Tentative Outline of Material

I. Thermodynamic principles [E&R pp. 5-13] *[1-13]3rd [1-11]2nd*
   A. Nature of thermodynamic arguments
   B. State variables and equations of state
      Pressure, Volume, Temperature
      1. Temperature- Ideal gas thermometer [E&R pp. 5-6; handout] *[5-6]3rd [4-6]2nd*
      2. Ideal gas law : relationship to mechanics and molecular structure
         [E&R pp 7-8; handout] *[2-4]3rd not in 2nd ed*
   3. non-ideal gases:
      van der Waals equation of state [E&R sec 1.5, also E&R sec 7.1-7.2]*also 3rd*

II. Mathematics applied to thermodynamics
   [**HANDOUT**, E&R ME.3 pp 39-40] *[45-49, Appendix B.2]3rd [41-45]2nd*

III. The first law of thermodynamics [E&R pp. 29-97] *[17-77]3rd [15-73]2nd*
   A. Heat and work
   B. Internal energy as a state function
   C. Enthalpy
   D. Maxwell-Euler relationships from dU and dH
   E. Heat capacities
   F. Applications to real and ideal gasses
   G. Thermochemistry [E&R 87-97] *[67-77]3rd [63-73]2nd*

MIDTERM #1 ON FRIDAY JANUARY 31ST

IV. The second law of thermodynamics [E&R pp.107-139] *[85-119]3rd [79-110]2nd*
   A. Physical statements of second law [E&R p.128; handout] *[p89]3rd [p. 83]2nd*
   B. Heat engines and efficiency [handout; E&R sec 5.10] *[sec 5.2]3rd*
   C. Disorder and the statistical nature of entropy
      [E&R sec 5.4 pp114-119] *[p. 383]3rd [p. 372]2nd*
   D. Mathematical definition of entropy and second law [E&R *p108???*] *[sec 5.3]3rd*
   E. Implications of the second law of thermodynamics [E&R sec 5.2] *[sec 5.5]3rd*
   F. Calculations of entropy changes [E&R sec 5.3] *[sec 5.4]3rd*
   G. Entropy of system and surroundings [E&R sec. 5.6] *[sec 5.7]3rd*
   H. Third law and absolute entropy [E&R sec 5.7] *[sec 5.8]3rd*
   I. Entropy changes in chemical reactions [E&R sec 5.9] *[5.10]3rd*

V. Free energy, spontaneity, and equilibrium [E&R pp 147-181] *[125-160]3rd [115-149]2nd*
   A. Helmholtz and Gibbs free energy and spontaneity [E&R sec 6.1] *[sec 6.1]3rd*
   B. Maxwell-Euler relationships from dA and dG [E&R sec 6.2-6.3] *[sec 6.3-6.3]3rd*
   C. Equilibrium conditions [E&R sec 6.4-6.7] *[sec 6-4-6.8]3rd*
   D. General relationships among thermodynamic variables
   E. Temperature and pressure dependence of free energy
      [E&R sec 6-9-6.12] *[sec 6.10-6.13]3rd*

MIDTERM #2 ON FRIDAY FEBRUARY 28TH

VI. Open and multicomponent systems
   A. Dependence of state functions on n_i
   B. Chemical potential μ_i and equilibrium [E&R sec 6.4] *[sec 6.4]$_{3rd}$*
   C. Phase changes and phase equilibrium [E&R 207-223] *[181-197]$_{3rd}$ [173-188]$_{2nd}$*

VII. Applications
   A. Non-ideal gasses; fugacity and activity [E&R sec 7.5] *[sec 7.5]$_{3rd}$*
   B. Solutions of nonelectrolytes [parts of E&R pp 237-267] *[209-239]$_{3rd}$ [199-229]$_{2nd}$*
      1. Ideal solutions
         a. Vapor pressure
         b. Colligative properties
      2. Non ideal solutions
   C. Solutions of electrolytes
      1. General considerations and ionic activities [E&R sec 10.3] *[sec 10.3]$_{3rd}$*
      2. Debye-Huckel theory of activity coefficients [summary of E&R sec 10.2 and 10.4]
   D. Electrochemistry [summary of E&R sec 11.1-11.8]

FINAL EXAM ON MARCH 19TH , THURSDAY 4:00-7:00 PM