TOBB EKONOMİ VE TEKNOLOJİ ÜNİVERSİTESİ

MAK 413 MECHANICS OF COMPOSITE MATERIALS

SPRING 2018

Due Date: 12.03.2018- Monday* (08:30)

HOMEWORK 4

1. Kaw 2nd ed. Prob. 3.2

3.2 A hybrid lamina uses glass and graphite fibers in a matrix of epoxy for its construction. The fiber volume fractions of glass and graphite are 40 and 20%, respectively. The specific gravity of glass, graphite, and epoxy is 2.6, 1.8, and 1.2, respectively. Find

1. Mass fractions
2. Density of the composite

2. Kaw 2nd ed. Prob. 3.4

3.4 A resin hybrid lamina is made by reinforcing graphite fibers in two matrices: resin A and resin B. The fiber weight fraction is 40%; for resin A and resin B, the weight fraction is 30% each. If the specific gravity of graphite, resin A, and resin B is 1.2, 2.6, and 1.7, respectively, find

1. Fiber volume fraction
2. Density of composite

3. Kaw 2nd ed. Prob. 3.5

3.5 Find the elastic moduli of a glass/epoxy unidirectional lamina with 40% fiber volume fraction. Use the properties of glass and epoxy from Table 3.3 and Table 3.4, respectively.

4. Kaw 2nd ed. Prob. 3.9

3.9 Find the elastic moduli for problem 3.5 using Halphin–Tsai equations. Assume that the fibers are circularly shaped and are in a square array. Compare your results with those of problem 3.5.

5. Kaw 2nd ed. Prob. 3.10

3.10 A unidirectional glass/epoxy lamina with a fiber volume fraction of 70% is replaced by a graphite/epoxy lamina with the same longitudinal Young's modulus. Find the fiber volume fraction required in the graphite/epoxy lamina. Use properties of glass, graphite, and epoxy from Table 3.1 and Table 3.2.

6. Kaw 2nd ed. Prob. 3.16

3.16 Find the five strength parameters of a unidirectional glass/epoxy lamina with 40% fiber volume fraction. Use the properties of glass and epoxy from Table 3.3 and Table 3.4.

7. Kaw 2nd ed. Prob. 3.17

3.17 A rod is designed to carry a uniaxial tensile load of 1400 N with a factor of safety of two. The designer has two options for the materials: steel or 66% fiber volume fraction graphite/epoxy. Use the properties of graphite and epoxy from Table 3.1 and Table 3.2. Assume the following properties for steel:

- Young's modulus of steel = 210 GPa
- Poisson's ratio of steel = 0.3
- Tensile strength of steel = 450 MPa
- Specific gravity of steel = 7.8

The cost of graphite/epoxy is five times that of steel by weight. List your material of choice if the criterion depends on just

1. Mass
2. Cost

Due date is **Monday 12th of March, 2018**. For each delayed day **15 points** will be reduced.