Department of Computer Science and Engineering
Bangladesh University of Engineering and Technology

COURSE OUTLINE
Course No: PHY 129
Level 1/ Term 1
Credit (Contact) Hours: 3.0

PART A: General Information

Description of Course PHY 129

1 Course Title : Structure of Matter, Electricity & Magnetism, Wave Mechanics

2 Type of Course : Non-departmental course

3 Offered to : Department of Computer Science and Engineering

4 Pre-requisite Course(s) : N/A

PART B: Course Details

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

Structure of Matter: Crystalline and amorphous solids, crystal systems, crystal directions, Miller indices, co-ordinations number, packing factor, Bragg's law of X-ray diffraction, crystal structure analysis, defects in crystal, bonds in solids, cohesive energy and bonding energy, free electron theory of metals, band theory of solids, solid state devices.

Electricity & Magnetism: Electrostatics: electric field, Gauss's law and its applications for various charge distributions, electric potential and equipotential surface, dielectrics and electrostatic energy in capacitors; Magnetostatics: magnetic field and forces, Hall effect, application of Biot-Savart and Ampere's laws, electromagnetic induction and inductance, energy in a magnetic field, Electromagnetic oscillations: RC, LR, LC and LRC circuits, working principle of transformers, motors and generators, magnetic materials and its applications in a computing device.

Wave Mechanics: Failure of classical mechanics and historical origins of the quantum mechanics, wave particle duality, uncertainty principle, postulates of quantum mechanics, wave function, operators, Schrödinger equation, expectation value, Ehrenfest theorem, eigen function and eigen values, particle in a box, square well potential, linear harmonic oscillator.

2. Course Objectives

Objective 1: To develop logical and critical thinking with scientific knowledge of structure of matter, electricity & magnetism, and wave mechanics required for the students of computer science and engineering.

Objective 2: To understand the different laws of Physics associated with structure of matter, electricity & magnetism, and wave mechanics, 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 structure of matter, electricity & magnetism, and wave Mechanics 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 structure of matter, electricity & magnetism, and wave Mechanics 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	PO(a)	C3, C4	e.g., Lectures, Homework	e.g., Written exams; viva voce; presentation;

	consequences.				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	• Crystalline and amorphous solids, crystal systems • Coulombs law, Electric field • Failure of Newtonian mechanics, Galilean transformation, concept of ether	CO1, CO2, CO3
2	• Different types of crystals • Electric flux, Gauss's law and its applications for various charge distributions • Michelson-Morley experiment, consequence of Michelson-Morley experiment	CO1, CO2, CO3
3	• Crystal directions, Miller indices, co-ordinations number, packing factor • Electric potential and equipotential surface, • Postulates of quantum mechanics, wave function	CO1, CO2, CO3
4	• Solving mathematical problems related to the crystal system • Dielectrics and electrostatic energy in capacitors • Schrodinger equation	CO1, CO2, CO3
5	• Bragg's law of X-ray diffraction • Solving mathematical problems related to electric field, potential and capacitance • Mathematical problems related to expectation value	CO1, CO2, CO3
6	• Class Test (Structure of Matter) • Magnetic field and forces, Hall effect • Quantum mechanical operators and expectation value	CO1, CO2, CO3
7	• Crystal structure analysis • Application of Biot-Savart and Ampere's laws • Ehrenfast theorem and its consequences	CO1, CO2, CO3
8	• Defects in crystal • Solving mathematical problems related to magnetic force and magnetic field • Class Test (Wave mechanics)	CO1, CO2, CO3
9	• Solving mathematical problems related to X-ray diffraction and Crystal defects. • Class Test (Electricity & Magnetism) • Eigen value, Eigen function and time-independent Schrodinger equation	CO1, CO2, CO3
10	• Bonds in solids, cohesive energy and bonding energy • electromagnetic induction and inductance, energy in a magnetic field, • Stationary states and their properties	CO1, CO2, CO3
11	• Free electron theory of metals • Electromagnetic oscillations: RC, LR, LC and LRC circuits	CO1, CO2, CO3

	• Infinite square well potential	
12	• Band theory of solids, • Working principle of transformers, motors, and generators • Free particle • Class Test-4	CO1, CO2, CO3
13	• Solid state devices. • Solving mathematical problems related to the magnetic induction. • Particle in a box	CO1, CO2, CO3
14	• Solving mathematical problems related to different theories of solid • Magnetic materials and its applications in a computing device. • Linear harmonic oscillator	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. Introduction to Solid State Physics; C. Kittel
2. Solid State Physics; M. A. Wahab
3. Fundamentals of Physics; D. Halliday, R. Resnick, and J. Walker
4. Quantum Physics; R. Eisberg, R. Resnick
5. Introduction to Quantum Mechanics, 2nd Ed., David. J. Griffiths
6. Physics for Engineers - Part-2; Giasuddin Ahmad

Prepared by:		
Name: Course Teacher Signature:	Name: Course Teacher Signature:	Name: Course Teacher Signature:
Date of Preparation: 01 November 2022		
Date of Approval by BUGS: 02 November 2022		