MAR IVANIOS COLLEGE (AUTONOMOUS) THIRUVANANTHAPURAM

Reg. No. :…………………   Name :………………….

First Semester B.Sc. Degree Examination, November 2016
First Degree Programme under CBCSS
Complementary Course: Physics – I (for Mathematics)
AUPY131.2c: Mechanics and Properties of Matter

Time: **3** Hours   Max. Marks: **80**

SECTION – A

*Answer **ALL** questions in a word or one or two sentences.*

1. What is a rigid body ? Does it conserve its shape during motion ?
2. What is the angular momentum of a body of moment of inertia I and rotational KE E ?
3. Give an example of a body having acceleration without itself having velocity.
4. What is a stationary wave ?
5. Give an example of a two body harmonic oscillator.
6. What are the factors on which the velocity of longitudinal waves in a gas depend ?
7. Define Young's modulus of elasticity.
8. What is the nature of resultant strain when a spiral spring is stretched by a force ?
9. Define angle of contact of a liquid.
10. What does Bernoulli's theorem express ?

(10 × 1 = 10 Marks)

SECTION – B

*Answer any **EIGHT** questions, not exceeding a paragraph.*

11. State the laws of parallel and perpendicular axes theorem.
12. Define moment of inertia and radius of gyration. Give its physical significance.
13. What is a restoring force ? Give an example.

P.T.O.

14. State the laws of transverse vibrations of strings. Give the mathematical equation for frequency and vibration.

15. Distinguish between forced oscillations and harmonic oscillations with examples

16. What is Poisson's ratio ? What are its limiting values ?

17. Define bending moment and flexural rigidity of a beam.

18. Why is a hollow rod better as a shaft than a solid one of the same mass ?

19. Define surface tension and surface energy of a liquid. How are they related ?

20. How does surface tension vary with temperature ? What is the value of surface tension at critical temperature ?

21. Distinguish between streamline flow and turbulent flow.

22. Define the coefficient of viscosity of a liquid. Give its significance.

$$(8 \times 2 = 16 \text{ Marks})$$

SECTION – C

Short essay type / Problems : Answer any SIX questions.

23. A circular disc of radius of 20 cm and mass 2 kg is rotating 15 times / second about an axis at right angles to its plane and passing through the centre. If the speed of rotation is to be increased to 30 times / second what work must be done ?

24. A sphere of mass 1 kg and diameter 0.1 m rolls without slipping with a velocity of 0.2 m / sec. Calculate its total energy.

25. A body suspended from a spring moves up and down simple harmonically. Find the potential and kinetic energies when the displacement is half the amplitude in terms of the total energy.

26. Plane waves of frequency 512 Hz and amplitude 10^{-6} m are produced in air. Calculate the energy radiated per unit volume of the medium and the energy current. (Density of air = 1.29 kg / m^3 and velocity of sound in air = 340 m / s.

27. A cantilever of length 0.6 m is depressed by 2 cm at the loaded end. Find the depression at a distance of 0.4 m from the fixed end.

28. A gold wire 0.04 cm in diameter and length 1 meter elongates by 2 mm when stretched by a force of 1.2 kg and twists through 1 radian when equal and opposite torques of 150 Nm are applied to its ends. Find the Young's modulus and rigidity modulus of the material.

29. Calculate the work done in spraying a drop of water 1mm radius into a million droplets of equal size.

$$(ST \text{ of water} = 7.2 \times 10^2 \text{ N} / \text{m})$$

30. Calculate the mass of water flowing in 10 minutes through a tube 10mm in diameter and 0.4m long under a constant pressure head of water. ($\eta = 0.0009$ mks units)

31. A small body rests on a horizontal platform which oscillates vertically with increasing amplitude. When the amplitude reaches 0.4 cm, the body cannot remain in continuous contact with the platform. Find the period of oscillation.

(6 × 4 = 24 Marks)

SECTION – D

*Long essay type : Answer any **TWO** questions.*

32. Derive expressions for moment of inertia about an axis passing through the centre
    (a) of a thin spherical shell
    (b) of a solid sphere.

33. Derive an expression for the oscillations of two particles connected by a spring. Apply it in the case of a diatomic molecule and show that the potential energy curve is parabolic.

34. Derive an expression for the depression produced at the free end of a cantilever. Describe an experimental method of determining the Young's modulus of a material using the cantilever.

35. Describe the Ostwald Viscometer and show that the coefficient of viscosities of two liquids are compared using this apparatus.

(2 × 15 = 30 Marks)

∫∗∫∗∫∗∫∗∫∗∫∗∫∗∫∗∫∗∫∗∫∗∫∗