**2023/TDC(CBCS)/ODD/SEM/
PHSHCC–102T/149**

TDC (CBCS) Odd Semester Exam., 2023

PHYSICS

(Honours)

(1st Semester)

Course No. : PHSHCC–102T

(Mechanics)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

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

SECTION—A

Answer *ten* questions, selecting any *two* from each Unit :   2×10=20

UNIT—I

1. Define conservative and non-conservative forces.

2. What do you mean by stable and unstable equilibrium?

3. What are the elastic and inelastic collisions?

24J/165   (*Turn Over*)

(2)

UNIT—II

4. State the principle of conservation of angular momentum.

5. Define moment of inertia of a body with respect to a particular axis of rotation.

6. Define the term 'elasticity' for a material. What is elastic limit?

UNIT—III

7. State the law of gravitation.

8. Assuming the earth to be a sphere of radius R, show that gravitational potential at any point on the surface of the earth can be expressed as gR, where g is the acceleration due to gravity.

9. What do you mean by inertial and gravitational mass?

UNIT—IV

10. The displacement of a moving point at any instant of time t is given by $y = A \sin \omega t$, where A is constant and ω is angular frequency. Show that the motion is simple harmonic in nature.

(3)

11. What do you mean by damped and forced oscillations?

12. What is Coriolis force? Mention its one application.

UNIT—V

13. Show that the length is invariant under Galilean transformation.

14. State the postulates of special theory of relativity.

15. Give a very brief idea about the Twin paradox.

SECTION—B

Answer *five* questions, selecting *one* from each Unit :   6×5=30

UNIT—I

16. Prove that the trajectory of a projectile fired at an angle with the horizontal direction is parabolic in nature. Obtain an expression for the horizontal range of the projectile.   3+3=6

17. Calculate the position, velocity and acceleration of centre of mass of two particles. Discuss in brief the work and kinetic energy theorem.   3+3=6

(4)

UNIT—II

18. What do you mean by radius of gyration? Obtain the moment of inertia of a solid cylinder about an axis passing perpendicularly through the middle of its length. $2+4=6$

19. Define Young's modulus, rigidity modulus and Poisson's ratio. Derive the relation $Y = 2\eta(1+\sigma)$, where Y = Young's modulus, η = rigidity modulus and σ = Poisson's ratio. $3+3=6$

UNIT—III

20. Define gravitational potential. Show that the gravitational potential at the centre of a solid sphere is $\frac{3}{2}$ times of that on the surface. $2+4=6$

21. (a) Starting from the law of gravitation, obtain Kepler's 3rd law of planetary motion. 4

(b) Give a brief account of GPS. 2

UNIT—IV

22. Obtain the differential equation of simple harmonic motion and solve it. Show that the total energy is conserved during simple harmonic motion. $4+2=6$

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(5)

23. (a) Explain resonance and sharpness of resonance. 3

(b) What do you mean by non-inertial frames and fictitious forces? 3

UNIT—V

24. What is mass-energy equivalence? Derive Einstein's mass-energy relation. $2+4=6$

25. Describe Michelson-Morley experiment and explain the physical significance of the negative result. 6

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