# LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – PHYSICS

FIRST SEMESTER – NOVEMBER 2007

**PH 1500 - PROP.OF MAT.& THERMAL PHYSICS**

**AC 1**

Date : 01/11/2007 Dept. No. Max. : 100 Marks
Time : 1:00 - 4:00

**PART-A**

Answer ALL the questions (10x2=20 marks)

1. Deduce the dimensional formula for gravitational constant.
2. The Young's modulus of the material of the wire is $2x10^{11}$ N/m$^2$ and its poission's ratio is 0.25.Calculate its rigidity modulus.
3. A 4m long aluminium wire whose radius is 1.5mm is used to support a mass of 50 kg. What will be the elongation of the wire?(Young's modulus for aluminium is $7x10^{10}$ N/m$^2$;g=9.8 m/s$^2$)
4. State any four postulates of the kinetic theory of gases.
5. Define root mean square velocity. Find the rms value of air at -100°C and 1000°C.
6. What are intensive and extensive variables?
7. Give the Classius statement of the second law of thermodynamics.
8. Why $C_T$ is not defined just as $C_P$ and $C_V$ are defined?
9. What is internal mechanical irreversibility?
10. What is meant by the equation of state?

**PART-B**

Answer any FOUR questions (4x7.5=30 marks )

11. a) Discuss the variation of acceleration due to gravity with attitude. (4.5)

    b) How far away from the earth does acceleration due to gravity become one percent of its value at the earth's surface? (3)
12. Derive an expression for the depression of the free end of a cantilever loaded at its free end, when the weight of the cantilever is negligible.
13. Derive an expression for the coefficient of viscosity of a gas on the basis of kinetic theory of gases.
14. Obtain the Classius inequality relation of thermodynamics.
15. a) Derive Ehrenfest's equation for a second order phase transition. (5.5)

    b) Give two examples of second order phase transition. (2)

## PART-C

Answer any FOUR questions (4x12.5=50 marks)

16. a) Determine the gravitational potential and gravitational field due to a spherical shell at a point outside the spherical shell. (9.5)

    b) The radius of the earth is $6.637 \times 10^6$ m, its mean density is 5570 $kgm^{-3}$ and the gravitational constant $6.67 \times 10^{-11}$ $N/m^2kg^{-2}$.

    Calculate the earth's surface potential. (3)

17. a) Derive Poiseuille's formula for the rate of flow of liquid in a capillary tube. (8.5)

    b) Calculate the mass of water flowing in 10 minutes through a tube of 0.001m diameter and 0.4m long if there is a constant pressure head of 0.2m of water. The coefficient of viscosity of water is 0.00082 $Nsm^{-2}$ (4)

18. Given the equation F(P,V,T)=0, obtain the thermodynamic relation $(\partial P/\partial V)_T\ (\partial U/\partial T)_P\ (\partial T/\partial P)_V=-1$ and hence obtain a value for the coefficient of cubical expansion for a van der waal gas.

19. Explain Joule-Kelvin experiment and inversion curve. Obtain an expression for Joule-Kelvin coefficient.

20. a) Derive Maxwell's thermodynamical relations. (8.5)

    b) One kg of water at 7°C is mixed with 3kg of water at a temperature of 47°C in a thermally insulated vessel. Find the change in entropy. ($C_P$ of water= 4180 J/Kg/K). (4)

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