

B.Sc. - Physics

I Semester End Examination March/April 2022 MECHANICS & PROPERTIES OF MATTER

Course Code: PHY1DSC01
Time: 2 hours

QP Code: 1013
Total Marks: 60

PART-A

Instructions: Use of non-programmable scientific calculator is allowed

Answer ALL questions. Each question carries ONE mark

5x1=5marks

1. The dimensions of 'k' in the equation of work, $W = \frac{1}{2} kx^2$ is
 - a) $[M^1 L^0 T^{-2}]$
 - b) $[M^0 L^1 T^{-1}]$
 - c) $[M^1 L^1 T^{-2}]$
 - d) $[M^1 L^0 T^{-1}]$
2. A bent bow used for shooting has
 - a) Potential energy
 - b) Kinetic energy
 - c) Gravitational energy
 - d) Elastic energy
3. If a body completely regains its original shape and size after the removal of an external deforming force, such a body is known as
 - a) Perfectly elastic body
 - b) Perfectly plastic body
 - c) Deformed body
 - d) Both plastic and deformed body
4. Mercury does not wet the glass. This is because,
 - a) Adhesive force is more than the cohesive force
 - b) Cohesive force is more than the adhesive force
 - c) Of adhesive force only
 - d) Both cohesive and adhesive forces are equal
5. Relative velocity of two parallel layers of water is 8 cm/s. If the perpendicular distance between the two layers is 0.1 m, then the velocity gradient is,
 - a) 40/s
 - b) 50/s
 - c) 60/s

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d) 80/s

PART-B

Answer any THREE questions. Each question carries TENmarks.

3x10=30marks

6. a) State the postulates of special theory of relativity.
b) Obtain an expression for the instantaneous velocity of a rocket in terms of initial velocity of the rocket, initial mass and velocity of exhaust. (2+8)
7. a) Obtain an expression for kinetic energy of rotation.
b) Derive an expression for moment of inertia of a rectangular lamina about an axis passing through its centre and parallel to one of its sides. (3+7)
8. a) Obtain an expression for position vector of centre of mass in the case of two particle system.
b) State and explain Kepler's laws of planetary motion with diagram. (4+6)
9. a) Define different moduli of elasticity.
b) Obtain an expression for the work done in stretching a wire. (3+7)
10. a) Show that the surface energy per unit area is numerically same as surface tension per unit length.
b) Obtain an expression for the terminal velocity of a small sphere falling through a viscous fluid. (5+5)

PART-C

Answer any THREE questions. Each question carries FIVEmarks.

3x5=15marks

11. A body travels uniformly a distance of (13.8 ± 0.2) meter in a time (4.0 ± 0.3) seconds. Calculate its velocity with the error limits. What is the percentage of error in its velocity?
12. A rod of length 2m is moving with half the velocity of light with respect to the laboratory frame of reference. What is the length of the rod as measured by an observer with respect to laboratory frame?
13. An artificial satellite revolves round the earth close to its surface. Calculate the period of revolution. Given R as 6.4×10^6 km and g as 9.8 m/s².
14. Calculate Poisson's ratio of silver. Given the Young's modulus as 7.25×10^{10} Nm⁻² and the bulk modulus as 12×10^{10} Nm⁻².
15. Water flows through a horizontal tube of length 0.4m and internal diameter of 0.2×10^{-2} m under a constant pressure head of liquid 5.2×10^{-2} m. If 24×10^{-6} m³ of water flows from the

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tube in 40s, find the coefficient of viscosity of water. Given the density of water as 10^3 kgm^{-3} and acceleration due to gravity as 9.8 ms^{-2} .

PART-D

16. Answer any FIVE questions. Each question carries TWO marks. 5x2=10marks

- a) Do constants have unit? Give an example.
- b) State and explain work-energy theorem.
- c) What is the momentum of a body when it is at rest? Explain.
- d) The weight of the firing riffle is heavy! Comment.
- e) The two identical springs made of steel and aluminum are equally stretched. On which spring more work needs to be done? Why?
- f) Is angular momentum a vector? If so, what is its direction?
- g) What is the effect of temperature on surface tension?
- h) A person standing near a fast moving train has a danger of falling towards the train. Explain.
