

Assignment #25

16.4 (a) What is the distinction between cement and concrete?

(b) Cite three important limitations that restrict the use of concrete as a structural material.

(c) Briefly explain three techniques that are used to strengthen concrete by reinforcement.

*16.7 (a) For a fiber-reinforced composite, the efficiency of reinforcement η depends on fiber length l according to

$$\eta = \frac{l - 2x}{l}$$

where x represents the length of the fiber at each end that does not contribute to the load transfer. Make a plot of η versus l to $l = 40$ mm (1.6 in.), assuming that $x = 0.75$ mm (0.03 in.).

(b) What length is required for a 0.80 efficiency of reinforcement?

16.8 A continuous and aligned fiber-reinforced composite is to be produced consisting of 30 vol% aramid fibers and 70 vol% polycarbonate matrix; the mechanical characteristics of these two materials are as follows:

	Modulus of Elasticity [GPa (psi)]	Tensile Strength [MPa (psi)]
Aramid fiber	131 (19×10^6)	3600 (520,000)
Polycarbonate	2.4 (3.5×10^5)	65 (9425)

The stress on the polycarbonate matrix when the aramid fibers fail is 45 MPa (6500 psi).

For this composite, compute the following:

(a) The longitudinal tensile strength

(b) The longitudinal modulus of elasticity

16.12 In an aligned and continuous carbon fiber-reinforced nylon 6,6 composite, the fibers are to carry 94% of a load applied in the longitudinal direction.

(a) Using the data provided, determine the volume fraction of fibers that will be required.

(b) What will be the tensile strength of this composite? Assume that the matrix stress at fiber failure is 30 MPa (4350 psi).

	Modulus of Elasticity [GPa (psi)]	Tensile Strength [MPa (psi)]
Carbon fiber	72.5 (10.5×10^6)	3400 (490,000)
Nylon 6,6	3.0 (4.35×10^5)	76 (11,000)