

Roll Number

Thapar Institute of Engineering and Technology

School of Physics and Materials Science

Mid-Semester Examination, 12th March 2019

B. Tech. (IV Semester)

UES012: Engineering Materials

Time: 02 Hours, MM: 50

Name of faculty: OPP, PNS, CBN, BCM,
LKB, JTK, MUK, CHK

Note: Attempt all parts of a question **together**. Assume any missing data suitably.

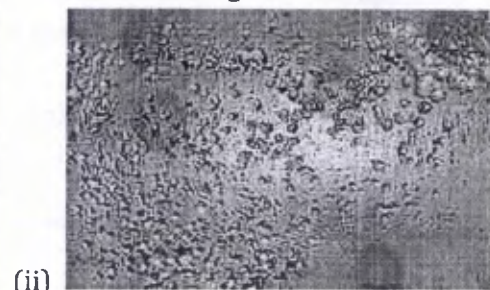
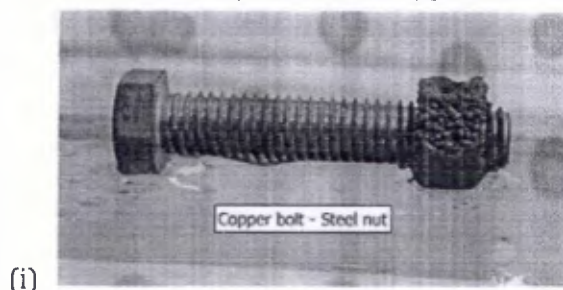
Q.1 (a) Categorize the following materials into metals, alloys, ceramics, polymers and composites: **(6)**
(i) Bronze (ii) Steel (iii) Alumina (iv) PVC (v) Concrete (vi) Titanium

(b) Identify **any two** structure sensitive properties from the following list: **(2)**
Density, Melting point, Yield strength, Young's modulus, Ductility.

Q.2 Would you expect MgO to have the cesium chloride, sodium chloride, or zinc blende structure? Justify your answer. Based on your answer, determine (i) the lattice parameter and (ii) the density. Given that $r_{\text{Mg}^{+2}} = 0.66 \text{ \AA}$ and $r_{\text{O}^{2-}} = 1.32 \text{ \AA}$. Atomic mass of Mg and O is 24.32 and 16.00 g/mol, respectively. **(6)**

Q.3 (a) Explain the crevice corrosion and list two preventive measures for the same. **(4)**

(b) Identify and briefly explain the type of corrosion in the following two cases: **(4)**

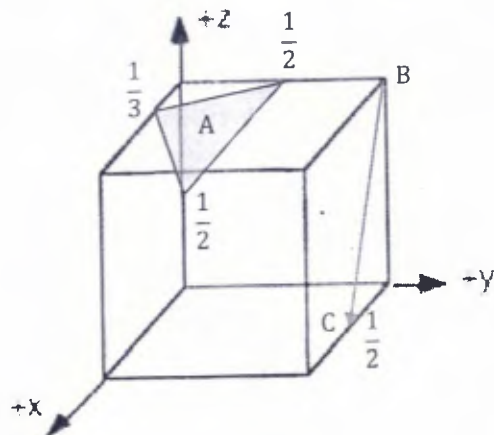


Q.4 Draw a neat diagram of edge dislocation. Show the relationship between the dislocation line vector and the Burger's vector. **(3)**

Q.5 (a) Show the atomic positions on the (111) plane of a (i) simple cubic and (ii) face centered cubic unit cell. Calculate and compare planar density of this plane corresponding to these two unit cells. Radius of atoms for both cases is 0.12 nm. **(4+4)**

PTO

- (b) Determine the miller indices of the plane A and the direction \overline{BC} in the following figure. (2)



- Q.6 Determine the number of vacancies needed for a BCC iron crystal to have a density of 7.87 g/cm³. The lattice parameter of BCC iron is 2.866 Å. Atomic mass of iron is 55.847 g/mol. (3)

- Q.7 Iron sulfide (FeS) forms a crystal structure that consists of an HCP arrangement of S²⁻ ions. With proper justification answer the following: (4)

- Which type of interstitial site will the Fe²⁺ ions occupy?
 - What fraction of these available interstitial sites will be occupied by Fe²⁺ ions?
- Given that ionic radii of S²⁻ and Fe²⁺ are 0.184 nm and 0.077 nm, respectively.

- Q.8 Briefly explain why (Limit your answer to 20-30 words) (4x2)

- Red laser light can't be used for determination of crystal structure using the diffraction technique.
- Although Pb and C belong to Group IV of the periodic table, diamond is brittle whereas Pb is ductile.
- Ligancy rule is not followed for ZnS.
- In ionic solids, Frenkel defects for anions in high concentrations are not expected.