



MAR IVANIOS COLLEGE (AUTONOMOUS)
THIRUVANANTHAPURAM

Reg. No. :.....

Name :.....

First Semester B.Sc. Degree Examination, November 2014

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. Write the dimensional formula of moment of inertia.
2. The rate of change of angular momentum is called _____.
3. What are the factors which affect the speed of a wave in a rod ?
4. Two springs of constants ' k_1 ' and ' k_2 ' equal maximum velocities, when executing simple harmonic motion. The ratio of their amplitudes (masses are equal) will be _____.
5. For a particle executing simple harmonic motion, the kinetic energy ' K ' is given by $K = K_0 \cos^2 \omega t$. The maximum value of potential energy is _____.
6. Within _____ stress is directly proportional to strain.
7. Surface energy is numerically equal to _____.
8. At critical temperature, the surface tension of a liquid is _____.
9. Soap helps in cleaning clothes because it reduces _____ of water.
10. What happens to the viscous drag of a fluid on a spherical body, when it doubles its speed ?

(10 x 1 = 10 Marks)

P.T.O.

SECTION – B

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

11. Define moment of inertia. What is its significance ?
12. State and explain the perpendicular axes theorem.
13. Give an expression for a plane progressive wave, with the symbols explained.
14. What happens to the period of a simple pendulum if (i) its length is doubled (ii) the mass that suspended is doubled ?
15. Write down the conditions under which the time period of a compound pendulum becomes maximum and minimum.
16. Explain why girders have I shaped cross section.
17. Define surface tension and angle of contact.
18. Derive Stoke's formula using the method of dimensional analysis.
19. How does temperature affect viscosity of fluids ? Why ?
20. What is critical velocity for a flow ?
21. Define energy density of a plane progressive wave.
22. Give an expression for torsional potential energy of a twisted wire.

(8 x 2 = 16 Marks)

SECTION – C

*Short essay type / Problems : Answer any **SIX** questions.*

23. The atoms of a diatomic molecule with mass ' m_1 ' and ' m_2 ' are at a separation ' r '. Calculate the moment of inertia of the molecule about an axis passing through its centre of mass.
24. The mass of a disc is 0.4 kg and its radius is 20 cm. Calculate the radius of gyration of the disc about a perpendicular axis passing through its centre of gravity.
25. What fraction of total energy of a simple harmonic oscillator is kinetic and what fraction is potential when its displacement is half the amplitude ?
26. A 4 kg block extends a spring 0.16 m from its unstretched position. The block is then removed and a 0.50 kg body is hung from the same spring. If the spring is then stretched and released, what is its period of motion ?
27. Calculate the mass of water flowing in 10 minutes through a tube of 0.001 m diameter and 0.4 m long if there is a constant pressure head of 0.2 m of water. Coefficient of viscosity of water is 0.00082 Nsm^{-2} .

28. Calculate the depth of water at which an air bubble of radius 4×10^{-4} m may remain in equilibrium. S.T of water is $70 \times 10^{-3} \text{ Nm}^{-1}$.
29. Two equal drops of water are falling through air with a steady velocity of 0.1 ms^{-1} . If the drops combine to form a single drop, what will be the new terminal velocity ?
30. A cantilever of length 60 cm is depressed by 20 mm at the loaded end. What is the depression at a distance 40 cm from the fixed end ?
31. A bar 1 m long, 0.04 m broad and 0.005 m thick is supported on two knife edges 0.8 m apart. The depression produced by a load of 2 kg suspended on the beam, at the centre of the knife edges is 0.005 m. Calculate the Young's modulus of the material of the bar.

(6 x 4 = 24 Marks)

SECTION – D

Long essay type : Answer any TWO questions.

32. Discuss the construction of a flywheel and describe the experimental procedure used to find its moment of inertia. Derive the expression used to calculate the moment of inertia.
33. (i). Obtain an expression for the couple required to produce unit twist in a metallic wire.
(ii). Derive the expression for the period of oscillations of a torsion pendulum.
(iii). Discuss an experiment to determine the rigidity modulus of the material of a wire using the method of torsional oscillations.
34. (i). Derive an expression for the elevation at the midpoint of a uniformly bent rectangular bar and describe the experimental procedure leading to the determination of Young's modulus using the derived formula.
(ii). Derive an expression for the depression at the loaded point of a cantilever of rectangular cross section.
35. (i). Define coefficient of viscosity and derive its dimensions.
(ii). Derive an expression for the rate of flow of a liquid through a horizontal capillary tube.
(iii). Obtain expressions for relevant corrections.

(2 x 15 = 30 Marks)
