M 19041

Reg. No. : A9PSPH 1604

Name : Prabitha.V.V.

# IV Semester M.A./M.Sc./M.Com. Degree (Regular/Supplementary/ Improvement) Examination, March 2011

## (2009 Admn.)

## PHYSICS

## PH 401 : Statistical Mechanics

Time : 3 Hours Max. Weightage : 50

*Instructions:* ***Each** question has **three** Parts. Section A – contains **four** essays of which the candidate has to answer **any two** and each question carries **10** marks. Section **B** – contains **eight** questions of which the candidate has to answer **five** questions and **each** question carries 3 marks. Section C – contains **five** problems of which the candidate has to answer **any three** questions and **each** question carries 5 marks.*

SECTION – A

(Answer **any two** questions, **Each** question carries **10** marks).

1. Distinguish between the three types of ensembles in statistical mechanics.
2. Discuss density fluctuations in grand canonical ensemble.
3. Explain the phenomenon of Bose-Einstein condensation. Calculate the critical temperature at which the condensation will start.
4. Define Ising model. Explain how this can simulate the lattice gas. **(2×10=20)**

SECTION – B

(Answer **any five** questions, **Each** question carries **3** marks).

5. What is Gibb's paradox ? How it has been resolved ?
6. State and explain Liouville's theorem.

**P.T.O.**

7. Describe how energy fluctuates in canonical ensemble.

8. Define density operator.

9. Explain Plank's theory of black body radiation.

10. Describe the behavior of an ideal Fermi gas.

11. Obtain the expression for specific heat of metals at low temperature and point out its physical significance.

12. Explain landau diamagnetism. **(5×3=15)**

## SECTION – C

(Answer **any three** questions, **Each** question carries **5** marks).

13. Show that the formulae $S = k\log \Gamma(E)$ and $k\log\omega(E)$ are equivalent to one another.

14. Derive the expression for the internal energy of classical ideal gas.

15. Prove that $<H^2> - <H>^2 = KT^2C_v$ in the case of canonical ensemble.

16. Determine the paramagnetic susceptibility of an ideal Fermi gas.

17. Determine the Helmholtz free energy per spin in one dimensional Ising model and represent the variation of magnetization graphically. **(3×5=15)**