Roll No.											

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – December 2025	
Date: 13 – 12- 2025	**Time:** 09:30am – 12:30pm

School: SOE	**Program:** B. Tech	
Course Code: MEC2020	**Course Name:** Materials Science and Metallurgy	
Semester: III	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5	CO6
Marks	**6**	**6**	**22**	**22**	**22**	**22**

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2 marks. **10Q x 2M=20M**

1.	State Fick's first law of diffusion **and mention the physical meaning of diffusion coefficient (D).**	**2 Marks**	**L1**	**CO1**
2.	Differentiate between edge and screw dislocations.	**2 Marks**	**L2**	**CO1**
3.	Distinguish between substitutional and interstitial impurities.	**2 Marks**	**L2**	**CO1**
4.	Define a phase and give one example of a solid phase in iron.	**2 Marks**	**L1**	**CO2**
5.	**Define component in a phase diagram?** Give any two examples.	**2 Marks**	**L1**	**CO2**
6.	**Define solubility limit** and state what happens if solute concentration exceeds solubility limit.	**2 Marks**	**L1**	**CO2**
7.	Identify the three important invariant points in the Iron-Iron Carbide phase diagram.	**2 Marks**	**L1**	**CO3**
8.	Tell about pearlite, and how does it form during cooling of austenite in eutectoid steel?	**2 Marks**	**L1**	**CO4**
9.	Define normalizing, and why is it carried out on steel?	**2 Marks**	**L1**	**CO5**
10.	Differentiate metals, ceramics and polymers based on mechanical and thermal properties.	**2 Marks**	**L2**	**CO6**

Part B

Answer the Questions. **Total Marks 80 M**

11.	Explain the four Hume-Ruthery conditions. Using a detailed, labeled sketch of the Copper-Nickel Binary Isomorphous Phase Diagram, illustrate how the following information is obtained at a given temperature and composition: the phases present, the composition of each phase and the relative amount of each phase.	**20 Marks**	**L3**	**CO3**
	Or			
12.	State and explain the Gibb's Phase Rule and the Condensed Gibb's Phase Rule. Define all variables used. Explain the significance of the Degree of Freedom (F) for a single-phase region and a two-phase region in a binary (two-component) system.	**20 Marks**	**L2**	**CO3**

13.	Sketch the formation of martensite in steel and describe its characteristics including diffusionless transformation mechanism and FCC → BCT transformation.	**20 Marks**	**L3**	**CO4**
	Or			
14.	Illustrate CCT (Continuous Cooling Transformation) diagrams and compare them with TTT diagrams in terms of s**hifting of curves to longer times, critical cooling rate and formation of pearlite, bainite, and martensite under different cooling rates.**	**20 Marks**	**L3**	**CO4**

15.	Illustrate the austempering heat treatment cycle with neat diagrams. Explain the sequence of operations, microstructure formed, advantages and limitations.	**20 Marks**	**L3**	**CO5**
	Or			
16.	Sketch the martempering (marquenching) heat treatment cycle with sequence of steps, applications and advantages.	**20 Marks**	**L3**	**CO5**

17.	Explain copper and copper alloys (brass, bronze, beryllium copper) with composition, mechanical properties, and applications.	**20 Marks**	**L2**	**CO6**
	Or			
18.	Describe properties and alloying behavior of aluminum and aluminum alloys. Include heat-treatable vs. non-heat-treatable alloys and their applications.	**20 Marks**	**L2**	**CO6**