



MAR IVANIOS COLLEGE (AUTONOMOUS)
THIRUVANANTHAPURAM

Reg. No. :.....

Name :.....

First Semester B.Sc. Degree Examination, November 2014

First Degree Programme under CBCSS

Complementary Course: Physics – I (for Chemistry)

AUPY131.2b: Rotational Dynamics and Properties of Matter

Time: 3 Hours

Max. Marks: 80

SECTION – A

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

1. When the torque on a system is zero, the _____ acting on it is zero.
2. In a SHM _____ is conserved.
3. What is radius of gyration ?
4. What are the conditions for an oscillatory motion to be simple harmonic ?
5. What is meant by neutral surface or layer ?
6. The main advantage of I section girder is _____.
7. In kerosene lamps, kerosene rises through the wicks due to _____.
8. Detergents help cleaning of cloths because they _____.
9. Terminal velocity of a glass bead falling through a highly viscous liquid is proportional to _____.
10. What is unit of co – efficient of viscosity ?

(10 x 1 = 10 Marks)

SECTION – B

Answer any EIGHT questions, not exceeding a paragraph.

11. State and prove perpendicular axis theorem.
12. Obtain an expression for the moment of inertia of a circular disc about a diameter.

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13. Derive the differential equations for a simple harmonic oscillator. Explain the terms.
14. Distinguish between center of suspension and center of oscillation of a pendulum.
15. Where does a particle executing SHM experience (i) maximum force and (ii) minimum force ?
16. The equation $y = 0.25 \sin(\pi t + \pi)$ meters give the displacement of a particle executing simple harmonic motion. Write the value of its (i) period (ii) amplitude and (iii) initial phase.
17. Distinguish between uniform and non – uniform bending. Give examples.
18. What do you mean by torsional couple ? Discuss its origin.
19. Distinguish between surface tension and surface energy.
20. Derive an expression for the excess pressure inside a spherical drop.
21. State and explain Newton's law of viscous flow for a liquid.
22. State Stoke's formula. Explain the symbols.

(8 x 2 = 16 Marks)

SECTION – C

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

23. A uniform meter scale is of mass 120gm. What is its moment of inertia, if the axis is perpendicular to its length and passes through (a) the center and (b) the 75cm mark ?
24. A sphere made of steel has a diameter 20cm. Calculate its M.I. about a diameter. Given density of steel = $7.9 \times 10^3 \text{ kg.m}^{-3}$.
25. A disc 0.1m in radius and weighing 1kg is suspended in a horizontal plane by a vertical wire 1.5m long attached to its center. The diameter of the wire is 10^{-3}m and the period of torsional oscillation of the disc is 5 seconds. Find the rigidity modulus of the material of the wire.
26. Calculate the pressure inside a soap bubble of radius 3mm. Surface tension of soap solution is $20 \times 10^{-3} \text{ Nm}^{-1}$. Also calculate the surface energy of the bubble.

27. The excess pressure inside a soap bubble of radius 10^{-2}m is balanced by that due to a vertical column of a liquid $1.6 \times 10^{-3}\text{m}$ high. If the density of the liquid is 800 kg.m^{-3} , calculate the surface tension of the soap solution.
28. A bar .01m square in cross section is supported on two knife edges 1 meter apart. A load of 1kg at the center of the bar produces a depression at the midpoint of the bar by $2.51 \times 10^{-3}\text{m}$. Find the Young's modulus of the material of the bar.
29. The equation for SHM of a particle is given by $y = 10 \sin \left(477 t + \frac{\pi}{4} \right)$ meter. Find the value of displacement, velocity and acceleration at $t = 2$ second. Find also the period of oscillation.
30. A metal plate 10^{-2} square meter in area rest on a layer of castor oil 2×10^{-3} meter thick. Viscosity of castor oil is 1.55 Nsm^{-2} . Calculate the horizontal force necessary to move the plate with a speed of $3 \times 10^{-2} \text{ ms}^{-1}$.
31. An air bubble of radius $5 \times 10^{-3} \text{ m}$ raise steadily through a liquid of relative density 0.83 at the rate of 22.6 ms^{-1} . Calculate the viscosity of the liquid. Neglect density of air.

(6 x 4 = 24 Marks)

SECTION – D

Long essay type : Answer any TWO questions.

32. Determine the moment of inertia of a rod about an axis perpendicular to its length if the axis passes through the (i) center and (ii) one end.
33. Describe with theory the torsion pendulum method of determining the rigidity modulus of the material of a wire.
34. Derive Poiseuille's formula for the flow a liquid through a narrow tube.
35. Describe with theory to find the surface tension of a liquid and its temperature dependence by Jaeger's method.

(2 x 15 = 30 Marks)
