

# Bangladesh Army University of Science and Technology

## Department of Computer Science and Engineering

Referred/Improvement/Backlog Examination, Winter 2018-2019

Level-1 Term-I

Course Code: PHY 1103

Course Title: Physics

Time: 03 (Three) hours

Full Marks: 210

N.B.: (i) Answer any three questions from each PART  
(iii) Marks allotted are indicated in the margin

(ii) Use separate answer script for each PART  
(iv) Symbols bear their usual meanings

### PART A

1. a) Define simple harmonic motion and discuss its characteristics. 02+06  
b) Calculate the total energy of a particle executing simple harmonic motion. 12  
c) Show that the time period of oscillation of a loaded spring is  $T = 2\pi \sqrt{\frac{Mx}{mg}}$  10  
d) A scale of spring balance reading 0-10 kg is 0.25 m. A body suspended from the balance oscillates with a frequency  $\frac{10}{\pi}$  hertz. Calculate the mass of the body attached to the spring. 05
2. a) Show that the energy of a progressive wave is given by,  $E = 2\pi^2 \rho n^2 a^2 v$ . 20  
b) A source of sound has frequency of 600 Hz and amplitude of 0.25 cm. What is the flow of energy across a square cm per second, if the velocity of sound in air is 332 m/s and the density of air is 0.00129 g/cm<sup>3</sup>? 05  
c) What is stationary wave? Two similar waves moving in opposite directions meet at a place, find the value of the resultant motion. 03+07
3. a) State uncertainty principle. Prove that, an electron cannot exist within the nucleus. 04+07  
b) Derive three-dimensional time-dependent Schrödinger equation. 17  
c) Prove that, a particle will not exist in a box if its energy is zero. Discuss the zero-point energy. 03+04
4. a) What are the restrictions on conventional cell axes and axial angles of an unit cell in seven crystal system? 14  
b) Calculate the packing factor for body-centered cubic crystal structure. 11  
c) Derive an expression for Bragg's law for X-ray diffraction. 10

### PART B

5. a) State and explain Coulomb's law of electrostatics. What are the limitations of the law? 08+02  
b) Deduce the relation,  $E = \frac{\lambda}{2\pi\epsilon_0 a}$ . 15  
c) Derive an expression for drift velocity of electron. 10
6. a) State and explain Faraday's laws of electromagnetic induction. 10  
b) Define self-inductance and mutual-inductance. Show that  $M = \sqrt{L_1 L_2}$ . 06+12  
c) A solenoid is 1 m long and 3 cm in mean diameter. It has 5 layers of winding of 850 turns each and carries a current of 5 amps. What is  $B$  at its centre? What is magnetic flux  $\phi_B$  for a cross section of the solenoid at its centre? 07

7. a) What do you mean by interference of light? Discuss the necessary conditions for interference of light. 04+08
- b) Define fringe width. Prove that the distance between two successive fringes formed in Young's experiment is given by  $\beta = \frac{\lambda D}{a}$ . 18
- c) Calculate the fringe width of interference pattern produced in Young's double slit experiment with two slit  $10^{-3}$  m apart on a screen 1 m away. 05
8. a) What do you mean by diffraction of light? Distinguish between Fresnel's and Fraunhofer's types of diffraction. 03+07
- b) Discuss the intensity distribution of Fraunhofer diffraction pattern obtained with a narrow slit illuminated by monochromatic light. Prove that, the width of the central maximum is inversely proportional to the slit width. 20
- c) Write short notes on: LASER. 05