Reg. No..... (Pages 2) **K 6133**

Name.....

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

Part III—Physics Subsidiary

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

(For Chemistry Main)

(2004 admissions)

Time : Three Hours Maximum : 50 Marks

## Section A

*Answer any* **two** *of the following questions.*
*Each question carries 7 marks.*

1. Derive an expression for the moment of inertia of a solid sphere about its diameter.
2. Derive an expression for torsional rigidity of a wire. Discuss static torsion method of determining rigidity modular.
3. State stefan's law. Verify it experimentally.
4. Describe carnot cycle and deduce the efficiency of an ideal heat engine.

(2 × 7 = 14 marks)

## Section B

*Answer any* **twelve** *of the following questions.*
*Each question carries 2 marks.*

5. Define moment of inertia. What is its physical significance ?
6. State and explain parallel axes theorem in moment of inertia.
7. What is a compound pendulum ? What is meant by its equivalent length ?
8. What is quality factor ? How is it related to frequency ?
9. Explain damped oscillations.
10. State Stoke's formula. Verify it dimentionally.
11. Explain streamline motion.
12. Derive an expression for the excess of pressure inside a spherical bubble.
13. State Graham's law of diffusion.
14. Bring out the analogy between liquid diffusion and heat conduction.
15. What do you mean by a black body ?
16. Explain Wein's displacement law.
17. Write the equation for cylindrical flow of heat. Explain the symbols used.
18. Derive the expression for work done during an isothermal process.

**Turn over**

19. Define phase space.
20. Explain first order phase transition.
21. What is super fluidity ?
22. State and explain Maxwell-Bottzman statistics.
23. What are Bosons and Fermions ?
24. Sketch the energy spectrum of a black body.

(12 × 2 = 24 marks)

## Section C

*Answer any* **four** *of the following questions.*
*Each question carries* 3 *marks.*

25. Calculate the moment of inertia of a solid cylinder of length 4 m, radius 0.5 m and mass 5 kg. about on axis passing through its geometric centre and perpendicular to it's length.
26. Velocity of longitudinal sound waves through a brass rod is 3,500 m/s. If the density of brass is 8,500 kg/m$^3$, calculate the Young's modulus of the rod.
27. A bar 1 m in length and 0.01 m square in section is clamped horizontally as a cantilever. When a load of 1 kg is applied to the free end, the depression of this end is 0.04 m. Find the Young's modulus of the material of the par.
28. Calculate the mass of water flowing in 10 secs. through a horizontal capillary tube of radius $10^{-3}$ m. fitted at the bottom of a constant level tank of depth 1m. Length of the tube is 0.3142 m. Coeffecient of viscosity of water is $10^{-3}$ Ns m$^{-2}$.
29. Estimate the effective temperature of the sun from the following data. Diameter of the sun $13.9 \times 10^5$ km. Mean distance of sun from earth $1.497 \times 10^8$ km. Solar constant 1400 J/m$^2$/s Stefan's constant is equal to $5.7 \times 10^{-8}$ w/m$^2$ K$^4$.
30. Find the efficiency of the Carnot engine working between steam point and ice point.
31. Calculate the depression of the melting point of ice, produced by $1.01 \times 10^5$ Pa increase. Specific latent heat of fusion of ice equals $3.3 \times 10^5$ J/kg. The densities of ice and water at 273 K are 920 kg/m$^3$ and 1000 kg/m$^3$.

(4 × 3 = 12 marks)