University of Asia Pacific (UAP)

Department of Computer Science and Engineering (CSE)

BSc in CSE Program

Course Outline – Physics for Computer Science

Part A – Introduction

1. **Course No. / Course Code:** **PHY 101**
2. **Course Title:** **Physics for Computer Science**
3. **Course Type:** **General Educational Course**
4. **Level/Term and Section:** **1st Year 1st Semester**
5. **Academic Session:** **Spring 2025**
6. **Course Instructor:** **Shuva Saha, Lecturer (Physics), UAP**
7. **Pre-requisite (If any):** **None**
8. **Credit Value:** **3.0**
9. **Contact Hours:** **3.0**
10. **Total Marks:** **100**
11. **Course Objectives and Course Summary:**
    The objectives of this course are to:
    1. Learn definitions necessary for understanding various phenomena in the physical world.
    2. Understand the basic concepts of properties of matter, waves, optics and thermodynamics.
    3. Apply the laws and phenomena of physics to solve problems in new situations.
    4. Differentiate and relate the basic physical principles to effectively solve problems encountered in engineering phenomena
    5. Justify a decision following the clear understanding of the elemental concepts of the physical world.

This physics course is developed at an elementary level, which includes Mechanics, Properties of Matter, Waves, Optics, Heat, and Thermodynamics. The course may provide the quantitative and analytical skills needed for analyzing and solving problems. Moreover, it is closely relevant to computer hardware.

12. Course Learning Outcomes: at the end of the Course, the Student will be able to -

CLO 1	Learn definitions necessary for understanding various phenomena in the physical world.
CLO 2	Understand the basic concepts of properties of matter, waves, optics, and thermodynamics
CLO 3	Apply the laws and phenomena of physics to solve problems in new situations
CLO 4	Differentiate and relate the basic physical principles to effectively solve problems encountered in engineering phenomena

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	**Corresponding PLOs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CLO1	PLO 1	Remember	Lecture, Classwork, Assignments	Quiz, Written exam
CLO2	PLO 1	Understand	Lecture, Classwork, Assignments	Quiz, Written exam
CLO3	PLO 2	Apply	Lecture, Classwork, Assignments	Quiz, Written exam
CLO4	PLO 2	Analyze	Lecture, Classwork, Assignments	Quiz, Written exam

Part B – Content of the Course

14. Course Content:

Structure of Matter: Crystalline and non-crystalline solids, single crystal and polycrystalline solids, unit cell, crystal systems, coordinations number, crystal planes and directions, sodium chloride and CsCl structure, packing factor, Miller indices, relation between interplanar spacing and Miller indices, Bragg's Law, methods of determination of interplanar spacing from diffraction patterns; Defects in solids: point defects, line defects; Bonds in solids, interatomic distances, calculation of cohesive and bonding energy; Introduction to band theory: distinction between metal, semiconductor and insulator.

Waves and Oscillations: Differential equation of a simple harmonic oscillator, total energy and average energy, combination of simple harmonic oscillations, Lissajous' figures, spring-mass system, calculation of time period of torsional pendulum, damped oscillation, determination of damping coefficient, forced oscillation, resonance, two-body oscillations, Reduced mass, differential equation of a progressive wave, power and intensity of wave motion, stationary wave, group velocity and phase velocity, architectural acoustics, reverberation and Sabine's formula.

Physical Optics: Theories of light; Interference of light, Young's double slit experiment; Displacements of fringes and its uses; Fresnel Bi-prism, interference at wedge shaped films, Newton's rings, interferometers; Diffraction of light: Fresnel and Fraunhofer diffraction, diffraction by single slit, diffraction from a circular aperture, resolving power of optical instruments, diffraction at double slit & N-slits-diffraction grating; Polarization: production and analysis of polarized light, Brewster's law, Malus law, Polarization by double refraction, retardation plates, Nicol prism, optical activity, polarimeters, polaroid.

Heat and Thermodynamics: Principle of temperature measurements: platinum resistance thermometer, thermo-electric thermometer, pyrometer; Kinetic theory of various gas: Maxwell's distribution of molecular speeds, mean free path, equipartition of energy, Brownian motion, Van der Waal's equation of state, review of the First Law of thermodynamics and its application, reversible and irreversible processes, Second Law of thermodynamics, Carnot cycle; Efficiency of heat engines, Carnot's Theorem, entropy and disorder, thermodynamic functions, Maxwell relations, Clausius-Clapeyron Equation, Gibbs Phase Rule, Third Law of thermodynamics.

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Structure of Matter	CLO 1-4
2	Waves and Oscillations	CLO 1-4
3	Physical Optics	CLO 1-4
4	Heat and Thermodynamics	CLO 1-4

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO
Principle of temperature measurements: platinum resistance thermometer, thermo-electric thermometer, pyrometer; Kinetic theory of gases: Maxwell's distribution of molecular speeds	To gain the basic idea of heat and temperature	Week 1	assignment/ quiz/Class test, and problem solving	Lecture, multimedia, Problem Solving	CLO 1-4
Mean free path, equipartition of energy, Brownian motion, Van der Waal's equation of state, review of the	To gain the basic idea of heat and thermodynamics	Week 2	assignment/ quiz/Class test, and problem solving	Lecture, multimedia, Problem Solving	CLO 1-4

