Mansoura University	Final Exam	2nd Year Production Students
Faculty of Engineering		Time: 3 Hours
Prod. & Mech. Design Dept.	Engineering Material II	June, 2013

Answer All Questions in the same order. Use equations and diagrams whenever possible

1 – Choose four different unit cells and calculate the packing factor for each of them .

2 – A cubic volume of MgO which is 4.2 angstroms along each edge contains 4 Mg^{+2} ions and 4 O^{-2} ions . What is the density of MgO ?

(Mg. at.wt. = 24 amu and at.wt. of O_2=16 amu) (Av. No = 6.02×10^{23} atom/atomic wt)

3 - Discuss Bragg's equation and Debye & Scherrer method .

4 – Titanium is BCC in its high-temperature form . The radius increases 2%. when the BCC changes to HCP during cooling . what is the percentage volume change (basis one atom)

5 – Draw the five possible binary diagrams .

6 – How many grains are observed in a microscope per square inch at magnification (X) 100 linear for grain size number 8 & 5

7 – Draw the iron – carbon Equilibrium Diagram .

8 – Draw the cooling curves for 1010 , 1020 , 1040 , 1080 and 1090 steels .

9 – Calculate the percentages of Ferrite , Cementite and Pearlite for the above mentioned steels at room temperature .

10 – Draw the continuous cooling transformation diagram (TTT diagram) for 1040 steel showing the effect of the cooling rate on the austenite transformation .

11 – Use the TTT diagram to illustrate the following heat treatment operations :
A – Annealing B – Normalizing C – Quenching D – Martempering E – Austempering.

12 – Discuss and derive Fick's first law of Diffusion .

Good Luck,

Prof. Essayed Abdelrasoul