

JK Lakshmipat University Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination, April 2018

B. Tech. in Mechanical Engineering, Semester IV

Roll No.....

ME-410: Material Science and Engineering

Time: 3.00 hours Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1 Objective type (1 marks each) 10

- i. Draw the plane (100) and (112) in cubic system.
- ii. Ductility of a metal _____ with decreasing temperature. (decreases/increases)
- iii. In edge dislocation, Burgers vector is _____ to the dislocation line.
(Parallel/ Perpendicular).
- iv. Schottky defects normally occur
(a) only in ionic crystal (b) in Covalent crystal
(c) in non-metallic crystal (d) in metallic and ionic crystals
- v. In tensile test, necking start at
(a) Lower yield stress (b) Upper yield stress
(c) ultimate tensile stress (d) just before Fracture
- vi. If two metals have very different electronegativity will they form a solid solution?
- vii. Creep curve is a plot of
(a) Strain vs time (b) strain vs temperature
(c) stress vs strain (d) elasticity vs temperature
- viii. Yield strength of the material is the stress at which the material
(a) Fractures (b) Develops cracks (c) Becomes plastic (d) Ruptures
- ix. Write the relation of atomic radius and edge length in case of BCC and FCC.
- x. The number of nearest neighbor in FCC lattice is
(a) 6 (b) 8 (c) 12 (d) 10

Q.2	Short answer type questions (2.5 marks each)	10
i.	Define Ductile fracture.	
ii.	Calculate the distance between parallel plane of a crystal which exhibits first order reflection at an angle 30° with X rays of wavelength 2×10^{-10} m.	
iii.	Explain the term Stress and Strain.	
iv.	Explain Galvanic corrosion with example.	
Q.3A	Explain the creep curve with labeled diagram, give its significance.	5
Q.3B	What are Miller's indices? Write the steps to find out miller indices for a plane.	5
Q.4A	Define the Burger vector? Explain the Screw dislocation with diagram.	5
Q.4B	Draw different types of Unit cell in cubic system? Calculate the atomic packing factor for FCC structure.	5
Q.5A	What are heat treatment and their purpose? Explain the Annealing process of surface hardening.	5
Q.5B	Copper has FCC Structure and its edge length is $3.61 \text{ \AA}$. Calculate its density. Given atomic weight of copper as 63.5 g/mol , $N_A = 6.023 \times 10^{23}$.	5
Q.6A	Derive the Bragg's equation to calculate the distance between two parallel planes of a crystal.	5
Q.6B	Write short notes on <u>any two</u> (i) Hardening (ii) cooling curve of iron (iii) Tilt Boundaries	5
Q.7A	What is Hook's law? Explain Young's modulus, bulk modulus and modulus of rigidity.	5
Q.7B	What is Solid solution? Explain the Substitutional and interstitial solid solution with suitable examples and figures.	5
	OR	
Q.7B	Explain the TTT diagram for steel and give its salient features.	5
Q.8	What is Elastic and Plastic deformation? Explain the Slip and Twinning in plastic deformation.	10
	OR	
Q.8	What is corrosion? Give the complete mechanism of Oxidation Corrosion.	10

Q.9 A steel wire of length 50 cm and radius 5 mm is subjected to a tensile force of 9200 newton. Find the elongation and the lateral contraction. (Yong's modulus of steel is 207 GPa and Poisson's ratio is 0.30) 10

OR

Q.9 Explain the term Fatigue. How it is tested by Rotating beam fatigue testing machine explain with figure. 10

Q.10 What are the different Phases of Iron? Draw the Iron carbon phase diagram and explain all the salient features of the diagram like Peritectic, Eutectic and Eutectoid reaction of the diagram and others. 10