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Reg. No. : .....

Name : .....

First Semester B.Sc. Degree Examination, February 2018
First Degree Programme and CBCSS
PHYSICS
Core Course – I
PY 1141 – Basic Mechanics and Properties of Matter
(2013 Admission)

Time : 3 Hours Max. Marks : 80

All Saints' College Tivandrum

SECTION – A

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

1. Give any two examples for conservative force.
2. Define torque.
3. What is meant by energy function ?
4. Define a simple harmonic motion.
5. Write down the relation between velocity and the displacement of a particle executing simple harmonic motion.
6. State Hook's law of elasticity.
7. Define the term neutral surface.
8. What is surface energy of a liquid ?
9. Why kerosene oil rises up in the wick of a lantern ?
10. Write the Poiseuille's formula for the rate of flow of a liquid through a capillary tube.

(10×1=10 Marks)

SECTION – B

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

11. "The laws of mechanics can be applied only to objects of large size and moving with velocities less than that of light". Discuss.
12. Define moment of inertia in terms of Torque and angular momentum.
13. Calculate the kinetic energy of a rolling body with circular symmetry.
14. Explain potential energy curve.
15. Explain work-energy theorem.
16. What are the positions at which acceleration becomes :
    i) minimum
    ii) maximum for a simple harmonic oscillator ?

    What are the minimum and maximum values?
17. Show that the work done per unit volume is $\frac{1}{2}$ (stress × strain) in the case of linear strain.
18. Explain bending moment.
19. What is surface tension of a liquid ? What are the factors affecting the surface tension of a liquid ?
20. Discuss Bernoulli's theorem.
21. Explain the principle of venturimeter.
22. Derive the equation of continuity in hydrodynamics. **(8×2=16 Marks)**

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SECTION – C

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

23. A solid sphere of mass 1 kg rolls without sliding with uniform velocity of 0.1 m/s along a horizontal table. Calculate the total energy of the sphere.
24. A flywheel rotating at the rate of 150 rotations per minute can just raise a load of 50 kg through 4 meters before coming to rest. Neglecting the friction at the bearings, calculate the moment of inertia of the flywheel.

25. Show that the force given by $F = \hat{i} \sin y - \hat{j} \cos y - \hat{k} \cos z$ is conservative.

26. A particle executing SHM makes 90 oscillations per minute. At the equilibrium position, its velocity is 9 cm/s. Find :
    i) The length of the path of the particle.
    ii) Its velocity at a point midway between its equilibrium position and extreme position.

27. Prove that oscillation of two particle connected by a spring is a simple harmonic oscillation.

28. A bar of length 1.2 m, breadth 3 cm and thickness 4 mm is used as a cantilever. When a load of 0.25 kg is attached to the free end, the depression at the free end is 1 cm. Calculate the Young's modulus of the material.

29. A metallic disc of mass 1 kg and radius 12 cm is suspended in a horizontal plane by a wire attached to its center. The radius of the wire is 0.6 mm and its length is 2 m. The period of oscillation is found to be 5 s. Find the modulus of rigidity of the wire.

30. Calculate the work done against surface tension in blowing a soap bubble of radius 5×10^{-2} m, if the surface tension of soap solution is 25×10^{-3} N/m.

31. A venturimeter is connected to a main water pipe, the diameters at the constrictions and outside are 10 cm and 20 cm respectively and the levels of the water column, in the two limbs differ y 8 cm. What is the volume of water flowing through the pipe in one hour?

(6×4=24)

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SECTION – D

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

32. State and prove parallel and perpendicular axes theorem. Also determine the moment of inertia of a hollow cylinder about its own axis.

33. i) Derive an expression for Kinetic Energy, Potential Energy and Total Energy of a harmonic oscillator. Also discuss the variation with respect to displacement.
    ii) Derive an expression for the time period of a simple pendulum.

34. Derive the relation connecting three elastic constants.

35. i) Discuss the variation of surface tension with temperature.
    ii) Explain Jaeger's method to determine the surface tension of a liquid.

(2×15=30 Marks)