

#4-54

$$L = 0.3 \text{ m}$$

$$k = 105 \text{ W/m}\cdot\text{C}$$

$$D = 0.01 \text{ m}$$

$$T_B = T_o = 200 \text{ C}^\circ$$

$$T_{\infty} = 20 \text{ C}^\circ$$

$$h = 1000 \text{ W/m}^2\cdot\text{C}$$

$$m = \sqrt{\frac{hP}{kA}} \rightarrow \frac{\pi D^2}{4} = \frac{\pi (0.01)^2}{4} = 7.854 \times 10^{-5} \text{ m}^2$$

$$P = \pi D = \pi (0.01) = 0.03142 \text{ m}$$

$$m = \sqrt{\frac{hP}{kA}} = \frac{1000(0.03142)}{105(7.854 \times 10^{-5})} = \sqrt{92.3} = 9.61 \text{ m}^{-1}$$

$$\frac{T(x) - T_{\infty}}{T_o - T_{\infty}} = \frac{\cosh(L-x)}{\cosh(mL)}$$

$$T(0.1) = 20 + (200 - 20) \frac{\cosh 9.61(0.3 - 0.1)}{\cosh 9.61(0.3)} = \boxed{90.1 \text{ C}^\circ}$$

$$\frac{T(x) - T_{\infty}}{T_o - T_{\infty}} = \frac{\cosh(L-x)}{\cosh(mL)}$$

$$T(0.2) = 20 + (200 - 20) \frac{\cosh 9.61(0.3 - 0.1)}{\cosh 9.61(0.3)} = \boxed{50.1 \text{ C}^\circ}$$