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Reg. No. : .....

Name : .....

First Semester B.Sc. Degree Examination, November 2019

First Degree Programme Under CBCSS

Physics

Core Course I

PY 1141 – BASIC MECHANICS AND PROPERTIES OF MATTER

(2018 Admission onwards)

Time : 3 Hours Max. Marks : 80

SECTION – A

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

1. Write down differential equation of wave motion.
2. Write down expression for kinetic energy of a rotating body.
3. The expression for conservative force (F) in terms of potential energy (U) is?
4. Write down any two differences between mechanical wave and electromagnetic waves.
5. Differential equation of spring mass system executing simple harmonic motion is?
6. The unit of surface tension is?
7. The motion of a particle executing simple harmonic motion (SHM) is given by $x = A\sin\omega t + B\cos\omega t$ What is its amplitude?

P.T.O.

8. Define Energy Function.

9. Give an example for conservative Force.

10. Define Poisson's ratio.

(10 × 1 = 10 Marks)

SECTION – B

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

11. What is Physical Significance of Moment of Inertia?

12. State Stoke's formula. Explain the symbols.

13. State theorems on Moment of Inertia.

14. Explain bending moment.

15. Explain why water rises in a glass capillary tube and mercury goes down in it.

16. Explain the advantages of 'I' section for girders.

17. State and explain Bernoulli's theorem.

18. Write short note on Torsion Pendulum. Obtain expression for the frequency of oscillations.

19. Show that moment of inertia of a disc about its diameter on its plane is half the MI of the same disc about an axis passing through the centre and perpendicular to its plane.

20. How does a compound pendulum differ from a simple pendulum?

21. Write a short note on Venturimeter.

22. Explain how surface tension varies with temperature.

(8 × 2 = 16 Marks)

SECTION – C

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

23. Obtain expression for kinetic energy(KE) and potential energy (PE) of a particle executing simple harmonic motion. Sketch KE and PE.

24. Obtain an expression for the moment of inertia of a solid sphere.

    (i) about a diameter

    (ii) about a tangent

25. Show that the Force $\vec{F} = yz\hat{i} + zx\hat{j} + xy\hat{k}$ is a conservative force.

26. A rod of 0.8 m in length and 2cm in diameter is clamped at one end. A torque is applied at the other end so that the rod get twisted through 45°. Find the torque applied. Rigidity modulus of the rod $7 \times 10^{10} Nm^{-2}$.

27. A particle which executes SHM along a straight line has its motion represented by $x = 4\sin(\pi t/3 + \pi/6)$.

    Find

    (a) the amplitude

    (b) time period

    (c) frequency ;

    (d) phase difference ;

    (e) velocity

    (f) acceleration, at t = 1s, × being in cm.

28. At what distance from the equilibrium position is the kinetic energy equal to the potential energy for a SHM? In SHM if the displacement is one-half of the amplitude show that the kinetic energy and potential energy are in the ratio 3:1.

29. Water flows through a horizontal pipe line of varying cross-section. At a point where the pressure of water is 0.05m of mercury the velocity of flow is 0.25 m/s. Calculate the pressure at another point where velocity of flow is 0.4 m/s. Density of water = 10^3 Kg/m^3

30. What would be the pressure inside a smaller air bubble of 0.1 mm radius situated just below the surface of water? Surface tension of water 0.072 N/m and atmospheric pressure = 1.013×10^5 N/m^2

31. A metal wire of length 3 meters and diameter 1mm is stretched by a weight of 10 Kg. If Youngs modulus for its material be 1.25×10^{11} dynes/cm^2 and σ for it equal to 0.26. calculate the lateral compression produced.

(6 × 4 = 24 Marks)

SECTION – D

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

32. Discuss a method with necessary theory to determine the moment of inertia of flywheel? What are the practical uses of flywheel?

33. Derive an expression for the oscillations of two particles connected by a spring. An HCl molecule executes fundamental vibration frequency at 8.7×10^{13} Hz. What is the effective force constant C between atoms. Mass of Chlorine 35 u and Mass of Hydrogen lu and u 1.66×10^{-27} Kg.

34. Deduce an expression for the couple per unit twist of a uniform cylindrical rod. Hence explain why a hollow cylinder is stronger than solid cylinder of same material, mass and length?

35. Deduce the expression a plane progressive harmonic wave. Hence obtain expression for energy density of a plane progressive Wave.

(2 × 15 = 30 Marks)