With $\begin{cases} Bi = 0.061 \\ Bi^2 Fo = 0.03 \end{cases}$ $\longrightarrow$ From Fig 5.6 $\frac{Q}{Q_o} = 0.65$

$$\frac{Q_o}{L} = \frac{\rho c V}{L}\theta_i = \frac{\rho c \pi r_o^2 L}{L}\theta_i$$

$$= 900 \times 2700 \times \pi (0.025)^2 (200-70)$$

$$= 6.203 \times 10^5 \ J/m$$

$$Q/_L = Q/_L \times 0.65 = 0.65 \times 6.203 \times 10^5 = 4.032 \times 10^5 \ J/m$$

Analytical solution

$Bi = 0.061$ Table 5.1 $\Longrightarrow$ $C_1 = 1.0148$, $\zeta_1 = 0.3438$

$$\theta_o^* = C_1 \exp(-\zeta_1^2 Fo) = 1.0148 \exp(-0.3438^2 \times 8.49) = 0.372$$

$$\theta = \theta_o^* J_o(\underbrace{\zeta_1 r^*}_{x}) \qquad x = \zeta_1 r^* = 0.3438 \times 0.5 = 0.1719$$

From table B.4 $J_o(\zeta_1 r^*) = 0.9921$

$$\theta^* = 0.372 \times 0.9921 = 0.3690$$

$$\theta^* = \frac{T - T_\infty}{T_i - T_\infty} \Rightarrow T = T_\infty + \theta^*(T_i - T_\infty)$$

$$= 70 + 0.3690(200-70)$$

$$= 118.0^\circ C$$