CEDAR CREST COLLEGE

Forensic Chemistry
FSC-507
Dr. Thomas A. Brettell
Fall 2008

Prerequisites: General Chemistry, Organic Chemistry, Instrumental Analysis

SYLLABUS

COURSE OBJECTIVES

1. Students will apply their knowledge of both organic and analytical chemistry in the classification and identification of controlled substances.

2. Students will study the various combustion reactions involved during the firing of a gun, arson, and explosions.

3. Students will apply their knowledge of organic, inorganic, and analytical chemistry for the analysis and identification of colorants used in ink and paint formulations.

4. Students will build upon their knowledge of organic chemistry in the area of polymers (adhesives and synthetic fibers).

5. Students will study the chemistry of soil and glass as forensic evidence.

COURSE OUTCOMES

1. Students will be able to design a protocol consisting of both presumptive and confirmatory tests, for the identification of an unknown controlled substance.

2. Provided with evidence from the site of a fire or explosion, students will be able to design a method for analysis, in order to determine whether or not the event was intentional or accidental.

3. Students will be able to design protocols for the instrumental analysis of organic and inorganic colorants found in ink and paint formulations.

4. Students will be able to design protocols for the identification of adhesive and synthetic fibers found at the scene of a crime.

5. Students will be able to identify the difficulties encountered in the analysis of soil and glass as forensic evidence.

REQUIRED MATERIALS FOR THE COURSE

There is no required book for this course because currently there is no single definitive well-written source to cover the content. Therefore, we will be using multiple texts and external reference sources. Texts are listed below. You may access the electronic versions of all the texts through ForensicnetBase. To access this service go to http://library.cedarcrest.edu then click on "full text" from the top menu. Next Scroll down to the FORENSICnet.Base tab *FSC 507 Forensic Chemistry Fall 2008* and click on it. You must be on campus to use this feature. Other required readings will either be distributed in class or posted on e-College.

MEETING TIMES

Lecture: Tuesday, Thursday: 9:30 – 10:45 AM; SCI-138

Instructor's office: Oberkotter 6; Phone: Ext. #3495

Office Hours: Regularly scheduled office hours are: Tues., Thurs. & Fri. 11 AM – 12 Noon.
I am always willing to help at anytime, if my schedule permits. Feel free to stop by whenever I am in my office. To ensure of my availability for assistance, it would be best to schedule an appointment.

Email: Tabrette@cedarcrest.edu

GRADING SYSTEM

The grade for this course is based on, three one-hour exams (300 pts), attendance/class participation (25 pts) and a comprehensive final exam (175 pts).

The final letter grade will be awarded according to the following scale:

93 – 100%	A	80 – 82.9%	B^-	67 – 69.9%	D^+
90 – 92.9%	A^-	77 – 79.9%	C^+	60 – 66.9%	D
87 – 89.9%	B^+	73 – 76.9%	C	Below 60%	F
83 – 86.9%	B	70 – 72.9%	C^-		

POLICIES

Classroom Attendance

Classroom attendance is **mandatory** in order to perform well in this class. If class is missed due to illness, sports event, or family emergence, the student is still responsible for any missed assignments and obtaining the lecture notes. No class participation points can be earned due to absences.

Attendance on Examination Days

Attendance on exam days is mandatory. If an exam is missed due to illness or a family emergency, a make-up test may be given upon receipt of a **written** excuse from either a doctor or the Dean of Students' Office.

Homework Assignments

Homework problems may be assigned throughout the course. At this level the student is expected to be able to complete these on her own. Answer keys will be posted and the instructor will be available to discuss or help the student upon her request.

Obtaining Assistance

Do not hesitate to seek assistance concerning class lectures, homework assignments, or grading. If the student can not make it to the instructor's scheduled office hours, she should make arrangements to meet with the instructor at an alternative time at both the student's and the instructor's convenience.

Honor Philosophy

"The Cedar Crest College Honor Philosophy states that students should uphold community standards for academic and social behavior in order to preserve a learning environment dedicated to personal and academic excellence. Upholding community standards is a matter of personal integrity and honor. Individuals who accept the honor of membership in the Cedar Crest College community of scholars pledge to accept responsibility for their actions in all academic and social situations and for the effect their actions may have on other members of the College community."

The instructor expects each student to abide by the college's honor code. This honor code applies to all activities associated with this course. The student should realize that the honor code is an important aspect of the educational process at Cedar Crest College.

