

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION MO/2024)

CLASS: B. TECH
BRANCH: ME & PIE

SEMESTER : III/ADD
SESSION : MO/2024

SUBJECT: PE214 METALLURGICAL AND MATERIALS ENGINEERING

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

Q.1(a)	I.	Distinguish between primitive and non-primitive unit cells and state the number of atoms per simple triclinic unit cell.	[1+1]	CO1	BL1 BL3
	II.	Calculate the coordination number of FeO and predict its probable crystal structure [Given that the ionic radius of Fe^{2+} and O^{2-} are 0.077 nm and 0.140 nm, respectively].			
Q.1(b)	I.	State the essential steps for indexing a plane in an orthogonal crystal lattice with the help of an example.	[1+1 +1]	CO1	BL2 BL4 BL1
	II.	'(110) peak is not observed in aluminum' - justify the statement with logical reasons.			
	III.	Classify the pure crystalline defects in terms of dimensions.			
Q.2(a)	I.	'Casting is not an appropriate process for manufacturing incandescent bulb filament' - Justify the statement with proper reasoning.	[1+1]	CO1	BL3 BL1
	II.	State the common defects encountered in the optical lens system and explain any one of them with a neat diagram.			
Q.2(b)	I.	'Dislocations are impossible to detect or see using an optical microscope' - explain briefly why.	[1+1 +1]	CO1	BL2 BL3 BL3
	II.	Sketch within a cubic unit cell the following planes: (a) (102), and (b) (111)			
	III.	Sketch within a tetragonal unit cell the following directions: (a) [110], and (b) [103]			
Q.3(a)	I.	Name any four strengthening mechanisms applicable to metallic solids	[1+1]	CO1	BL3
	II.	Explain in brief how grain size refinement can strengthen a single-phase crystalline metallic solid.			
Q.3(b)	I.	Summarize the four (4) factors that govern the formation of a substitutional solid solution.	[1+2]	CO2	BL2 BL2
	II.	State Gibbs Phase Rule for the non-condensed and condensed systems mentioning the necessary assumption.			
Q.4(a)	I.	Draw a schematic Gibbs energy versus temperature diagram of a pure component to explain the solid-to-liquid (or reverse) phase change.	[1+1]	CO2	BL3 BL4
	II.	'Cast iron is characterized by transformed (t)-ledeburite in the microstructure' - distinguish between ledeburite and t-ledeburite.			
Q.4(b)		Define allotropism and mention the various allotropic forms of pure iron.	[1+2]	CO2	BL1
Q.5(a)	I.	Name two major applications for Ti and Cu-based alloys each.	[2+2]	CO2	BL1 BL2
	II.	State the typical characteristics of ferrite and austenite stabilizing elements for steel with two examples of each.			
Q.5(b)		Sketch a neat, labeled iron-cementite diagram showing the three invariant transformations with the reactants, products, and their crystal structures.	[3]	CO2	BL3

:::23/09/2024:::