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Reg. No. : .....

Name : .....

First Semester B.Sc. Degree Examination, November/December 2011
First Degree Programme Under CBCSS (Complimentary Course)
PY 1131.2 : ROTATIONAL DYNAMICS AND PROPERTIES OF MATTER
(For Chemistry and Polymer Chemistry)

Time : 3 Hours Total Weight : 30

SECTION – A

This Section contains **four** bunches **each** of **four** questions. Answer **all** questions. **Each** bunch carries **a** weight of **one**.

Bunch 1

1. Moment of inertia of a circular disc about any tangent is
   a) $MR^2/4$ b) $MR^2/2$ c) $5MR^2/4$ d) $2MR^2/5$

2. In a simple harmonic motion
   a) The acceleration is proportional to the displacement and is directed towards the extreme position.
   b) The acceleration is proportional to the displacement and is directed towards the mean position.
   c) The acceleration is proportional to the square of the displacement and is directed towards the extreme position.
   d) The acceleration is proportional to the square of the displacement and is directed towards the mean position.

3. Waves coming from a source at infinity is called
   a) spherical wave b) elliptical wave
   c) plane progressive wave d) parabolic wave

4. The twisting couple per unit angular twist of the cylinder is called
   a) Young's modulus b) Bulk modulus
   c) Modulus of elasticity d) Modulus of torsion

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Bunch 2

5. Soap helps in better cleaning of cloths because
   a) it reduces the surface tension of solution
   b) it gives strength of solution
   c) it absorbs the dirt
   d) chemical of soap change

6. A liquid does not wet the surface of a solid if the angle of contact is
   a) zero b) an acute one c) 45° d) an obtuse one

7. A small drop of water falls from rest through a large height 'h' in air, the final velocity is
   a) proportional to $\sqrt{h}$ b) proportional to h
   c) inversely proportional to h d) almost independent of h

8. Water is flowing through a horizontal pipe in stream line flow. At the narrowest part of the pipe
   a) velocity is maximum and pressure is minimum
   b) pressure is maximum and velocity is minimum
   c) both pressure and velocity are maximum
   d) both pressure and velocity are minimum

Bunch 3

9. A sphere of moment of inertia I moves down an inclined plane. The percentage of energy which is rotational is _____

10. The moment of inertia of a body comes into play in _____ motion.

11. The surface tension of a liquid _____ with raise of temperature.

12. Two rain drops are found to hit the ground with terminal speeds in the ratio 9:4. Then diameters are in the ratio of _____

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Bunch 4

State whether the following statements are **true** or **false**.

13. In a progressive wave the wave curve advances with changing the shape.
14. Small drops are spherical in shape due to surface tension.
15. Surface tension of a pure solvent is less than that of solution.
16. Viscosity in fluid motion is analogous to friction in the motion of solids.

SECTION – B

(Answer **any eight** questions. **Each** question carries a weight of **one**).

17. Compare the moment of inertia of a circular disc about any of its diameters with that of the same disc about a tangent lying in its plane.
18. A man turns on a rotating table. He is holding two equal masses at arms length. Without moving his arms, he drops the two masses. What change, if any, is there in his angular speed ?
19. "All simple harmonic motions are periodic but all periodic motions are not simple harmonic". Explain the statement.
20. Explain the terms centre of suspension and centre of oscillation of a pendulum.
21. What are the characteristics of a progressive wave ?
22. Differentiate between angle of twist and angle of shear.
23. What is a cantilever ? What is its difference with ordinary lever ?
24. What are the factors affecting surface tension of a liquid ?
25. Why oil drops spread on the surface of water ?
26. Why farmers plough agricultural land before summer ?
27. What is the relation between the coefficient of viscosity of a liquid and temperature ?
28. What are the limitations of Poiseuille's equation ?

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SECTION – C

(Answer **any five** questions. **Each** question carries **a** weight of **two**).

29. Calculate the moment of inertia of a solid sphere about a diameter. Mass of the sphere = 1 kg and radius = 10 cm.

30. The equation of a progressive wave is given by $y = 5 \sin 2\pi (t/0.004 - x/136)$. Determine the (a) amplitude (b) wave length (c) frequency and (d) velocity of the wave.

31. The frequency of a progressive wave is 500 Hz. Its amplitude of displacement is 10^{-5} m and velocity in air is 340 m/s. If the density of air be 1.29 kg/m^3. Calculate energy density and intensity of the wave.

32. The vibrational frequency of H^1Cl^{35} molecule is 8990×10^{10} Hz. Deduce the vibrational frequency of H^2Cl^{35} molecule, assuming the force constant to be the same in the two cases.

33. Two discs D_1 and D_2 of masses 1 kg and 2 kg respectively are connected to the two ends of a mass less spring and placed on a table with the spring vertical and the heavier disc resting on the table. Calculate the frequency of oscillation of the system, if the force constant of the spring be 10^3 N/m.

34. Calculate the force required to separate two plates of glass of area 10 sq. cm each with a layer of water 0.001 mm thick in between them. The surface tension of water = 0.072 N/m.

35. Find the terminal velocity of an oil drop of density 950 kg/m^3 and radius 10^{-6} m falling through air of density 1.3 kg/m^3. If the viscosity of air is 181×10^{-5} N-s-m^{-2}.

36. A capillary tube 10^{-3} m in diameter and 0.2 m in length is fitted horizontally to a vessel kept full of alcohol of density 800 kg/m^3. The depth of the axis of the capillary tube below the surface of alcohol is 0.3 m. The coefficient of viscosity of alcohol is 0.0012 N-s-m^{-2}. Calculate the volume of alcohol that flows out of the tube in 5 minutes.

SECTION – D

(Answer **any two** questions. **Each** question carries **a** weight of **four**).

37. Define compound pendulum. Derive the expression for the period of oscillation of a compound pendulum. What are the advantages of compound pendulum over a simple pendulum ?

38. Derive an expression for the twisting couple per unit twist of a cylinder.

39. Describe how the "Ostwald viscometer" apparatus is using to compare the viscosities of two liquid.

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