



MAR IVANIOS COLLEGE (AUTONOMOUS)
THIRUVANANTHAPURAM

Reg. No. :.....

Name :.....

First Semester B.Sc. Degree Examination, November 2016

First Degree Programme under CBCSS

Core Course: Physics – I

AUPY141: Basic Mechanics & Properties of Matter

(Common for **Regular** – 2016 Admn. and **Improvement** – 2015 Admn.)

Time: 3 Hours

Max. Marks: 80

SECTION – A

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

1. Distinguish between linear momentum and angular momentum.
2. State the theorem of moment of inertia for perpendicular axis.
3. Distinguish between conservative force and non – conservative force.
4. Write down the expression for the total energy of a simple harmonic oscillator.
5. Compare any two characteristics of mechanical waves and electromagnetic waves.
6. What are the different modes of vibration of a stretched string ?
7. Define the acoustic absorption coefficient of a surface.
8. Define Poisson's ratio. What are the limiting values of Poisson's ratio ?
9. Explain the term bending couple.
10. Write down the Poiseuille's equation for the flow of liquid through a tube.

(10 × 1 = 10 Marks)

SECTION – B

Answer any EIGHT questions, not exceeding a paragraph.

11. Obtain the expression for the moment of inertia of a thin disc about an axis through its centre and perpendicular to its plane.
12. Obtain an expression for the kinetic energy of a body rotating about an axis through its centre of mass.

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13. State and prove the work energy principle.
14. Distinguish between static friction and sliding friction. Write down the Coulomb's laws of friction.
15. What do you mean by a compound bar pendulum. Write down an expression for the determination of acceleration due to gravity using compound bar pendulum.
16. Draw a graph showing the variation of kinetic energy and potential energy with displacement for a simple harmonic oscillator and give a brief explanation.
17. Derive the expression for the minimum time period of a compound pendulum.
18. Define energy density of a plane progressive wave. Write down the expression for the energy density.
19. What is meant by reverberation ? Explain its significance.
20. Explain the advantages of 'I' section for girders.
21. Explain Stokes law for a body moving in a viscous medium.
22. Derive a relation for calculating the work done in blowing a small bubble.

(8 × 2 = 16 Marks)

SECTION – C

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

23. Obtain an expression for the moment of inertia of a solid sphere.
 - i). about a diameter
 - ii). about a tangent
24. A wheel of mass 500 kg and 2 m diameter makes 500 rotations per minute. assuming mass to be concentrated at the rim, calculate the moment of inertia and energy of the rotating wheel.
25. Show that the time period of a compound pendulum is the same about the centre of suspension and centre of oscillation.
26. A wave is represented by $y = 0.00025 \sin(500 t - 0.025 x)$, where y, t, and x are in m, s and m respectively. Find out the amplitude, time period, angular frequency and wave length.
27. A flexible string of length 0.8 m and mass 2.5 gm is stretched to produce transverse vibrations. The string vibrates in four segments with a frequency of 600 Hz. Calculate the tension in the stretched wire.

28. The volume of a room is 1500 m^3 . The area of wall, floor and ceiling are 260 m^2 , 140 m^2 and 140 m^2 respectively. The average sound absorption coefficient for wall is 0.03 Sabine, for floor 0.06 Sabine and for ceiling 0.8 Sabine, Calculate the average absorption coefficient and reverberation time.
29. Show that the Young's modulus Y , bulk modulus K and Poisson's ratio σ are connected by the relation $K = Y / [3(1 - 2\sigma)]$.
30. Derive an expression for the strain energy in a twisted wire.
31. The pressure of air inside a soap bubble 0.7 cm diameter is 8 mm of water above the atmospheric pressure. Calculate the surface tension of the soap solution.

(6 × 4 = 24 Marks)

SECTION – D

Long essay type : Answer any TWO questions.

32. i). Explain the law of conservation of angular momentum with suitable examples.
 ii). Derive an expression for the total kinetic energy of a body rolling over a smooth horizontal surface.
 iii). Obtain an expression for the velocity of a body rolling freely down an inclined plane.
33. Obtain the differential equation for a particle executing simple harmonic motion. and derive expressions for the amplitude, velocity and displacement at any instant.
34. i). Derive the expression for the torsional rigidity of a cylindrical rod when one end is fixed and twisted by a couple applied at the other end.
 ii). Show that the torsional rigidity for a hollow cylinder is greater than that for a solid one of the same material, mass and length.
35. With the help of a neat diagram explain the theory and experiment to determine the surface tension of a liquid by Jaeger's method. What are the advantages of this method ?

(2 × 15 = 30 Marks)

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