

## Solutions to Sample Final Exam

### Question 1:

See the solution to Problem 4 of Homework 7.

### Question 2

$$E_c = xE_f + (1-x)E_m$$

$$x = 36.8\%$$

$$\frac{P_f}{P_m} = \frac{A_f E_f}{A_m E_m} = 1.689$$

$$P_c = P_f + P_m = 2.689P_m$$

$$P_m = 0.372P_c$$

$$\frac{\sigma_f}{E_f} = \frac{\sigma_m}{E_m}, \text{ hence } \sigma_f = 2.9\sigma_m$$

Therefore, when the matrix stress reaches the strength of 120 MPa, the carbon fiber has not reached its strength of 2400 MPa yet.

### Question 3

$$\dot{\varepsilon} = \frac{v}{h}$$

$$F = \sigma A = C \varepsilon^m A = 600 \text{ kN}$$

$$Ah = A_0 h_0$$

$$h = 32.9 \text{ mm}$$

### Question 4.

See the solution to Problem 3 of Homework 5.

**Question 5**

See the solution to Problem 2 of HW 6.

**Question 6:**

$$\alpha = \frac{14}{180} * \pi = 0.244$$

$$F = C * \left( \frac{6 * V_1}{D_0} * \left( \frac{9}{12} \right)^2 * \ln \left( \frac{A_0}{A_1} \right) \right)^m \left[ \left( 1 + \frac{\mu}{\alpha} \right) \ln \left( \frac{A_0}{A_1} \right) + \frac{2}{3} * \alpha \right] * A_1$$

Based on the above equation:

$$V_1 = \mathbf{0.58\text{mm/s}}$$

**Question 7**

7.1 (c)

7.2 (c)