

(6 pages)

Reg. No. :

Code No. : 6379

Sub. Code : HPHM 33

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2013.

Third Semester

Physics

STATISTICAL MECHANISMS

(For those who joined in July 2012 onwards)

Time : Three hours

Maximum : 75 marks

SECTION A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Γ space is ———— dimensional space
(a) $6N$ (b) N
(c) $3N$ (d) $2N$
2. $\rho(p, q) = \text{const}$ if $E < H(p, q) < E + \Delta$, $\Delta = 0$
otherwise is the density functions of
(a) Gran canonical ensemble
(b) canonical ensemble
(c) Micro canonical ensemble
(d) None of these

3. $A+Ts$ is
(a) free energy (b) bound energy
(c) total energy (d) internal energy
4. All the systems in canonical ensemble have the same
(a) Energy (b) Volume
(c) Temperature (d) None of these
5. Thermal wavelength is of the order of
(a) 3
(b) 2
(c) de broglie wave length
(d) none of these
6. The internal energy of fermi gas is directly proportion to
(a) pressure (b) volume
(c) temperature (d) none of these
7. $u_p(r) = \frac{1}{\sqrt{r}} e^{i \vec{p} \cdot \vec{r} / \hbar}$ forms
(a) orthogonal set (b) non orthogonal set
(c) degeneracy (d) none of these

Page 2

Code No. : 6379



8. For fermions, $[\psi(r), \psi(r')]$ is equal to
- (a) zero (b) one
(c) infinity (d) none of these
9. Mean field critical exponents have the dimensionality of
- (a) space (b) energy
(c) momentum (d) force
10. The van der Waals equation of state can be regarded as a mean - field theory of
- (a) Solid - gas transition
(b) Gas - liquid transition
(c) Solid - liquid transition
(d) None of these

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions choosing either (a) or (b).

11. (a) Explain the postulate of equal a priori probability.
- Or
- (b) Explain the Boltzmann's postulate of entropy.

Page 3 Code No. : 6379

12. (a) Distinguish the different ensembles one from the other.

Or

- (b) Write a note on chemical potential of ideal gas.

13. (a) Define the density matrix for canonical ensemble and hence obtain the ensemble average.

Or

- (b) Obtain the internal energy for ideal Fermi gas.

14. (a) Bring out the features of fermi gas at finite time.

Or

- (b) Write a note on chemical equilibrium.

15. (a) Discuss briefly the scaling hypothesis.

Or

- (b) Write about the upper critical dimensions of a system under phase transition.

Page 4 Code No. : 6379
[P.T.O.]



SECTION C — ($5 \times 8 = 40$ marks)

Answer ALL questions choosing either (a) or (b).

16. (a) Describe Gibb's paradox.

Or

- (b) State and prove Lieuville theorem.

17. (a) Obtain the entropy and position functions of a system in contact with a heat reservoir. Use the same to derive the thermo dynamical parameters.

Or

- (b) Discuss the fluctuation of particle number when the system is in contact with a particle reservoir.

18. (a) Describe Mean field theory.

Or

- (b) Obtain density matrices for a system with one electron in a magnetic field and hence deduce the thermo dynamical parameters.

19. (a) Describe Ising model.

Or

- (b) Describe the Saha ionisation formula.

20. (a) Deduce the scaling relations.

Or

- (b) Discuss the Landau's theory.
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