Reg. No ..... Name **23U254**

B. Sc. DEGREE END SEMESTER EXAMINATION : MARCH 2023

SEMESTER 2 : COMPLEMENTARY PHYSICS FOR MATHEMATICS

COURSE : **19U2CPPHY03: MECHANICS AND ASTROPHYSICS**

(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. Plot the velocity versus time graph of a simple harmonic oscillator.
2. Define the term density of a wave. What do you mean by the intensity of a wave?
3. What do you mean by the quality factor of an oscillator?
4. What do you mean by a progressive wave?
5. What are the essential features of angular momentum?
6. What is force? How is it related to the acceleration of a body?
7. What is the relation between temperature and color of a star.
8. Show the plot showing Amplitude of the forced oscillator as a function of driving frequency in the case where the damping is small.
9. What do you mean by Moment of Inertia?
10. What is Doppler effect? Give an expression for the apparent frequency when the source is moving and the observer is stationary.

(2 x 8 = 16)

PART B

Answer any 6 (4 marks each)

11. A flywheel of an engine starts from rest and acquires an angular velocity of 20π rad/s in 5 s. Calculate a) the average angular acceleration and b) the number of revolutions made during this time.
12. Show that the angular momentum of a satellite of mass m moving round the mass M is $\sqrt{GMm^2r}$ where r is the radius of the orbit.
13. The equation of a plane progressive wave is given by y= 10 sin π (0.01x-2t), where y and x in cm and t is in seconds. Determine a) frequency of the wave and b) phase difference between two points 200 cm apart.
14. A grind stone has a moment of Inertia of 800 kgm^2. What constant torque is to be applied on it to develop a speed of 180 rotations per minute in 10 s after starting from rest.
15. Determine the velocity of sound in a gas which waves of wavelength 50 cm and 50.5 cm produces 6 beats per second.
16. Calculate the time in which the amplitude of the damped harmonic oscillator having damping constant 0.02 reduces to $1/e^2$ of its undamped value.
17. A simple harmonic motion is represented by the equation x=10 sin(20t-π/4), where x is measured in meters and phase angle in radians. Calculate the maximum displacement and the maximum velocity.
18. A square board if side 2 m hinged along the upper edge and is made to oscillate in a vertical plane. Determine the period of oscillation.

(4 x 6 = 24)

PART C

Answer any 2 (10 marks each)

19. What is a flywheel. Explain its working and theory.
20. Explain the terms a) speed b) average velocity c) instantaneous velocity d) force e) average acceleration and f) instantaneous acceleration
21. Explain the evolution of a star.
22. Prove that the average value of Potential energy of a harmonic oscillator is a constant.

(10 x 2 = 20)