

B.Sc. DEGREE EXAMINATION NOVEMBER 2022
BRANCH I - MATHEMATICS
FIRST SEMESTER

COURSE : ALLIED – CORE
PAPER : PHYSICS FOR MATHEMATICS - I
TIME : 3 HOURS
MAX. MARKS : 100

SECTION – A (25 MARKS)

ANSWER ALL QUESTIONS:

I. CHOOSE THE CORRECT ANSWER: (10 x 1=10)

- The moment of inertia of a body does not depend upon its -----
a) angular velocity b) distribution of mass c) mass d) axis of rotation
- The value of e for perfectly elastic collision is
a) $e=0$ b) $e=-1$ c) $e=0.5$ d) $e=+1$
- If x is the displacement from mean position then the total energy of a particle executing simple harmonic motion is proportional to -----
a) x b) x^2 c) independent of x d) x^3
- When constraints are applied to a system the degrees of freedom will -----
a) Reduce b) Increase c) Equal to constraints d) Not change
- Two wires of the same radii and material have their lengths in the ratio 1:2 if these are stretched by the same force, the strains produced in the two wires will be in the ratio.
a) 1:4 b) 1:2 c) 2:1 d) 4:1
- The couple per unit twist of the wire is independent of its-----
a) length b) radius c) rigidity modulus d) none of the above
- Surface tension of a liquid -----
a) tends to maximize the surface area b) tends to minimize the surface area
c) increases the surface thickness d) decreases the surface energy
- Choose the correct statement
a. The viscosity of liquid decreases with increase of temperature.
b. The viscosity of liquid increases with increase of temperature
c. The viscosity of liquid decreases with decrease of temperature
d. The viscosity of liquid increases with decrease of temperature

9. According to the theory of relativity if c – velocity of light then ____
 a) an object can travel more than 'c' b) an object can travel with 'c'
 c) 'c' does not vary in moving frame d) 'c' varies in a moving frame
10. The fundamental physical laws and principles are identical in all inertial Frames of reference is ____
 a) General theory of relativity b) Newtonian relativity
 c) Special theory of relativity d) Twin paradox

II. Fill in the blanks :**(5 x 1 = 5)**

11. The impulsive force is a measure of change in _____.
 12. The Generalized coordinate for a system of N particles Constrained by m equations is _____.
 13. The young's modulus of the material is inversely proportional to _____.
 14. The velocity above which the flow of a liquid becomes turbulent is known as _____.
 15. Unaccelerated frames of reference are called _____.

III. Answer briefly :**(5 x 2 = 10)**

16. State Hooke's law.
 17. State Conservation of linear momentum
 18. Define SHM.
 19. What is twin paradox?
 20. Define centre of mass with one example.

SECTION – B**ANSWER ANY FIVE QUESTIONS:****(5 x 6 = 30)**

21. Derive Euler's equation of continuity and explain its importance.
 22. A structural steel rod has a radius of 10mm and a length of 1 m. A 100 kN force F stretches it along its length. Calculate (a) the stress, (b) elongation, and (c) strain on the rod. Given that the Young's modulus, Y of the structural steel is $2.0 \times 10^{11} \text{ Nm}^{-2}$.
 23. If two springs are connected in series and parallel, what is its equivalent spring constant?
 24. The pressure of air in a soap bubble of $7 \times 10^{-3} \text{ m}$ diameter is $8 \times 10^{-3} \text{ m}$ of water above the atmosphere pressure. Calculate the S.T. of the soap solution.
 25. A body of mass 1 kg is executing simple harmonic motion given by $y = 6.0 \cos (100t + \pi/4) \text{ cm}$. What is the (i) frequency (ii) Initial phase (iii) velocity and (iv) acceleration?
 26. A ball of mass 4 kg, moving with a velocity of 12 ms^{-1} impinges directly on another ball of mass 8 kg moving with velocity 4 ms^{-1} in the same direction. If $e = 0.5$, find their velocities after impact and calculate the loss of KE due to impact .of both after impact.

27. A rod 1m moving along its length with velocity of $0.6C$ calculate its length as it appears to an observer a) on the earth and b) moving with the rod itself.

SECTION – C

ANSWER ANY THREE QUESTIONS:

(3 X 15 = 45)

28. Explain the term bending moment. Derive the expression for the bending – moment of a thin uniform bar of rectangular cross –section.
29. State the postulates of special theory of relativity and derive the Lorentz transformation equation.
30. Explain the molecular theory of surface tension and how to determine the surface tension and interfacial surface tension by drop weight method.
31. Explain the Lagrangian equation and the applications of Lagrangian equation in Atwood’s machine and simple pendulum.
32. Define elastic collision. Explain the elastic collision of two different masses and discuss their velocity after collision with the special cases.