First Law of thermodynamics and its application, reversible and irreversible processes					
Second Law of thermodynamics, Carnot cycle; Efficiency of heat engines, Carnot's Theorem, entropy and disorder, thermodynamic functions, Maxwell relations, Clausius-Clapeyron Equation, Gibbs Phase Rule, Third Law of thermodynamics.	To gain the basic idea of heat and thermodynamics	Week 3	assignment/ quiz/Class test, and problem solving	Lecture, multimedia, Problem Solving	CLO 1-4
Crystalline and non-crystalline solids, single crystal and polycrystal solids, unit cell, crystal systems, co-ordinations number, crystal planes and directions	To gain the basic idea of the structure of matter	Week 4	assignment/ quiz/Class test, and problem solving	Lecture, multimedia, Problem Solving	CLO 1-4
Sodium chloride and CsCl structure, packing factor, Miller indices, relation between interplanar spacing and Miller indices, Bragg's Law	To gain the basic idea of the structure of matter	Week 5	assignment/ quiz/Class test and mid-semester examination	Lecture, multimedia, Problem Solving	CLO 1-4
Methods of determination of interplanar spacing from diffraction patterns; Defects in Solids: point defects, line defects.	To gain the basic idea of the structure of matter	Week 6	assignment/ quiz/Class test, and problem solving	Lecture, multimedia, Problem Solving	CLO 1-4
Bonds in solids, inter-atomic distances, calculation of cohesive and bonding energy; Introduction to band theory: distinction between	To gain the basic idea of the structure of matter	Week 7	assignment/ quiz/Class test, and problem solving	Lecture, multimedia, Problem Solving	

metal, semiconductor and insulator.					
MID-TERM EXAMINATION					
Differential equation of a simple harmonic oscillator, total energy, average energy, combination of simple harmonic oscillations, Lissajous' figures, spring-mass system.	To gain details of waves and oscillations.	Week 8	assignment/ quiz/Class test, and problem solving		CLO 1-4
Calculation of time period of torsional pendulum, damped oscillation, determination of damping coefficient, forced oscillation, resonance, two-body oscillations, Reduced mass	To gain details of waves and oscillations.	Week 9	assignment/ quiz/Class test, and problem solving		CLO 1-4
Differential equation of a progressive wave, power and intensity of wave motion, stationary wave, group velocity and phase velocity, architectural acoustics, reverberation and Sabine's formula.	To gain details of waves and oscillations.	Week 10	assignment/ quiz/Class test, and problem solving		CLO 1-4
Theories of light; Interference of light, Young's double slit experiment; Displacements of fringes and its uses; Fresnel Bi- prism.	To gain details of the theories of light, interference.	Week 11	assignment/ quiz/Class test, and problem solving		CLO 1-4
Interference at wedge-shaped films, Newton's rings, interferometers; Diffraction of light: Fresnel and Fraunhoffer	To gain details of interference of light, Newton’s ring, and diffraction of light.	Week 12	assignment/ quiz/Class test, and problem solving		CLO 1-4

diffraction, diffraction by single slit,					
Diffraction from a circular aperture, resolving power of optical instruments, diffraction at double slit & N-slits-diffraction grating;	To gain details of the diffraction of light.	Week 13	assignment/ quiz/Class test, and problem solving		CLO 1-4
Polarization: production and analysis of polarized light, Brewster's law, Malus law, Polarization by double refraction, retardation plates, Nicol prism, optical activity, polarimeter, polaroid	Details of Polarization of light, optical activity, and polarimeter.	Week 14	assignment/ quiz/Class test, and problem solving		CLO 1-4
FINAL EXAMINATION					

17. **Teaching-Learning Strategies: Face-to-Face** Learning (lecture), Guided Learning, Independent Learning, Assessment
18. **Assessment Techniques of each topic of the course:**

Assessment Type	**% weight**	**CLO1**	**CLO2**	**CLO3**	**CLO4**
Final Exam	50%	5	25	15	5
Mid Term Exam	20%	4	10	6	-
Class performance (Class Test, Assignment, Problem solving session)	30%	10	10	10	
Total	**100%**	**19**	**45**	**31**	**5**

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether, 4 class tests may be taken during the semester,2 class tests will be taken for the midterm, and 2 class tests will be taken for the final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of a maximum 4 members. The topic or case studies will be given as an assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as an assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 30)	**Class Tests (30)**
Remember	**10**
Understand	**10**
Apply	**10**
Analyze	
Evaluate	
Create	

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	**Test**
Remember	**9**
Understand	**35**
Apply	**21**
Analyze	**5**
Evaluate	
Create	

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75

50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Required Reference(s):

1. Brij lal & N. Subrahmanyam, Name of the book: Heat and Thermodynamics, Edition: 16^{th}, Year: 1995, Publisher: S. Chand & Company Ltd.
2. Brij lal & N. Subrahmanyam, Name of the book: A text book of optics, Edition: 22^{nd}, Year: 1993, Publisher: S. Chand & Company Ltd.
3. Brij lal & N. Subrahmanyam, Name of the book: A text book of sound, Edition: 2^{nd}, Year: 1994, Publisher: Vikas Publishing House PVT Ltd.
4. Brij lal & N. Subrahmanyam, Name of the book: Properties of matter, Edition: 6^{th}, Year: 1997, Publisher: Eurasia Publishing House PVT. Ltd.

22. **Recommended Reference(s):**

1. “Concept of Modern Physics” by Arthur Beiser, 6th edition.
2. “Introduction to Solid State Physics” by C. Kittel; 7th edition.
3. “Physics” Part II by Robert Resnick and David Halliday, 3rd Wiley Eastern Reprint, 1972.
4. “Fundamental of Optics” by Francis A. Jenkins & Harvey E. White; 4th edition.
5. “Fundamentals of Physics” by Jearl Walker (Resnick- Halliday extended), 6th edition.