ME 323 Heat Transfer: Portland State University. Prof. Mark Weislogel. 3/30/04

This review reads like a "what you should know from this course" summary.

1. Heat Transfer Basics
   - Modes of heat transfer: conduction, convection, radiation
   - Mechanisms of each mode
   - General quantitative behavior of each mode
   - Resistor analogy using all three (parallel and serial)
   - Conductive (including contact resistance) and convective resistance forms (L/kA, 1/hA, not radiation)
   - Know when conduction is 2-D and when shape factor is used in resistance model

2. Heat transfer from fins
   - Conduction along fin, simplified governing equation, solutions
   - Limitations of solutions
   - Heat transfer coefficient heat sink
   - Boundary conditions
   - Table of exact solutions (Table 3.4, B.C.s, T(x), Q)

3. Transient Heat conduction
   - General method to approach problems
   - Bi < 0.1, Bi > 0.1 Fo > 0.2 approx. analytic solution, numerical solution
   - Cartesian, cylindrical, spherical
   - Meaning of Bi and Fo
   - Numerical- discretization and meaning of discretized Fo

4. Forced convection
   - Meaning of Nu, Pr, Re

   Internal flow
   - General knowledge of momentum and thermal boundary layers, entrance lengths and fully developed states
   - Exact solutions for Nu (laminar flow, T_s = const., q_s = const.)
   - When correlations needed (turbulent, complex geometry)
   - 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. $Re_x > 50{,}000$)
   - Re_L, Nu_L, C_{fL} and the general idea of surface averaged quantities

5. 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 iterate until converge if needed (laminar exact, other correlation)
- 'Feel' for natural convection in enclosures

6. Heat exchanger design
    - Log mean temperature difference
    - Co-flow counter flow design
    - Compact heat exchangers and performance metrics

7. Radiation
    - Spectrum of radiation and emissive power
    - Blackbody, graybody, surface properties
    - Impact of emissivity, absorptivity, reflectivity, transmissivity
    - Shape factors

8. General approach to mixed H.T.: conduction, convection, and radiation