MMPD - 103 M.E./M.Tech., 1 Semester

Examination, December 2014 Material Technology And Failure Analysis

Time: Three Hours

Maximum Marks: 70

Note: i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.

- ii) All parts of each questions are to be attempted at one place.
- iii) All questions carry equal marks, out of which part A and B (Max.50 words) carry 2 marks, part C (Max.100 words) carry 3 marks, part D (Max.400 words) carry 7 marks.
- iv) Except numericals, Derivation, Design and Drawing etc.
- 1. a) Specify three that you add to pure silicon to make it an extrinsic semiconductor of
 - i) The-n-type
- ii) The-p-type
- b) Define atomic packing factor and find the atomic packing factor for FCC structure.
- c) What is super conductivity? Explain its properties and application.
- d) Define the term 'dislocation'. Explain different types of dislocation in detail.

OR

Calculate the number of atom per mm² surface area for

- i) (100) plane
- ii) (110) plane and
- iii) (111) plane for aluminium having FCC structure and lattice parameter a 7 4.049 Å.
- 2. a) Define the term 'creep'.
 - b) What is 'hot working'?
 - c) Explain the term `thereto elastic effect'.
 - d) What do you understand by the term `inelastic behaviour'? What is relaxation time and relaxation process?

A sample of glass has a crack of half length 2 pm. The Young's modulus of glass is 70 GNm⁻² and the specific energy (surface) is 1 lm⁻². Estimate its fracture strength and compare if with young's modulus.

- 3. a) What is slip phenomenon in deformation?
 - b) Define the term 'recrystallization'.
 - c) Describe 'grain boundaries' in crystal with sketch.
 - d) Compute the line energy of dislocations in BCC iron. The Burgers vector in iron is of the $^{1}/2 < 111 >$ type. The shear modulus of iron is 80.2 GN^{2} , Burger vector b = 2.49 A°

OR

Describe the different stages of 'work hardening' in detail and explain the pile up theory.

- 4. a) Define 'Endurance limit'.
 - b) What is S-N curve'?
 - c) Explain Gerber and Goodman line with sketch and differentiate between them.
 - d) Describe the 'mechanism of creep' in detail.

OR

Explain the procedure for fatigue testing with neat diagram.

- 5. a) Define the term 'fracture toughness'.
 - b) Define fracture' and what are the processes of fracture?
 - c) Differentiate between critical stress intensity and stress intensity factor.
 - d) What are the basic mode of crack propagation? Explain each of them with neat sketches.

OR

Describe Griffith theory of mechanism of fracture.