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

COURSE OUTLINE
Course No: PHY 169
Level 1/ Term 2
Credit (Contact) Hours: 3.0

PART A: General Information

Description of Course PHY 169

1	**Course Title**	: Physics II
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)

States of matter, Elastic properties of solids, Theorems related to flow of liquids, Mechanics of fluid flow, Viscosity, Surface tension;

Crystalline and non-crystalline solids, Bragg's Law, Defects in solids, Bonds in solids, Band structures, Metal, semiconductor and insulator;

Heat and work, Maxwell's distribution of molecular speed, First law of thermodynamics, Second law of thermodynamics, Carnot's theorem, Entropy and disorders, Maxwell thermodynamic relations, Third law of thermodynamics.

2. Course Objectives

Objective 1: To develop logical and critical thinking with scientific knowledge of properties of matter, structure of matter, and heat & thermodynamics required for the students of Materials and Metallurgical engineering.

Objective 2: To understand the different laws of physics associated properties of matter, structure of matter, and heat & thermodynamics, 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 properties of matter, structure of matter, and heat & thermodynamics 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 properties of matter, structure of matter, and heat & thermodynamics 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	• State of matters: Solids, liquids, gases and intermolecular force • Crystalline and non-crystalline solids, single crystal and polycrystalline solids, unit cell, crystal systems • Heat and work, Kinetic theory of gases: Maxwell distribution of velocities, mean velocity	CO1, CO2
2	• Elastic properties of solid, stress-strain curve, Modulus of elasticity • Co-ordinations number, density and packing factor • Most probable velocity, root mean square velocity, most probable energy, and average energy	CO1, CO2, CO3
3	• Hook's law, Poisson's ratio, Relation among elastic constants • Crystal planes and directions, Miller indices • Degrees of freedom, equipartition of energy, ratio of specific heats of monoatomic, diatomic, and triatomic molecules	CO1, CO2, CO3
4	• Work done by a deformed body, Twisting of a cylinder, solving mathematical problem related to elastic constant • Relation between interplanar spacing and Miller indices, mathematical problems related to crystal directions • Brownian motion, mean free path, solving mathematical problems of previous lectures	CO1, CO2, CO3
5	• Torsion pendulum, Bending of beam, Cantilever, Determination of elastic modulus • Class test (Structure of matter) • Van der Waals' equation of state, finding critical constants, and Van der Waals' constants	CO1, CO2, CO3
6	• Streamline and turbulent motion, Rate of flow, continuity equation • Crystal structures: NaCl, CsCl, etc • First law of thermodynamics, applications of first law	CO1, CO2, CO3
7	• Class Test (Properties of matter) • Electric current, resistance and Ohm's law - resistors in series and parallel - power in electric circuits - Kirchhoff's laws and solving circuits - RC circuits • Reversible and irreversible processes, Carnot's cycle, second law of thermodynamics	CO1, CO2, CO3
8	• Energy of a liquid in motion, Bernoulli's Theorem • Bonds in solids, interatomic distances • Class Test (Heat & Thermodynamics)	CO1, CO2, CO3
9	• Application of Bernoulli's theorem: Venturimeter, speed of efflux of a liquid • Calculation of cohesive and bonding energy; mathematical problems related to bonds in solids.	CO1, CO2, CO3

	• Carnot's theorem, entropy, entropy in reversible and irreversible processes	
10	• Viscosity, coefficient of viscosity, Stoke's law, Poiseuille's method for coefficient of viscosity • Introduction to band theory • Thermodynamic functions and potentials, mathematical problems	CO1, CO2, CO3
11	• Surface energy, Surface tension, Examples of surface tension • Distinction between metal, semiconductor, and insulator • Maxwell's thermodynamic relations	CO1, CO2, CO3
12	• Excess of pressure inside a spherical liquid drop, difference of pressure across a curved surface • Defects in solids, point defects • Clausius-Clapeyron equation, specific heat for perfect gas and Van der Waals' gas	CO1, CO2, CO3
13	• Angle of contact, determination of the angle of contact • Line defects, plane defects • Gibbs phase rule, third law of thermodynamics, and its applications for perfect gas	CO1, CO2, CO3
14	• Capillarity, determination of surface tension, Quincke's Method • Volume defects, consequences of defects and discussion based on application point of view. • Third law of thermodynamics, applications of hhird law of thermodynamics	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. Solid State Physics; M. A. Wahab
3. Introduction to Solid State Physics; C. Kittel
4. Mechanics and Properties of Matter; R. C. Brown
5. Heat and Thermodynamics; N. Subrahmanyam and Brij Lal.
6. Physics for Engineers - Part-1 & Part-2; Giasuddin Ahmad

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