M 25052

Reg. No. : .....

Name : .....

IV Semester M.A./M.Sc./M.Com. Degree (Reg./Sup./Imp.) Examination, March 2014
PHYSICS
PH 401 : Statistical Mechanics

Time: 3 Hours Max. Marks : 50

Instructions : *Section – **A** : Contains **four** essays of which answer **any two** questions.*
*Section – **B** : Contains **eight** questions of which answer **any five** questions.*
*Section – **C** : Contains **five** problems of which answer **any three** questions.*

SECTION – A

Answer **any two** questions. **Each** question carries **ten** marks.

1. Discuss equipartition theorem and virial theorem.

2. State and explain Liouvilles theorem.

3. Considering the free electrons in a metal to form a Fermi gas, obtain the Richardson Dushmann equation for thermionic emission of electrons.

4. What is Bose-Einstein statistics ? What are the basic postulates used ? Starting from Bose-Einstein energy distribution law, derive Planck's law of black body radiation. **(2×10=20)**

SECTION – B

Answer **any five** questions. **Each** question carries **three** marks.

5. Discuss the microscopic and macroscopic states of a system.

6. Explain Gibbs paradox.

P.T.O.

7. State Liouvilles theorem and give its consequences.

8. Write a note on the density and energy fluctuations in grand canonical ensemble.

9. Discuss Bose-Einstein condensation.

10. Discuss the Debye theory of specific heat of solids.

11. Obtain an expression for the number of states of a Fermi gas in two dimension between the energy range E and E+dE. Derive an expression for the average energy of a two-dimensional Fermi gas at absolute zero of temperature.

12. Write a note on Ising model. **(5×3=15)**

SECTION – C

Answer **any three** questions. **Each** question carries **five** marks.

13. In a system of 8 distinguishable particles distributed in two equal sized compartments, calculate the probability of the macrostate (3, 5), (4, 4), (2, 6).

14. Find out the average number of photons in an enclosure of 22.4 litres at 273 K.

15. We have two equal amounts of two identical ideal gases at the same temperature T but at different pressures P_1 and P_2 in two containers which are connected. Show that the change in entropy is $NK\,ln\left\{\frac{(P_1+P_2)^2}{4P_1P_2}\right\}$.

16. Show that the specific heat of a strongly degenerate Fermi-Dirac gas is directly proportional to its absolute temperature.

17. Show that Helmholtz's free energy tends to a minimum in system at constant temperature and volume. **(3×5=15)**
