Roll No. .....

74601

M. Sc. Physics 2nd Semester

Examination – May, 2016

STATISTICAL MECHANICS

Paper : V

Time : Three Hours] *[Maximum Marks : 80*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. All questions carry equal marks.

UNIT – I

1. Write short notes on : $4 \times 4 = 16$

(i) Quantization of phase space

(ii) Gibbs paradox

(iii) Anomalous properties of liquid helium

(iv) Energy fluctuations in quantum statistics

UNIT – II

2. Write notes on :

(a) Ergodic hypothesis

(b) Postulate of equal a priori probability of Eigen states and

(c) Statistical interpretation of entropy. Prove that the density of system in the neighborhood of some given system in phase space remains constant in time. 16

3. Differentiate between macroscopic and microscopic states and obtain expression of entropy S for a perfect monatomic gas in a microcanonical ensemble. 16

UNIT – III

4. Define partition function and calculate its value for a grand canonical ensemble. Use it to derive expression for chemical potential, Helmholtz free energy and Gibb's free energy. 16

5. What is meant by micro-canonical, canonical and grand canonical ensembles ? Describe the canonical ensemble and calculate the entropy of a perfect gas. Explain how the internal energy and equation of state can be derived. 16

UNIT – IV

6. State the basic assumptions with which the classical Fermi-Dirac, and Bose. Einstein statistics start and deduce expressions for distribution function in the three cases. Mention the cases where the respective distribution functions are applicable. 16

7. Derive the expressions for energy and pressure of an ideal Fermi-Dirac gas. Discuss the concept of Fermi energy and its relation with chemical potential. 16

UNIT – V

8. What are the phase transitions of first and second kind ? How cooperative phenomenon accounts for phase transitions of second kind ? Present the analysis of Ising Model in two dimensions. 16

9. Explain the concept of one dimensional random walk. Analyse Brownian motion as an example of fluctuating force. 16