

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2016

(CUCBCSS—UG)

Core Course—Physics/Applied Physics

PHY 2B02/APY 2B02—PROPERTIES OF MATTER WAVES AND ACOUSTICS

Time : Three Hours

Maximum : 80 Marks

Section A

Answer all questions.

1. The bending moment needed to produce a curvature of unit radius in a beam is called _____.
2. The potential energy of a body executing simple harmonic motion is zero at _____ position.
3. Sound travels _____ in humid air.
4. The intensity of loudest sounds that the ear can tolerate without pain is called the _____ of pain.
5. What is Q-factor ?
6. What is Decibel ?
7. What is sharpness of resonance ?

State whether the statement is True or False (8-10).

8. For any kind of strain, work done per unit volume is equal to $\left(\frac{1}{2}\right) \times \text{stress} \times \text{strain}$.
9. The potential energy of a particle executing SHM, at its extreme position is maximum.
10. The pressure amplitude of sound is proportional to the displacement amplitude.

(10 × 1 = 10 marks)

Section B

Answer all questions.

Write in one or two sentences.

11. Define Poisson's ratio. What are its limiting values ?

Turn over

12. Explain why girders are of I-shape ?
13. Define SHM. Obtain the differential equation of SHM.
14. Show that the total energy of a harmonic oscillator is equal to its maximum kinetic energy.
15. What are the characteristics of plane progressive wave ?
16. What is fundamental frequency ?
17. What are ultrasonics ?

(7 × 2 = 14 marks)

Section C

Answer any five questions.

Write in one paragraph.

18. Derive an expression for the depression at the end of a loaded cantilever.
19. Show that shearing stress is equivalent to an equal tensile stress and an equal compressive stress at right angles to each other.
20. Derive an expression for the period of oscillation of two particles connected by a spring.
21. Show that simple harmonic motion may be expressed as either a sine or a cosine function, the difference being only a difference in initial phase in the two cases.
22. Distinguish between forced oscillations and damped oscillations.
23. What are ultrasonic waves ? How are they produced ?
24. Explain the importance of Fourier's series in acoustics.

(5 × 4 = 20 marks)

Section D

Solve any four problems.

25. Two wires made of the same material are subjected to forces in the ratio 1 : 2. Their lengths are in the ratio 8 : 1. Find the ratio of their extension.
26. When a wire of length 5 m. and diameter 1 mm. was stretched by a load of 5 kg. the elongation produced in the wire was 1 mm. Find the energy stored in per unit volume of the wire.

27. The acceleration due to gravity on the surface of moon is 1.7 ms^{-2} . What is the time period of a simple pendulum on the moon if its time period on the earth is 3.5 s ? (g on the earth molecule if the fundamental = 9.8 ms^{-2})
28. Calculate the effective force constant for the coupling forces between the atoms HCl molecules if the fundamental frequency of vibration of the molecule is $8.7 \times 10^{13} \text{ Hz}$. Reduced mass of HCl molecule is 0.97 amu .
29. A string vibrates with frequency 200 Hz . Its length is doubled and its tension is altered until it begins to vibrate with frequency 300 Hz . What is the ratio of the new tension to the original tension?
30. The maximum variation in pressure P that the ear can tolerate in loud sound is about 28 Nm^{-2} . What is the corresponding maximum displacement for a sound of frequency 500 Hz in air. Density of air 1.22 kgm^{-3} and velocity of sound 330 ms^{-1} .
31. Calculate the percentage change in intensity when the intensity level is changed by 1 dB .

(4 × 4 = 16 marks)

Section E

Answer any two questions

32. Show that a shearing stress is equivalent to an equal tensile stress and an equal compressive stress at right angles to each other.
33. Explain damped harmonic motion. Obtain the differential equation for damped harmonic oscillation. Discuss the solution and explain the terms :
- (i) Under damped.
 - (ii) Over damped ; and
 - (iii) Critically damped motions.
34. Derive an expression for the velocity of longitudinal waves in a gas.
35. What is piezo-electric effect ? Explain how ultrasonic waves are produced using this effect.

(2 × 10 = 20 marks)