Department of Materials and Metallurgical Engineering
Bangladesh University of Engineering and Technology

COURSE OUTLINE
Course No: PHY 125
Level 1/ Term 1
Credit (Contact) Hours: 3.0

PART A: General Information

Description of Course PHY 125

1	**Course Title**	: Physics I
2	**Type of Course**	: Non-departmental course
3	**Offered to**	: Department of Materials and Metallurgical Engineering
4	**Pre-requisite Course(s)**	: N/A

PART B: Course Details

1. Course Content (As approved by the Academic Council)

Combination of lenses, Defects of images, Optical instruments, Resolving power of optical instruments, Interference of light, Diffraction of light, Polarization of light;

Simple harmonic motion, Combination of simple harmonic oscillations, Damped oscillation, Forced oscillation, Two-body oscillations, Progressive wave, Stationary wave;

Electrostatic force and electric field, Electric potential, Capacitors and dielectrics, Magnetic field, Ampere's law, Biot-Savart law, Kirchoff's law, Electromagnetic induction.

2. Course Objectives

Objective 1: To develop logical and critical thinking with scientific knowledge of optics, waves & oscillation, and electricity & magnetism required for the students of Materials and Metallurgical engineering.

Objective 2: To understand the different laws of Physics associated with physical optics, waves & oscillation, and electricity &magnetism, and apply them to solve the real life problems.

3. Knowledge required

Insert previous knowledge requirements: N/A

4. Course Outcomes

CO No.	CO Statement At the end of the course, a student should be able to	Corresponding PO(s)*	Domains and Taxonomy level(s)**	Delivery Method(s) and Activity(-ies)	Assessment Tool(s)
CO1	Describe the basic laws of Physics related to physical optics, waves & oscillation, and electricity & magnetism to express different phenomena in the physical world.	PO(a)	C1	e.g., Lectures, Homework	e.g., Written exams; viva voce; presentation; assignment
CO2	Explain the fundamental concepts and theories of physical optics, waves & oscillation, and electricity & magnetism applicable for different physical conditions.	PO(a)	C2	e.g., Lectures, Homework	e.g., Written exams; viva voce; presentation; assignment
CO3	Apply the relevant laws of physics to solve various mathematical problems and interpret the result and its consequences.	PO(a)	C3, C4	e.g., Lectures, Homework	e.g., Written exams; viva voce; presentation; assignment

***POs**

PO (a): Engineering knowledge; PO(b): Problem analysis; PO (c): Design/development of solutions; PO(d): Investigation; PO(e) Modern tool use; PO(f): Engineer and society; PO(g): Environment and sustainability; PO(h): Ethics; PO(i): Individual work and teamwork; PO(j): Communication; PO(k): Project management and finance; PO(l): life-long learning

****Domains**

C-Cognitive : C1: Knowledge; C2: Comprehension; C3: Application; C4: Analysis; C5: Synthesis; C6: Evaluation

A-Affective : A1: Receiving; A2: Responding; A3: Valuing; A4: Organizing; A5: Characterizing

P-Psychomotor: P1: Perception; P2: Set; P3: Guided Response; P4: Mechanism; P5: Complex Overt Response; P6: Adaptation; P7: Organization

