysteresis	1	
Total credit hour			**30**	

Engineering Physics Practical I **[30 Hrs.]**

1. Find volume and density of hollow tube using Vernier calipers.
2. Determine density of a steel / glass using micrometer screw gauge.
3. Determine thickness volume and density of a glass plate using spherometer.
4. Determine the acceleration due to gravity by using simple pendulum.
5. Determine the magnetic movement of a bar magnet using deflection magnetometer.
6. Determine the refractive index of the material of prism.
7. Determine the specific heat capacity of solid by the method of mixture.
8. Determine the specific latent heat of ice by the method of mixture.
9. Determine specific gravity of different solids by up thrust method.
10. Determine focal length of a converging lens by displacement method.

Prescribed Books

1. Engineering Physics –I, 5th edition, Devkota Binaya, Poudyal Khem Nath, Poudyal Dhan Prasad, Gupta Suresh Prasad, Laxmi publication Kathmandu.
2. Advanced level physics by Nelkon and Parker, 5th and later editions
3. College physics by sears, Zemansky and Young, Fourth and later editions
4. Physics practical by S.K. Neupane

Learning materials:

1. Reference to be selected by the related lecture(s) from among the texts available in the market that meet the content needs of this subject.
2. The related institute may develop its own textbook and approve from the related authority so as to have a prescribed textbook of this subject.

Evaluation Scheme

There will be questions covering all the chapters in the syllabus. The evaluation scheme for the questions will be as indicated as in the table below.

S. N.	Units	Sub Units	Credit Hrs.		Total marks
1	Mechanics	Unit and Measurement	2	9	8
		Scalars and Vectors	3		
		Kinematics	2		
		Newton's Law of Motion	2		
		Works, Energy and Power	3	13	16
		Gravity and Gravitation	3		
		Uniform Circular Motions	3		
		Simple Harmonic Motion	2		
		Rotation of Rigid Bodies	2		
2	Heat and Thermal Dynamics	Heat phenomena and quantity of heat	3	18	16
		Change of State and Hygrometry	2		
		Thermal Expansion	3		
		Transfer of Heat	2		
		Gas Laws and Kinetic theory of Gas	3		
		Thermodynamics	5		
3	Optics	Reflection through Plane Surface	2	12	12
		Reflection through Spherical Surface	2		
		Refraction through Plane Surface	3		
		Refraction through prism and lenses	5		
4	Magnetism	Magnets and Magnetic Fields	3	8	8
		Terrestrial Magnetism	2		
		Magnetic properties of Materials	3		
Total credit hour			**60**	**60**	**60**