

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.

- 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 _____.
- The value of Poisson's ratio cannot be :

(a) 0.01.	(b) 0.1.
(c) 0.4.	(d) 0.6.
- When the amplitude of a particle executing simple harmonic motion increases, the time period _____.
- The maximum possible acceleration for a simple harmonic oscillator is _____.

(a) $\omega^2 a$.	(b) $\omega \sqrt{a^2 - x^2}$.
(c) ωa .	(d) ωa^2 .
- Write an expression for the quality factor ?
- 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) $\frac{3}{4}$.
- 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° . The rigidity modulus of the material of the wire is 8×10^{10} N/m².
27. A particle executing simple harmonic motion has an acceleration 0.03 m/s² 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 it's 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/m³ 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)