

Answers to ES205 Examination II, 1996-1997

Problem 1

a) $\rho V c_v \frac{dT_{T/C}}{dt} + h A T_{T/C} + \epsilon \sigma A T^4 = h A T_\infty + \epsilon \sigma A T_{sur}^4$

b) calculate the Biot number. $Bi = .01$ so lumped capacitance OK.

c) $T_{ss} = 196 \text{ }^\circ\text{C}$

Problem 2

a) $\frac{\pi h^4}{k^4} \dot{h} + C_d A_o \sqrt{2g} \sqrt{h} = 0$

b) $h = \left(h_o^{9/2} - \frac{9 C_d A_o \sqrt{2g} k^4}{2\pi} t \right)^{2/9}$

Problem 3

$\dot{W}_{in} = 6,231 \text{ hp}$ (answers may vary depending on f used)

$\dot{W}_{shaft} = 10,385 \text{ hp}$ (depends on answer for \dot{W}_{in})

Problem 4

$$\frac{A(a+b)}{k_v a} \dot{y} + y = \frac{a+b}{a} x$$