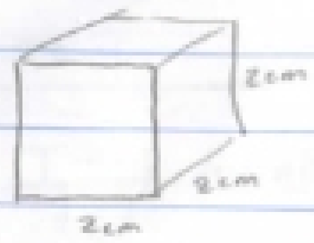
6/19

$$Bi = \frac{hL_c}{k_s} \rightarrow L_c = \frac{Vol}{A_s}$$

Problem 2 from practice midterm



$k = 15 \frac{W}{m°C}$

$h = 400 \frac{W}{m^2 °C}$

$T_i = 30°C$

$T_\infty = 100°C$

$$L_c = \frac{(.02m)^3}{6(.02m)^2} = 0.0033m$$

$$Bi = \frac{400(.0033)}{15} = 0.089$$

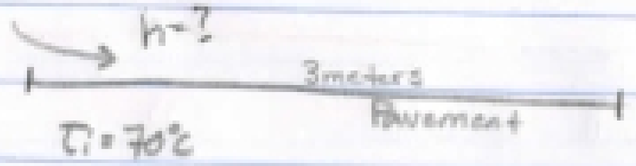
$$\dot{E}_{st} = \dot{E}_{in} - \dot{E}_{out} + \dot{E}_g \rightarrow \frac{m}{mc}\frac{dT}{dt} = -\frac{hA}{mc}(\underbrace{T - T_\infty}_{\theta})$$

$$\frac{1}{\theta}dt\frac{d\theta}{dt} = \frac{-hA}{mc}\theta\, dt \frac{1}{\theta} \rightarrow \int_{\theta_i}^{\theta}\frac{d\theta}{\theta} = \int_0^t \frac{-hA}{mc}dt$$

$$\ln\theta - \ln\theta_i = \frac{-hA}{mc}t \rightarrow \frac{\theta}{\theta_i} = e^{-\left(\frac{hA}{mc}\right)t} = e^{-t/t_c}$$

Could ask semi infinate solid on midterm!
↳ would have to use tables in back of book for

5m/s $T_\infty = 10°C$ $T_{avg} = 318K$



To find $\bar{h}$:

$\bar{Nu} = \frac{\bar{h}L}{k_{air}}$

$\nu = 16 \times 10^{-6} \frac{m^2}{s}$

$k_{air} = 27 \times 10^{-3} \frac{W}{m°C}$ @ 313K

$$Re_L = \frac{VL}{\nu} = \frac{(5\frac{m}{s})(3m)}{16 \times 10^{-6}\frac{m^2}{s}} = 9.376 \times 10^5 \rightarrow \text{turbulant}$$

$P_{r_{air}} = .7$

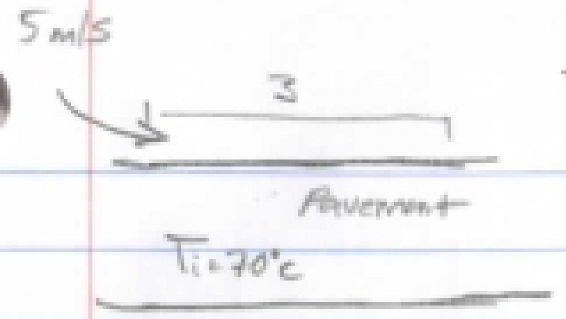
7-31 $\bar{Nu}_L = (.037 Re_L^{4/5} - 871) P_r^{1/3}$

$\bar{Nu}_L = (.037(9.376 \times 10^5)^{4/5} - 871)(.7)^{1/3} \rightarrow 1195.18$

$\bar{Nu}_L = \frac{\bar{h}L}{k_{air}} \rightarrow 1195.18 = \frac{\bar{h}(3)}{27 \times 10^{-3}} \rightarrow \bar{h} = \frac{k_f \bar{Nu}_L}{L} \rightarrow h = 10.8 \frac{W}{m^2 °C}$

continued →

$h = 10.8 \frac{W}{m^2}$



$T_\infty = 10°C$

$\alpha = \alpha_{asphalt}$

$$\frac{T - 70}{10 - 70} = erfc\left(\frac{x}{2\sqrt{\alpha t}}\right) - exp$$