Oct-2014

Seat Number

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कुमकुम - 043

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

P. Pages : 4

Time : Two Hours **Max. Marks : 40**

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with blue ink only. Graph or diagram should be drawn with the same 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 indicate full marks.
5. Draw neat diagram wherever necessary.
6. Use of logarithmic table or standard electronic calculator is allowed.

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

i) The equation $m\frac{d^2y}{dt^2}+R\frac{dy}{dt}+Ky=0$ represents equation of motion for ---------

a) Free vibrator b) Damped harmonic oscillator
c) Forced oscillator d) Resonant oscillator

ii) Resonance is a special case of ----------

a) Undamped free oscillations b) Damped free oscillations
c) Forced oscillations d) None of the above

iii) Apparent frequency of sound heard by a listener is less than the actual frequency of sound emitted by source. Then, the

a) listener moves towards source
b) source moves towards listener
c) listener moves away from source
d) source and listener move towards each other

iv) Ultrasonic waves are produced by utilizing ---------
a) Piezo-electric effect b) Peltier effect
c) Doppler effect d) Magneto-optic effect

v) Lissajous figures are obtained whenever a particle is subjected to two simple harmonic motions simultaneously ----------
a) along the same straight line
b) at right angles to each other
c) at angle of $3\pi/4$ to each other
d) none of the above

vi) Oscillations of simple pendulum is example of ----------
a) Undamped free oscillations b) Damped free oscillations
c) Forced oscillations d) Resonant oscillations

vii) In case of forced oscillations ----------
a) amplitude remains constant
b) amplitude decays exponentially with time
c) amplitude increases with time
d) none of the above

viii) Ultrasonic waves have frequency ----------
a) as that of the audible range
b) above audible range
c) below audible range
d) none of the above

ix) If an external periodic force is applied on an oscillator then it executes ----------
a) Undamped free oscillations b) Damped free oscillations
c) Forced oscillations d) None of the above

x) What sort of waves exhibits the Doppler effect ?
a) light waves b) sound waves
c) all of the above d) none of the above

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

a) State any four types of resonance in forced oscillations.

b) Write short note on ultrasonic waves.

c) State any two applications of Doppler effect.

d) What are Lissajous figures ?

e) The equation of motion of an oscillator is

$$\frac{d^2y}{dt^2}+20\frac{dy}{dt}+100y=0.$$

What will be nature of motion ?

f) A source emitting a sound note of frequency 900 Hz is moving with a velocity of 30 m/s towards stationary listener. Determine the apparent rise in frequency. Assume the velocity of sound to be 330 m/s.

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

a) Give an analytical treatment for composition of two S.H.M.'s perpendicular to each other and having their frequencies in the ratio 1:2.

b) The equation of forced oscillations of an oscillator is given as

$2\frac{d^2y}{dt^2}+4\frac{dy}{dt}+50y=100\sin 5t$, determine the amplitude and phase difference between the periodic force and displacement in c.g.s. unit.

c) Show that, in sound, Doppler effect is asymmetric in nature.

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

i) Obtain an expression of logarithmic decrement.

ii) Write down the differential equation of the damped oscillations. Also write its solution. Hence discuss the condition of over damped motion.

iii) Starting with a differential equation for forced oscillations, in the form,

$$m\frac{d^2y}{dt^2}+R\frac{dy}{dt}+ky=f\sin qt,$$

show that the amplitude for forced oscillations is

$$A=\frac{f}{\sqrt{\left(K-mq^2\right)^2+(qR)^2}}.$$

b) Give any two applications of Lissajous figures. **2**

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

a) Explain methods of detection of ultrasonic waves. Give any two applications of ultrasonic waves.

b) i) What is amplitude resonance ? Obtain its condition for amplitude resonance.

ii) The equation of critically damped motion is in the form $3\frac{d^2y}{dt^2}+R\frac{dy}{dt}+48y=0$. Determine the value of R.

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