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

Final 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   (ii) Use separate answer script for each PART
(iii) Marks allotted are indicated in the margin   (iv) Symbols bear their usual meanings

PART A

1. a) "Total energy of a simple harmonically vibrating particle at any instant is constant". Explain with figure. — 07

   b) Deduce the resultant vibration of a particle influenced by two mutually perpendicular simple harmonic vibrations of equal time periods having the different amplitudes and different phases by: i) 0, ii) π, iii) $\frac{\pi}{2}$ (when $a = b$ and $a \neq b$). Draw Lissajous figures for the different phases. — 18

   c) If the displacement of a particle is represented by $y = A \sin \omega t + B \cos \omega t$, show that the motion of the particle is simple harmonic and find the amplitude of the motion when $A = 12\,m$ and $B = 9\,m$. — 10

2. a) What are meant by undamped, damped and forced vibration? — 10

   b) For a progressive wave, show that the average kinetic energy per unit volume and the average potential energy per unit volume are equal and each are equal to half of the total energy per unit volume. — 17

   c) A progressive wave is represented by $y = 0.1 \sin\left(200\pi t - \frac{20\pi x}{17}\right)$. Here all the quantities are in S.I. unit. Determine the amplitude, frequency, wavelength and wave velocity. — 08

3. a) Derive one dimensional time-dependent Schrödinger equation. — 16

   b) Write down the fundamental postulates of quantum mechanics. — 10

   c) State uncertainty principle. Calculate the minimum energy required for an electron to stay in a nucleus. — 03+06

4. a) What are ionic bonds and covalent bonds? — 06

   b) What are the restrictions on conventional cell axes and axial angles of an unit cell in seven crystal system? — 14

   c) Discuss Schottky and Frenkel defects in crystals. — 06

   d) Calculate the packing factor for body centered cubic crystal structure. — 09

PART B

5. a) Calculate the electric field due to a long straight uniform charged wire. — 12

   b) Define the terms: current, current density, resistance and resistivity. — 08

   c) State and Prove Gauss's law of electrostatics. — 15

6. a) Applying Ampere's law, calculate the magnetic field for a long solenoid.   13

   b) State and explain Faraday's laws of electromagnetic induction.   07

   c) What are meant by self-inductance and mutual-inductance?   07

   d) An air core toroidal coil has 500 turns and a mean diameter 32 cm with a cross-sectional   08
      area of 2 cm^2. Calculate: i) the inductance of the coil and ii) the average emf induced when
      a current of 2 amp is reversed in a time of 0.02 sec.

7. a) Write short notes on: i) Coherent sources, ii) Interference of light, iii) Fringe width.   09

   b) Discuss the formation of Newton's rings by reflected light and calculate the radius of the   15+03
      n^{th} dark ring. Why the centre of Newton's ring is dark?

   c) Diameter of 10th dark ring in the Newton's ring system viewed normally by reflected light   08
      of wavelength 5890 Å is 5 mm. Calculate the radius of curvature of the plano-convex lens
      and the thickness of the air film.

8. a) Describe the Fraunhoffer diffraction pattern produced by a single slit illuminated by   20
      monochromatic light. Prove that, the width of the central maximum is proportional to the
      wavelength of light.

   b) Find the angular width of the central bright maximum in the Fraunhoffer diffraction pattern 07
      of slit width 12×10^{-5} cm when the slit is illuminated by monochromatic light of
      wavelength 6000 Å.

   c) What is polarization of light? Explain and sketch the plane of polarization and the plane of 08
      vibration.