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Reg. No. : .....

Name : .....

First Semester B.Sc. Degree Examination, February 2018
First Degree Programme Under CBCSS
Physics
Core Course – I
PY 1141 : BASIC MECHANICS AND PROPERTIES OF MATTER
(2014 Admission Onwards)

Time : 3 Hours Max. Marks : 80

All Saints' College Trivandrum

SECTION – A

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

1. What do you mean by centre of mass of a system ?
2. Give the expression for the rotational work done by a torque.
3. Define radius of gyration.
4. What do you mean by conservative force ? Give one example.
5. Define work energy theorem.
6. Two spheres are identical in mass and volume, but one is hollow and the other is solid. How will you identify them experimentally ?
7. What is resonance in forced oscillations ?
8. Show that the oscillations of a loaded spring are simple harmonic.
9. Define flexural rigidity.
10. Define surface energy. What is its unit ?

(10×1=10 Marks)

SECTION – B

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

11. State and explain parallel axes theorem with an example.
12. Derive the expression for total energy of a rotating body.
13. Distinguish between elastic and inelastic collisions.
14. A light body and heavy body have equal kinetic energy. Which will have greater momentum ?
15. "Centre of suspension and centre of oscillations are interchangeable". Justify.
16. What are beats ? Mention two important application of beats.
17. Explain the Poiseoulle's formula for determining the viscosity of a liquid.
18. What is an I-section girder ? Write its two advantages.
19. Explain Doppler effect.
20. Discuss the factors affecting acoustics of building.
21. What is Reynold's number ? What is its importance ?
22. Explain the principle and working of Venturimeter. **(8×2=16 Marks)**

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SECTION – C

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

23. Four spheres of a diameter of a 2a and mass M are placed with their centres on the four corners of a square of side b, calculate the moment of inertia of the system about the side of the square ?
24. Determine the earth's angular momentum magnitude, due to its daily rotation. Mass of the earth is 6×10^{24} kg and its radius of 6.4×10^{6} m.
25. Two bodies A and B of masses 100 g and 400 g respectively are moving towards each other with speeds 1 m/s and 0.1 m/s respectively. They stick together after a head on collision. Find :
    a) The velocity of the bodies after the collision and
    b) Loss in kinetic energy during the collision.
26. A metallic disc of radius R with its plane vertical is made to oscillate about a horizontal axis passing through any one of a number of holes drilled along a diameter. Show that the minimum period of oscillation is given by $T = 2\pi\sqrt{\frac{1,414R}{g}}$.

27. An air bubble of radius 5×10^{-3} m rises steadily through a liquid of relative density 0.83 at the rate of 22.6 m/s. Calculate the viscosity of the liquid. Neglect the density of air.

28. Calculate the mass of water flowing in 10 minutes through a tube of 0.1 cm diameter, 40 cm long, if there is a constant pressure head of 20 cm of water. The coefficient of viscosity of water is 0.0089 CGS units.

29. An ideal fluid is flowing through a tube of cylindrical cross section with smoothly varying radius. The velocity of fluid particles at the point where tube's cross sectional area is 1×10^{-4} m^2 is given by 0.01 m/s. Find the velocity at a point where the cross sectional area is 2×10^{-4} m^2.

30. Two metal wires A and B having lengths l and 2l and radii R and 2R respectively are joined end to end along their axis. When one end of the system is fixed and the other end is pulled with constant force F, the elongation in both the wires is equal. Find the ratio of their young's moduli.

31. An air bubble of diameter 1 cm is situated just below the surface of water. What is the pressure inside the bubble if the atmospheric pressure on the surface is 10^5 N/m^2 and the surface tension is 72×10^{-2} N/m ? **(6×4=24 Marks)**

SECTION – D

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

32. Define moment of inertia of a body and discuss its physical significance. Derive expression for MI of a straight rod about :
    a) An axis passing through the centre and perpendicular to its plane and
    b) About an axis passing through one end perpendicular to its length.

33. Distinguish between a transverse and a longitudinal wave and obtain an expression for a plane progressive wave. Also derive the general differential equation of one dimensional.

34. Derive the expression for potential and kinetic energy of in a simple harmonic motion. Show that the total energy of a simple harmonic oscillator is a constant.

35. What is a torsional pendulum ? Obtain an equation for couple per unit twist when a cylindrical rod fixed at one end is given a twist at the other end and hence obtain the expression for rigidity modulus. **(2×15=30 Marks)**

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