6. (a) Define unit cell. Differentiate among insulator, semiconductor, and conductor. [04]

(b) Prove that the interplanar spacing d of a plane (h, k, l) in a simple cubic lattice is given by- [04]

$$d = \frac{a}{\sqrt{h^2 + k^2 + l^2}}.$$

(c) What is Bragg's law? Derive Bragg's equation for X-ray diffraction. [04]

7. (a) What are the Lissajous' Figures? Explain the significance of Lissajous figures in the laboratory. [04]

(b) What is physical significance of damped harmonic motion? Distinguish between simple harmonic oscillation and damped harmonic oscillation. [05]

(c) After landing on an unfamiliar planet, a space explorer constructs a simple pendulum of length 50 cm. She finds that the pendulum makes 100 complete swings in 136 s. What is the value of g on this planet? [03]

$$T = 2\pi \sqrt{\frac{L}{g}}$$

$$100 \to 136$$

$$T \to 1.36 \, sec$$

8. (a) What is Brewster's law? Derive the formula of Brewster angle. [04]

(b) What is called the diffraction of light? Explain Fresnel and Fraunhofer region. Write the difference between Fresnel region and Fraunhofer region. [04]

(c) Explain Malus law. Why do circular fringes appear in Newton's rings? [04]

GOOD LUCK!!!

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

UNIVERSITY OF BARISHAL

BS (Hons.) 1st Year 1st Semester Final Exam-2025
Session: 2024-25 (Ad. 2024-25)

Course Name: **Physics**
Duration: **3.0 Hours**

Course Code: **PHY-1105**
Full Marks: **60**

Answer any five (5) from the following questions. Parts of same question should be answered consecutively.

1. (a) Define temperature and heat. Derive an expression for the mean kinetic energy of a gas molecule using the kinetic theory of gases. [03]

   (b) Define mean free path. Derive the expression of mean free path of ideal gas. [06]

   (c) A Carnot engine operates between 500 K and 300 K. Calculate its efficiency. If the engine absorbs 600 J of heat from the source, determine the work done by the engine. [03]

2. (a) What are the line defects? Explain co-ordination number and packing fraction with examples. [03]

   (b) Define crystal. Calculate the packing fraction for a face-centered cubic (fcc) structure and for a body-centered cubic (bcc) structure. [05]

   (c) What are Miller indices? How can Miller indices be determined? [04]

3. (a) Define free, force and damped oscilations? [03]

   (b) What do you mean by phase velocity and group velocity? Show the relationship between phase velocity and group velocity. [05]

   (c) What are transverse wave and longitudinal wave? Write down the characteristics of longitudinal waves. [04]

4. (a) What are coherent sources? Describe the Young's double slit experiment. [05]

   (b) What is optical activity? What is the physical significance of optical activity? [04]

   (c) An interference spectrum is formed in the screen at a distance of 1.5 m from two slits having separation of 0.3 mm. If the wavelength of light is 6000 Å. Find the distance <u>between two</u> <u>successive bright bands.</u> [03]

5. (a) Explain the following: Seebeck effect, and Brownian motion. [02]

   (b) Define RMS velocity of a gas molecule. Derive an expression for the pressure of an ideal gas and show that: $P = \frac{1}{3}\rho c^2$. Where symbols have their usual meanings. [07]

   (c) The kinetic energy of a molecule of Hydrogen at 0°C is 5.64×10^{-14} ergs and the molecular gas constant R equals to 8.32×10^7 ergs.g^{-1}.mol^{-1}. K^{-1}. Calculate Avogadro's number N. [03]