Reg. No. : .....

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D – 4998

Name : .....

First Semester B.Sc. Degree Examination, February 2018
First Degree Programme Under CBCSS
Complementary Course I for Mathematics
PY 1131.1 : MECHANICS AND PROPERTIES OF MATTER
(2013 Admission Onwards)

Time : 3 Hours

Max. Marks : 80

SECTION – A

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

1. How does viscosity varies with temperature ?
2. Define Young's modulus.
3. What is spring constant ?
4. Define surface tension.
5. Write down the equation for a plane progressive wave.
6. Define energy density of wave.
7. Write down the differential equation of forced harmonic oscillator.
8. What is Newton's law of VISCOUS flow ?
9. What do you mean by shearing stress ?
10. What is the moment of inertia of a circular disc about an axis passing through the centre and perpendicular to its plane ? **(10×1=10 Marks)**

SECTION – B

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

11. Define moment of inertia. What is its significance ?
12. Distinguish between steady flow and turbulent flow of liquid.

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13. Water spreads on a glass plate but collects into drops on a greased glass plate. Why ?

14. Derive an expression for the torsional potential energy.

15. What is sharpness of resonance ?

16. Distinguish between transverse wave and longitudinal wave.

17. Explain variation of surface tension with temperature.

18. State the laws of vibrating string.

19. Write down the three dimensional wave equation and explain the symbols.

20. Explain simple harmonic motion of a particle.

21. The mass of a fly wheel is concentrated at its rim. Why ?

22. Define bulk modulus and rigidity modulus. **(2×8=16 Marks)**

SECTION – C

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

23. Calculate the M.I. of a ring of mass 200 gm and radius 20 cm about i) an axis passing through its centre and perpendicular to its plane ii) about its diameter.

24. A liquid flows through two capillary tubes under the same pressure head. The lengths of the tubes are in the ratio 2 : 1 and the ratio of their diameters is 2 : 3. Compare the rates of flow of liquid through the tubes.

25. Calculate the pressure inside air bubble of diameter 0.2 mm situated just below the surface of water. Surface tension of water is 7.2×10^{-2} N/m.

26. A wire of length 15 m and diameter 4 mm elongates 0.3 mm when stretched by a weight of 2.2 kg. Calculate the Young's modulus of the material of wire.

27. A wire of 0.5 m length vibrates 100 times a second. If the length of the wire is shortened to 0.4 m and the stretching force is increased to 4 times its original value, what will be the new frequency ?

28. A metal disc of radius one metre with its plane vertical can be made to swing about a horizontal axis passing through any one of the holes bored along its diameter. Calculate the minimum period.

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29. Two spheres, each of 100 gm mass and 5 cm diameter are joined by a weightless rod so that their centres are 10 cm apart. Calculate the moment of inertia of the system about

    i) the line PQ joining their centres and

    ii) a line which bisects PQ and is perpendicular to it.

    Locate also the position of centre of mass.

30. Calculate the frequency of oscillation of hydrogen molecule if its force constant is 4.8×10^2 N/m and mass of hydrogen atom is 1.67×10^{-27} kg.

31. A solid sphere of mass 100 gm and radius 2.5 cm rolls without sliding with a uniform velocity of 10 cm per second along a straight line on a smooth horizontal table. Calculate its total energy. **(6×4=24 Marks)**

SECTION – D

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

32. Derive an expression for bending moment. Describe in detail an experiment to determine Young's modulus of the material of the rod using cantilever.

33. Derive the expression for velocity of longitudinal waves in rods.

34. Derive an expression for the M.I. of a sphere about i) its diameter and ii) its tangent.

35. Describe Jaeger's experiment to determine the surface tension of a liquid.

(2×15=30 Marks)

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