BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP/2023)

CLASS: **B. TECH** **SEMESTER : IV**
BRANCH: **ECE/CIVIL** **SESSION : SP/2023**

SUBJECT: PE227 ENGINEERING MATERIALS

TIME: **02 Hours** **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

			CO	BL
Q.1(a)	Sketch the following directions in the cubic unit cells: 1. [101] 3. [301] 2. $[0\bar{1}\bar{1}]$ 4. [113]	[2]	1	3
Q.1(b)	Estimate the volume in terms of atomic radius R and the atomic packing fraction of BCC unit cell.	[3]	1	2
Q.2(a)	Differentiate between substitutional and interstitial solid solution with examples?	[2]	2	1
Q.2(b)	Illustrate the interrelationship between processing, structure, properties, and performance of materials with the help of a specific example	[3]	1	4
Q.3(a)	Sketch the following planes in the cubic unit cell: 1. (111) 3. (110) 2. (102) 4. (002)	[2]	1	3
Q.3(b)	Explain Hume Rothery rules for substitutional solid solutions.	[3]	2	1
Q.4(a)	If five distinct phases are observed in a laboratory specimen of a binary alloy made at one atmospheric pressure. Argue if such an observation possible is not.	[2]	2	5
Q.4(b)	Sketch and explain the binary phase diagram (components are A and B) for the following conditions: 1. Complete insolubility of A and B both in liquid and solid state 2. Complete solubility of A and B in liquid but no solubility in solid state 3. Complete solubility of A and B both in liquid and solid state	[3]	2	3
Q.5(a)	Define heat treatment and classify the various types of heat treatment processes.	[2]	2	2
Q.5(b)	Draw the Fe-C diagram and explain the phase transformation of 0.4% C steel from austenite stability region with appropriate microstructures.	[3]	2	3

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