C. W. POST CAMPUS
Long Island University

Chm 39. Forensic Instrumentation (cross-listed as FSC 2)

The purpose of this one semester undergraduate course is to introduce the student to the use of instrumental chemical techniques to the analyses of physical evidence materials of forensic import. The course includes lectures and has as a critical portion laboratory sessions. At the conclusion of the course the successful student will understand the fundamental use and operation of certain types of chemical instrumentation and their application to forensic analytical problems. He will also be able to choose the proper technique to successfully analyze a material and increase his knowledge and understanding of the analytical approach and interpretation of quantitative data.

The lectures include the descriptions of various instruments including their designs, the theory of operation and the fundamental science on which they are based. Applications of these instruments to forensic samples will be introduced.

This course is concentrated on spectroscopy and chromatography, although other instrumentation topics will be covered.

Topics to be covered, time-line, grading and additional information is found on the attached course outline.

Required Text: "**Forensic Chemistry**" by Suzanne Bell, Prentice Hall, Upper Saddle River NJ, (2006).

Additional assigned reading from Photocopied handouts and assignments from various Forensic Science Textbooks.

Bibliography:

Principles of Instrumental Analysis 5th ED, Skoog, Holler and Neiman, Saunders College Publishing. (Harcourt Brace Jovanovich) N.Y. This is an excellent book with increased information on instrumental analysis. 4th edition is also fine and is inexpensive over the internet.

Spectrometric Identification of Organic Compounds, Silverstein and Bassler, John Wiley & Sons, N.Y.

Organic Structures from Spectra, Steinhell and Kalman, John Wiley and Sons, N.Y.

An Introduction to Error Analysis, J. Taylor, University Science Books, Sousalito Ca.

Basic Instrumental Analyses, B. Pease, D. Van Nostrand Co., N.Y.

Statistical Analyses, S.K. Kachigan, Rodues Press, N.Y.

Isolation and Identification of Drugs, E.E.G. Clark, The Pharmaceutical Press, London.

Instrumental Methods of Analysis, Hobart H. Willard, Lynne L. Merritt Jr., John A. Dean, and Frank A Settle Jr., Wadsworth Publishing Co., 1988 7th Edition.

The Essential Guide to Analytical Chemistry, G. Schwedt, John Wiley & Sons, New York. 1997.

Mass Spectroscopy Principles and Application, E. De Hoffmann, J. Charette and V. Stroobant, John Wiley & Sons, New York. 1996.

Modern Infrared Spectroscopy, B. Stuart, B. George and P. McIntyre, John Wiley & Sons, New York. 1996.

Isolation and Identification of Drugs, E.G.G. Clark.

Forensic Science Handbook, Vol.1, 2nd Ed., R. Saferstein, Prentice Hall.

Forensic Science Handbook, Vol.2, R. Saferstein, Prentice Hall.

Forensic Science Handbook, Vol.3 R. Saferstein, Prentice Hall.

Criminalistics, An Introduction to Forensic Science, Saferstein Prentice Hall.

Forensic Science: An Introduction to Scientific and Investigative Techniques, S. H. James and NJ. J. Norby, CRC Press 1st or 2nd Edition.

ASTM Standards on Disc. Volume 14.02.

Selected Powder Diffraction Data for Forensic Materials Data Book, ICDD, Newton Square, PA.

Selected Powder Diffraction Data for Forensic Materials Search Manual, ICDD.

Students are **REMINDED** that the use of another student's data or results, which includes working together, unless specifically allowed by the teacher, for laboratory reports is a form of plagiarism at a minimum and may actually be considered to be **CHEATING**. This will result in the assignment of a ZERO grade for that laboratory experiment as a minimum and could likely result in failure of the laboratory portion of the course or the entire course itself. Be mindful that the college could impose an even stricter penalty on the transgressor(s).

Course Outline

Week Topics

1, 2. Introduction to: instrumental analyses, measurements and errors, statistics, course goals and methods. Spectroscopy: general introduction, light interactions.

3. Spectroscopy: instrument design, sources, monochromators, detectors. NO CLASS on January 21, 2009 this class will be made up on April 29th the study day.

4. Atomic Spectroscopy: instruments, methods, emission & absorption, arc spark, flame, plasmas, furnaces.

5. No classes AAFS Meeting February 18 possibly 2/17 to 21, 2008, Washington, D.C. Students should be aware of the advantages of attending this meeting. Go online to AAFS for information.

