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N – 4059

Reg. No. : .....

Name : .....

**First Semester B.Sc. Degree Examination, June 2022**

**First Degree Programme under CBCSS**

**Physics**

**Complementary Course for Home Science**

**PY 1131.5 : MECHANICS AND PROPERTIES OF MATTER**

**(2020 Admission Onwards)**

Time : 3 Hours

Max. Marks : 80

**SECTION – A**

Answer **all** questions. **Each** question carries **1** mark.

1. What is a rigid body?
2. What are the factors in which the moment of inertia of a body depend on?
3. Give an example for a simple harmonic motion.
4. Define reduced mass of a vibrating system.
5. What is neutral surface of a beam?
6. What is a torsion pendulum?
7. Define molecular range.
8. Expression for the excess pressure inside a liquid is:
9. What are the factors on which viscous forces between two layers depend on?
10. Write any two limitations of Poiseulle's formula.

**(10 × 1 = 10 Marks)**

P.T.O.

## SECTION – B

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

11. Explain the radius of gyration.
12. Explain the parallel axes theorem.
13. If angular momentum is conserved in a system whose moment of inertia is decreased, will its rotational kinetic energy be conserved?
14. Write the mathematical representation of a plane, progressive harmonic wave.
15. Define phase velocity.
16. Describe the potential energy curve of a diatomic molecule.
17. What is flexural rigidity?
18. Differentiate angle of twist and angle of shear.
19. Compare the couple required to twist a hollow and a solid cylinders of same mass, length and material through 1 radian.
20. Explain why the free surface of a liquid tend to have the minimum possible area.
21. Compare the excess pressures in the case of a single spherical surface and a spherical film.
22. Why are large drops on a flat surfaces become flattened?
23. Define the coefficient of viscosity.
24. Explain the limitations of Poiseuille's formula.
25. Explain the variation of viscosity in liquids with temperature.
26. What is Reynold's and what is its significance?

(8 × 2 = 16 Marks)

## SECTION – C

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

27. Find the moment of inertia of a disc of mass 3 kg and radius 50 cm about the following axes: (a) axis passing through the center and perpendicular to the plane of the disc, (b) axis touching the edge and perpendicular to the plane of the disc and (c) axis passing through the center and lying on the plane of the disc.
28. Calculate the radius of gyration of a solid sphere rotating about its diameter if its radius is 5.0 cm.
29. Find the rotational kinetic energy of a ring of mass 9 kg and radius 3m rotating with 240 revolutions per minute about an axis passing through its center and perpendicular to its plane.
30. Write down the equation of wave travelling in the negative direction along X-axis and having an amplitude 0.01 m, a frequency 550 Hz and speed 330 m/s.
31. A steel rod of length 50 cm, width 2 cm and thickness 1cm is bent into the form of an arc of radius of curvature 2.0 m. Calculate the bending moment. Young's modulus of the material of the rod =  $210^{11} \text{ N/m}^2$ .
32. A brass bar 1 cm square in cross-section is supported on two knife edges one metre apart. A load of 1 kg at the centre of the bar depresses that point 2.51 mm. What is Young's modulus of brass?
33. Calculate the excess pressure inside a soap bubble.
34. Calculate the work expended in spraying a drop of water of one millimeter diameter into  $10^6$  droplets all of the same size, the surface tension of water being  $7.2 \times 10^{-2} \text{ N/m}$
35. A soap bubble of surface tension 0.025 N/m has a radius 5cm. If the bubble is blown to a radius of 10 cm, what is the amount of work done?
36. Calculate the mass of water flowing in 10 minutes through a tube 0.1 cm in diameter, 40cm long if there is a constant pressure head of 20 cm of water. The coefficient of viscosity of water is 0.0089 C.G.S. Units.
37. A gas bubble of diameter 2 cm rises steadily through a solution of density 1.75 gm/cc. at the rate of 0.35 cm/sec. Calculate the coefficient, of viscosity of the solution. (Neglect density of the gas).

38. In the Poiseuille experiment, the following observations were made: Volume of water collected in 5 minutes =  $40 \text{ cm}^3$ ; Head of water =  $0.4 \text{ m}$ ; length of capillary tube =  $0.602 \text{ m}$  and radius of capillary tube =  $0.52 \times 10^{-3} \text{ m}$ . Calculate the coefficient of viscosity of water.

(6 × 4 = 24 Marks)

SECTION – D

Answer any two questions. Each question carries 15 marks.

39. Calculate the moment of inertia of a solid cylinder
- About its own axis
  - About an axis perpendicular to its geometrical axis and passing through its center.
40. (a) Explain the parallel axis theorem.  
(b) Derive the expression for the moment of inertia of a solid uniform bar of rectangular cross-section about an axis perpendicular to its length and passing through one of its corners.
41. What is a two body harmonic oscillator? Prove that the oscillations of two particles connected by a spring are simple harmonic.
42. Derive an expression for the depression at the centre of a beam loaded in the middle.
43. Show that surface tension is:
- The amount of work done in increasing the surface area of liquid film by unity under isothermal conditions.
  - Equal to the mechanical part of the surface energy.
44. (a) Derive the Stokes formula.  
(b) Explain the Stoke's method to determine the viscosity of a highly viscous liquid.

(2 × 15 = 30 Marks)