U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

August 2023 Semester End Make-Up Examinations

Programme: B.E. **Semester: III**
Branch: Mechanical Engineering **Duration: 3 hrs.**
Course Code: 22ME3PCMSM/19ME3DCMSM **Max Marks: 100**
Course: Material Science and Metallurgy **Date: 16.08.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may suitably be assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

UNIT - I

1	a)	Derive an expression for critically resolved shear stress.	**10**
	b)	Define fatigue. Explain any two fatigue mechanisms.	**10**

OR

2	a)	Discuss in brief the concepts of recovery, recrystallization and grain growth in metals and alloys.	**06**
	b)	Define creep. Explain various stages in creep.	**08**
	c)	Explain the concept of Bauschinger's effect.	**06**

UNIT - II

3	a)	Define and classify the solid solutions. State Hume-Rothary rules for formation of solid solutions.	**06**
	b)	Derive an expression for the formation of critical radius during nucleation process.	**08**
	c)	With an aid of an example explain Lever rule.	**06**

OR

4	a)	Elucidate how the phase diagrams are derived from cooling curves.	**08**
	b)	Two metals A and B are used to form an alloy containing 75%A and 25% B. A melts at 650 ° C and B at 450 ° C. When alloyed together A and B do not form any compound or intermediate phase. The solid solubility of metal A in B and of B in A are negligible. The metal pair forms a eutectic at 40%A and 60% B which solidifies at 300 ° C. Assume the liquidus and solidus line to be straight. Draw the phase diagram for the alloy series and find; i) the temperatures at which the alloy starts and completes solidification. ii) The percentage of eutectic in the alloy at room temperature. iii) The amount of liquid present and its composition, at a temperature of 390° C. iv) Specific gravity of the alloy, if specific gravity of metal A is 2.0 and metal B is 7 .0.	**12**

UNIT - III

5 a) Draw Iron-Carbon equilibrium diagram with all phase fields with temperatures. Explain all the invariant reactions. **12**

b) Write a note on Hypo and hyper eutectoid steels. **08**

UNIT - IV

6 a) Define case hardening. Explain Carburizing process with its merits and demerits. **08**

b) What is diffusion. Explain the steady state diffusion as discussed by Adolf Fick. State the factors affecting diffusion **06**

c) What is Cyaniding? With the necessary equations explain Cyaniding process. **06**

UNIT - V

7 a) Define composite material. Classify based on matrix and reinforcement materials. **08**

b) Explain stir casting method to produce Metal Matrix Composites with a neat sketch. **06**

c) With a neat sketch explain pultrusion process for FRP manufacturing. **06**

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