INTRODUCTION TO CHEMICAL ANALYSIS

GENERAL COURSE INFO:

- **The course** will meet Tuesday and Thursday, at 12:10 pm, room 1210. (also selected review sessions on Saturday mornings (9 AM; Feb. 1, March 8, April 12) and Monday evenings (5 pm; Feb. 3, March 3, April 7)

- **Textbook**: Exploring Chemical Analysis (ECA); by Daniel C. Harris (2nd Ed)

- **Course Web-site**: www.umich.edu/~241/

- **Lecture notes**, assigned text problems, and old exams will be posted on course Web-site---Please check site after 5 pm on Mondays for weekly update of materials. **PLEASE NOTE THAT YOU MUST ATTEND ALL LECTURES AS ADDITIONAL MATERIAL/EXPLANATIONS WILL BE COVERED THAT MAY NOT NECESSARILY BE POSTED ON WEB-SITE OR FOUND WITHIN ECA TEXTBOOK!!**

- **Grades**: Course grades will be based on two exams worth 100 pts each (Exam #1: February 4, 6-8 pm; Exam #2: March 11, 6-8 pm) and a cumulative final exam (April 18, 1:30-3:30 pm) worth 200 pts. (total 400 possible points). It is anticipated a B grade in this course will require a score of 80% (320 total points) on the three exams. **NO MAKE-UP EXAMS WILL BE GIVEN; YOU MUST PLAN TO TAKE THE EXAMS AT THEIR SCHEDULED TIMES**

- **Course Expectations**: Concurrent enrollment in Chem 242, the associated laboratory portion of this course, is mandatory. You are expected to read chapters in ECA in advance of the lectures. To prepare for exams, you should review all sample problems within the assigned chapters, and also work problems that are assigned each week at the end of given chapters. The answers to the problems are in the back of the book, and we will review how to set-up and solve these problems at our review sessions, prior to the 3 exams.

- **Additional Info**: Course sequence will not exactly follow chapter order in ECA so that certain topics can be covered earlier to help with your efforts to understand concepts in early labs within the Chem 242 lab-course.
Jan 7. Intro to Chemical Analysis; relevance, approaches, definition of terms, concentration units, equilibrium constants (Chapters 0 and 1 in ECA)

Jan 9. Preparing standard solutions, primary standards, principles of volumetric analysis (Chapters 2 and 5.1-5.3 ECA)

Jan 14. Significant figures, types of errors, propagation of errors, precision and accuracy, gaussian distribution, spreadsheets (Chapters 3 and 4 ECA)

Jan 16. Spectrophotometry, transmittance, absorbance, Beer’s Law (Chapter 17 ECA)

Jan 21. Statistics, t-test, Q-test, least squares (Chapter 4 ECA)

Jan 23. Statistics Con’t (Chapter 4 ECA) and solubility products, common ion effect, precipitation titrations (Chapter 5 ECA)

Jan 28. Gravimetric analysis, combustion analysis (Chapter 6 ECA)

Jan 30. Intro to acids and bases, strong and weak acids/bases, pH of solutions of acids/bases (Chapter 7 ECA)

Feb. 4. Buffers, Henderson-Hasselbalch equation, ionic strength and temperature dependance of buffers, indicators (Chapter 8 ECA)

Feb 4. EXAM #1, 6-8 pm

Feb. 6. Acid-Base titrations, calculating pH at endpoint (Chapter 9 ECA)

Feb. 11. Polyprotic acids and bases, fractional composition diagrams, titrations of polyprotic systems (Chapter 10 ECA)

Feb. 13. Ionic strength, activity coefficients, real definition of pH, charge balance/mass balance and simultaneous equilibria problems (Chapter 11 ECA)
Feb. 18. Chelation and EDTA titrations, indicators (Chapter 12 ECA)

Feb. 20. Redox chemistry, electrode potentials, standard potentials, Nernst equation, reference electrodes, electrochemical cells and equilibrium constants (Chapter 13 ECA)

Mar. 4. Potentiometry, pH electrodes and pH measurements, ion-selective electrodes (Chapter 14, ECA)

Mar. 6. Membrane electrodes con’t, redox titrations (Chapters 14 & 15 ECA)

Mar. 11. Voltammetry, amperometry, oxygen electrodes, enzyme electrodes (Chapter 16, ECA)

Mar. 11. EXAM #2; 6-8 pm

Mar. 13. Spectrophotometry, molecular spectroscopy, simple instrumentation (Chapters 17 & 18 ECA).

Mar. 18. Atomic emission, atomic absorbance, boltzmann distribution, ionization in atomizer, ICP (Chapter 19, ECA)

Mar. 20. Principles of chromatography, partition coefficient, stationary phases, mobile phases, band spreading, plate height, van-Deemter equation (Chapter 20, ECA)

Mar. 25. Gas chromatography, instruments, stationary phases, detectors, capillary columns (Chapter 21, ECA)

Mar. 27. Liquid chromatography, normal and reversed phase columns, high pressure/performance LC (Chapter 21, ECA)

April 1. Ion-exchange chromatography, affinity chromatography, electrophoresis (Chapter 22, ECA)

April 3. Mass spectrometry, general principles, types, applications (special topic)
April 8. Enzymatic methods of analysis, immunoassays (special topic) (Chapter 18-5, ECA)

April 10. Luminescence techniques: fluorescence, chemiluminescence, applications (Chapter 18, ECA)

April 15. General End-of-Term Review