M.Sc. DEGREE EXAMINATION, NOVEMBER 2016.

First Semester

Material Science and Nanotechnology

Paper II — CONCEPTS IN MATERIALS SCIENCE

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. Define lattice, unit cell and Bravais lattice.

2. Sketch the crystal of NaCl.

3. Write a note on colour centers.

4. Write a note grain boundary defects.

5. What are phonons and mention its characteristics?

6. Explain quantization of lattice vibrations.

7. Write a note on Brillouin zones.

8. Distinguish between metals, insulators and semiconductors based on band theory.

PART B — (4 × 15 = 60 marks)

Answer ALL questions.

Each question carries 15 marks.

Each answer should not exceed 6 pages.

9. What is Miller indices? How it is calculated? Find the Miller indices of a plane that makes an intercepts of 2a, 3b and c along the crystallographic axis (a, b and c are the primitive vectors of the lattice)

Or

10. Define packing fraction. Calculate the packing fraction for face centered cubic structure.

11. What are point defects? Derive an expression for Schottky defect concentration.

Or

12. What are dislocations? Explain the role of dislocations in crystal growth. How do you estimate dislocation density.

13. What are lattice vibrations and derive the dispersion relation for monoatomic lattice.

Or

14. Discuss the scattering of phonons by neutrons and photons and derive the dispersion relation for diatomic lattice.

15. Discuss the motion of electron in periodic potential.

Or

16. Prove the Bloch theorem and explain the significance of the effective mass of the electron.

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