

## SECOND SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2017

(CUCBCSS—UG)

Core Course—Physics/Applied Physics

PHY 2B 02 / APY 2B 02—PROPERTIES OF MATTER, WAVES AND ACOUSTICS

Time : Three Hours

Maximum : 80 Marks

## Section A

Answer all questions.

1 mark each.

1. The Young's modulus of a wire of length  $L$  and radius ' $r$ ' is  $Y \text{ Nm}^{-2}$ . If the length is reduced to  $L/2$  and radius  $r/2$ , its Young's modulus will be \_\_\_\_\_.
2. The value of Poisson's ratio cannot be :
  - (a) 0.01.
  - (b) 0.1.
  - (c) 0.4.
  - (d) 0.6.
3. When the amplitude of a particle executing simple harmonic motion increases, the time period \_\_\_\_\_.
4. The maximum possible acceleration for a simple harmonic oscillator is \_\_\_\_\_.
  - (a)  $\omega^2 a$ .
  - (b)  $\omega \sqrt{a^2 - x^2}$ .
  - (c)  $\omega a$ .
  - (d)  $\omega a^2$ .
5. Write an expression for the quality factor ?
6. In a simple harmonic motion, when the displacement is one half the amplitude, what fraction of the total energy is kinetic ?
  - (a) 0.
  - (b)  $\frac{1}{4}$ .
  - (c)  $\frac{1}{2}$ .
  - (d)  $\frac{3}{4}$ .
7. Write the relation between wave velocity and group velocity of a wave ?

Turn over



22. Obtain the expression for period of a simple pendulum.
23. Prove that variation of pressure in the case of a longitudinal progressive wave travelling through a gas is given by  $P = -E \frac{dy}{dx}$ .
24. Write a brief note on acoustics of buildings.

(5 × 4 = 20 marks)

### Section D

*Solve any four problems.*

*4 marks each.*

25. Find the stress to be applied to a steel wire to stretch it by 0.25% of its original length. Young's modulus for steel is 90 GPa.
26. Find the amount of workdone in twisting a steel wire of radius  $10^{-3}$  m and length 0.25 m through an angle of  $45^\circ$ . The rigidity modulus of the material of the wire is  $8 \times 10^{10}$  N/m<sup>2</sup>.
27. A particle executing simple harmonic motion has an acceleration  $0.03$  m/s<sup>2</sup> when its displacement is 0.09 m. Find the time period of oscillation ?
28. A particle in simple harmonic motion has velocity values 6 m/s and 5 m/s when its distance from the equilibrium positions are 2 cm and 3 cm respectively. Find the amplitude and frequency of oscillation ?
29. If the potential energy of a harmonic oscillator in its resting position is 5 joules and the total energy is 9 joules, when the amplitude is 1 m, what is the force constant ? If its mass is 2 kg, what is the period ?
30. If in air, a plane wave of frequency 256 Hz and amplitude  $\frac{1}{1000}$  mm is produced, calculate the radiated energy per unit volume and the energy current. Density of air =  $1.29$  kg/m<sup>3</sup> and velocity of sound in air is 332 m/s.
31. Calculate the change in intensity level when the intensity of sound increases 100 times its original intensity.

(4 × 4 = 16 marks)

Turn over

## Section E

Write any two questions;

10 marks each.

32. With relevant theory, explain how the Young's modulus of the material of a cantilever can be determined?
33. Deduce the differential equation for a damped harmonic oscillator and discuss in the cases of critical damping and under damping.
34. State Fourier's theorem. Give the conditions for the applicability of Fourier's theorem. Apply it to a sawtooth wave.
35. Discuss the production, properties and applications of ultra sonics. How are they detected?

(2 × 10 = 20 marks)