15131

M.Sc. DEGREE EXAMINATION, NOVEMBER 2017.

FIRST SEMESTER

Material Science and Nanotechnology

Paper I — CLASSICAL AND STATISTICAL MECHANICS

Time : Three hours Maximum : 75 marks

(No additional sheet will be supplied)

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SECTION A — (5 × 3 = 15 marks)

Answer any FIVE questions.

Each question carries 3 marks.

Each answer should not exceed 1 page.

1. Discuss holonomic and non holonomic constraints.

2. State and explain D Alembert's principle.

3. Describe the conditions for transformation to be canonical.

4. What are action angle variables and discuss its importance

5. Define ensemble and phase space.

6. Write the properties of partition functions.

7. State and explain equipartition theorem.

8. Discuss the degeneracy of Fermi gas.



SECTION B — (4 × 15 = 60 marks)

Answer ALL questions.

Each question carries 15 marks.

Each answer should not exceed 6 pages.

9. (a) Obtain Lagrange's equation from Hamilton's principle.

(b) Solve the problem of Linear harmonic oscillator using Lagrange's equation.

Or

10. (a) Obtain Hamilton's equation of motion.

(b) Solve the problem of simple pendulum using Hamilton equation.

11. (a) What is a generating function write its properties.

(b) Derive the canonical equations in terms of Poisson bracketl.

Or

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

(b) Solve the problem of one dimensional harmonic oscillator using Hamilton-Jacobi equation.

13. (a) Discuss the differences between different ensembles.

(b) State and explain Liouville's theorem.

Or

14. (a) Obtain the expression for translational, rotational partition functions.

(b) Discuss electronic and nuclear partition functions.

15. (a) Obtain the expression for Maxwell-Boltzmann distribution function.

(b) Deduce the expression lot Maxwell's distribution of velocities.

Or

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

(b) Obtain Planck's law, Rayleigh — Jean's law from Bose-Einstein statistics.

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