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First Semester B.Sc. Degree Examination, August 2021

First Degree Programme Under CBCSS

Physics

PY 1141 : BASIC MECHANICS AND PROPERTIES OF MATTER

(2020 Admission Regular)

Time : 3 Hours

Max. Marks : 80

PART – A

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

1. What is the SI unit of coefficient of viscosity?
2. What are the three modulii of elasticity?
3. What is a conservative force?
4. State work energy theorem.
5. What is meant by turbulent flow?
6. Define Young's modulus.
7. What is the Stokes formula for the force acting on a spherical object of radius r falling through a viscous liquid?
8. What is the excess pressure inside a soap bubble of radius r ?

P.T.O.

9. What is meant by a transverse wave?

10. What is the working principle of a venturimeter?

(10 × 1 = 10 Marks)

PART – B

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

11. State Bernoulli's theorem.

12. State and explain perpendicular axis theorem.

13. Obtain the differential equation of simple harmonic motion?

14. Define the terms stress and strain. Give their units.

15. What do you mean by the intensity of a wave?

16. What are harmonics and overtones?

17. Define Poisson's ratio. What is its unit?

18. Show that the horizontal oscillations of a mass connected to a spring is simple harmonic.

19. Obtain the expression for potential energy of a harmonic oscillator.

20. What is an aerofoil?

21. Distinguish between elasticity and plasticity.

22. What are the factors upon which the critical velocity of a liquid depends and hence obtain an expression for critical velocity.

23. How is surface tension related to surface energy?

24. Explain the terms 'neutral axis' related to bending of beams.

25. Obtain the expression For kinetic energy of a simple harmonic oscillator.

26. What is moment of inertia of a disc about a tangent?

(8 × 2 = 16 Marks)

PART – C

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

27. A disc of moment of inertia 2 kg m^2 rotates about its axis at 50 rpm. Find the torque that can stop it in one minute.

28. A square glass of sides 6 cm is placed on 0.5 mm thickness of an oil layer spread on another big plate. If a force 0.3 N is needed to move the plate with a velocity 0.02 m/s, calculate the coefficient of viscosity of the oil.

29. Two steel wires of the same length have radii in the ratio 1:2. When they are stretched by different forces, the elongations are found to be the same. Find the ratio of the forces applied.

30. Prove that the velocity of a particle in simple harmonic motion at a distance $\frac{\sqrt{3}}{2}$ of its amplitude from the centre is half of its velocity at the central position.

31. What is the work done in blowing a soap bubble of radius 100 mm? Given surface tension T= 0.03 J/m^2

32. If the centre of mass of three particles of masses 1,2 and 3 gm be at a point (1, 2, -3), then where should a fourth particle of mass 4 gm be placed so that the combined centre of mass may be at the point (1,1,1).

33. A flywheel weights 100 kg and the whole of the weight may be considered as concentrated at a distance 80 cm from the axis. What is the amount of energy stored in the flywheel when rotating at a speed of 100 revolutions per minute?

34. Calculate the linear depression of a cantilever loaded by 2.5 kg if its dimensions are 80 cm × 3 cm × 0.8 cm and its Young's modulus Y =200 GPa.

35. Two identical drops of water are falling through air with steady velocity 5cm/s. If the two drops combine together, what will be the terminal velocity?

36. The total energy of a particle executing SHM of period 2π seconds is 10.24×10^{-4} J. The displacement of the particle at $\frac{\pi}{4}$s is $8\sqrt{2}$ cm. If the initial phase is zero calculate the amplitude of motion and mass of the particle.

37. A uniform circular disc of mass 100 g, radius 2 cm is rotated about one of its diameters at an angular speed of 10 rad/s. Find the kinetic energy of the disc and angular momentum about the axis of rotation.

38. A 0.02 cm liquid column balances excess pressure inside a soap bubble of radius 7.5 mm. Find the density of the liquid if surface tension of soap solution =0.03 N/m.

(6 × 4 = 24 Marks)

PART – D

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

39. Derive an expression for the moment of inertia of a hollow cylinder about its own axis of cylindrical symmetry and about an axis passing through the centre and perpendicular to its length.

40. Derive the relation connecting modulii of elasticity and Poisson's ratio.

41. Derive the one dimensional differential equation of wave motion and also explain the characteristics of wave motion.

42. Explain the principle of continuity for the steady and irrotational flow of an incompressible fluid.

43. Distinguish between streamline flow and turbulent flow. Explain the equation of continuity in the case of a fluid flowing through a pipe of varying cross-section.

44. Illustrate with the help of two examples that a conservative force can be expressed as the negative gradient of potential.

(2 × 15 = 30 Marks)
