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**B.M.S COLLEGE FOR WOMEN, AUTONOMOUS**  
**BENGALURU – 560004**  
**SEMESTER END EXAMINATION – JANUARY/FEBRUARY 2023**

**B.Sc. Physics - I Semester**

**MECHANICS AND PROPERTIES OF MATTER**  
**(NEP Scheme 2021-22 onwards F+R)**

**Course Code: PHY1DSC01**

**QP Code: 1013**

**Duration: 2 ½ Hours**

**Max. Marks: 60 marks**

**Instructions: Use of non- programmable scientific calculator is allowed.**

**PART – A**

**Answer ALL questions. Each question carries ONE Mark (5x1=5)**

- The dimensional formula of force is  
a)  $M^0L^1T^{-2}$       b)  $M^1L^1T^{-2}$       c)  $M^1L^1T^{-1}$       d)  $M^1L^1T^1$
- Which of these represent angular momentum?  
a)  $\vec{L} = \vec{r} \cdot \vec{p}$       b)  $\vec{L} = m\vec{r} \times \vec{p}$       c)  $\vec{L} = \vec{r} \times \vec{p}$       d)  $\vec{L} = \vec{r} \times \vec{F}$
- The ratio of tangential stress to shearing strain is called  
a) Young's modulus      b) bulk modulus      c) rigidity modulus      d) poissons ratio
- A water drop is spherical due to  
a) surface tension      b) Viscosity      c) Elasticity      d) None of these
- If the temperature of the liquid is increased its surface tension  
a) Decreases      b) increases      c) remains same      d) none of these

**PART – B**

**Answer any THREE questions. Each question carries TEN Mark (3x10=30)**

- a) Check correctness of the equation  $S = ut + \frac{1}{2}at^2$  .  
b) State and explain positive, negative and zero work.

- c) What are conservative and non-conservative forces? Give example for each. (3 + 3 + 4)
7. a) Mention two postulates of special theory of relativity.
- b) Derive an expression for moment of inertia of a solid cylinder about an axis of cylindrical symmetry.
- c) Explain length contraction. (2 + 6 + 2)
8. a) State and explain parallel and perpendicular axis theorem.
- b) Derive an expression for escape velocity for a body.
- c) Derive  $\vec{F} = m \vec{a}$  where symbols have usual meanings. (4 + 4 + 2)
9. a) Derive an expression for work done in stretching a wire.
- b) Derive an expression for the depression in a single cantilever. (5 + 5)
10. a) Derive an expression for pressure difference across a curved liquid surface.
- b) Derive equation of continuity of liquid flow. (6 + 4)

### PART – C

**Answer any THREE questions. Each question carries FIVE Mark (3x5=15)**

11. How fast would a rocket have to go relative to an observer for its length to be contracted to 99% of its length at rest?
12. Calculate the acceleration due to gravity on the surface of Jupiter. If mass of Jupiter is 317 times that of earth and radius of Jupiter is 10.95 times that of earth. Given  $g = 9.8 \text{ ms}^{-2}$  on earth.
13. Find the amount of work done in twisting a steel wire of radius 1 mm, length 0.25m through an angle of  $45^\circ$ . Given rigidity modulus for steel is  $8 \times 10^{10} \text{ Nm}^{-2}$ .
14. A horizontal force of 0.0775 N is required to move a metal plate 5 cm x 5cm with a speed of 2 cm/s on a layer of castor oil 1 mm thick. Find the coefficient of viscosity of castor oil.
15. Poisson's ratio for a material is 0.5 and young's modulus is  $3 \times 10^{10} \text{ Nm}^{-2}$ . Calculate the rigidity modulus of the material.

**PART – D**

**16. Answer any FIVE questions. Each question carries TWO Mark**

**(5x2=10)**

- a. Can center of mass lie outside the body? Explain.
- b. Can work done be negative. Explain.
- c. Moving clocks runs slow. Explain.
- d. While catching a cricket ball, the player lowers his hands. Justify.
- e. Why is steel used to make springs not copper?
- f. A spring balance which is used for a long time shows wrong reading. Why?
- g. Water sticks to glass surface, while mercury does not. Explain.
- h. When we try to close a water tap with our fingers, fast jets of water comes out. Why?

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