

THEORY OF OSCILLATIONS QUESTION BANK FOR BSC STUDENTS

Short answer type (2 - 4 marks each)

- 1) What do you understand by a simple harmonic motion. Draw its potential energy curve.
- 2) A circuit has 8mH inductance and 2microF capacitance. If the potential difference between the plates of capacitors is 4 volts, Find frequency & energy of Electrical oscillator.
- 3) Discuss effects of damping on the frequency & amplitude of a harmonic oscillator.
- 4) Write a short note on velocity resonance in a driven oscillator.
- 5) Deduce the frequency of oscillations of damped electrical oscillator, LCR with $L = 2 \times 10^{-3}$ henry, $C = 5 \times 10^{-6}$ farad and $R = 0.2$ ohm.
- 6) Two masses 6 gm & 2 gm are connected with a massless spring of force constant 1 newton per m. Calculate the frequency of oscillations.
- 7) If the relaxation time of a damped harmonic oscillators is 50 seconds, Find the time in which amplitude falls to $1/e$ of initial value.
- 8) Does the amplitude resonance occur exactly at natural frequency of body?
 - a. When damping is absent.
 - (ii) When the damping is present
- 9) What is logarithmic decrement? State?
- 10) The equation of motion of a particle is: $x = 2\sin \{ \pi t/2 + \pi/4 \}$ cm. Find period and maximum velocity of particle.
- 11) Define quality factor & relaxation time for a damped harmonic oscillator.
- 12) Show graphically the effect of damping on sharpness of resonance.
- 13) A particle describes SHM in a line 4cm long, It's velocity when passing through centre 12 cm/s. Find the period.
- 14) What is conditions of a galvanometer to be: (a) dead beat (b) oscillatory
- 15) Distinguish between electrical impedance & mechanical impedance.

- 16) Define Lissajous figures.
- 17) Show that the damping reduces the frequency of an underdamped oscillator by $1/2Q^2$ percent, where Q is quality factor of oscillator.
- 18) What is transient state behavior of system in forced oscillations? Explain.
- 19) Explain the terms frequency, wavelength, and phase for SHM.
- 20) Turning forks A and B of nearly same frequency complete a Lissajous figure in 20 seconds.
- 21) If B is loaded with a little wax the time for complete cycle becomes 10 seconds. If the frequency of A is 300Hz, find the original frequency of B.
- 22) Discuss in brief the physical significance of Quality factor.
- 23) Describe anharmonic oscillator in brief, give essential equations.
- 24) Simple pendulum is ideal concept, explain.
- 25) Find the resultant of two perpendicular SHM having amplitudes & time period in ratio 1:2 and a phase difference of 90° .
- 26) Obtain the equation of an oscillatory series LC circuit and hence give relation for its frequency.

Long answer type (5 - 10 marks each)

- 1) What is damping? Write differential equation for a damped harmonic oscillator & solve for the underdamped case.
- 2) Describe Lissajous figures and their applications. Find resultant equation for two SHMs of equal frequency of forming such figures. Solve it for phase difference 0° , 90° & 180° .
- 3) What is a compound pendulum? Obtain relation for its time period. Also find equation for minimum value of time period.
- 4) Explain a driven series LCR circuit. Under what conditions a series resonant circuit is

obtained.

- 5) Discuss the oscillatory discharge of capacitor through a circuit containing inductance and resistance. What is frequency of oscillations ? Obtain quality factor for an LCR circuit.
- 6) Show that when damping is light, the galvanometer coil executes SHM. What is conditions of galvanometer to be ballistic?
- 7) Discuss analytically the composition of two rectangular SHM of different amplitudes & frequency in the ratio 2:1. What are the figures obtained when phase difference is π .
- 8) Solve the differential equation of a forced harmonic oscillator and find an expression for velocity amplitude of the oscillator. What is velocity resonance?
- 9) Solve the differential equation for a driven harmonic oscillator. Obtain resonance condition.
- 10) The equation of motion of an oscillating body is $x = 6\cos\{3\pi t + \pi/3\}$ meter. Find the period frequency and phase constant of the motion.
- 11) What is meant by sharpness of resonance? How is it related with the band width of resonance? Draw a figure to show band width of resonance.
- 12) What are Lissajous figures? How do these figures provide an important method for comparing frequencies of two tuning forks when the frequencies are in whole number ratio.
- 13) Describe torsional pendulum and obtain its time period. Why its time period remain unaffected even if the amplitude be large?

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