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

Part III—Physics Subsidiary

Paper I—MECHANICS PROPERTIES OF MATTER THERMAL PHYSICS STATISTICAL MECHANICS AND ERROR ANALYSIS

(For Statistics Main)

Time : Three Hours   Maximum : 50 Marks

Section A

Answer any two questions.

1. Calculate the moment of inertia of a thin circular disc of mass m and radius r,

   (i) about its diameter.

   (ii) about a parallel axis to the diameter and tangential to the disc.

2. Derive Maxwell - Boltzman distribution law and its application to the ideal gas.

3. Attempt a critical Survey of the liquefaction of helium, bringing out clearly the particular difficulties encountered and how they were overcome.

4. Attempt a short essay on the Second law of thermodynamics and on Carnot's contribution to thermodynamics.

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

Section B

*Answer any **twelve** questions.*

5. Explain Wien's Displacement law and give its importance.

6. What is the effect of temperature on the surface tension of a liquid ?

7. Define coefficient of viscosity of a liquid. What is the effect of the pressure on viscosity ?

8. Write a short note on errors of measurement.

9. Explain Wiedemann and Franz Law.

10. What kind or kinds of energy result from the work done by a fluid against viscosity ?

11. Give the characteristics of progressive waves.

12. How does an Otto Cycle differ from Diesel cycle ?

13. Deduce the expression for work done is an isothermal process.

14. Explain Gaussian law of errors. What is Significant figures ?

15. What is torsional rigidity of wire ? Write down the expression for tensional rigidity.

16. Write down the expression for intensity of a plane progressive wave.

17. What forces determine the shape of a liquid drop on a horizontal plate ?

18. Define thermal conductivity and thermometric conductivity.

Turn over

19. Give the method of calculation of entropy when ice is converted into steam.

20. Define compound pendulum.

21. Define Angular Velocity and Relative angular Velocity.

22. Give the theory of forced harmonic oscillator.

23. State the general solution of the simple harmonic motion equation.

24. What is meant by Q factor ? How is it defined.

$$(12 \times 2 = 24 \text{ marks})$$

Section C

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

25. The temperature of the filament of a 40 w tungsten lamp is 2170°C and the effective surface area of the filament is 0.66 Cm². Estimate the value of Stefan's constant assuming that the energy radiate is 0.25 of that from a perfect radiation under Similar Conditions. Neglect the effect due to radiation from the glass envelope.

26. A body oscillates harmonically with amplitude 0.05 m. At a certain instant of time its displacement is 0.01 m and acceleration 1.0 m s^{-2} Calculate :

    (a)   the period of oscillation ; (b) its velocity at this instant, and ; (c) the maximum velocity.

27. Calculate the work done to break up a drop of mercury of diameter 1.0×10^{-2} m into eight drops, all of the same size. Surface tension of mercury is 0.035 N/m.

28. A steel wire of radius 0.5×10^{-3} m radius is bent into the form of a circle of radius 0.1 m. If the Young's modulus for steel is 20×10^{10} N/m², Calculate the bending moment and the maximum stress.

29. A metal plate 10^{-2} Square metre in area rests on a layer of caster oil 2×10^{-3} m thick. η of oil is 1.55 Nsm⁻². Calculate the horizontal force necessary to move the plate with a speed of 3×10^{-2} m/s.

30. The period of tensional oscillations of a heavy circular disc Suspended at the end of a wire is 4 seconds. Find the period, if the length of the wire is reduced to half the original value.

31. The quantity x is calculated from the formula $x = \dfrac{1}{y} + \dfrac{1}{z}$. If the % error in y and z are 1 and 2 respectively, calculate the percentage error in x.

$$(4 \times 3 = 12 \text{ marks})$$