Menoufiya University Faculty of engineering, Shebin El-Kom Prod. Engineering & Mech. Design Dept. Final Exam /Second Term (2013-2014) Date: 11/06/2014		Subject: Engineering Materials Code: PRE 501 Level: 500 Time Allowed: 3 hours Total Marks: 100 marks

Solve the following questions:

Question no. 1 **(20 marks)**

a) Define in your own words the main strengthening mechanisms existed in metal alloys.
b) Describe and explain the phenomenon of strain hardening (or cold working) in terms of dislocations and strain field interactions.
c) Describe and explain solid-solution strengthening for substitutional impurity atoms in terms of lattice strain interactions with dislocations.

Question no. 2 **(20 marks)**

a) Explain briefly the effect of the alloying elements and impurities on Aluminum properties.
b) Describe the designation system used for wrought aluminum alloys.
c) For 2xxx aluminum, explain the heat treatment techniques that could be subject to the alloy and describe their effects on the alloy properties.
d) Explain the main feature of 2xxx aluminum alloy.

Question no. 3 **(20 marks)**

a) Name and describe four forming operations that are used to shape metal alloys?
b) Name and describe five casting techniques that are used in fabricating metal alloys?
c) State the purposes of, and describe procedures for the following heat treatments:
Process annealing, Stress relief annealing, Normalizing, Full annealing, and Spheroidizing.
d) Explain the difference between hot working and cold working on the behavior of metal alloys.

Question no. 4 **(20 marks)**

a) Cite and briefly describe the types of ceramic materials.
b) Describe the process that is used to produce glass-ceramics?
c) Name two types of clay products, and then give two examples of each?
d) Cite three important requirements that normally must be met by refractory ceramics and abrasive?

Question no. 5 **(20 marks)**

a) Name the three main divisions of composite materials, and cite the distinguishing feature of each?
b) Briefly describe the sintering process of powder particles aggregates.
c) Cite one similarity and two differences between precipitation hardening and dispersion strengthening.
d) A continuous and aligned glass fiber-reinforce composite consists of 40 vol% of glass fibers having a modulus of elasticity of 69 GPa and 60 vol% of a polyester resin that, when hardened, displays a modulus of 3.4 GPa.
   i) Compute the modulus of elasicity of this composite in the longitudinal direction.
   ii) If the cross-sectional area is 250 mm^2 and a stress of 50 MPa is applied in this longitudinal direction, compute the magnitude of the load carried by each of the fiber and matrix phases.
   iii) Determine the strain that is sustained by each phase when the stress in part (ii) is applied.

========== **GOOD LOOK** ==========

Examiner: Dr. Al-Badrawy A. Abo El-Nasr