

JK LakshmiPat University Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination, November 2016
B. Tech. in Mechanical Engineering, Semester III

Roll No.....

ME304: 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. Yield strength of the material is the stress at which the material
(a) Fractures (b) Develops cracks (c) Becomes plastic (d) Ruptures
- 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. What is the effect of Grain size of the meatal on the corrosion?
- vii. Creep curve is a plot of
(a) Strain vs time (b) strain vs temperature
(c) stress vs strain (d) elasticity vs temperature
- viii. In the Phase diagram, the curve below which the alloy is in the solid state for all compositions is called_____.
- 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	Define the Burger vector? Explain the Screw dislocation with diagram.	5
Q.3B	What do you mean by Vacancy? Explain the Frankel defect in ionic crystals with diagram.	5
Q.4A	Explain the creep curve with labeled diagram, give its significance.	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 Nitriding 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	What is a TIE line? Explain the Lever rule through suitable phase diagram.	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 solid solution with figure.	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. 10