ST. SAINTS COLLEGE

(Pages : 4) **N – 3979**

Reg. No. : .....

Name : .....

First Semester B.Sc. Degree Examination, June 2022

First Degree Programme under CBCSS

Physics

Core Course – I

PY 1141 : BASIC MECHANICS AND PROPERTIES OF MATTER

(2020 Admission Onwards)

Time : 3 Hours Max. Marks : 80

SECTION – A

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

1. What are rigid bodies?
2. Give the moment of inertia tensor.
3. What is the unit and dimension of moment of inertia?
4. Define Poisson's ratio.
5. Give example of a Catenoid surface.
6. If a liquid wet a solid surface, angle of contact is?
7. The equation of continuity for a fluid expresses the conservation of ————————
8. What is the instrument used to measure rate of flow of water through a pipe?
9. Give an example for simple harmonic motion.
10. Define amplitude.

(10 × 1 = 10 Marks)

P.T.O.

SECTION – B

Answer **any eight** questions. Each questions carries **2** marks each.

11. Differentiate rotational motion with translational motion of a rigid body.
12. Give the properties of moment of inertia tensor.
13. Give two examples of rigid bodies having equal values of principal moments of inertia.
14. State work energy theorem.
15. Differentiate stress and strain.
16. What is torsional oscillation? Give equation for time period of torsional oscillation:
17. Define surface tension.
18. Give a short note on molecular theory of surface tension.
19. What is angle of contact?
20. Surface tension of a soap solution is 0.03n/m. How much work is done to produce the soap bubble of radius 0.05m?
21. Oil spreads over surface of water whereas water does not spread over surface of oil. Explain.
22. What happens to angle of contact if temperature is increased?
23. Explain Stoke's law of a viscous liquid.
24. Differentiate streamline and turbulent flow.
25. What is a simple harmonic motion?
26. Distinguish mechanical and electrical equations of motion.

(8 × 2 = 16 Marks)

SECTION – C

Answer **any six** questions, not exceeding a paragraph. Each carries **4** marks.

27. Show that the motion of a rotating rigid body obeys the rotational analogue of Newton's second law of motion.

28. Show that the torque on a rigid body about a given axis is equal to the product of moment of inertia of the body and its angular acceleration about that axis and that its angular momentum about the given axis is equal to the product of its moment of inertia and its angular velocity about that axis.

29. Obtain the expression for energy of a rotating rigid body.

30. Consider a drop of mass 1.00 g falling from a height 1.00 km. It hits the ground with a speed of 50.0 ms^{-1}.

    (a) What is the work done by the gravitational force?

    (b) What is the work done by the unknown resistive force?

31. With suitable example, prove the conservation of energy of a particle.

32. Obtain the expression of depression at loaded end of a cantilever, with weight of the cantilever not neglected.

33. A uniform beam of length *l* is supported symmetrically on two knife edges in same horizontal plane and loaded a weight W in the middle. Deduce the equation for depression of the beam.

34. Two solid cylinders of solid material having length *l* and 2 *l* and radii r and 2r are joined coaxially. Under a couple applied between free ends, the shorter cylinder show twist 30° Calculate the twist of the longer cylinder.

35. Derive the continuity equation for compressible and incompressible fluid.

36. A pendulum is of length 50 cm. Find its period when it is suspended in

    (a) a stationary lift

    (b) a lift falling at the constant velocity of 5m/s

37. Find the time period and the frequency of a block of mass one kg attached to a spring and stretches the spring by 7cm.

38. Deduce the general equation of wave motion.

(6 × 4 = 24 Marks)

SECTION – D

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

39. (a) Discuss the theorems of moment of inertia.

    (b) Calculate the moment of inertia of a circular disc of mass M and radius R about

        (i) its own axis,

        (ii) about tangential axis parallel to its own axis.

        (iii) about its diameter, and

        (iv) about a tangential axis parallel to its diameter.

40. What is elasticity? Obtain the relation connecting three elastic constants.

41. Deduce the expression for excess of pressure on the curved liquid surface like spherical surface, cylindrical surface and catenoid.

42. With a neat diagram, derive Bernoulli's equation for steady flow of a liquid. What is the significance of Bernoulli's equation? Mention its practical applications.

43. (a) Give a note on conservation laws in mechanics.

    (b) Define :

        (i) Work

        (ii) Power

        (iii) Kinetic energy

        (iv) Potential energy

    (c) Using work energy theorem, show that sum of kinetic and potential energy is always constant.

44. What is a compound pendulum? What are the advantages of compound pendulum over simple pendulum? Discuss the interchangeability of suspension and oscillations of a compound pendulum.

(2 × 15 = 30 Marks)
