TB242356S

Reg. No :.....

Name :.....

BACHELOR'S DEGREE (C.B.C.S) EXAMINATION, MARCH 2024

2023 ADMISSIONS REGULAR

SEMESTER II - Mathematics COMPLEMENTARY COURSE 2

PH2B01B23 - Mechanics and Astrophysics

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

Part A

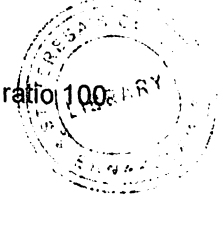
I. Answer any Ten questions. Each question carries 1 marks **(10x1=10)**

1. Write the SI units of rotational kinetic energy and torque.
2. State Newton's laws of motion in rotational dynamics
3. Two masses m and M(M>m) have same radius of gyration about the axis of rotation and same angular momentum. Which one has greater kinetic energy. Justify the answer.
4. With appropriate formula, convert 1 radian into degree.
5. Name the methods by which ultrasonic waves are produced.
6. The epoch of harmonic motion is 90 degree. Explain the motion graphically.
7. Distinguish between damped and forced oscillations.
8. Graphically represent the velocity -time curve for SHM.
9. State and explain the principle of superposition of waves. Name a situation when it does not hold true.
10. Name the spectral classes in which the hottest and coolest stars appear.
11. Explain the relation between surface temperature and colour of a star.
12. Write down the Harward classification of stars.

Part B

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

13. A uniform metre scale is of mass 120 g. What is its moment of inertia if the scale is rotated about an axis perpendicular to its length and passes through (i)the centre (ii) the 80 cm mark.
14. Calculate the radius of gyration of a disc of mass 100 gm and radius 5 cm about an axis passing through its centre of gravity and perpendicular to its plane.
15. A grind stone has a moment of inertia of $800\,kgm^2$. Find the constant torque that has to be applied to develop a speed of 180 rotations per minute in 10 seconds after starting from rest.
16. Write a note on Main sequence stars.
17. Prove that the kinetic and potential energies of harmonic oscillator is oscillating with half of time period.
18. A simple harmonic motion is represented by the equation $x = 10sin(10t - \frac{\Pi}{6})$, where x is measured in metres and phase angle in radians. Calculate (i) the maximum displacement (ii) the maximum velocity (iii) the maximum acceleration (vi) displacement, velocity and acceleration at time t=1s
19. 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.
20. Describe electron degeneracy and neutron degeneracy in the context of evolution of a star.
21. Calculate the magnitude difference between two celestial objects having their brightness in the ratio 100:



Part C

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

22. 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.
23. Set up the differential equation for a damped harmonic oscillator and obtain its solution. Hence discuss the condition for oscillatory motion.
24. Derive an equation for energy density of a progressive wave.
25. Narrate the birth and evolution of stars.