

CBCS SCHEME

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Third Semester B.E. Degree Examination, Dec.2019/Jan.2020 Material Science and Metallurgy

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Calculate APF for BCE crystal structure. (08 Marks)
b. Discuss briefly point and surface imperfections in crystals. (07 Marks)
c. Explain briefly the various factors affecting diffusion in solids. (05 Marks)

OR

- 2 a. A 12.5mm Aluminium alloy test bar is subjected to a load of 2 tons. If the diameter of the bar is 12.4mm at this load. Calculate engineering strain, engineering stress, true stress and true strain. Assume no change in volume. (12 Marks)
b. Explain briefly stiffness and modulus of resilience for a mild steel bar. (08 Marks)

Module-2

- 3 a. Explain Type I, Type II and Type III fractures in metals. (12 Marks)
b. Define Creep. Explain three stages of creep process. (08 Marks)

OR

- 4 a. What is Creep strength and Creep rupture strength? (04 Marks)
b. Define 'Fatigue'. Explain the various types of fatigue loading with examples. (08 Marks)
c. With a diagram, explain fatigue testing. (08 Marks)

Module-3

- 5 a. Derive an expression for critical radius in homogeneous nucleation during solidification. (08 Marks)
b. Discuss Hume-Rothary rules for the formation of substitutional solid solutions. (08 Marks)
c. Explain briefly the types of solid solutions. (04 Marks)

OR

- 6 a. State Gibb's phase rule and discuss various terms involved in phase rule. (05 Marks)
b. Two metals A and B have 100% mutual solubilities in the liquid and solid states. The melting point of pure metals A and B are 800°C and 600°C respectively. Details of start and end of solidification of various alloys in the series are as below:

Alloys of Composition	Temperature at the start of solidification	Temperature at the end of solidification °C
90% A + 10% B	798°C	750°C
70% A + 30% B	785°C	705°C
50% A + 50% B	757°C	675°C
30% A + 70% B	715°C	645°C
10% A + 90% B	650°C	615°C

- i) Draw the phase diagram for A-B series.
ii) Predict the number, type and relative amounts of phases present in an alloy of 40% A and 60% B at 700°C. (15 Marks)

Module-4

- 7 a. With the help of TTT and CCT curves, explain mar tempering process. (10 Marks)
b. Explain Case Carburizing process. (05 Marks)
c. Discuss flame hardening process for surface hardening. (05 Marks)

OR

- 8 a. Explain age-hardening for Al-Cu alloys. (10 Marks)
b. Discuss properties, composition and uses of Grey Cast Iron and S.G. Cast Iron. (10 Marks)

Module-5

- 9 a. Discuss any two types of Cu-Zn alloys with respect to properties, composition and applications. (06 Marks)
b. Discuss the properties, composition and applications of Al-Cu alloy and Al-Si alloy. (06 Marks)
c. With a neat diagram, explain 'Hand-Lay up' process for producing FRP. (08 Marks)

OR

- 10 a. Give briefly the classification of composite materials. (05 Marks)
b. With a neat diagram, explain 'Filament Winding' process for the production of FRP. (10 Marks)
c. Discuss various applications of composites. (05 Marks)
