FIRST YEAR B.Sc. DEGREE EXAMINATION, APRIL/MAY 2005

Part III—Physics Subsidiary

PH (ST) 11—MECHANICS, PROPERTIES OF MATTER, THERMAL PHYSICS AND STATISTICAL MECHANICS

(For Statistics Main)

(2004 admissions)

Time : Three Hours   Maximum : 50 Marks

Section A

Answer any two questions.
Each question carries 7 marks.

1. Derive the expression for the moment of inertia of a solid sphere about a diameter.

2. Explain with theory, the Non-Uniform bending experiment to calculate Young's modulus.

3. How do you determine thermal conductivity of a bad conductor by Lees dis method. Explain.

4. Describe the working of carnot's engine. Derive expression for its efficiency.

$(2 \times 7 = 14 \text{ marks})$

Section B

Answer any twelve questions.
Each question carries 2 marks.

5. State parallel and perpendicular axes theorem.

6. Derive the expression for period of oscillation of two particles connected by a spring.

7. Write a note on Intensity of wave and spherical waves.

8. Write down the expression for velocity of longitudinal waves in a gas with symbols explained.

9. What do you understand by terms plane of bending and bending moment ?

10. Distinguish between angle of twist and angle of shear.

11. Define torsional rigidity of a wire. How is it related to modulus of rigidity ?

12. Explain the equilibrium of a liquid drop over a solid surface.

13. Write down Poiseuille's formula. What are its limitations ?

14. Write a note on variation of viscosity with temperature.

15. Distinguish between thermal conductivity and thermoelectric conductivity.

16. State Wiedman—Franz law.

17. Sketch the energy spectrum of a black body.

18. Show that entropy of a system increases in irreversible process.

19. Write a note on entropy and available energy.

20. Obtain expression for work done in Isothermal process.

21. Write down Kelvin and Clausius statement of second law of thermodynamics.

22. State Rayleigh–Jeans formula.

23. Write down Planck's radiation formula and explain the terms.

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$(12 \times 2 = 24$ **marks**$)$

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Section C

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

24. Calculate moment of inertia and kinetic energy of a uniform circular disc of mass 200kg and diameter 1m rotating about acentral perpendicular axis at the rate of 120 rotations per minute.

25. Two masses 10 gm and 90 gm are connected by a spring of length 10 cm force constant 10^3 Nm^{-1}. Calculate frequency of oscillation.

26. A body suspended symmetrically from lower and of a wire, 100 cm long, 1.22 mm in diameter oscillates about the wire as axis with a period 1.25 sec. If rigidity modules of the wire = 8×10^{10} Nm^{-2}, Calculate M.I of the body.

27. The pressure inside a soap bubble of diameter 1cm is 20 Nm^{-2} over atmospheric pressure. Calculate the surface tension of soap solution. Calculate the work done in blowing it to have a diameter 2 cm.

28. One mol of a gas at 300k expands adiabatically to double its volume. Calculate work done R = 8.3JK^{-1} mol^{-1}, r = 1.4.

29. The efficiency of an ideal heat engine is 20%. If temperature of sink is lowered by 20°C the efficiency becomes 25%. Calculate temperature of source and sink.

30. Calculate surface temperature of sun, if wavelength of maximum energy in solar spectrum is 475nm and wien's constant is 2.898×10^{-3} mK.

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$(4 \times 3 = 12$ marks$)$

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