Oct - 2013

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

P. Pages : 3

Time : Two Hours

Max. Marks : 40

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answersheet 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 indicates full marks.
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 option. 8

   i) Lissajous figures is used for ....
      a) to determine unknown frequency of tuning fork
      b) to measure the weight of tuning fork
      c) to detect ultrasonic waves
      d) none of the above

   ii) The equation of critically damped motion of an oscillator is in the form

      $4\dfrac{d^2y}{dt^2} + R\dfrac{dy}{dt} + 9y = 0$ Then the value of R is -

      a) 36 units   b) 24 units
      c) 48 units   d) 12 units

   iii) When the natural frequency $\dfrac{\omega}{2\pi}$ is equal to the forcing frequency $\dfrac{q}{2\pi}$ then,

      a) velocity resonance takes place
      b) amplitude resonance takes place
      c) both velocity as well as amplitude resonance takes place
      d) none of the above

   iv) When the source of sound and medium are at rest and listener is moving towards the source then listener receive sound waves which have apparent frequency n'
      a) n' = n   b) n' < n
      c) n' > n   d) none of the above

v) The waves used in sonography are -
   a) micro-waves
   b) infrared waves
   c) ultraviolet waves
   d) ultrasonic waves

vi) Lissajous figure 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

vii) An observer approaches a stationary 1000 Hz sound source at twice the speed of sound. What frequency does the observer hear ?
   a) 4000 Hz
   b) 3000 Hz
   c) 2000 Hz
   d) none of the above

viii) Sound of frequency below 20 Hz is called........
   a) audio sounds
   b) infrasonic
   c) ultrasonic
   d) supersonic

ix) The equation of motion of damped oscillator is of the form
   $$4\frac{d^2y}{dt^2} + 20\frac{dy}{dt} + 25y = 0$$ State whether the motion is ....
   a) over damped motion
   b) critically damped
   c) damped oscillatory
   d) none of the above

x) $$m\frac{d^2y}{dt^2} + R\frac{dy}{dt} + ky = f\sin qt$$ represents differential equation for -
   a) undamped free oscillations
   b) damped free oscillations
   c) forced oscillations
   d) none of the above

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

a) State Magneto-striction effect.

b) Explain Barton's pendulum to demonstrate forced oscillations.

c) Write short note on Lissajous figures.

d) Distinguish between a damping force and restoring force.

e) What is resonance and resonant oscillations ?

f) A person is standing a platform. A railway engine moving away from the person with a speed of 72 km/hr blows a whistle of pitch 740 Hz. Calculate the apparent pitch of whistle as heard by the person. The velocity of sound = 350 m/s.

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

a) Give different methods used in the detection of ultrasonic waves explain one of them.

b) What is logarithmic decrement ? Obtain an expression of logarithmic decrement.

c) State general expression for apparent frequency due to Doppler effect in sound. Discuss any three cases.

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

i) Explain any one method to demonstrate Lissajous figures.

ii) Obtain an expression of Q-factor for the damped oscillations.

iii) Write short note on Doppler effect.

b) Give any four applications of ultrasonic waves.   2

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

a) In case of forced oscillations show that the total average energy (E) of the system is constant.

b) i) A particle is subjected to two rectangular directions such that the displacement at any instant is given by $x = 2\sin\left(\omega t + \dfrac{\pi}{4}\right)$ and $y = 2\sin\omega t$. Find the nature and equation of path.

ii) What is meant by piezo-electric effect ? Draw a circuit diagram of piezo-electric oscillator.

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