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Reg. No. :

Name :

First Semester B.Sc. Degree Examination, August 2021

First Degree Programme under CBCSS

Physics

Complementary Course for Chemistry and Polymer Chemistry

PY 1131.2–ROTATIONAL DYNAMICS AND PROPERTIES OF MATTER

(2013, 2015–2017 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer **all** the questions in **one** or **two** sentences. Each question carries **1** mark:

1. What the factors on which moment of inertia of a body depends?
2. Which type of energy is stored in the flywheel?
3. State the perpendicular axes theorem for a plane lamina.
4. Give the moment of inertia of disc.
5. What are the conditions for the motion of a particle to be simple harmonic?
6. Distinguish between periodic and oscillatory motions.
7. State Hooke's law.

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8. Define Poisson's ratio.
9. What are the factors affecting surface tension?
10. What is meant by streamline flow?

(10 × 1 = 10 Marks)

SECTION– B

Answer any **eight** questions, not exceeding a paragraph. Each question carries 2 marks:

11. What are the conditions for the motion of a particle to be simple harmonic?
12. Derive expression for moment of inertia of a thin circular ring. Which physical quantity does it resemble in linear motion?
13. Define simple harmonic motion. Give two examples.
14. Write the expression for
 - (a) Velocity of a particle executing linear SHM
 - (b) Acceleration of a particle of executing linear SHM.
15. List out any two characteristics of progressive waves.
16. Define stress and strain.
17. Explain bending moment.
18. What are torsional oscillations?
19. Bring out the expression for excess of pressure inside a spherical liquid drop and aspherical bubble.
20. Which rain drops fall faster, big ones or small ones? Why?

21. Give any two applications of surface tension.
22. Why hot water is preferred to cold water for washing clothes?

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. Each question carries 4 marks:

23. A fly wheel of mass 500 kg and radius 1m makes 500 rev/minute. Assuming the mass to be concentrated along the rim, calculate the energy of the fly wheel.
24. The equation of a progressive harmonic wave is $y = 8 \sin \pi \left(\frac{1}{0.05} - x \right)$ cm. Find the amplitude, frequency, velocity and wavelength.
25. 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.
26. A metal bar having 1 cm square in cross – section is supported on two knife edges 100 cm apart. A load of 2 kg at the centre of the bar depresses that point by 5.02 mm. Calculate its Young's modulus.
27. A torsional pendulum is made by suspending a metal disc having mass 1.5 kg, radius 0.1 m at the end of a wire of length 12.5 cm and radius 0.6 mm. If the period of torsional oscillations is 2 second, find the rigidity modulus of the given wire.
28. 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 $1.9 \times 10^{11} \text{ Nm}^{-2}$.
29. A drop of water having surface tension $7.12 \times 10^{-2} \text{ Nm}^{-1}$ of radius $6 \times 10^{-3} \text{ m}$ is split into 216 equal tiny drops. Find the excess of pressure in any one of the small drops.

30. A circular wire loop of 0.03 m radius is rested on the surface of a liquid and then raised. The pull required is 0.003 kg wt greater than the force acting after the film breaks. Find the surface tension of the liquid.
31. Fine particles of sand are shaken up in water contained in a tall cylinder. If the depth of water in the cylinder is 0.3 m, calculate the size of the largest particle of sand that can remain suspended after 40 minutes.
Assume density of sand = 2600 kg m^{-3} and viscosity of water = $10^{-3} \text{ N s m}^{-2}$.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. Each question carries **15** marks:

32. With necessary theory, describe a method for determining the moment of inertia of a fly wheel.
33. Derive an expression for the period of oscillation of a compound pendulum.
34. What is a cantilever? Derive an expression for the depression produced at the free end of cantilever loaded at its free end.
35. Derive Stoke's formula for a small sphere falling through a viscous liquid. Also explain how this is used to determine the viscosity of the given liquid.

(2 × 15 = 30 Marks)