



**2022/TDC/ODD/SEM/PHSDSC/  
GE-101T/149**

**TDC (CBCS) Odd Semester Exam., 2022**

**PHYSICS**

**( 1st Semester )**

Course No. : PHSDSC/GE-101T

**( Mechanics )**

Full Marks : 50

Pass Marks : 20

Time : 3 hours

*The figures in the margin indicate full marks  
for the questions*

**UNIT—I**

1. Answer any *three* of the following questions :

1×3=3

(a) Define scalar triple product.

(b) Give an example of second-order differential equation.

(c) What is homogeneous differential equation?

(d) What is the value of  $\vec{A} \cdot (\vec{A} \times \vec{B})$ ?



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2. Answer any *one* of the following questions : 2
- (a) Define order and degree of a differential equation.
- (b) Show that the vector  $12\hat{i} + 4\hat{j} - 6\hat{k}$  is parallel to  $6\hat{i} + 2\hat{j} - 3\hat{k}$ .

3. Answer any *one* of the following questions : 5

(a) Define vector triple product. Show that

$$\vec{A} \times (\vec{B} \times \vec{C}) = \vec{B}(\vec{A} \cdot \vec{C}) - \vec{C}(\vec{A} \cdot \vec{B}) \quad 1+4=5$$

(b) For the given vectors

$$\vec{A} = 4\hat{i} - 5\hat{j} + 3\hat{k}, \vec{B} = 2\hat{i} - 10\hat{j} - 7\hat{k},$$

$$\vec{C} = 5\hat{i} + 7\hat{j} - 4\hat{k}$$

find  $\vec{A} \times (\vec{B} \times \vec{C})$  and  $\vec{A} \cdot (\vec{B} \times \vec{C})$ .  $2\frac{1}{2} + 2\frac{1}{2} = 5$

UNIT—II

4. Answer any *three* of the following questions :  $1 \times 3 = 3$

- (a) Define centre of gravity.
- (b) Give an example of zero work.
- (c) Define radius of gyration.
- (d) How much will be the mechanical energy of an object which has 64 J of kinetic energy and 136 J of potential energy?

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5. Answer any *one* of the following questions : 2

- (a) Discuss the significance of moment of inertia.
- (b) Find the relation between torque and angular momentum.

6. Answer any *one* of the following questions : 5

- (a) State and prove work energy theorem.
- (b) Calculate the moment of inertia of a rectangular bar about an axis passing through its centroid.

UNIT—III

7. Answer any *three* of the following as directed :  $1 \times 3 = 3$

- (a) State Newton's law of gravitation.
- (b) If the distance between two masses is doubled, what will happen to the gravitational force between them?
- (c) What is geosynchronous satellite?
- (d) A geostationary satellite seems to be fixed in the sky because it does not orbit the earth.

( State True or False )



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8. Answer any *one* of the following questions : 2

- (a) What are the necessary conditions for a satellite to be geosynchronous?
- (b) What are the characteristics of a central force?

9. Answer any *one* of the following questions : 5

- (a) State Kepler's three laws of planetary motion. Mention some of the uses of geostationary satellites.  $3+2=5$
- (b) Show that for a particle moving under a central force, its aerial velocity is constant and the angular momentum is conserved.  $2\frac{1}{2}+2\frac{1}{2}=5$

UNIT—IV

10. Answer any *three* of the following as directed :  $1 \times 3 = 3$

- (a) State Hooke's law.
- (b) Define Poisson's ratio.

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(c) Changing the dimension of a body does not affect the elasticity of a substance.

( State True or False )

(d) The modulus of elasticity is dimensionally equivalent to

- (i) stress
- (ii) strain
- (iii) surface tension
- (iv) Poisson's ratio

( Choose the correct answer )

11. Answer any *one* of the following questions : 2

- (a) Draw stress-strain diagram.
- (b) On what factors does elasticity depend?

12. Answer any *one* of the following questions : 5

- (a) What is torsional pendulum? Find the expression of its time period.  $1+4=5$
- (b) Find the relation between  $Y$ ,  $K$  and  $\sigma$ , where the symbols have their usual meanings.



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UNIT—V

13. Answer any *three* of the following as directed : 1×3=3

(a) The rise of liquid in a capillary tube is due to

(i) viscosity

(ii) surface tension

(iii) osmosis

(iv) diffusion

( Choose the correct answer )

(b) What is the SI unit of viscosity?

(c) What is surface tension?

(d) Define inertial frame of reference.

14. Answer any *one* of the following questions : 2

(a) Define coefficient of viscosity and find its dimension.

(b) Write down the Lorentz transformation equations.

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( Continued )

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15. Answer any *one* of the following questions : 5

(a) Deduce Poiseuille's formula for the rate of flow of liquid in a capillary tube.

(b) What are the postulates of special theory of relativity? Deduce length contraction formula. 2+3=5

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