

FIRST YEAR B.Sc. DEGREE EXAMINATION, APRIL/MAY 2005**Part III—Physics Subsidiary****Paper I—MECHANICS, PROPERTIES OF MATTER THERMAL
PHYSICS, LAGRANGIAN DYNAMICS AND PHYSICS OF THE EARTH****(For Geology Main)****Time : Three Hours****Maximum : 50 Marks****Section A**

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

1. Derive an expression for the change of entropy of a perfect gas.
2. Define co-efficient of thermal conductivity. Describe the radial flow method for determining the thermal conductivity of a rod. Mention some of its limitations.
3. What are generalised coordinates ? Arrive at the rotations for displacements, velocity, acceleration and force in terms of generalised coordinates.
4. Derive an expression for the gravitational potential due to a uniform solid sphere at a point (i) inside the sphere and (ii) outside the sphere.

(2 × 7 = 14 marks)**Section B**

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

5. Derive a relation for work done / unit volume in shearing strain.
6. Discuss the variation of intrinsic energy with volume for a gas obeying Van der Waals equation.
7. Define the three Moduli of elasticity.
8. Explain Weidmann and Franz law.
9. Distinguish between an isothermal change and an adiabatic change.
10. What are the properties of HeII ?
11. Write a note on atmospheric pollution.
12. Write a note on stress-strain diagram.
13. Distinguish between uniform and non-uniform bending.
14. Write a note on 'atmospheric composition'.
15. What are the disadvantages of Newtonian Mechanics.
16. What are holonomic and non-holonomic constraints.
17. Discuss the special features of entropy.

18. State the laws of transverse vibration of a stretched string.
19. Explain 'damped' and forced harmonic oscillators.
20. Write a note on equipotential surfaces.
21. Explain the temperature structure of atmosphere.
22. What is the relation between Kinetic Energy and generalized velocities ?
23. Discuss the vibration state of a diatomic molecule.
24. What is a plane progressive harmonic wave ?

(12 × 2 = 24 marks)

Section C

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

25. Two tubes A and B of lengths 1m and 0.5m have radii 10^{-4} 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 pressures, at the junction of A and B.
26. 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.
27. When 100gm. of water at 75°C is mixed with 50gm of water at 25°C . Calculate the change in entropy.
28. Find the amount of work done in twisting a wire steel of radius 10^{-3} m and length 0.25m through an angle of 45° . G of steel is 8×10^{10} Pa.
29. A space craft is moving relative to the earth. An observer on the earth finds that according to her clock 3601 s elapse between 1 p.m and 2 p.m. on the spacecraft's clock. What is the spacecraft's speed relative to the earth ?
30. Data from Lee's disc experiment :
Steady temperature of the upper disc = 372.5°K .
Steady temperature of the lower disc = 356.5°K .
Time taken to cool from 359°K to 354°K = 4 minutes.
Thickness of the lower disc = 4.8×10^{-3} m.
Mass of the Cardboard = 800 g.
Radius of the cardboard = 0.05m.
Specific heat capacity of copper = 380 J/Kg/K .
Calculate the thermal conductivity of cardboard.
31. The depression at the free end of the cantilever of length L and uniform cross section is 0.02 m. What will be the depression at a distance L/2 from the fixed end ?

(4 × 3 = 12 marks)