Roll Number

Thapar Institute of Engineering and Technology, Patiala

School of Physics and Materials Science

END SEMESTER EXAMINATION

B. E.: Semester-III, VII (2017/18) (COE/ ECE/ ENC/ELE)	Course Code: UES012 Course Name: Engineering Materials
December 07, 2017	Thursday , 9 AM
Time: 03 Hours, MM: 100	Name of faculty: OPP, KUS, PNS, CBN, BCM, LKB, DBD, PPS, JTK, MUK, CDK

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) Draw a neatly labelled binary isomorphous phase diagram of two components A and B having melting points 700 °C and 1000 °C, respectively. (i) For an overall composition of 50 % B at 850 °C, calculate the weight fraction of the liquid and solid phases in the system. (ii) Calculate the degrees of freedom in two phase region. **(14)**

(b) Discuss (with suitable diagram) the microstructural changes which occur for eutectic composition during solidification. **(6)**

2. (a) Calculate and compare the planar density for (200) plane in monoatomic BCC and FCC crystal structures. **(6)**

(b) List any four differences between the screw and the edge dislocations. **(6)**

3. (a) Draw diagrams for stiff and relax dislocations. In Ni, the dislocation width is 4 times the magnitude of the burger vector; calculate the stress required to move a dislocation. The shear modulus of Ni is 70 GPa. **(6)**

(b) Briefly explain (30-40 words): **(2x3)**
i. Peierls and Nabarro stress for movement of a dislocation
ii. Solute strengthening method

(c) Sketch the true stress - true strain curve for a ductile specimen. State the relation between; **(6)**
(i) engineering stress and true stress
(ii) engineering strain and true strain

4. (a) Briefly explain pitting corrosion and galvanic corrosion. Name two methods of prevention for each. **(8)**

(b) Write the expression for relaxation time (t_r) for an anelastic material. Draw stress – strain curves when (i) $t << t_r$ (ii) $t >> t_r$ (iii) $t \sim t_r$, where t is the duration of loading cycle. **(8)**

5. (a) Differentiate between (using suitable diagrams): (3x6)
   i. Type I and type II superconductors.
   ii. Paramagnetic and ferromagnetic materials
   iii. Electronic and orientational polarization in solids

   (b) List the properties required in a material for the following applications (4)
   i. Heating element
   ii. Electrical contacts

6. (a) Determine the lattice parameter for a cubic crystal from the given XRD peak positions (2θ): 38.7°, 45.4°, 65.7°, 78.8°. (λ=0.154 nm) (8)

   (b) Draw a neatly labelled unit cell for NaCl structure. Draw the Burgers vector, if a dislocation were to occur in this structure. (4)