BACHELOR'S DEGREE (C.B.C.S) EXAMINATION, MARCH 2025
2018, 2019, 2020, 2021, 2022 ADMISSIONS SUPPLEMENTARY
SEMESTER II - COMPLEMENTARY COURSE 2 (PHYSICS)
PH2C01B18 - Mechanics and Astrophysics

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 longitudinal and transverse waves with one example for each.

3. If the mass of the object is doubled then what will be the effect of time period of the compound pendulum?

4. Give examples of two functions that can be used to represent wave motion.

5. Define radius of gyration.

6. Find the ratio of maximum acceleration to the maximum velocity of a particle performing S.H.M.

7. Give the concept of restoring force with suitable example.

8. Define damping coefficient. Give its SI unit.

9. Discuss the phase of a harmonic motion.

10. The luminous stars near the top of HR diagram are called ——.

11. Justify why Sun is a G star.

12. In terms of their initial mass, distinguish between white dwarfs and black dwarfs.

Part B

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

13. Distinguish between centripetal and centrifugal force. How do they act? Give an example of both these.

14. When two tuning forks P and Q are sounded together the frequency of the beats heard is 4.00 Hz. P has a known frequency of 256 Hz. When small loads are added to the prongs of Q, the beat frequency is reduced to 200 Hz. Obtain the original frequency of Q.

15. Two circular discs A and B of the same mass and same thickness are made of two different metals whose densities are ρ_A and ρ_B where $\rho_A > \rho_B$. Their moments of inertia about the axes passing through their centres of gravity and perpendicular to their planes are I_A and I_B. Find the disc with the greater moment of inertia.

16. Four spheres each of mass **M** and diameter **2a** are placed with their centres of the four corners of a square of side **b**. Calculate the moment of inertia of the system about one side of a square.

17. 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.

18. Discuss the condition of critical damping and over damped motion.

19. A particle undergoes SHM of time period 4s and amplitude 8cm. Find the time it takes to travel 3cm from the positive extremity of its oscillation.

20. Write notes on a) pulsars and b) Chandrasekhar limit.

21. Sirius is 10^4 times fainter than A-type stars. Sirius has a distance of 3 parsecs from earth, and an absolute magnitude of M = 1. Sirius is orbited by a white dwarf known as Sirius B. Find the apparent magnitude of Sirius B.

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 solid cylinder about an axis through its centre of gravity at right angles to its length.

24. Derive an expression for the energy of a particle executing simple harmonic motion.

25. Write an essay on a) white dwarf b) black hole c) supernova d) red giant.