Reg. No ..... Name **23U242**

B. Sc. DEGREE END SEMESTER EXAMINATION : MARCH 2023

SEMESTER 2 : PHYSICS (COMPLEMENTARY FOR CHEMISTRY)

COURSE : **19U2CPPHY04: MECHANICS AND SUPERCONDUCTIVITY**

(For Regular - 2022 Admission and Improvement / Supplementary – 2021/2020/2019 Admissions)

Time : Three Hours Max. Marks: 60

PART A

Answer any 8 (2 marks each)

1. What is superconductivity?
2. State the law of conservation of angular momentum for a system of particles.
3. What is meant by resonance or resonant oscillations?
4. Give relation between linear acceleration and angular acceleration.
5. What do you mean by quality factor of an oscillator?
6. Write down an expression for velocity of a particle executing simple harmonic motion. State the condition under which a) it is maximum b) it is minimum.
7. A tuning fork of unknown frequency gives four beats per second, when sounded with another of frequency 256 Hz. The fork is now loaded with a piece of wax and again 4 beats per second are produced. Calculate the frequency of the unknown fork
8. What is energy density of a wave?
9. What is doppler effect in sound?
10. What is meant by length of an equivalent pendulum?

(2 x 8 = 16)

PART B

Answer any 6 (4 marks each)

11. A simple harmonic wave travelling in the x-direction is given by $y = 5\sin 2\pi(0.2t - 0.5x)$ cm. Calculate the amplitude, frequency, wavelength, wave velocity, particle velocity and amplitude of particle velocity
12. A sphere made of steel has a diameter of 20cm. Calculate its M.I about a diameter. Given the density of the steel 7.9×10^3 kg/m^3.
13. A thin uniform rod of mass 1.2 kg and length 1.8m is bent to form a regular hexagon. Calculate the M.I about an axis passing through the centre and perpendicular to the plane of the hexagon.
14. An observer is driving between two stationary sources of sound A and B at a speed of 13.4 m/s. If the frequency of each source is 100 Hz, calculate the number of beats heard by the observer. Velocity of sound is 330m/s.
15. Calculate the angular speeds and linear speeds of the tips of seconds, minutes and hour hands of a wall clock. Given that the lengths of the respective hands are 7 cm, 8 cm, and 6 cm .
16. Amplitude of a damped harmonic oscillator is reduced to $(1/10)^{th}$ of the initial value after 100 oscillations. If the time period of oscillation is 2s, calculate the damping constant.

17. A mass of 1 kg is suspended from a spring of force constant 10^2 N/m and damping coefficient 10 Ns/m. The spring is driven by a periodic force of peak value 10 N and frequency double the natural frequency of the system without damping. Calculate the amplitude of vibration.

18. What is the frequency of the alternating current obtained from a Josephson junction, where a voltage of 2mV is applied?

(4 x 6 = 24)

PART C

Answer any 2 (10 marks each)

19. Determine the moment of Inertia of a rod about an axis perpendicular to its length if the axis passes through the a) centre b) one end.

20. What do you mean by compound pendulum? Obtain an expression for the time period of a compound pendulum. Show that the centre of suspension and the centre of oscillation of a compound pendulum are interchangeable.

21. Solve the differential equations of a damped harmonic oscillator. Discuss the three cases in detail.

22. Discuss the effect of magnetic field in superconductors. Distinguish between type I and type II superconductors.

(10 x 2 = 20)