S.S.R. DEGREE COLLEGE, (AUTONOMOUS)
NIZAMABAD (C.C:5029)
I SEMESTER INTERNAL ASSESSMENT I EXAMINATIONS
PHYSICS QUESTION BANK
SUB: WAVES

I. Multiple Choice Questions

1. Transverse wave velocity in a stretched string? ( )

   a) $\sqrt{\frac{T}{e}}$ b) $\sqrt{\frac{e}{\mu}}$ c) $\sqrt{\frac{T}{\mu}}$ D) $\sqrt{\frac{y}{e}}$

2. Which type of wave is a light wave. ( )

   a) Transverse wave b) Longitudinal wave

   c) Both d) None of the above

3. A travelling wave in a stretched string is described by the equation y= A sin(ωt-kx).

   The maximum velocity… ( )

   a)Aω b) $\frac{\omega}{k}$ c) $\frac{\omega}{v}$ d) $\frac{k}{\omega}$

4. In longitudinal vibrations of a bar, the particles of the bar ( )

   a)move perpendicular to the length of the bar

   b) move parallel to the length of the bar

   c) remain at rest

   d) move in a circular path

5. In a bar fixed at one end and free at the other, the fundamental frequency is ( )

   a) $V_1 = \frac{n}{2l}\sqrt{\frac{y}{e}}$ b) $V_1 = \frac{n}{4l}\sqrt{\frac{y}{e}}$

   c) $V_1 = \frac{2n}{2l}\sqrt{\frac{y}{e}}$ d) $V_1 = \frac{n}{l}\sqrt{\frac{y}{e}}$

6. The rate at which a wave transports energy is directly proportional to… ( )

   a) The square of the wave's amplitude

   b) the square of the wave's frequency

   c) Both the square of the wave's amplitude and the square of its frequency.

   d) The wave's frequency.

7. The frequency of transverse vibration of a stretched string is inversely proportional to.. ( )

   a) Length of the string

   b) Square root of the tension

c) Square root of the mass per unit length

d) Diameter of the string.

8. If the tension in a stretched string is increased four times, keeping the length and mass per unit length constant, the fundamental frequency will. ( )

a) Double b) Halve c) Remain the same d) None of the above

9. Which of the following is the governing differential equation for the free longitudinal vibration of a thin uniform bar. ( )

a) $\frac{\partial^2 y}{\partial x^2} = \frac{1}{v^2} \frac{\partial^2 y}{\partial t^2}$ where v= $\sqrt{\frac{y}{e}}$

b) $\frac{\partial^2 y}{\partial t^2} = \frac{1}{v^2} \frac{\partial^2 y}{\partial x^2}$ where v= $\sqrt{\frac{y}{e}}$

c) $\frac{\partial^2 y}{\partial x^2} + \frac{w^2}{v^2} \frac{\partial^2 y}{\partial t^2} = 0$

d) $\frac{\partial^2 y}{\partial x^2} = v^2 \frac{\partial^2 y}{\partial t^2}$

10. What is the primary cause of longitudinal vibrations in a bar? ( )

a) Gravity b) Temperature changes

c) External forces d) Internal stresses.

11. The mode shapes of a bar free at both ends have. ( )

a) Antinodes at both ends

b) Nodes at both ends.

c) Node at one end and antinode at other

d) Random displacement

12. Transverse wave equation in a bar is… ( )

a) $\frac{\partial^2 y}{\partial t^2} = \frac{-k^2}{v^2} \frac{\partial^4 y}{\partial x^4}$ b) $\frac{\partial^2 y}{\partial t^2} = -k^2 v^2 \frac{\partial^4 y}{\partial x^4}$

c) $\frac{\partial^4 y}{\partial x^4} = -\frac{k^2}{v^2} \frac{\partial^2 y}{\partial t^2}$ d) None

13. For a wave y= A sin (kx-wt). the wave length x is given by ( )

a) $\lambda = \frac{2\pi}{k}$ b) $\lambda = \frac{k}{2\pi}$ c) $\lambda = \frac{w}{2\pi}$ d) $\lambda = \frac{2\pi}{w}$

14. In a stationary wave, the distance between two consecutive nodes is… ( )

a) λ b) $\frac{\lambda}{2}$ c) $\frac{\lambda}{4}$ d)2λ

15. If the fundamental frequency of a string is f, the frequency of the second overtone is. ( )

a) 2f b) 3f c) 4f d) $\frac{f}{2}$

16. The energy transported by a transverse wave is proportional to ( )

a) Amplitude b) Frequency

c) Time period d) Wave length

17. The transverse mechanical impedance of a vibrating bar is defined as ( )

a) $\frac{Force}{acceleration}$ b) $\frac{Force}{velocity}$

c) $\frac{velocity}{force}$ d) $\frac{displcement}{force}$

18. The S.I unit of transverse mechanical impedance is ( )

a) $\frac{N-s}{m}$ b) $\frac{N}{m}$ c) $\frac{m}{s^2}$ d) $\frac{kg}{m}$

19. The wave length of the n^{th} mode in a bar free at both ends is ( )

a) $\lambda_n=\frac{2l}{n}$ b)) $\lambda_n=\frac{l}{n}$ c)) $\lambda_n=\frac{4l}{n}$ d)) $\lambda_n=\frac{l}{2n}$

