

ME 211 Key Equations For Final Exam

$$m_{cv}(t) - m_{cv}(0) = \sum_i m_i - \sum_e m_e$$

$$U_{cv}(t) - U_{cv}(0) = Q_{cv} - W_{cv} + \sum_i m_i h_i - \sum_e m_e h_e$$

$$s_2 - s_1 = \int_1^2 \left(\frac{\delta Q}{T} \right)_b + \sigma$$

$$\frac{ds}{dt} = \sum_j \frac{\dot{Q}_j}{T_j} + \dot{\sigma}$$

$$s(T_2, v_2) - s(T_1, v_1) = \int_{T_1}^{T_2} c_v(T) \frac{dT}{T} + R \ln \frac{v_2}{v_1}$$

$$s(T_2, v_2) - s(T_1, v_1) = c_v \ln \frac{T_2}{T_1} + R \ln \frac{v_2}{v_1}$$

$$\frac{dS_{cv}}{dt} = \sum_j \frac{\dot{Q}_j}{T_j} + \sum_i \dot{m}_i s_i - \sum_e \dot{m}_e s_e + \dot{\sigma}_{cv}$$

$$0 = \sum_j \frac{\dot{Q}_j}{T_j} + \sum_i \dot{m}_i s_i - \sum_e \dot{m}_e s_e + \dot{\sigma}_{cv}$$

$$s(T_2, p_2) - s(T_1, p_1) = \int_{T_1}^{T_2} c_p(T) \frac{dT}{T} - R \ln \frac{p_2}{p_1}$$

$$s(T_2, p_2) - s(T_1, p_1) = s^\circ(T_2) - s^\circ(T_1) - R \ln \frac{p_2}{p_1}$$

$$\eta_t = \frac{\dot{W}_{cv}/\dot{m}}{(\dot{W}_{cv}/\dot{m})_s} = \frac{h_1 - h_2}{h_1 - h_{2s}}$$

$$\eta_{\text{nozzle}} = \frac{V_2^2/2}{(V_2^2/2)_s}$$

$$\eta_c = \frac{(-\dot{W}_{cv}/\dot{m})_s}{(-\dot{W}_{cv}/\dot{m})} = \frac{h_{2s} - h_1}{h_2 - h_1}$$

$$\frac{p_2}{p_1} = \frac{p_{r2}}{p_{r1}}$$

$$\frac{v_2}{v_1} = \frac{v_{r2}}{v_{r1}}$$

$$\frac{T_2}{T_1} = \left(\frac{p_2}{p_1} \right)^{(k-1)/k}$$

$$\frac{T_2}{T_1} = \left(\frac{v_1}{v_2} \right)^{k-1}$$

$$\frac{p_2}{p_1} = \left(\frac{v_1}{v_2} \right)^k$$