M 26989

Reg. No. : .....

Name : .....

IV Semester M.A./M.Sc./M.Com. Degree (Reg./Sup./Imp.) Examination, March 2015

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. Explain Gibbs paradox. How can it be removed ? Obtain an expression for the partition function which is free from Gibb's paradox.

2. Explain BE condensation. Calculate the critical temperature at which condensation into the lower order starts.

3. Explain Landau diamagnetism of an ideal Fermi gas.

4. What is Ising model ? Use a suitable approximation method to obtain expressions for entropy and free energy under this model. **(2×10=20)**

SECTION – B

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

5. What is phase space ?

6. Show that the entropy of the system is proportional to the logarithm of probability of that system.

P.T.O.

7. Distinguish between canonical and microcanonical ensemble.

8. Write a note on the postulate of equal a priori probability in quantum statistics.

9. Derive an expression for the energy distribution of bosons.

10. Write a note on the statistical distribution of white dwarfs.

11. Define equipartion theorem.

12. Derive Richardson Dushman equation for thermionic emission of electrons. **(5×3=15)**

SECTION – C

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

13. Two states with energy difference 4.83×10^{-21} J occur with relative probability e^2. Calculate the temperature.

14. Show that the magnetic susceptibility of free electrons is given by $\chi = \frac{3n}{2kT_F} \mu_H^2$;

    where n is the conduction electrons per unit volume, μ_H is the magnetic moment, k is the Boltzmann constant and T_F is the Fermi temperature.

15. Derive the expression for the root mean square and most probable speed of classical gas.

16. Calculate the fermi energy in electron volts for sodium assuming that it has one free electron per atom. Given density of sodium = 0.97 $gmcm^{-3}$, atomic weight of sodium = 23.

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