

FIRST YEAR B.Sc. DEGREE EXAMINATION, APRIL/MAY 2005**Part III—Physics Subsidiary****Paper I—MECHANICS, PROPERTIES OF MATTER, THERMAL PHYSICS, LAGRANGIAN DYNAMICS AND THEORY OF RELATIVITY**

(For Maths Main)

Time : Three Hours

Maximum : 50 Marks

Section A

*Answer any two questions.
Each question carries 7 marks.*

1. Derive Lagrangean equation of motion using D'Alembert's principle.
2. Derive an expression for the excess of pressure over a curved surface. Write a note on the variation of Surface Tension with temperature.
3. Distinguish between Isothermal and Adiabatic process. Derive the expression for the work done by a perfect gas in (i) isothermal change and (ii) an adiabatic change.
4. Describe the Michelson-Morley experiment and explain the physical significance of the negative result.

(2 × 7 = 14 marks)

Section B

*Answer any twelve questions.
Each question carries 2 marks.*

5. Find an expression for the Moment of Inertia of a solid disc.
6. Derive the relation between the elastic constants.
7. What are damped and forced oscillations ?
8. Find the variation of intrinsic energy with volume for a gas obeying Van der Waals equation.
9. Explain entropy change in an irreversible process.
10. Define torque and angular momentary.
11. Explain 'length contraction' and time dilation'
12. State two laws of thermodynamics and explain their significance.
13. What are reversible and irreversible processes ?
14. Derive $Pv^\gamma = \text{constant}$ for an ideal gas.
15. How is energy distributed in a black body spectrum ?
16. Show that Rayleigh - Jeans law and Wien's law are special cases of Planck's law.
17. Explain Weidmann and Franz law.

18. Explain the source of solar energy.
19. Write a note on liquid helium I and II.
20. What is meant by Q-factor? Write down the equation for a forced harmonic oscillator.
21. State the laws of transverse vibration of a stretched string.
22. Explain 'damped' and 'forced' harmonic oscillations.
23. What are the disadvantages of Newtonian Mechanics?
24. What are holonomic and Non-holonomic constraints?

(12 × 2 = 24 marks)

Section C

*Answer any four questions.
Each question carries 3 marks.*

25. A force $F = 3\vec{i} + 2\vec{j} + 4\vec{k}$ is acting at a point (1, -1, 2). Calculate its torque about the point (2, -1, 3).
26. Two tubes A and B of lengths 1m and 0.5m have radii 10^{-4} m and 2×10^{-4} m respectively. If a liquid is passing through the two tubes entering A at a pressure of 0.8m of mercury and leaving B at a pressure of 0.76m of mercury, find the pressure at the junction of A and B.
27. Calculate the Kinetic Energy of an electron moving with a velocity of 0.98c in the laboratory system. $M_0 = 9.11 \times 10^{-31}$ Kg
28. Find the amount of work done in twisting a steel wire of radius 10^{-3} m and of length 0.25m through an angle of 45° . G for steel is 8×10^{10} Pascals.
29. A quantity of air ($\gamma = 1.4$) at 27°C is compressed (i) slowly and (ii) suddenly to one third its volume. Find the change in temperature in each case.
30. Calculate the change in entropy when a certain mass of ice is completely converted into steam.
31. A copper plate of thickness 0.5cm has a temperature difference of 100°K between its opposite faces. If the area of the plate is 500 cm^2 . Calculate the quantity of heat flowing through the plate in 1 minute. K of copper is 385 w/m/k .

(4 × 3 = 12 marks)