Instructor: Dr. Ngee-Sing Chong; Office phone: 898-5487; Email: nchong@mtsu.edu; Office: DSB 231; Office hours: MW 8:00-9:00 am, TR 10:00-11:00 am, other hours by appointment. Instructor Homepage: www.mtsu.edu/~nchong/Main.html

Description: This course covers the theory and practice of analytical chemistry as applied to the identification and quantitation of analytes in samples typically encountered in chemical and allied industries. Course emphasis will be placed on chromatography, optical spectroscopy, mass spectrometry, and microscopy as well as sample preparation techniques, statistical data treatment, and quality assurance of data. The prerequisite is CHEM 2230 (Quantitative Analysis) or another equivalent course.


Laboratory: There will be about eight experiments or projects for this course depending on the rate of class progress and instrument service requirements. Each of these is worth 50 points and will be graded on the basis of a short presentation of experimental methods, data, and results in class. The grading criteria include adherence to proper experimental procedures, demonstrated analytical proficiency, accuracy and precision of data, meaningful or logical interpretation of results, and answers to questions relevant to the experiments. Experimental data should be well organized and written in a lab notebook with numbered pages and the raw data in your notebook should be photocopied to accompany the lab reports or presentations. Data and PowerPoint presentation files for all your lab projects or experiments should be saved onto designated computers.

The laboratory will be in DSB 206 and 207. These rooms are available to you during the scheduled laboratory periods plus other hours by prior arrangement with the instructor. Please confine all wet chemistry to Room 206. Be cautious with the operation of analytical instruments and do not change the instrumental parameters without permission. You may be held responsible for replacing any equipment or accessories that you break. Since some of the analytical instruments are shared by faculty and students in research and instructional projects, you have to sign-up for the use of instruments such as GC-MS, AA, and FTIR as directed.

Safety rules must be adhered to and goggles are required in the laboratory during sample preparation. A bound laboratory notebook and a calculator are required for recording raw data and calculating lab measurements, respectively.
Grading: Three 100-point exams 300 points
Final exam 200 points
Eight 50-point lab reports or presentations 400 points
Lab practical/final (instrumental proficiency) 100 points

The grading scale for your total score is as follows: A for >= 850; B for 725-849; C for 600-724; D for 475-599; and F for <475. **Plus/minus grading scheme will be used** as follows; the plus and minus grades will be given to the top 3% and bottom 3%, respectively, of the 12.5% range for each grade interval. For instance, a score of 820-849 will be assigned a “B+” and 600-629 will be assigned a “C-“. The exam dates will be announced in class.

Attendance: Regular attendance of class lectures is expected due to the coverage of materials beyond the textbook and the discussions of laboratory procedures and data analysis pertaining to the experiments. You are responsible for timely submission of lab reports and class presentations during scheduled class periods.

Lecture outline: Jan. 14 – Feb. 4
**Introductory Concepts in Analytical Chemistry:** Classical and instrumental methods of chemical analysis; units of measurement; spreadsheet calculations; qualitative versus quantitative analysis; quantitation via calibration standards, internal standardization, and standard addition; sample collection, preparation, and preconcentration methods; quality assurance/quality control protocols (QA/QC); statistics for sampling and data analysis; analytical figures of merit.

Feb. 8 – March 2
**Separation Techniques:** Gas chromatography (GC) with flame ionization detector (FID), electron capture detector (ECD), photoionization detector (PID), and mass spectrometry (MS) detectors; high pressure liquid chromatography (HPLC) with electrochemical, UV-Vis and MS detectors; ion chromatography with conductivity detector; gel and capillary electrophoresis.

March 4 – April 8
**Atomic and Molecular Spectrometry:** Ultraviolet-visible (UV-Vis) spectrophotometry, fluorimetry and single molecule detection, Fourier Transform infrared spectrometry (FTIR), Raman spectrometry and surface-enhanced Raman Scattering (SERS), nuclear magnetic resonance spectroscopy (NMR), atomic absorption spectroscopy (AAS), inductively coupled plasma-atomic emission spectrometry (ICP-AES), inductively coupled plasma-mass spectrometry (ICP-MS), X-ray fluorescence spectrometry (XRF).

April 12- April 29
**Electrochemical Techniques, Microscopy, and Other Methods:** potentiometric analysis, cyclic voltammetry, polarography, coulometry, and stripping voltammetry; radioactivity detectors; scanning electron microscopy (SEM); X-ray microanalysis; transmission electron microscopy (TEM), and microfluidics.
Experiments:

- Analysis of trace metals in water by ICP/MS
- Analysis of trivalent and hexavalent chromium by UV-Vis spectrometry
- Determination of chromium by atomic absorption spectroscopy
- Analysis of greenhouse gases by FT-IR
- Quantitation of anions in storm water by ion chromatography
- Quantitation of explosives in soil by HPLC
- Determination of volatile organic compounds by GC/MS
- Quantitation of kerosene by GC/FID

Lab practical/final will consist of performing tasks that would have been performed during each of the labs. These include analyzing a sample to performing data analysis on previously generated data. There also will be written questions based on information provided during the lab briefings. The practical and final will be closed notes and will be worth 100 points. Each lab is worth 50 points.

Important Dates:
- January 27, 2010 – Last day to drop without a grade
- March 3, 2010 – Last day to drop with a “W” grade

Disabilities:
If you have a disability that may require assistance or accommodation or questions related to any arrangements for testing, note takers, readers, etc., you MUST contact the Office of Disabled Students Services (898-2783) and let me know the arrangements.

Lab Safety Rules
1. Wear safety goggles and gloves when working with hazardous chemicals
2. Never keep or consume food or drink in a chemistry laboratory.
3. Never pipet by mouth to avoid accidental ingestion.
4. Be cautious when working with instruments that have high voltage or heated components such as the GC injector, quadrupole analyzer in MS, and spectrometer lamps.
5. Use proper care in dispensing, mixing, and handling chemicals to avoid skin contact.
6. Know the location of emergency equipment such as first aid kit, eyewash fountain, fire extinguisher, fire alarm, and the nearest telephone.
7. Read the Material Safety Data Sheets of chemicals encountered in the lab and follow the proper precautions and handling instructions.
8. Use the fume hood when working with volatile chemicals or solvents to avoid inhalation.
9. Ask for instructor’s or classmate’s assistance when gas cylinders need to be changed.
10. Be aware of waste disposal options for organic wastes (halogenated versus non-halogenated), metal-containing wastes, and broken glassware.

To retain Tennessee Education Lottery Scholarship eligibility, you must earn a cumulative TELS GPA of 2.75 after 24 attempted hours and a cumulative TELS GPA of 3.0 thereafter. A grade of C, D, F, or I in this class may negatively impact TELS eligibility. Dropping a class after 14 days may also impact eligibility. If you withdraw from this class and it results in an enrollment status of less than full time, you may lose eligibility for your lottery scholarship. For additional lottery scholarship rules please refer to your Lottery Statement of Understanding form, review lottery scholarship requirements on the web at http://scholarships.web@mtsu.edu/telsconteligibility.htm, or contact the MTSU financial aid office at 898-2830.

THIS SYLLABUS IS SUBJECT TO CHANGE AT THE DISCRETION OF THE INSTRUCTOR.