Roll Number

Thapar Institute of Engineering and Technology

School of Physics and Materials Science

Mid Semester Examination, March 2018

B. Tech. (*IV* Semester)	**UES012: Engineering Materials**
Time: 02 Hours, MM: 50	Name of faculty: KUS, PNS, CBN, BCM, JTK, PPS, CHK

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

Q.1 Categorize the following materials into metals, alloys, ceramics, polymers and composites: Barium titanate, Zinc, Bronze, Carbon reinforced steel and PVC. **5**

Q.2 For a polycrystalline material, X-ray diffraction peaks at following 2θ values (in degrees) were observed: 14.76, 17.06, 24.22, 28.48, 29.78, 34.52, 37.72 and 38.74. **8**
(i) Identify the diffracting planes (*hkl* values), (ii) determine the crystal structure, and (iii) lattice parameter(s) (λ for CuK_α = 1.54 Å).

Q.3 (a) List the zero dimensional defects in ionic solids and explain with a suitable diagram any one of them. **4**

(b) The atomic radius and shear modulus of FCC copper are 0.127 nm and 48 GPa, respectively, calculate the distortional energy associated with an edge dislocation. **4**

Q.4 Draw a FCC unit cell and show an octahedral void and a tetrahedral void in it. **4**

Q.5 Draw the crystal structure of CsCl and find out its density. (Given r_{Cs+}= 0.167 nm and r_{Cl-} = 0.181 nm; atomic masses of Cs and Cl are 132.90 and 35.45 g/mol, respectively). **6**

Q.6 Draw the following planes and directions in a unit cell. **8**

(i) [1 $\bar{1}$ 0] (ii) (2 0 $\bar{3}$) (iii) [1 1 3] (iv) (0 1 $\bar{1}$ 2)

Q.7 Define Burger's vector '$\vec{b}$' and its correlations with dislocation line for edge dislocation and screw dislocation. **3**

Q.8 Explain why? **8**

(i) Zinc blende does not follow the ligancy rule.

(ii) Packing fraction of diamond cubic crystal is less than that of FCC.

(iii) Burger's vector is larger for ionic solids as compared to metallic solids.

(iv) At room temperature, solid solubility of zinc in copper is upto 35% but that of copper in zinc is limited to only 1%.