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Reg. No. : .....

Name : .....

First Semester B.Sc. Degree Examination, June 2022

First Degree Programme Under CBCSS

Physics

Complementary Course for Chemistry

PY 1131.2 — ROTATIONAL DYNAMICS AND PROPERTIES OF MATTER

(2018-2019 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

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

1. State the parallel axis theorem.
2. Which type of energy is stored in the flywheel?
3. Define a rigid body.
4. Give moment of inertia of disc.
5. What are the characteristics of SHM?
6. Distinguish between periodic and oscillatory motions.
7. What is meant by coefficient of viscosity?
8. Clouds float in the atmosphere due to ———— and the raindrops falling through the atmosphere attains terminal velocity due to ————.

P.T.O.

9. Define surface energy.

10. Define critical velocity of a liquid.

(10 × 1 = 10 Marks)

SECTION – B

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

11. Explain the law of conservation of angular momentum.

12. Find the moment of inertia of a thin ring about an axis passing through its diameter.

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 executing linear SHM.

15. List out any two characteristics of progressive waves.

16. Every SHM is periodic motion but every periodic motion need not be SHM. Why?

17. Distinguish between transverse wave motion and longitudinal wave motion.

18. Write the practical applications of viscosity.

19. Write down the differential equation for a simple harmonic oscillator. Explain the different terms.

20. Find an expression for the moment of inertia of a solid cylinder about its axis.

21. Why hot water is preferred to cold water for washing clothes?

22. What are the limitations of Poiseuille's formula?

(8 × 2 = 16 Marks)

SECTION – C

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

23. Starting from rest, the flywheel of a motor attains an angular velocity 100 rad/s from rest in 10 s. Calculate (a) angular acceleration and (b) angular displacement in 10 seconds.

24. A thin metal ring of diameter 0.6m and mass 1kg starts from rest and rolls down on an inclined plane. Its linear velocity on reaching the foot of the plane is 5 m s^{-1}, calculate (a) the moment of inertia of the ring and (b) the kinetic energy of rotation at that instant.

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 8×10^{10} Nm^{-2}, calculate the moment of inertia of the both 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 1.9×10^{11} Nm^{-2}.

29. Calculate the amplitude, angular frequency, frequency, time period and initial phase for the simple harmonic oscillation $y = 2 \cos (2\pi t)$.

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} N s m^{-2}.

($6 \times 4 = 24$ Marks)

SECTION – D

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

32. Define moment of inertia of a rotating body. What is its physical significance? Calculate the moment of inertia of a solid sphere about (a) its diameter (b) a tangent.

33. Derive expressions for velocity, acceleration and total energy of a particle executing SHM.

34. 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.

35. Describe Jaeger's method for measuring the surface tension of liquid.

(2 × 15 = 30 Marks)