CHEMICAL INSTRUMENTATION (CHE6510) 3 credit hours
Syllabus
Spring 2011

Required Materials: Chemical Analysis: *Modern Instrumentation Methods and Techniques* by Francis Rouessac and Annick Rouessac. (ISBN: 978-0-470-85903-2)

PREREQUISTES: *Graduate Standing*

Disclaimer: *Although I expect to conduct the course according to the following. I reserve the right to make modifications if circumstances dictate.*

COURSE DESCRIPTION

An intensive course in the theory, operation, and application of modern chemical instrumentation with emphasis in separation science, spectroscopy, thermal analysis, and diffraction. Lecture materials will be augmented by practical applications and analyses. The course will have practical, written, and oral proficiency evaluations.

Rationale for course: Chemical instrumentation is concerned with the theory and practice of instrumental methods for the separation, identification and quantitative analysis of chemical substances. Satisfactory completion of this course will afford students a working knowledge of analytical instrumentation typically employed in chemical and biochemical research laboratories. The course will emphasize spectroscopic and chromatographic instruments and methods. Topics covered includes: pre-experiment planning, preparative methods, analytical methods, statistical evaluation of data, and examination and presentation of results. The course also introduces students to basic computer modeling and visualization of biological molecules.
Notice: **No cell phones should be powered on while in class.** Use of cell phone calculator function is not allowed, rather each student should acquire a scientific calculator which is able to handle exponential and log functions. Graphing calculators model TI89 or lower may be used. ***The memory functions of such calculators should not be used to store formulas, equations, or any information written on paper would constitute cheating.***

Attendance*:** Your attendance at all class meetings is expected. Please refer to the *2010-2011 Mississippi College Graduate Catalog.* An accumulation of **3** absences results in an automatic **F** in this course. Attendance will be checked each day. Absences are recorded on the grade report that is submitted to the registrar's office by instructor. If a regular class meeting is missed, it is the student's responsibility to obtain any assignments or instructions that were given by the instructor. Missing a class is **not** an excuse for not preparing for the next class meeting or not having an assignment ready on time. Don't miss a scheduled test! **No makeup tests will be given. In extreme emergencies, the final exam will be used in place of the missed test. If subsequent tests are missed, a grade of zero will be entered for each additional test.** *The last day to drop this class is* ***Friday, March 25.

METHODS OF INSTRUCTION: Class will consist primarily of lectures annotated with laboratory demonstrations.

Methods of Evaluating Student Progress: three tests will be given during the semester, each with a value of 100 points. Exams contain essay questions that require the student to express thoughts in a well organized manner consistent with accepted writing form. The final exam is comprehensive and worth 100 points. The grading scale is based on the percentage of total points earned in the course.

Exams (3):	300 pts	**(7Feb2011; 7Mar2011; 11Apr2011)**
Final Exam:	100 pts	**(2May2011 @ 6:00 PM)**
Laboratory:	150 pts	(due one week after completion of lab)
Reports (2):	150 pts	(a separate handout will be given regarding specifics)
Total:	700 pts	

The grading scale for this course is based on the percentage of total points earned in the course and is as follows:

≥90-100%	A
85.0-89.9%	B+

84.9-80.0%	B
75.0-79.9%	C+
70.0-74.9%	C
60.0-69.9	D
Below 60.0%	F

Tuition Refund: The last day to drop a class with 100% refund of tuition is January 20, 2010.

Special Accommodations: In order for a student to receive disability accommodations under Section 504 of the Americans with Disabilities Act, he or she must schedule an individual meeting with the Director of Student Counseling Services **immediately upon recognition of their disability** (if their disability is known they must come in before the semester begins or make an appointment **immediately** upon receipt of their syllabi for the new semester). The student must bring with them written documentation from a medical physician and/or licensed clinician that verifies their disability. If the student has received prior accommodations, they must bring written documentation of those accommodations (example Individualized Education Plan from the school system). Documentation must be current (**within 3 years).** The student must meet with SCS **face-to face** and also attend two (2) additional follow up meetings (one mid semester before or after midterm examinations and the last one at the end of the semester). Please note that the student may also schedule additional meetings as needed for support through SCS as they work with their professor throughout the semester. Note: Students must come in **each semester** to complete their Individualized Accommodation Plan (example: MC student completes fall semester IAP plan and even if student is a continuing student for the spring semester they must come in again to complete their spring semester IAP plan).

Student Counseling Services is located in Alumni Hall Room #4 or they may be contacted via email at christia@mc.edu or rward@mc.edu. You may also reach them by phone at **601-925-7790.**

Academic Integrity: University policy 2.19 clearly defines the behavior that the college considers academically dishonest (also see *http://www.mc.edu/resources/publications/policies/*), students are expected to conduct themselves as professionals. If dishonest behavior is detected, it will be reported to the appropriate administrator and the student will receive no credit for the work**.**

Topics to be Covered

1. Qualitative and quantitative analysis: sources of error in experimental results, precision, accuracy, standard deviation, determinate and indeterminate errors.
2. Introduction to chromatography, principles of chromatography.
3. Efficiency of the chromatographic process, Van Deemter equation, theoretical plate concept. A PC database of gas-chromatograms viewing utility will be used to learn and compare different gas chromatography (GC) column applications in modern gas chromatography.
4. Gas chromatography, theory, and equipment.
5. Different detectors and columns used in GC and their application and modes of operation.
6. Liquid chromatography, detectors, normal phase versus reversed phase chromatography, ion exchange, gel permeation and supercritical fluid chromatography.
7. Electrophoresis
8. Mass spectrometer detectors; quadrapole, time of flight and ion trap.

   Theory and demonstration of actual applications in GC/MS and HPLC/MS/MS analysis; interpretation of MS and MS/MS spectra.
9. Spectrophotometry; (fluorometry, colorimetry, polarimetry, nephelometry, turbidimetry).

   The absorption laws of spectrophotometry. Demonstration of spectrophotometric equipment. Methods used in single-beam and double-beam spectrophotometry.

10. Circular Dichroism Spectroscopy

    Introduction to CD and demonstration of CD instrumentation

11. Nuclear magnetic resonance (NMR).

    Properties of nuclei, molecular motion, effect of radiant energy on molecules, principles of quantum theory, quantization of nuclei in magnetic field, chemical shifts, spin-spin splitting in proton NMR.

12. Infrared absorption

13. Sample Preparation

14. Basis of computer aided 3D visualization and modeling of molecules