

[Total No. of Questions - 9] [Total No. of Printed Pages - 3]
(2125)

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B. Tech 4th Semester Examination
Material Science & Engineering (OS)
ME-4052

Time : 3 Hours

Max. Marks : 100

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Section E is compulsory. Candidates are required to attempt all the questions in section E. In addition to that candidates are also required to attempt 4(four) questions selecting at least one question from each section A, B, C & D. Marks of questions are indicated against each question. Draw neat and comprehensive sketches wherever necessary to clearly illustrate your answer. Assume missing data suitably if any and specify the same. Use of non-programmable calculator is allowed.

SECTION - A

1. (i) Explain the various types of crystal structures and crystal systems. Illustrate with suitable examples.
(ii) What do you understand by reciprocal lattice? State their significance. (14+6=20)
2. (i) What are Miller indices? Explain their significance.
(ii) Find the perpendicular distance between the two planes indicated by miller indices (111) and (222) in a unit cell of a cubic lattice with lattice constant parameter 'a'.
(iii) Define closed packed structures. Draw a closed packed structure with in the unit cell of an FCC (Face Centred Cubic) crystal and give its Miller indices. (7+5+8=20)

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SECTION - B

3. (i) What do you understand by 'points of imperfections'? Explain briefly.
(ii) What is dislocation? What are the sources of dislocation? Explain dislocation theory. What is the significance of dislocations in the plastic deformation of metals? Explain with justifications. (6+(2+2+5+5)=20)

4. (i) State and explain the atomic model of diffusion. Is it obeying the Fick's law of diffusion? Explain with justification.
(ii) Explain the detail procedure of solution of Fick's second law. Give application based solution to the law in favour of your answer.
(iii) State and explain the Kirkendall effect. ((5+3)+8+4=20)

SECTION - C

5. (i) What are elastic properties? Discuss the factors affecting the elastic properties of metals.
(ii) Draw a stress-strain curve for a low carbon steel specimen indicating the proportional limit, elastic limit, yield point, maximum loading point and rupture. Explain all above important points briefly.
(iii) What do you understand by shear strength of a perfect crystal? Explain. ((2+5)+8+5=20)
6. (i) What is creep? How will you characterize the creep curve? Draw a neat labeled creep test curve and explain briefly three stages of creep.
(ii) What do you understand by mechanical failure? Explain briefly with examples of mechanical failures. ((2+3+7)+8=20)

SECTION - D

7. (i) Explain the quantum theory of free electrons.
- (ii) Define the following terms in context of the electrical properties of materials (a) Relaxation time, (b) Collision time, (c) Mean free path.
- (iii) State and explain the mechanisms of polarization. (5+3x3+6=20)
8. (i) What are semiconductors? Differentiate between intrinsic and extrinsic semiconductors.
- (ii) 'Semiconductors have negative temperature co-efficient of resistance' justify the sentence and explain.
- (iii) Write short notes on the followings (a) Hall effects and its applications, (b) Fermi energy. ((2+4)+6+2x4=20)

SECTION - E

9. Short Questions (compulsory)
- (i) Define London equations.
- (ii) Distinguish between edge and screw dislocation.
- (iii) What is plastic deformation?
- (iv) Why does a metal fail by fatigue?
- (v) Differentiate between dia and para magnetism.
- (vi) What are ferrites? Is a ferrite free from carbon?
- (vii) How will you classify the materials on the basis of band gap?
- (viii) What is polarizability?
- (ix) What is flux quantization?
- (x) What is closed packed structures? (10×2=20)