

MANUFACTURING & MECHANICAL ENGINEERING

FOURTH SEMSTER-REGULATION 2015

ML7451 ENGINEERING MATERIALS AND METALLURGY

Time: 3Hr

Max.Mark:100

Answer ALL Questions

Part -A (10x2=20 Marks)

1. Differentiate solid solution and intermetallic compounds
2. The mass fraction of eutectoid ferrite in a Fe-Fe₃C system is 0.71. On the basis of this information, is it possible to determine the composition of the alloy? If so, what is the composition?
3. Martensite transformation in steel is not reversible: True or false- Justify your answer.
4. Why is not low carbon steel hardened by heat treatment?
5. What is the difference between ductile and malleable iron?
6. Manganese addition reduces hot shortness tendency in steel: true or false- Justify your answer.
7. Why is glass the most used reinforcements for composites
8. Distinguish between addition polymerization and condensation polymerization.
9. What is the hardness technique used for measuring hardness on soft materials?
10. Draw a fatigue cycle for R= 0

Part - B (5x13 = 65 Marks)

11a (i) Bismuth and antimony are completely soluble in both the liquid and solid states. Bismuth melts at 520°F and antimony melts at 1170°F. An alloy containing 50 percent bismuth starts to solidify at 940°F by separating crystals of 90 percent antimony. An alloy containing 80 percent bismuth starts to solidify at 750°F by separating crystals of 75 percent antimony. For an alloy containing 40 percent antimony, (a) give the temperature of initial solidification, (b) give the temperature of final solidification (c) give the chemical composition and relative amounts of the phases present at 800°F (6)

(ii) Apply lever rule principle to explain the peritectic reaction. (7)

OR

11b (i) Draw the iron-iron carbide equilibrium diagram and mark all the regions and (13)

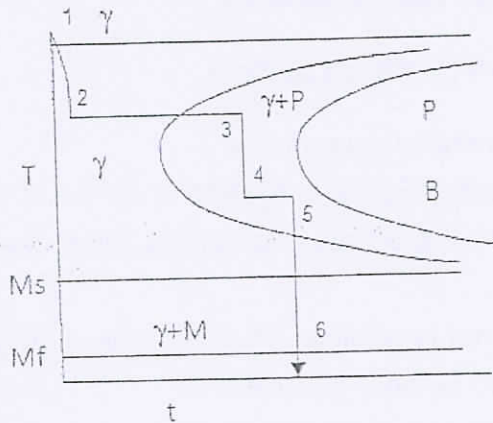


explain the microstructure formation in eutectoid, hypo eutectoid and hyper eutectoid region.

- 12a (i) Argue the use of (a) Full annealing, (b) stress relief annealing, and (c) spheroidising in industries. What are the microstructural changes in the medium carbon steel after each of the heat treatment processes? (13)

OR

- 12b (i) Apply TTT diagram on the heat treatment path shown below to discuss the microstructural changes during the 1-6 stages of heat treatment process. (6)



- (ii) What is hardenability? Explain the procedure to measure the hardenability. (7)

- 13a (i) Justify the importance of precipitation strengthening treatment on Al-Cu alloy. Critically comment on the microstructural changes. (8)

- (ii) Explain the properties and applications of different Ni alloys (5)

OR

- 13b (i) Explain the effect due to the addition of Mn, Cr, W, Mo, V, Ti on the steel. (13)

- 14a (i) Identify suitable ceramic material(s) for the following applications and justify your selection and discuss the properties (6)

(a) cutting tool (insert) (b) refractory bricks

- (ii) Classify the composites based on matrix materials used and suggest materials that can be used as matrix and reinforcement materials for composite making. (7)

OR

- 14b (i) Explain the properties and applications of (a) PVC, (b) PMMA (c) ABS (d) PEEK (8)



- (ii) How does nanocomposite differ from macro composite? (5)
- 15a (i) What is fracture? Explain different types of fracture and their characteristic features (5)
- (ii) Draw the stress-strain diagram of a elasto-plastic material and explain the different properties that can be predicted for a material from the stress-strain diagram (8)

OR

- 15b (i) Identify and explain the failure mechanism from the following conditions (10) given
- (a) An axle used in an automobile continuously transmitting power got broken
- (b) a steam turbine blades got broken due to continuous rotation
- (ii) What is the effect of temperature on the fracture toughness of a material? (3)

Part C (Mark: 15)

- 16 (i) You have been given a gear with broken tooth that has failed prematurely in service. Suggest suitable surface treatment, heat treatment to hardening the surface of the tooth- explain in details the steps followed in surface treatment and heat treatment process that you suggest (15)



15
22/22
13/13

100
22/18

15
22/22

18
592