

B. Sc. DEGREE END SEMESTER EXAMINATION - MARCH 2024**SEMESTER 2 - COMPLEMENTARY PHYSICS FOR MATHEMATICS****COURSE : 19U2CPPHY03 - MECHANICS AND ASTROPHYSICS***(For Regular - 2023 Admission and Improvement / Supplementary – 2022/2021/2020/2019 Admissions)*

Time : Three Hours

Max. Marks: 60

PART A**Answer any 8 (2 marks each)**

1. What do you mean by beats?
2. Plot the acceleration versus time graph of a simple harmonic oscillator.
3. Write down the differential equation of a forced harmonic oscillator. Explain the different terms.
4. Give the relation between torque and angular momentum.
5. What do you mean by supernova?
6. Give expressions for the acceleration of a simple harmonic oscillator.
7. What is Doppler effect?
8. What do you mean by radius of gyration? What is its unit?
9. What is the difference between speed and velocity?
10. Explain the term intensity of a wave. Obtain an expression for the same.

(2 x 8 = 16)**PART B****Answer any 6 (4 marks each)**

11. A mass of 1Kg is suspended from a spring of force constant 10^2 Nm^{-1} and damping coefficient 10 Nsm^{-1} . The spring is driven by periodic force of peak value 10N and the frequency double the natural frequency of the system. Calculate the amplitude of vibration.
12. A particle of mass m moving in a circular orbit of radius r has angular momentum L about center. Calculate the kinetic energy of the particle in terms of L, m and r .
13. Calculate the moment of Inertia of a copper sphere of radius 10 cm, about a tangent to the plane. Density of copper is 8.9 g/cm^3 .
14. 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, amplitude of particle velocity, particle acceleration and amplitude of particle acceleration.
15. A metal disc of radius 2 m with its plane vertical can be made to swing about a horizontal axis passing through any one of the holes bored along its diameter. Determine the minimum time period of the disc.
16. Consider a wave of frequency 500 Hz travelling with a velocity 200 m/s. Find the phase change in the time interval 10^{-3} sec. Also find the path difference between two points that differ by $\pi/2$ radian.
17. A simple harmonic motion is represented by the equation $x = 10 \sin(20t - \pi/4)$, where x is measured in meters and phase angle in radians. Calculate the maximum displacement and the maximum velocity.
18. A particle of mass m , moving in a circular orbit of radius r has angular momentum L about the centre. Calculate the kinetic energy in terms of L, m , and r .

(4 x 6 = 24)

PART C

Answer any 2 (10 marks each)

19. Write a short note on :
 - a) Magnitude of stars
 - b) Temperature and color of a star.
 - c) Stellar spectra.
 - d) Mass and luminosity of a star.
20. What do you mean by a compound pendulum? Obtain an expression for the time period of a compound pendulum? Show that the centre of suspension and centre of oscillation of a compound pendulum are interchangeable.
21. Set up the differential equation of a simple harmonic oscillator. Solve the equation to obtain the expressions for displacement, velocity, acceleration.
22. Derive an expression for moment of Inertia of a hollow cylinder about a) its own axis, b) axis passing through the center and perpendicular to its own axis.

(10 x 2 = 20)