QP Code: S253A040 | Reg. No | | | | | | | | | | | AY 23

Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)

B. Tech (Third Semester – Regular & Supplementary) Examinations, November 2025

23BMEPC23003 – Material Science

(Mechanical Engineering)

Time: 3 hrs | Maximum: 60 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

	Q.1. Answer ***ALL*** questions	CO #	Blooms Level
a.	Define Lattice. Define space lattice (or) crystal lattice.	CO1	K1
b.	Explain the term Critical Resolved Shear Stress (CRSS).	CO2	K2
c.	What are the types of heat Treatment?	CO4	K1
d.	What is the critical angle ϕc for light passing through diamond? Take n1=2.41 into air & n2=1	CO5	K1
e.	Differentiate alloy & composite.	CO6	K3

PART – B **(10 x 5 = 50 Marks)**

	Answer ***ALL*** the questions	Marks	CO #	Blooms Level
2. a.	Define packing factor and obtain the packing factor for the Hexagonal Closed packing factor.	5	CO1	K3
b.	Explain recovery, recrystallization and grain growth with proper diagram.	5	CO2	K3
	(OR)			
c.	Find the number of atoms associated in each BCC, FCC and HCP unit cells. Calculate the equilibrium number of vacancies per cubic meter for copper at 100^0 C. The energy for vacancy formation is 0.9 eV/atom; the atomic weight and density for copper are 63.5 g/mol and 8.45 g/cm^3, respectively. Take Avogadro's number as $6.023x10^{23}$ atoms/mol. k=$8.62*10^{-5}$ eV/atom.	5	CO1	K3
d.	Explain in details the mechanism of slip & twinning as modes of plastic deformation in crystalline material.	5	CO2	K2
3.a.	Copper has FCC structure and its atomic radius is 1.273 A, find the lattice parameter and the density of copper. (i) Atomic weight of copper =63.5gm (ii) Avogadro's number = $6.023*10^{26}$ atoms/Kilomole.	5	CO1	K3
b.	Write the difference between thermoplastics and thermo setting plastics?	5	C05	K2
	(OR)			
c.	Draw the following plane and direction in FCC structure. i. (2 1 2) (-2 1 0) (1 ½ 1) ii. [1 2 1] [1 -2 1] [1 ½ 1]	5	CO1	K3
d.	Explain the working principle of Ruby Laser with proper diagram.	5	CO5	K3
4.a.	Explain the factors affecting solid solubility of a solution (or) Explain Hume Rothery rules.	5	CO3	K2
b.	What are Optical fibres? Explain the structure and working principle of optical fibre.	5	CO5	K2
	(OR)			

c.	Draw the Cu-Ni alloy phase diagram & explain with proper labelling.	5	CO3	K3
d.	What are ceramic materials? Explain briefly different types of ceramics.	5	CO5	K2
5.a.	What is allotropy? Explain briefly with cooling curve for iron-allotropy.	5	CO3	K2
b.	Explain about various type of annealing.	5	CO4	K2
	(OR)			
c.	Define non-equilibrium cooling. What is the impact of this cooling?	5	CO3	K2
d.	What is meant by Normalizing? List the objectives of normalizing.	5	CO4	K2
6.a.	What are different types of heat treatment? Explain in brief.	5	CO4	K2
b.	What is composite? Explain briefly how continuous-glass fibres are made. What is the difference between fibre and whisker?	5	CO6	K2
	(OR)			
c.	Define hardenability. Explain Jominy End-Quench Test.	5	CO4	K2
d.	Write short notes on:			
	i. Metal matrix composites	5	CO6	K2
	ii. Fibre reinforced plastic			

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