



24019232

QP CODE: 24019232

Reg No :

Name :

**B.Sc DEGREE (CBCS) REGULAR / IMPROVEMENT / REAPPEARANCE
EXAMINATIONS, MAY 2024
Second Semester**

Complementary Course - PH2CMT01 - PHYSICS-MECHANICS AND ASTROPHYSICS

(Common for B.Sc Mathematics Model I, B.Sc Statistics Model I)

2017 ADMISSION ONWARDS

409751FD

Time: 3 Hours

Max. Marks : 60

Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. What do you mean by the term centre of oscillation of a compound pendulum?
2. When a boy on a rotating table suddenly stretches his hands outwards, the speed of rotation decreases. Why?
3. Give the expression for moment of inertia of a rod about an axis at one end and perpendicular to its length.
4. Give the expression for moment of inertia of a disc about its diameter.
5. Discuss the properties of a Flywheel.
6. What is a simple harmonic motion?
7. Explain the term "resonance" related to forced harmonic oscillator.
8. What is a plane progressive wave? Write an expression for it.
9. What is Beat frequency?
10. Explain Doppler Effect in sound.
11. What is a protostar?
12. Define Chandrasekhar limit.

(10×1=10)





Part B

Answer any **six** questions.

Each question carries **5** marks.

13. In an experiment using Kater's pendulum the distance between the knife edges is 89.28cm. The centre of gravity of the pendulum is 54.4cm from a knife edge. If the periods of oscillation about the two knife edges are 1.933 s and 1.92 s, determine the value of acceleration due to gravity at the place.
14. A mass of 0.5 kg is attached to the end of a string of length 1 m and is whirled in a horizontal circle with a uniform speed of 10 m/s. Determine the centripetal force acting on the bob.
15. State the expression for the moment of inertia of a uniform cylinder of length l and radius R about an axis through its centre and normal to its length. If the above moment of inertia is to be minimum, determine the ratio l/R , when the mass of the cylinder is kept constant and show that the ratio is $\sqrt{3} : \sqrt{2}$.
16. Four identical spheres each of mass M and radius R are at the four corners of a square of side l . What is the moment of inertia of the system about an axis through any diagonal of the square?
17. A particle executes a simple harmonic motion of time period T . Find the time taken by the particle to go directly from its mean position to half the amplitude.
18. Calculate the kinetic energy at displacement one fourth to the amplitude in case of Simple Harmonic Motion.
19. A plane wave of frequency 256 Hz and amplitude 10⁻³mm is produced in air. Calculate the energy density and energy flux of the wave. Given the density of air = 1.29 kg m⁻³ and velocity of sound wave in air = 332 ms⁻¹.
20. Explain the evolution of a protostar to the main sequence star.
21. A star will appear blue or red, if the wavelength of maximum emission from it is in the range 450 to 490 nm or 620 to 770 nm, respectively. Calculate the range of temperature corresponding to the cases in which the star appears blue or red. Given the Wein's constant is 2898×10^{-6} mK.

(6×5=30)

Part C

Answer any **two** questions.

Each question carries **10** marks.

22. Prove that there are four points in a compound pendulum about which the time periods are same. Obtain the conditions for the minimum and maximum time periods of a





compound pendulum.

23. Explain moment of inertia and radius of gyration of a rigid body. State and prove the parallel and perpendicular axes theorems of moment of inertia.
24. Discuss the origin of damping. Set up the differential equation for a damped harmonic oscillator. Discuss the different terms involved. Obtain the condition for critically damped, over damped and under damped cases.
25. Explain the formation of white dwarfs, neutron stars and black holes.

(2×10=20)

