E 2131 (Pages : 3) Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MAY 2015

Second Semester

Core Course—MECHANICS AND PROPERTIES OF MATTER

(Common for the programme B.Sc. Physics (Model I), B.Sc. Physics (Model II) B.Sc. Physics EEM, B.Sc. Physics Instrumentation)

[2013 Admission onwards]

Time : Three Hours Maximum : 60 Marks

Candidates can use non-programmable scientific calculators.

Part A (Very Short Answer Questions)

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

1. What is centripetal force ? What is its direction ? Write expression for it.
2. Explain, why the mass of a flywheel is generally concentrated at its rim.
3. State the principle of superposition of waves.
4. What is a cantilever ? Why a cantilever of uniform cross-section is more likely to break near its fixed end ?
5. What are the factors affecting surface tension of a liquid ?
6. What are the characteristics of turbulent flow ?
7. Point out two effects produced by damping.
8. Explain the concept of pure bending.

(8 × 1 = 8)

Part B (Brief Answer Questions)

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

9. A body starting from rest is accelerated uniformly. Find the ratio of distances covered in the first 5 second and the next 5 seconds.
10. Why does a cyclist lean while negotiating a turn ? Derive an expression for the angle of lean.
11. A particle executes SHM and when its displacement from the mean position is 2.5 cm., its kinetic and potential energies are of equal magnitude. Determine the amplitude of motion. Draw neat sketches.

12. What is a compound pendulum ? Differentiate between symmetric and unsymmetric configuration.
13. Derive an expression for the orbital velocity of a satellite.
14. Calculate the moment of inertia of a thin uniform rod about an axis perpendicular its length and passing through one end.
15. Derive the expression for the moment of inertia of a solid sphere about its tangent.
16. A rectangular bar of iron is supported at its two ends on knife edges and a load is applied at the middle point. Calculate the depression at the middle point. How can this be used to determine Young's modulus of iron ?
17. What is free surface energy ? Find a relation between surface tension and free surface energy.
18. State Stoke's law. Apply it to derive an expression for the terminal velocity of a sphere falling through a liquid.

(6 × 2 = 12)

Part C (Problems/Derivations/Short Essays)

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

19. An elevator has an upward acceleration of 1 m/s.^{2} What pressure will be transmitted to the floor of the elevator by a man weighing 600 N travelling in the elevator ? What pressure will be transmitted if the elevator has a downward acceleration of 2 m/s.^{2} ?
20. An automobile track is so designed that when a car travels at 100 km./hour, the force between the car and track acts as normal to the surface of the track. Find the angle of banking of the track assuming it to be a circle of radius 265 m.
21. A body performing SHM has an amplitude of 1 m. and the period of oscillation 2.05 sec. Find the velocity and acceleration of the body 0.4 second after passing the mean position.
22. The total energy of a particle moving SHM is E. Calculate its kinetic and potential energies when the displacement is one-half the amplitude.
23. A material has Poisson's ratio 0.2. If a uniform rod of it suffers longitudinal strain 4.0×10^{-3}, calculate the percentage change in its volume.
24. Calculate the mass of the water flowing in 10 minutes through a tube 0.1 cm. in diameter, 0.4 m. long, if there is a constant pressure head of 0.2 m. of water. The coefficient of viscosity of water is 0.00089 MKS units.

(4 × 4 = 16)

Part D (Long Answer/Essay Questions)

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

25. What is centripetal and centrifugal forces ? Explain. Derive expressions for the average centripetal acceleration and centripetal force, from fundamentals.
26. Differentiate between free, forced and damped oscillations. Derive the governing equations of motion and explain their practical applications.

27. Derive Poiseulle's formula for the rate of flow of a liquid through a capillary tube. Explain how this formula is used for determining the viscosity of a liquid by capillary flow method.
28. Calculate the moment of inertia of a circular disc (i) about an axis through its centre and perpendicular to its plane ; (ii) about a diameter ; (iii) about a tangent.

(2 × 12 = 24)