Menoufiya University Faculty of engineering, Shebin El-Kom Prod. Engineering & Mech. Design Dept. Final Exam /Second Term (2014-2015) Date: 13/6/2015		Subject: Composite Materials Code: PRE 504 Level: 500 Time Allowed: 3 hours Total Marks: 100 marks

Solve the following questions:

Question no. 1 (20 marks)

a) Define composite materials, types, and their general characteristics?

b) What are the major ingredients of a composite material? How do they enhance the properties of the composite?

c) Define the interface and explain its role in strengthening the composite materials.

d) Describe the isostress and isostrain state and write the elastic stress relation for each.

e) Cite one similarity and two differences between precipitation hardening and dispersion strengthening.

Question no. 2 (20 marks)

a) i) List four reasons why glass fibers are most commonly used for reinforcement.

ii) Why is the surface perfection of glass fibers so important?

ii) What measures are taken to protect the surface of glass fibers?

b) Cite several reasons why fiberglass reinforced composites are utilized extensively. Cite several limitations of this type of composite.

c) What are the advantages and disadvantages of short fiber composites?

d) A continuous and aligned glass fiber-reinforced 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 elasticity 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 the previous part is applied.

Question no. 3 (20 marks)

a) What is a hybrid composite? List two important advantages of hybrid composites over normal fiber composites.

b) For a polymer-matrix fiber-reinforced composite, List three functions of the matrix phase. Compare the desired mechanical characteristics of matrix and fiber phases.

c) Cite two reasons why there must be a strong bond between fiber and matrix at their interface.

e) Verify that Equation $\frac{F_f}{F_m} = \frac{E_f V_f}{E_m V_m}$, the expression for the fiber load-matrix load ratio is valid. What is the F_f/F_c ratio in terms of E_f, E_m, and V_f?

Question no. 4 (20 marks)

a) Briefly describe pultrusion process; cite the advantages and disadvantages.

b) Briefly describe filament winding process; cite the advantages and disadvantages.

c) Briefly describe prepreg process; cite the advantages and disadvantages.

d) Define the following: critical fiber length, load carrying capacity, specific strength, specific modulus

Question no. 5 (20 marks)

a) Briefly describe laminar composites, and what is the prime reason for fabricating these materials?

b) (i) Briefly describe sandwich panels.
(ii) What is the prime reason for fabricating these structural composites?
(iii) What are the functions of the faces and the core?

c) Describe two manufacturing processes that are used for producing metal matrix composites

d) Describe two manufacturing processes that are used for producing ceramic matrix composites

========== GOOD LOOK ==========