**2023/TDC(CBCS)/ODD/SEM/**
**PHSDSC/GE-101T/150**

**TDC (CBCS) Odd Semester Exam., 2023**

# 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*

## SECTION—A

Answer *fifteen* questions, selecting any *three* from each Unit : 1×15=15

### UNIT—I

1. Can two vectors of different magnitudes be combined to give a zero resultant?

2. What is the condition for two vectors being collinear?

3. Give an example of scalar triple product.

4. State the difference between first-order and second-order differential equations.

UNIT—II

5. Does kinetic energy increase with momentum?

6. As friction increases, momentum decreases. Write True or False.

7. What is SI unit of angular velocity?

8. Is momentum a scalar or a vector quantity?

UNIT—III

9. What is gravity in Physics?

10. State Kepler's third law of planetary motion.

11. Can satellites circle in a circular orbit?

12. What is a geostationary satellite?

UNIT—IV

13. Give SI unit of modulus of elasticity.

14. Define elastic potential energy.

15. What is Poisson's ratio and its unit?

16. Young's modulus of steel is much more than that of rubber. For the same longitudinal strain, which one will have greater tensile stress?





UNIT—V

17. Does surface tension increase with decrease in temperature?

18. Is earth an inertial or non-inertial frame of reference?

19. How are viscosity and flow rate related?

20. What are Galilean transformations?

SECTION—B

Answer *five* questions, selecting *one* from each Unit : 2×5=10

UNIT—I

21. Prove that the vectors $\hat{i}+2\hat{j}-3\hat{k}$ and $5\hat{i}-7\hat{j}-3\hat{k}$ are perpendicular to each other.

22. Show that for any vector $\vec{a}$, $\vec{a}\cdot\vec{a}=a^2$ and $\vec{a}\times\vec{a}=0$.

UNIT—II

23. Establish the relation between linear velocity and angular velocity.

24. Define radius of gyration. Write its physical significance.

UNIT—III

**25.** Why a planet revolving around the sun in an elliptical orbit does not have a constant angular momentum?

**26.** What is weightlessness? Give an example of it.

UNIT—IV

**27.** Differentiate between angle of twist and angle of shear.

**28.** What are the types of modulus of elasticity? Define Young's modulus of elasticity.

UNIT—V

**29.** Why does water form a spherical shape when we use to drop water up or throw water around?

**30.** State the postulates of special theory of relativity.





SECTION—C

Answer *five* questions, selecting *one* from each Unit : 5×5=25

UNIT—I

**31.** Show that the scalar product of three vectors $\vec{a}$, $\vec{b}$, $\vec{c}$ represents the volume of the parallelopiped whose coterminous edges are represented by $\vec{a}$, $\vec{b}$, $\vec{c}$.

**32.** Solve :

$$\frac{dy}{dx} = \frac{x-y}{x+y}$$

UNIT—II

**33.** Derive the equation of motion of a rocket.

**34.** Calculate the moment of inertia of a solid cylinder about its own axis.

UNIT—III

**35.** What is conservation of angular momentum? Establish the relation between torque and angular momentum.

**36.** What are the types of GPS? Give examples of GPS. Why is a GPS system important?

UNIT—IV

**37.** Deduce the relation for isotropic medium of material

$$\frac{1}{K} = \frac{3}{\eta} + \frac{9}{Y}$$

where symbols have their usual meanings.

**38.** Define modulus of rigidity. Derive an expression for the couple required to twist a uniform solid cylinder through an angle $\phi$.

UNIT—V

**39.** Define surface tension and surface energy. How to obtain the relation between surface tension and surface energy?

**40.** What is time dilation in STR? Deduce the time dilation formula with example.

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