2021/TDC/CBCS/ODD/
PHSDSC/GE-101T/149

TDC (CBCS) Odd Semester Exam., 2021
held in March, 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

SECTION—A

Answer any *fifteen* of the following questions : 1×15=15

1. State parallelogram law of vector addition.

2. Does commutative law hold good in the scalar product?

3. What is the scalar product of two oppositely directed vectors?

4. For the orthogonal triad of unit vectors $\hat{i}$, $\hat{j}$ and $\hat{k}$, what are the values of $\hat{i} \times \hat{i}$ and $\hat{i} \times \hat{j}$?

5. State the law of conservation of momentum.

6. Define torque.

7. Give an example of the application of Newton's third law of motion.

8. State the difference between inertial and non-inertial frame of reference.

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

10. Define gravitational constant.

11. What do you mean by central force?

12. Give the time period of geo-stationary satellite.

13. State Hooke's law.

14. What do you mean by elastic limit?

15. Define rigidity modulus.

16. State the limiting value of Poisson's ratio.

17. Define surface tension of a liquid.

18. Write the Poiseuille's formula for the flow of a liquid through a capillary tube.

19. Give the SI unit and dimension of coefficient of viscosity of a liquid.

20. Write the expression for sum of two relativistic velocities.

SECTION—B

Answer any *five* of the following questions : 2×5=10

21. If $\vec{A} = 4\hat{i} + 6\hat{j} - 3\hat{k}$ and $\vec{B} = 2\hat{i} + 5\hat{j} + 7\hat{k}$, find the angle between $\vec{A}$ and $\vec{B}$.

22. Find the unit vector perpendicular to each of unit vectors $\vec{a} = 3\hat{i} + \hat{j} + 2\hat{k}$ and $\vec{b} = 2\hat{i} - 2\hat{j} + 4\hat{k}$.

23. Define angular velocity and angular momentum.

24. Explain in brief the centre of mass for two-particle system.

25. Explain in brief the weightlessness of a body.

26. Give basic idea of Global Positioning System (GPS).

27. What is the work done in stretching a wire?

28. Which is more elastic—steel or rubber? Explain in brief.

29. State the postulates of special theory of relativity.

30. Define coefficient of viscosity of liquid.

SECTION—C

Answer any *five* of the following questions : 5×5=25

31. Prove that

$$\vec{A} \times (\vec{B} \times \vec{C}) = \vec{B}(\vec{A} \cdot \vec{C}) - \vec{C}(\vec{A} \cdot \vec{B})$$

32. *(a)* What do you mean by first-order homogeneous differential equation? 2

(b) Solve :

$$(x^2 + y^2)dx = 2xy\,dy$$ 3

33. Show that work done = change in kinetic energy.

34. State Newton's second law of motion. Show the first law is contained in the second law of motion. 2+3=5

35. Write short notes on *(a)* orbital velocity and *(b)* geosynchronous orbit. 2½+2½=5

36. Estimate the mass of the sun, assuming the orbit of the earth round the sun to be a circle. The distance between the sun and the earth is $1{\cdot}49\times10^{11}$ m and $G = 6{\cdot}66\times10^{-11}\ \text{Nm}^2\ \text{kg}^{-2}$. Assume the time period of earth's motions round the sun is 365 days.

37. *(a)* Show that for a homogenous isotropic medium $Y = 2\eta(1+\sigma)$, where letters have their usual meaning. 3

(b) If $\eta = 8\times10^{11}\ \text{N/m}^2$ and $Y = 20\times10^{11}\ \text{N/m}^2$ for iron, calculate Poisson's ratio. 2

38. Deduce an expression for the couple required to twist a uniform solid cylinder by an angle.

39. Deduce the expression for excess pressure inside a spherical liquid drop.

40. Write short notes on *(a)* length contraction and *(b)* time dilation. 2½+2½=5

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