15131

M.Sc. DEGREE EXAMINATION, NOVEMBER 2016.

FIRST SEMESTER

Material Science and Nanotechnology

Paper I — CLASSICAL AND STATISTICAL MECHANICS

Time : Three hours Maximum : 75 marks

(No additional sheet will be supplied)

PART A — (5 × 3 = 15 marks)

Answer any FIVE questions.

Each question carries 3 marks.

Each answer should not exceed 1 page.

1. Discuss holonamic and non holonamic constraints.

2. State and explain D'Alemberts principle.

3. Write the conditions for transformation to be canonical.

4. Write the properties of Lagrangian bracket.

5. Write the relation between thermodynamics and statistical mechanics.

6. Define ensemble. Discuss different ensemblesunction.

7. Obtain Fermi-Dirac distribution function.

8. State and explain equipartition theorem.

PART B — (4 × 15 = 60 marks)

Answer ALL questions.

Each question carries 15 marks.

Each answer should not exceed 6 pages.

9. (a) State and explain principle of virtual work.

(b) Obtain Lagranges equation of motion

Or

10. (a) Discuss Hamilton's principles

(b) Obtain the expression for energy of harmonic oscilllator using Lagrange's equation.

11. (a) Write the properties of generating function.

(b) Obtain canonical equations in terms of Poisson bracket notation.

Or

12. (a) Hamilton-Jacobi equations from Hamilton's principle.

(b) Obtain the energy of harmonic oscillator using Hamilton-Jacobi equation.

13. (a) Write about phase space and ensemble average.

(b) State Liouville's theorem and show the density in phase space is constant.

Or

14. (a) Obtain the exptessions for translational and vibrational partition functions.

(b) Derive the expression for the rotational partition function, and the contribution of rotational energy to specific heat.

15. (a) Obtain Maxwell — Boltzmannn distribution function.

(b) Obtain the expressions of average value, mean value and root mean square value from Maxwell's distribution of velocities.

Or

16. (a) Obtain Bose- Einstein distribution function.

(b) Describe Bose-Einstein condensation.