E 8112 (Pages : 3) Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MAY 2014

Second Semester

Core Course—MECHANICS AND PROPERTIES OF MATTER

(Common for the Programmes : B.Sc. Physics (Model I), B.Sc. Physics (Model II), B.Sc. Physics—EEM, B.Sc. Physics—Instrumentation)

[2013 Admissions]

Time : Three Hours Maximum : 60 Marks

Candidates can use non-programmable scientific calculators.

Part A (Very Short Answer Questions)

Answer **all** *questions briefly.*
Each question carries 1 *mark.*

1. Explain the importance and applications of Kater's pendulum.
2. State and explain parallel axis theorem.
3. State and explain Doppler effect in sound.
4. Explain why steel girders and rails are made in the form of I section.
5. What are cohesive and adhesive forces ?
6. Define surface tension. How it is related to surface energy ?
7. What are lubricants ? Discuss the flow behaviour of lubricants.
8. What is critical damping ? Explain.

(8 × 1 = 8)

Part B (Brief Answer Questions)

Answer any **six** *questions.*
Each question carries 2 *marks.*

9. State and explain perpendicular axis theorem. Describe one application.
10. Derive an expression for the distance covered by a uniformly accelerated body during the *n*th second of its motion.
11. If two acting and reacting forces are equal and opposite, why can they never balance ? Explain with neat sketches.
12. Derive expression for the energy of progressive wave.
13. Derive the mathematical expression for the resultant wave, on superposition. Explain its applications.

Turn over

14. Calculate the moment of inertia of a cylinder about an axis through its centre and perpendicular to its axis, when the cylinder is hollow.

15. Describe an experiment to determine the moment of inertia of a flywheel. Derive the necessary formula without neglecting friction.

16. Show that for a light cantilever of length l and carrying a load W at the free end, the depression of a point x distance apart from fixed end is given by

$$y = \frac{W}{Y I_g}\left[\frac{lx^2}{2} - \frac{x^3}{6}\right].$$

17. Explain, why the pressure on the concave side of a liquid surface is greater than that of its convex side. Derive an expression for the excess pressure inside a spherical soap bubble of radius r.

18. Derive Poiseuille's formula for the rate of flow of a liquid through a capillary tube.

(6 × 2 = 12)

Part C (Problems/Derivations/Short Essays)

Answer any **four** *questions.*
Each question carries 4 *marks.*

19. A body is thrown vertically up. It was found to travel a distance of 5.0 m. during its 3rd second of the travel. Calculate the initial velocity with which the body was thrown up ?

20. A cyclist riding on a level road has to turn a corner of radius 50 m. Find the maximum speed with which he can travel without the fear of skidding ? What is the angle he shall make while negotiating the corner ? Assume the coefficient of friction between the tyres and track $\mu = 0.15$.

21. A particle moving with SHM has velocities of 8 m/s and 4 m/s when at the distance of 1 m. and 2 m. from the mean position. Determine (a) amplitude, (b) period, (c) maximum velocity and (d) maximum acceleration of the particle.

22. A horizontal plat form vibrates up and down with SHM of amplitude 2 mm. At what frequency an object kept on the platform will just loose contact with the platform ?

23. Calculate the Poisson's ratio for silver. Given its Young's modulus = 7.25×10^{10} N/m.^{2} and bulk modulus = 11×10^{10} N/m.^{2}

24. A blood sample passes through a capillary 1 mm. long and 2.5 μm in radius if the speed of the blood through the centre of the capillary is 6.6×10^{-4} cm/s. What will be the pressure drop in the blood ? Take viscosity of blood sample as 4×10^{-3} Ns/m.^{2}

(4 × 4 = 16)

Part D (Essay Questions)

Answer any **two** *questions in detail.*
Each question carries 12 *marks.*

25. With neat sketches, explain the features of a compound pendulum. Derive an expression for the acceleration due to gravity for an unsymmetric compound pendulum.

26. Obtain the differential equation for a damped harmonic oscillator. Discuss the conditions for it to be overdamped, critically damped and underdamped.

27. (a) State Stoke's law and apply it to derive an expression for the terminal velocity of a sphere falling through a fluid.

    (b) Describe an accurate method to determine the coefficient of viscosity of a liquid.

28. Describe, with necessary theory, how would you determine the rigidity modulus of a rod, by the static torsion method.

$(2 \times 12 = 24)$