USN ☐☐☐☐☐☐☐☐☐☐   **BMR303**

Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024
Material Science

Time: 3 hrs.   Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

Module – 1			M	L	C
Q.1	a.	Explain the following terms: i) Space lattice ii) Unit cell iii) Atomic packing factor.	6	L2	CO1
	b.	Derive an expression for atomic packing factor for an FCC unit cell.	8	L3	CO1
	c.	The center distance between the atoms in the basal plane of zinc unit cell is $2.66 \overset{\circ}{A}$ and it has HCP structure. Calculate volume of the unit cell. Given $A = 65.37$ $C = 4.935 \overset{\circ}{A}$.	6	L3	CO1
OR					
Q.2	a.	What are crystal imperfections? Explain point defects in detail.	12	L2	CO1
	b.	The unit cell of chromium atom is cubic and contains 2 atoms. Determine the dimensions of the chromium unit cell. Given $A = 52$ and density of the chromium 7.19 g/cm^3.	8	L3	CO1
Module – 2					
Q.3	a.	Sketch and explain the stress-strain graph for mild steel.	8	L2	CO1
	b.	Compare the plastic deformation of single crystal by slip and twinning.	12	L3	CO1
OR					
Q.4	a.	Define fracture. Sketch and explain the stages in ductile fracture.	10	L2	CO1
	b.	Define creep. With a neat sketch enumerate the stages in creep.	10	L3	CO1
Module – 3					
Q.5	a.	Sketch and explain the mechanism of solidification.	6	L2	CO1
	b.	What is homogeneous nucleation? Derive an expression for critical radius in homogeneous nucleation.	8	L3	CO1
	c.	State and explain Hume-Rothery rule for the formation of solid solution.	6	L2	CO1
OR					
Q.6	a.	With a neat sketch, explain the Iron-carbon diagram. Illustrate the various phases and reactions in the system.	10	L3	CO1
	b.	Explain any ten alloying elements and theory effects on steel.	10	L2	CO2

Module – 4					
Q.7	a.	Explain briefly about copper alloys and state their applications.	10	L2	CO2
	b.	Compare the composition, properties and applications grey CI with malleable iron.	10	L3	CO3
OR					
Q.8	a.	Enumerate the properties and parameters to be considered in the fabrication of permanent joints.	6	L3	CO4
	b.	Define corrosion. Explain the different forms of environmental degradation.	8	L2	CO4
	c.	Write a short note on protective coatings to prevent corrosion.	6	L2	CO4
Module – 5					
Q.9	a.	With a neat sketch explain the construction of T-T-T diagram.	10	L3	CO4
	b.	Define hardening. After hardening the tempering is compulsorily done for steel components, illustrate with an example.	5	L3	CO4
	c.	Differentiate between Austempering and Martempering.	5	L2	CO4
OR					
Q.10	a.	Define carburizing. Explain the different types of carburizing process.	8	L3	CO4
	b.	What is flame hardening? Explain any one type.	6	L4	CO4
	c.	With a neat sketch enumerate the induction hardening process and state their advantages.	6	L4	CO4

* * * * *