6. Molecular Spectroscopy - UV, visible, luminescence, fluorescence, phosphorescence.

7. Vibrational - rotational spectra.

8. Midterm examination - on or about March 4, 2008. This may move forward or backward one week.

9. FT infrared and Raman instruments - Data generation and other special techniques.

10. Introduction to separation techniques: general treatment of the principles and theory of separation techniques. (Distillation & crystallization). Solvent extraction and partition methods: solvent extraction as an isolation procedure prior to further analysis. Use in drug and toxicological analysis.

11. Chromatography: absorption and partition process. Procedures and applications of column, paper and thin layer chromatography. Gas chromatography: components of the gas chromatograph; discussion of hyphenated techniques.

12. Gas chromatography (cont'd): gas chromatograph detectors - theory and operation. High performance liquid chromatography (HPLC) instruments and combined methods. Electrophoresis, SCF extraction.

13. X-Ray methods - fluorescence, and diffraction, instruments, theory, methods.

Lecture periods and topics are planned but may be varied due to time restraints and student progress. The Mid Term will likely be in week 8, but this may vary by a week or two either way.

Final Grade Calculation:

The final grade is based on the following:
Mid Term 35%
Final Exam 35%
Lab Grade 30%

Laboratory Grade:

There are seven laboratories assigned this semester based on a possible nine in the lab manual. The lab grade will be based on the best five grades. That is, the lowest grades will be dropped. All seven labs need to be completed or an Incomplete will be given. Laboratories completed late to cure an incomplete will result in a grade with a 25% penalty for tardiness if less than four weeks late. If greater than four weeks the penalty will be 50% of the earned grade.

Labs are graded 75% on result and 25% on documentation and write up of results. Quantitative grades are based on deviation from reference value (see individual lab notes). Answers to lab questions in handouts may be spot checked and points deducted from the documentation grade if found by the instructor to be insufficient.

NOTE that in order to solve the problem of students not reporting lab results in a timely manner the following rules are in effect.

1) **No more than two labs** can be handed in for evaluation (grading) in any one week.

2) The last day to hand in lab books for grading is the last day the teacher is on campus prior to the final exam.

3) No student may have more than two (unreported and ungraded) unknowns at any one time (you must report and have graded a laboratory if you have two unknowns previously checked out prior to receiving a third unknown.)

IMPORTANT NOTE

Students are hereby put on notice that in order to ensure the safety of students, faculty and visitors all safety rules (especially safety eye ware) will be enforced. Failure to do so will mean ejection from the lab period.

Additionally, please **NOTE** that a student must have accumulated at least 110 raw points from the exams in order to receive a C and 125 raw points from the exams in order to receive a B for the entire course. That is, there is a minimum that you must attain in lecture in order to pass the course or receive a B. Raw points equal the total points accumulated from the Mid Term and Final Exams where each exam is valued at 100 points. If the exam values change the above referenced points will be adjusted proportionately.

Reading Assignments

Please read the indicated material prior to the lecture period as this is the expected procedure.

TEXTS: Forensic Chemistry by Suzanne Bell, Prentice Hall, Upper Saddle River NJ, (2006). "B" below means Suzanne Bell's Text.

Lecture Period	Reading Assignment Chapters **Read** materials in **Bell** text **FIRST**.
1,2	James and Norby 1st ed, Ch. 14, 2nd ed, Chapt. 16, "Microanalysis and Examination of Trace Evidence", B - Chapters 1, 2, 3.
3	B-Chapter 5.1 - 5.4.
4	Saferstein Vol. 1 Gun Shot Residue Chapter, B- Chapters 5.1 - 5.4
5	AAFS Meeting, Saferstein, Vol. 2 Chapt. 4 to p.189.
6	Saferstein, -Chapters 13, 14, 15. B - 5.2, 5.4, 6.1, 6.2, 6.3.
7	Saferstein, Vol. 3, Chapt's 3 and 4, B - 6.1, 6.2, 6.3, 7.1 - 7.5.
8	Midterm Exam.
9	B - review 5 and 6.
10, 11	Clark's Extractions, Kingston's handouts B - 4.1 -4.6, 5.5, 7, 8, 9, 10, Saferstein, Vol. 1, Arson and Explosives.
12, 13	Saferstein, Vol. 1, Paint Chapter, B – 12, B - 4, 7, 14, Saferstein, Vol. 2, Glass Chapter.

For practical application of many techniques **Read** appropriate sections in Clarke's Isolation and Identification of Drugs that cover the same instrumental techniques as in the Bell text and other Forensic Texts as it is a very good easy to understand source.