5. Lecture Plan

wk	Lecture Topics	Corresponding CO(s)
1	• Combination of lenses, equivalent lens and equivalent focal length, power of a lens, power of equivalent lens and solving mathematical problem related to lens system. • Definition of wave motion and Simple harmonic motion (SHM), differential equation of SHM. • Electric charge, Coulomb's law, Electric field, electric field lines, electric field due to a point charge, electric dipole, line of charge and charged disk, movement of charge in an electric field.	CO1, CO2, CO3
2	• Defects of images, common causes of lens defect, monochromatic aberration, spherical aberration, mathematical problem related to monochromatic aberration. • Solution of differential equation of SHM, velocity and acceleration of SHM, Significance of angular frequency, and solving mathematical problems. • Flux - Gauss' Law - application of Gauss' Law: cylindrical, spherical and planar symmetry.	CO1, CO2, CO3
3	• Distortion, curvature, spherical aberrations, chromatic aberrations mathematical problems. • Total energy and average energy of SHM, and solving mathematical problems related to energy of SHM • Electric potential energy and electric potential, equipotential surface, calculating potential from the field.	CO1, CO2, CO3
4	• Optical instruments, Resolving power of optical instruments. • Examples of SHM: spring-mass system, effect of spring mass in the oscillation (effective mass), torsional pendulum, and solving mathematical problems • Potential due to a point charge and a group of point charges, potential due to continuous charge distribution, Conductors in electrostatic equilibrium.	CO1, CO2, CO3
5	• Theories of light, Interference of light, Young's double slit experiment, displacements of fringes and its uses, Fresnel bi-prism • Combination of simple harmonic motions (in a same line and right angles), Lissajous figures • Class Test (Electricity & Magnetism)	CO1, CO2, CO3
6	• Interference at parallel and wedge-shaped films, • Damped harmonic oscillation (over-, under- and critical-damping conditions), quality factor, and logarithmic decrement • Capacitance - Capacitors in series and in parallel - Energy stored in an electric field - Capacitors with dielectric	CO1, CO2, CO3
7	• Newton's rings, interferometers • Forced oscillation, resonance, two-body oscillations and reduced mass • Electric current, resistance and Ohm's law - Resistors in series and parallel - Power in electric circuits - Kirchhoff's laws and solving circuits - RC circuits	CO1, CO2, CO3
8	• Class Test (Optics)	CO1, CO2, CO3

	• Solving mathematical problems related to damped, forced and two-body oscillations • Magnetic fields, Hall effect, Biot-savart law, Torque on a current loop, Magnetic dipole moment	
9	• Diffraction of light, Fresnel and Fraunhofer diffraction, diffraction due to single slit • Class Test (Waves & Oscillations) • Magnetic field due to a current, force between two parallel currents, ampere's law, solenoid	CO1, CO2, CO3
10	• Diffraction from a circular aperture, diffraction at double slits, N-slits-diffraction grating • Various types of waves, progressive wave equation and differential equation of a progressive wave, and solving mathematical problems. • Faraday's law of induction, Lenz's law, induction and energy transfer, induced electric field	CO1, CO2, CO3
11	• Solving mathematical problems related to diffraction of light • Energy, power and intensity of wave motion, stationary wave, analytical treatment of stationary wave, and solving mathematical problems. • Inductors and inductance, self-induction, energy stored in a magnetic field, mutual induction, LR circuit	CO1, CO2, CO3
12	• Polarization of light, production and analysis of polarized light, Brewster's Law, Malus law • Energy of stationary wave, group velocity, phase velocity and relation between group velocity and phase velocity. • Magnetic properties of matter, types of magnetic materials, application of magnetic materials	CO1, CO2, CO3
13	• Polarization by double refraction, retardation plates, Nicol prism, optical activity • Architectural acoustics, reverberation and Sabine's reverberation formula for growth of intensities • Hysteresis curve; electromagnetic oscillation: L-C oscillations and its analogy to simple harmonic motion.	CO1, CO2, CO3
14	• Polarimeters, polaroid, solving mathematical problems related to polarization of light • Sabine's reverberation formula for decay of intensities, equation for reverberation time and solving mathematical problems related to reverberation. • Mathematical problems related to magnetic field and magnetism	CO1, CO2, CO3

6. Assessment Strategy

- Class Participation: Class participation and attendance will be recorded in every class.
- Continuous Assessment: Continuous assessment any of the activities such as quizzes, assignment, presentation, etc. The scheme of the continuous assessment for the course will be declared on the first day of classes.
- Final Examination: A comprehensive term final examination will be held at the end of the Term following the guideline of academic Council.

7. Distribution of Marks

Class Participation	10%
Continuous Assessment	20%
Final Examination	70%
Total	100%

8. Textbook/ Reference

1. Fundamentals of Physics; D. Halliday, R. Resnick, and J. Walker
2. Fundamentals of Optics; F. A. Jenkins, and H. E. White
3. Vibrations & Waves; A. P. French
4. Waves & Oscillations; N. Subrahmanyum and Brij Lal
5. Physic for Engineers; Part 1; Giasuddin Ahmad
6. Physic for Engineers; Part 2; Giasuddin Ahmad

Prepared by:		
Name: Course Teacher Signature:	Name: Course Teacher Signature:	Name: Course Teacher Signature:
Date of Preparation: 03 August, 2022		
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