Centre 6 - G-Block. O/C

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Roll Number

Thapar University
School of Physics and Material Science
Mid-Semester Examination, 20th September 2017

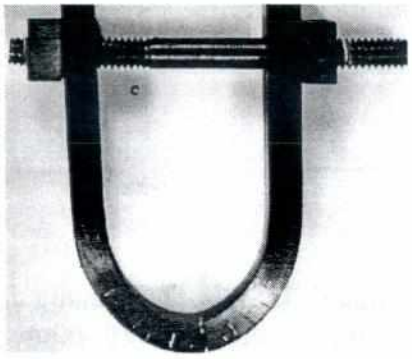
B. Tech. **UES012: Engineering Materials**

Time: 02 Hours, MM: 50 **Name of faculty: OPP, KUS, PNS, CBN, BCM, LKB, DBD, CHK, JK, MUK, PPS**

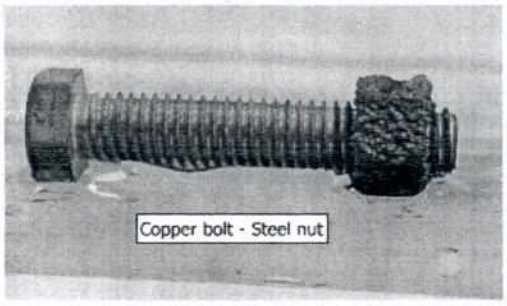
Note: 1. Attempt all parts of questions together.
2. Answers should be precise and to the point.
3. Assume any missing data suitably.

1. (a) Identify the type of corrosion from the following pictures. (4)

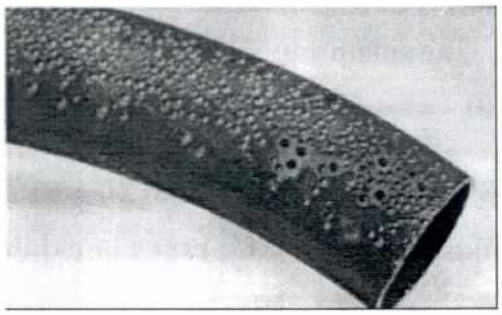
(i)



(ii)



(iii)



(iv)

(b) Define uniform and crevice corrosion with two prevention methods in each case. (6)

2. Would you expect NiO to have the CsCl, NaCl, or ZnS crystal structure? Justify your answer. Based on your answer, determine (i) the lattice parameter and (ii) the density. Given that $r_{Ni^{+2}} = 0.69$ Å and $r_{O^{-2}} = 1.32$ Å; Atomic mass of Ni and O is 58.71 and 16 g/mol, respectively. (7)

3. (a) Name one technique each (along with its magnification range) used to determine (2)
(i) microstructure and (ii) substructure of materials.

(b) Classify the following into different classes of engineering materials: (4)
(i) Brass, (ii) PVC, (iii) Quartz , (iv) Steel radial tyres

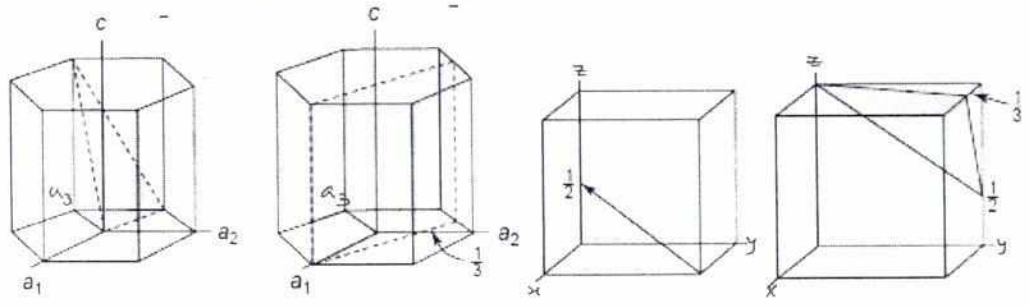
(c) Define the following properties of materials and state whether those are structure sensitive or structure insensitive properties. (4)

(i) Stiffness and (ii) strength.

4. (a) With a neat diagram, show that the critical radius ratio for triangular coordination around a central cation in an ionic crystal is 0.155. (3)

(b) For which set of crystallographic planes will a first-order diffraction peak occur at a diffraction angle (2θ) of 46.21° for BCC iron when monochromatic radiation of wavelength of 0.0711 nm is used? Given that radius of Fe atom is 0.124 nm. (4)

5. (a) Write the Miller indices for the following planes and the directions: (4)



(i) (ii) (iii) (iv)

(b) Cu has FCC structure having a lattice parameter a = 0.543 nm. Sketch the atom arrangement on the (110) plane and [110] direction. Calculate the corresponding planar density and linear density. (6)

6. Explain why? (2 x 3)

(i) Laser light cannot be used to determine crystal structure by the diffraction technique.

(ii) A regular pentagonal 2*D* lattice is not possible.

(iii) Stainless steel is prone to weld-decay.