18|05|2019

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Printed Pages : 3

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BT-4 / M-19
MATERIAL SCIENCE
Paper–ME-204 E

Time allowed : 3 hours] *[Maximum marks : 100*

Note : *Attempt any **five** questions selecting at least **one** question from each unit.*

Unit–I

1. What is the difference between space lattice and bravais lattice? Mention different types of Bravais lattices. Show that the atomic packing factor for BCC crystal structure is 0.68. 20

2. (a) Briefly describe a twin and a twin boundary. 5

(b) Cite the difference between mechanical and annealing twins. 5

(c) Would you expect Frenkel defects for anions to exist in ionic ceramics in relatively large concentrations ? Why or why not ? 5

(d) Differentiate between edge and screw dislocations based on the : 5

(i) Burgers vector and

(ii) Direction of movement of atoms with dislocation movement

Unit–II

3. (a) What is the difference between substitutional and interstitial solid solutions ? Explain the Hume-Rothery's rules. 5

   (b) Draw iron carbon equilibrium diagram and label the various phase, fields and temperature. Discuss in brief different reactions that take place in the system. 15

4. Explain the characteristics and applications of the following Heat Treatment processes : 20

   (a) Annealing (b) Hardening

   (c) Normalising (d) Carburising

Unit–III

5. (a) Explain the critical resolved shear stress of a polycrystalline material. 8

   (b) Briefly write the differences between recovery and recrystallization processes.

   (c) Explain the differences in grain structure for a metal that has been cold worked and one that has been cold worked and then recrystallized.

   (d) State the major differences between slip and twinning deformation mechanism. 12

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6. (a) Describe the Bauschinger effect. 5

(b) Differentiate between Ductile and Brittle Fracture. 5

(c) Define the term 'Fatigue'. Describe the mechanism of Fatigue failure. 5

(d) Describe the process of Season's Cracking. 5

Unit–IV

7. Show a characteristics creep curve and describe three stages in creep deformation. Explain the significance of secondary stage in an ideal creep curve. What is the relationship between creep rate of secondary stage and temperature ? What will be the effect of increasing stress on this creep rate ? Discuss some of the measures to improve creep resistance in the Materials. 20

8. (a) What are polymers ? Describe briefly the terms 'saturated polymer' and 'unsaturated polymer'. Differentiate between thermoplastic and thermosetting polymers. 12

(b) Why are ceramic materials generally brittle ? What is 'glass transition temperature' ? 8