PVP 20

Code: 20ES1303

II B.Tech - I Semester – Regular / Supplementary Examinations
DECEMBER 2022

MATERIAL SCIENCE AND METALLURGY
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

BL – Blooms Level CO – Course Outcome

			BL	CO	Max. Marks
UNIT-I					
1	a)	Using neat sketches explain the following imperfections: (i) Dislocations, (ii) Grain boundary and (iii) Point defects.	L2	CO1	6 M
	b)	Draw the unit cells of Simple cubic, BCC, FCC crystal structures and mention the co-ordination number of each unit cell. Give one material example for each unit cell.	L2	CO1	8 M
OR					
2	a)	Explain clearly how the Miller indices are designated to the crystallographic planes. Sketch neatly the following planes in the cubic lattice: (100), (121), (103).	L2	CO1	6 M
	b)	Show that FCC is closely packed than that of BCC.	L2	CO1	8 M

		UNIT-II			
3	a)	Explain the factors governing the formation of substitutional solid solutions.	L2	CO2	6 M
	b)	Two metals *A* and *B* have 100% mutual solubility in the liquid and solid states. The melting points of pure metals *A* and *B* are 800°C and 600°C respectively. Details of the start and end of solidification of various alloys in the series are as follows: **Alloy of Composition** | **Temperature at Start of Solidification (°C)** | **Temperature at End of Solidification (°C)** 90% A +10% B | 798 | 750 70% A + 30% B | 785 | 705 50% A + 50% B | 757 | 675 30% A + 70% B | 715 | 645 10% A + 90% B | 650 | 615 i. Draw the phase diagram of the series if there are no solid-state reactions and label all regions. ii. Predict the number, type, relative amounts and concentration of phases present in an alloy of 40% *A* and 60% *B* at 700°C.	L3	CO2	8 M
		OR			
4	a)	Draw a neat iron–iron carbide phase diagram and identify all phases present at different temperatures and carbon percentages.	L2	CO2	8 M
	b)	Consider 3 kg of austenite containing 0.3 wt% C, cooled to below 727° C. i) What is the proeutectoid phase? ii) How many kilograms each of total ferrite and	L3	CO2	6 M

		cementite form? iii) How many kilograms each of pearlite and the proeutectoid phase form?			
		UNIT-III			
5	a)	What is a TTT curve? Explain with a neat sketch of the TTT curve for the eutectoid steel. Describe the information that can be gathered from the diagram?	L2	CO3	6 M
	b)	Explain how the following heat treatments are applied with reference to the applications in steel industry (i) Normalizing, (ii) Annealing, (iii) Hardening, (iv) Tempering.	L3	CO3	8 M
		OR			
6	a)	What is the purpose of case hardening? Classify the methods of case hardening and describe briefly any two of them.	L2	CO3	6 M
	b)	Using the relevant portion of the iron–iron carbide equilibrium diagram and TTT diagram, explain the 'normalizing' heat treatment of a plain carbon steel containing 0.8% carbon. What changes in properties and microstructure do you expect due to the heat treatment?	L3	CO3	8 M
		UNIT-IV			
7	a)	Discuss briefly the structure, properties and uses of gray cast iron and white cast iron.	L2	CO4	7 M

	b)	What are the different types of Tool steels? Explain any two in detail about the properties, alloying elements, and applications with examples.	L2	CO4	7 M
OR					
8	a)	Explain the properties, alloying elements, and applications of Shock Resistance and Hot-Work Tool Steels.	L2	CO4	7 M
	b)	Explain the properties, alloying elements, and applications of Ferritic and Austenitic stainless steels with examples.	L2	CO4	7 M
UNIT-V					
9	a)	What are α and β phases in Cu/Zinc alloys? Give applications of following copper-base alloys: Cartridge Brass, Gun Metal, and Naval Brass.	L2	CO5	7 M
	b)	How the composites are classified? Explain the properties and applications of any two composites.	L2	CO5	7 M
OR					
10	a)	Explain the alloying elements, properties and applications of Duralumin, Hindalium, and Magnalium.	L2	CO5	7 M
	b)	Explain the alloying elements, properties and applications of α, β and α- β Alloys.	L2	CO5	7 M