Review for ME323 final exam, spring 06:

Closed book and notes—I will provide sheet of equations and other necessary information. Calculators ok.

The exam is like a test of concepts more than crunching numbers. There will be some calculations that emphasize knowing what terms go into which expression.

1. Forced convection

- meaning of Nu, Pr, Re
- exact solutions for Nu (laminar flow, T_s = const., q_s = const.)
- when correlations needed (turbulent, complex geometry)

Internal flow

- general knowledge of momentum and thermal boundary layers, entrance lengths and fully developed states, boundary layer transition point (i.e. $Re_{D,c} \approx 2300$)
- use of hydraulic diameter
- use of T_f, film temperature to evaluate fluid properties

External flow

- momentum and thermal boundary layers and thicknesses, turbulent transition points (i.e. $Re_{x,c} \approx 50{,}000$)
- Re_L, Nu_L, Cf_L and the general idea of surface averaged quantities
- use of $T_{m,}$ average of the mean temperature to evaluate fluid properties

2. Natural convection

- meaning of Gr, Ra, β, Pr
- general understanding of mechanism, velocity and temperature profiles
- general solution procedure: guess temperature(s) if not provided, compute $h_{nat\ conv.}$ and go improving temperature difference if needed
- 'feel' of natural convection in enclosures

3. Heat exchanger design

- heat exchanger types
- overall heat transfer coefficient
- general knowledge of log mean temperature difference and NTU methods

4. Radiation

- radiation spectral intensity
- emissive power of radiation, irradiation, and radiosity
- shape factors
- blackbody, graybody, surface properties
- impact of emissivity, absorptivity, reflectivity, transmissivity
- resistor analogy

5. general approach to mixed H.T.: conduction, convection, radiation