Seat Number

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Nov-2015

कर्ता - 023

# PHYSICS PAPER- I : PHY-231
## Waves and Oscillations
## (23125)

P. Pages : 4

Time : Two Hours

Max. Marks : 40

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Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Graph or diagram should be drawn with the black ink pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All questions are compulsory and carry equal marks. Figures to the right indicates full mark.
5. Draw neat diagram wherever necessary.
6. Use of Logarithmic table or electronic calculator is allowed.

1. Attempt **any eight** of the following. Select correct answer. 8

i) Sound waves whose frequencies are greater than 20,000 Hz are called.
   a) supersonic b) infrasonic
   c) audio sound d) ultrasonic

ii) When the observer moves towards stationary source, the apparent frequency of sound
   a) Remains the same b) Decreases
   c) Increases d) None of the above

iii) $m\frac{d^2x}{dt^2}+R\frac{dx}{dt}+kx=f\sin qt$ represents the differential equation for
   a) Damped free oscillations
   b) Forced oscillations
   c) simple harmonic oscillator
   d) undamped free oscillations

iv) The amplitude of vibrations goes on decreasing continuously and ultimately the body stops vibrating such vibrations are called
   a) undamped free vibrations
   b) damped free vibrations
   c) forced oscillations
   d) None of the above

v) Lissajous figures are obtained whenever a particle is subjected to two simple harmonic motions simultaneously.
   a) at angles of $\pi/2$ to each other
   b) at angles of $\frac{3\pi}{4}$ to each other
   c) at angles of $\pi/4$ to each other
   d) along the same straight line

vi) The equation of motion of damped oscillator is of the form, $4\frac{d^2x}{dt^2}+20\frac{dx}{dt}+25x=0$, state the motion is
   a) Overdamped motion
   b) Critically damped
   c) damping oscillatory
   d) None of the above

vii) The apparent change in frequency of sound due to relative motion between the source and the observer is called
   a) Piezoelectric effect
   b) Magnetostriction effect
   c) Doppler effect
   d) None of the above

viii) The path followed by the particle when subjected to two rectangular S.H.M.s of equal frequencies is
   a) straight line
   b) ellipse
   c) circular
   d) None of the above

ix) Lissajous figures is used for
   a) to detect the ultrasonic waves
   b) to measure the weight of the tuning fork
   c) to determine the ratio of time periods
   d) None of the above

x) Using the principle of Doppler effect,
   a) The speed of rotation of sun can be determined
   b) The speed of heavenly bodies can be determined
   c) The temperature of the gas can be estimated
   d) All of the above

2. Attempt **any four** of the following. 8

i) What is doppler effect?

ii) State magnetostriction effect.

iii) What is the half width of resonance curve?

iv) What are Lissajous figures?

v) What is meant by forced oscillations and driving frequency?

vi) The equation of motion of an oscillator is

$$2\frac{d^2x}{dt^2} + 20\frac{dx}{dt} + 100x = 0$$

What will be the nature of motion?

3. Attempt **any two** of the following. 8

a) Derive an expression for the half width of amplitude resonance curve.

b) Describe the applications of Doppler effect.

c) Describe magnetostriction method for the production of ultrasonic waves.

4. a) Attempt **any two** of the following. 6

i) Obtain an expression for the apparent frequency of sound when the source, medium and observer are in motion.

ii) What is velocity resonance? What is the condition for velocity resonance?

iii) Show that the equation $\frac{d^2x}{dt^2} + 8\frac{dx}{dt} + 16x = 0$ represents a critically damped motion.

b) Enlist the four applications of ultrasonic waves. 2

5. Attempt **any one** of the following. 8

a) Derive an expression for the resultant motion when two mutually perpendicular S.H.M.s of amplitudes a and b, their frequencies in the ratio 1:2 and phase difference $\phi$ acting on it.

b) i) A mass of 3 gm is subjected to a force constant of 400 dyne/cm and damping constant of 20 dyne second per cm. Show that the motion is oscillatory and find the frequencies of oscillations.

ii) Describe any method used for the detection of ultrasonic waves.

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