TB252736H

Reg. No :.....

Name :.....

BACHELOR'S DEGREE (C.B.C.S) EXAMINATION, MARCH 2025

2018, 2019, 2020, 2021, 2022 ADMISSIONS SUPPLEMENTARY

SEMESTER II - COMPLEMENTARY COURSE 2 (PHYSICS)

PH2C02B18 - Mechanics and Crystallography

Time : 3 Hours **Maximum Marks : 60**

Part A

I. Answer any Ten questions. Each question carries 1 mark **(10x1=10)**

1. Distinguish between a gravitational force and the force of gravity. Obtain the relation between G and g.
2. Distinguish between speed and velocity of a particle in motion.
3. Can a particle possess zero velocity and non-zero acceleration? Explain.
4. A progressive harmonic wave is given by 10sin(0.3x-4.0t). If x is in cm and t in seconds, find the frequency and wavelength of the wave.
5. Define a flywheel.
6. Give the concept of restoring force with suitable example.
7. Find the displacement of a harmonic oscillator when its velocity is half of its maximum velocity.
8. Plot the variation of potential and kinetic energy with displacement of a harmonic oscillator.
9. Explain the characteristics of oscillatory motions.
10. Explain what is meant by translation vectors in crystallography.
11. Briefly explain why fcc and hcp are said to be closed packed structure.
12. Define unit cell of a crystal.

Part B

II. Answer any Six questions. Each question carries 5 marks **(6x5=30)**

13. Derive an expression for the change in the value of acceleration due to gravity at a place of latitude θ due to rotation of earth.
14. Two trains at 100 km/h cross each other while one of them sounds horn. If the frequency of the note is 750 Hz, find the apparent frequency as heard by an observer in the other train when they approach and also when they recede. Velocity of sound in air is 335 m/s.
15. A particle of mass m, moving in circular orbit of radius r has angular momentum L about its centre. Calculate the kinetic energy of the particle in terms of L, m, and r.
16. A square thin lamina has a moment of inertia of $100\ kgm^2$ about its diagonal. Compute its moment of inertia about an axis through its centre and perpendicular to the plane of the lamina.
17. Identify the relation between L and R if the moment of inertia of the cylinder about its axis is to be the same as the moment of inertia about equatorial axis.
18. Discuss the condition of critical damping and over damped motion.
19. 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.
20. Explain spacing of planes in crystal lattice. Obtain an expression for the interplanar distance for a simple cubic structure of crystal.
21. The spacing between successive (100) planes in NaCl is 2.82 Å. X-rays incident upon the surface of this crystal gives rise to first order Bragg reflection at a glancing angle of 9^0. Calculate the wavelength of the X-

rays and the angle at which the second order Bragg reflection would occur.

Part C

III. Answer any Two questions. Each question carries 10 marks **(2x10=20)**

22. Derive an equation for energy density of a progressive wave.
23. Deduce the expression for the moment of inertia of a thin circular disc about (i) an axis through its centre and perpendicular to its plane (ii) a diameter and (iii) a tangent.
24. Set up the differential equation of forced oscillations and discuss its solution.
25. Explain packing fraction of a crystal structure. Calculate the packing fraction for fcc, hcp and bcc crystal structure.