20. If a steel bar has Y=2.0x10^{11} N/m^2 and $\rho = 7800$ kg/m^3, the velocity of longitudinal waves is approximately ( )

a) 1600m/s b) 5100 m/s

c) 8000 m/s d)12000 m/s

21. Which one of the following is the differential equation of SHM ( )

a) $\frac{d^2x}{dt^2} + w^2$ x = 0 b) $\frac{dx}{dt}$ = wx

c) $\frac{d^2x}{dt^2} - w^2$ x = 0 d)) $\frac{d^2x}{dx^2}$ + k = 0

22. In SHM, the acceleration is always …. ( )

a) constant

b) Directed towards the mean position

c) Directed away form mean position.

d) Perpendicular to velocity

23. At what point in its oscillation is the speed of a particle in SHM maximum. ( )

a) At the extreme positive displacement

b) At the extreme negative displacement

c) At the equilibrium position.

d) The speed is constant throughout the motion

24. A torsional pendulum oscillates due to ( )

a) Gravitational force b) Frictional force

c) Restoring torque due to wire d) Inertia of mass

25. If suspension and oscillation points are interchanged, the time period ( )

a) Halves b) Doubles c) Remain same d) Infinite

26. The time period of a torsional pendulum is ( )

a) T = $2\pi\sqrt{\frac{I}{C}}$ b) T = $2\pi\sqrt{\frac{c}{T}}$ c) T = $2\pi\sqrt{\frac{m}{K}}$ d) T = $2\pi\sqrt{\frac{L}{g}}$

27. Torsional pendulum is often used to determine ( )

a)Acceleration due to gravity

b) Torsional rigidity of a wire

c) Young's modulus of a material

d) Magnetic field of earth

28. In a damped harmonic oscillator, the amplitude of oscillation. ( )

a) Increases with time

b) Remains constant with time

c) Decreases exponentially with time

d) Decreases linearly with time

29. The equivalent length of a compound pendulum is ( )

a) L = $\frac{I}{mg}$ b) L = $\frac{I}{ml}$ c) L = $\frac{I}{mk}$ d) L = $\frac{I}{m}$

30. A compound pendulum can be used to determine ( )

a)Gravitational acceleration (g) b) Modulus of rigidity

c) Young's modulus d) Coefficient of restitution

31. The restoring torque in a compound pendulum is proportional to ( )

a) velocity b) Angular displacement

c) Acceleration d) Mass

II. Fill in the blanks

1. The impedance of a transverse wave on a string z=_____.
2. In a bar fixed at both ends, the second overtone corresponds to the _____ harmonic.
3. The n^{th} mode frequency of a bar fixed at one end and free at the other is v_n=_____.
4. The boundary condition for a fixed end of a vibrating bar is that the displacement is_____.
5. In transverse vibrations, the particles of the bar move _____ to the length of the bar.
6. The product of transverse impedance and particle velocity gives the _____ in the wave.
7. For a bar in transverse vibrations, the impedance depends on its_____, _____ and _____.
8. The relationship between velocity, wave length and frequency _____
9. The general equation of a transverse harmonic wave moving in the +x direction is_____.
10. The time taken for a particle to complete one oscillation is called the_____.
11. Example for longitudinal waves._____

12. The frequency of torsional pendulum is _____.
13. The general equation of motion for a damped harmonic oscillator is_____
14. The time period of a compound pendulum is._____
15. A uniform bar suspended from one end and oscillation an example of a _____ pendulum
16. The distance covered by a particle executing SHM with amplitude A in one time period is _____.
17. Equation for a SHM of particle is y=0.3 sin (t+ $\frac{\pi}{6}$). Then frequency _____.
18. The motion that repeats itself after equal intervals of time is called_____.
19. A particle executes SHM with amplitude A= 0.05m and angular frequency w=10rad/s^2
    V_{max}=_____
20. The phase difference between displacement and velocity in SHMis _____.
21. The restoring force in simple harmonic motion is always directed towards the _____ position

III. Short answer questions

1. Show that the wave equation in case of transverse waves on a string is given by $\frac{\partial^2 y}{\partial x^2} = \frac{1}{v^2}\frac{\partial^2 y}{\partial t^2}$ where v= $(\frac{T}{m})^{1/2}$
2. What are the characteristics of a simple harmonic motion?
3. What are damped oscillations? Deduce the equation of motion of a damped harmonic oscillator and obtain its solution.
4. Define transverse waves? Obtain the frequencies of vibrations of stretched string clamped at both ends.
5. Explain how the rigidity modulus of the material of a given wire is determined.