



MAR IVANIOS COLLEGE (AUTONOMOUS)
THIRUVANANTHAPURAM

Reg. No. :.....

Name :.....

First Semester B.Sc. Degree Examination, November 2015
First Degree Programme under CBCSS
Complementary Course: Physics – I (for Chemistry)
AUPY131.2b: Rotational Dynamics and Properties of Matter
(for 2015 Admissions Only)

Time: 3 Hours

Max. Marks: 80

SECTION – A

Answer ALL questions in a word or one or two sentences.

1. What the factors on which moment of inertia of a body depends ?
2. What do you mean by resonance and resonant frequency ?
3. Surface tension is due to _____ force and is numerically equal to_____.
4. State the principle of superposition of waves.
5. Explain the concept of pure bending.
6. What are the factors affecting surface tension of a liquid ?
7. Clouds float in the atmosphere due to _____ and the raindrops falling through the atmosphere attains terminal velocity due to _____.
8. What is meant by coefficient of viscosity ?
9. Define critical velocity of a liquid.
10. What do you mean by flexural rigidity ?

(10 × 1 = 10 Marks)

SECTION – B

Answer any EIGHT questions, not exceeding a paragraph.

11. Find an expression for the moment of inertia of a solid cylinder about its axis.
12. State and prove perpendicular axis theorem.

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13. What do you mean by precession of a spinning top ?
14. What do you mean by the phase of a harmonic motion ? What is its initial phase ?
15. Define Progressive wave.
16. Explain bending moment.
17. What are torsional oscillations ?
18. Mention two essential properties of lubricants.
19. Give any two applications of surface tension.
20. Distinguish between surface tension and surface energy.
21. Which rain drops fall faster, big ones or small ones ? Why ?
22. What are the limitations of Poiseuille's formula ?

(8 × 2 = 16 Marks)

SECTION – C

*Short essay type / Problems : Answer any **SIX** questions.*

23. A thin hollow cylinder open at both ends and weighing 10 kg
 - i). slides with a speed of 10 m/s without rotating.
 - ii). rolls with a speed of 10 m/s without slipping.
 Calculate the kinetic energy of the cylinder in each case.
24. In an experiment for determining the surface tension of water by capillary rise, a capillary tube of diameter 1 mm is used. The height of the water in the capillary tube was found to be 3 cm. Calculate the surface tension of water. [Take density of water = 10^3 kg/m^3].
25. A particle executes a simple harmonic motion of time period T. Find the time taken by the particle to have a displacement from mean position equal to one half of the amplitude.
26. Calculate the mass of water flowing in 10 second through a horizontal capillary tube of circular cross section of radius 10^{-3} m . The tube is fitted at the bottom of a constant level tank at a depth of 1m. Length of the tube is 0.3142 m.
27. A solid cylinder of mass 200 kg rotates about its axis with angular speed 100 s^{-1} . The radius of the cylinder is 0.25 m. What is the kinetic energy associated with the rotation of the cylinder ?

28. In Jaeger's experiment, a capillary tube of internal diameter 0.5 mm dips 3 cm inside water contained in a beaker. The difference in level of water manometer when the bubble is released is 0.09 m. Calculate the surface tension of water.
29. A body suspended symmetrically from the lower end of a wire, 100 cm long and 1.22 mm diameter oscillates about the wire as axis with a period of 1.25 s. If the modulus of rigidity of the material of the wire $8 \times 10^{10} \text{ Nm}^{-2}$, calculate the moment of inertia of the body about the axis of rotation.
30. Calculate the depression at the free end of the light cantilever loaded by 1.8 kg at the free end if it has a length of 1.2 m, breadth 3 cm and thickness 9 mm. Young's modulus of the material is $1.9 \times 10^{11} \text{ Nm}^{-2}$.
31. Discuss briefly the method of comparing the coefficients of viscosity of two liquids using an Ostwald's viscometer.

(6 × 4 = 24 Marks)

SECTION – D

Long essay type : Answer any TWO questions.

32. Calculate the moment of inertia of a circular disc
 - i). about an axis through its centre and perpendicular to its plane;
 - ii). about the diameter;
 - iii). about a tangent.
33. Obtain an expression for the depression of the midpoint of a beam loaded at the centre. Hence arrive at the expression for Young's modulus of a bar of rectangular cross section.
34. Differentiate between free, forced and damped oscillations. Derive the governing equations of motion and explain their practical applications.
35. State Stoke's law. Apply it to derive an expression for the terminal velocity of a sphere falling through a liquid. Also explain why bubbles of carbon – di – oxide rise up in soda water at a slow rate.

(2 × 15 = 30 Marks)
