

Day : Tuesday
Date : 16/10/2018

W-2018-0726

Time : 03.00 P.M. To 06.00 P.M
Max. Marks : 60

N.B.:

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.

Q.1 Attempt **ANY TWO** of the following: [12]

- a) Explain symmetric nature of Doppler effect in sound.
- b) What do you understand by forced oscillations? Set up its differential equation.
- c) Derive an expression for the velocity of transverse wave on a stretched string.

Q.2 Attempt **ANY TWO** of the following: [12]

- a) Obtain the resultant path of two S.H.M's mutually perpendicular to each other and having frequency ratio 1:1, also check all cases of $\phi = 0$, $\phi = \pi/2$.
- b) The equation of forced oscillations is given by $2 \frac{d^2x}{dt^2} + 3 \frac{dx}{dt} + 16x = 30 \sin 2t$
all quantities are expressed in CGS units. Find the velocity, amplitude and the maximum kinetic energy.
- c) What is velocity resonance? Obtain the condition for velocity resonance.

Q.3 Attempt **ANY TWO** of the following: [12]

- a) Write a short note on logarithmic decrement in damped oscillation.
- b) Plane harmonic waves of frequency 500 Hz are produced in air with displacement amplitude of 2×10^{-3} cm. Find : i) pressure amplitude ii) energy density iii) energy flux in the wave. (Given : Density of air 1.29×10^{-3} cm, velocity of sound in air = 340 m/s).
- c) The two S.H.M's acting on the particle simultaneously are given as $x = a \sin 3\omega t$ and $y = a \sin \omega t$. Find the equation of resultant path.

Q.4 Attempt **ANY THREE** of the following: [12]

- a) What are Lissajous figures? Explain any one method to demonstrate Lissajous figures.
- b) Derive expression for quality factor Q of a damped oscillator.
- c) A car travelling with a speed of 30 m/s on the highway, sound its horn for overtaking another car travelling with speed 20 m/s in the same direction. If the frequency of horn sound is 550 Hz, determine the frequency heard by the driver in the slower car (i) before passing and (ii) after passing. (Assume the speed of sound to be 340 m/s)
- d) What are P-waves, S-waves, R-waves and L-waves?

Q.5 Attempt **ANY FOUR** of the following: [12]

- a) State three applications of resonance.
- b) A stroboscopic disc with 16 spots equally spaced is seen through the movable slit fixed to the prong of tuning fork. The dots (spots) appeared stationary when disc was making 100 resolutions in 6.25 sec after gradually increasing the speed. Determine the frequency of fork.
- c) A capacitor of $0.4 \mu\text{F}$, an inductor of 50 mH and resistor of 400Ω are connected in series. Can the electrical circuit be oscillatory?
- d) State the difference between damped oscillations and forced oscillation.
- e) Explain Red shift and Violet shift in case of Doppler effect.
- f) What do you understand by phase velocity and group velocity?