Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third Semester B.Tech Degree (S,FE) Examination December 2022 (2015 scheme)

Course Code: ME210

Course Name: METALLURGYAND MATERIALS ENGINEERING (MC)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any three questions, each carries 10 marks.

			Marks
1	a)	Copper has an atomic radius of 0.128 nm, an FCC crystal structure, and an atomic weight of 63.5 g/mol. Compute its theoretical density and compare the answer with its measured density	(5)
	b)	Draw the planes for the following Miller indices a) (110) b) (111) c) (102) d) (101) e) (121)	(5)
2	a)	With the help of neat sketches explain two modes of plastic deformation.	(5)
	b)	Consider a metal single crystal oriented such that the normal to the slip plane and the slip direction are at angles of 60° and 35°, respectively, with the tensile axis. If the critical resolved shear stress is 6.2 MPa, will an applied stress of 12MPa cause the single crystal to yield? If not, what stress will be necessary?	(5)
3	a)	Explain in detail the two mechanisms of crystallisation.	(5)
	b)	Explain with neat sketches 0-dimesional defects in crystals.	(5)
4	a)	Briefly explain why small-angle grain boundaries are not as effective in interfering with the slip process as are high-angle grain boundaries.	(5)
	b)	For BCC iron, compute (a) the interplanar spacing, and (b) the diffraction angle for the (220) set of planes. The lattice parameter for Fe is 0.2866 nm. Also, assume that monochromatic radiation having a wavelength of 0.1790 nm is used, and the order of reflection is 1.	(5)

PART B

Answer any three questions, each carries 10 marks.

5		With a neat sketch explain the reactions in Fe-C phase diagram.	(10)
6		Explain any 5 heat treatment methods for materials.	(10)

7	a)	Discuss the effect of various alloying elements in steel.	(5)
	b)	Explain the process of recovery recrystallisation and grain growth.	(5)
8		Compare precipitation hardening and the hardening of steel by quenching and tempering with regard to (a) The total heat treatment procedure (b) The microstructures that develop (c) How the mechanical properties change during the several heat treatments stages.	(10)

PART C

Answer any four questions, each carries 10 marks.

9	a)	With a neat sketch explain fatigue test.	(5)
	b)	Discuss the factors affecting fatigue strength of the material.	(5)
10	a)	Define fatigue and explain the characteristics of fatigue failure.	(5)
	b)	List and explain the methods used to prevent fatigue failure.	(5)
11	a)	Explain Griffith theory of fracture.	(5)
	b)	Differentiate between ductile and brittle fracture.	(5)
12	a)	List the needs, properties and applications of a few modern engineering materials.	(5)
	b)	Explain the mechanism of creep.	(5)
13		Briefly explain different classification of ceramics.	(10)
14		Briefly explain the classification, need and application of composites.	(10)

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