Cedar Crest College Faculty and Administration support the following statement concerning Classroom Protocol:

> "Appropriate classroom behavior is implicit in the Cedar Crest College Honor Code. Such behavior is defined and guided by complete protection for the rights of all students and faculty to a courteous, respectful classroom environment. That environment is free from distractions such as late arrivals, early departures, inappropriate conversations, and any other behaviors that might disrupt instruction and/or compromise students' access to their Cedar Crest College education."

Please be sure to put all cell phones and pagers on vibrate during class times.

Community Standards for Academic Conduct:

"Academic integrity and ethics remain steadfast, withstanding technological change. Cedar Crest College academic standards therefore apply to all academic work, including but not limited to, handwritten or computer-generated documents, video or audio recordings, and telecommunications.

As a student at Cedar Crest College, each student shall:

- Only submit work which is his/her own.
- Adhere to the rules of acknowledging outside sources, as defined by the instructor, never plagiarizing or misrepresenting intellectual property.
- Neither seek nor receive aid from another student, converse with one another when inappropriate, nor use materials not authorized by the instructor.
- Follow the instructions of the professor in any academic situation or environment, including taking of examinations, laboratory procedures, the preparation of papers, properly and respectfully using College facilities and resources, including library and computing resources to ensure that these resources may be effectively shared by all members of the College community.
- Abide by the Cedar Crest Computer Use Policy.
- If a student perceives a violation of the Academic Standards, he/she will go to their instructor.
- If you are unable to resolve the problem with the instructor, you should go to the chair of the department. If you need further assistance after the consultation with the instructor and the chair, you should see the Provost."

It is the instructor's policy to deal with violations of these Standards for Academic Conduct by awarding a grade of 0 for the assignment or examination in question.

Students with Learning Disabilities

The instructor supports the Cedar Crest College policy regarding learning disabilities as follows:

> "Students with documented disabilities who may need academic accommodations should discuss these needs with their professors during the first two weeks of class. Students with disabilities who wish to request accommodations should contact the Advising Center."

CHRONOLOGICAL PLAN FOR THE COURSE

The schedule on the following page lists the dates and topics, which constitute the lectures pertaining to this course. A summary of the testing schedule and content is provided. The schedule **may be** modified throughout the course, as needed.

Testing Schedule Summary

2007 Date	Test	Material Included
Thurs. 9/18	Exam 1	Lectures 1 through 7 plus reading materials
Thurs. 10/23	Exam 2	Lectures 8 through 14 plus reading materials
Tues. 11/18	Exam 3	Lectures 15 through 20 plus reading materials
TBA	Final Exam	Comprehensive

Lecture Topics Schedule

Date:	**Topic**	**Reading Assignment**:
8/26	Introduction to Forensic Chemistry	Handout
8/28	Statistics in Forensic Chemistry	Ref. 1, Ch. 13.3: Ref. 10, Ch. 5 & 12
9/2	Sampling, and Data Quality	Handout
9/4	Multivariate Statistics, Calibration, and Quality Control	Handout
9/9	Sample Preparation, & Immunoassay	Ref. 3, Ch. 5.2.6; Appendix L
9/11	Forensic Aspects of Controlled Substances	Ref. 2, Ch. 1
9/16	Forensic Drug Analysis I	Ref. 5, Ch. 4
9/18	**Exam 1**	
9/23	Forensic Drug Analysis I	
9/25	Forensic Drug Analysis II: Basic Drugs	
9/30	Forensic Drug Analysis I	
10/2	**No Class - NEAFS**	
10/7	Chemistry of Clandestine Drug Production	Ref. 3, Ch. 5
10/9	Chemistry of Medico-legal Analysis of Ethanol	Ref. 6, Ch. 5; Ref. 4, Ch. 12
10/14	**Fall Break!**	
10/16	Chemistry of Combustion and Explosives	Ref. 7, Ch. 1
10/21	Chemistry of Combustion and Arson	Ref. 8, Ch. 4
10/23	**Exam 2**	
10/28	Combustion Part II: Forensic Analysis of Physical Evidence Associated with Combustion	Ref. 9, Ch. 11
10/30	"	
11/4	Chemistry of Color and Colorants	Ref. 10, Ch. 8
11/6	"	
11/11	Forensic Chemistry and Analysis of Inks	Ref. 4, Ch. 13 (pp. 727-738)
11/13	Forensic Chemistry and Analysis of Paints	Ref. 4, Ch. 8; Ref. 10, Ch.7, 9-11
11/18	**Exam 3**	
11/20	Chemistry & Forensic Analysis of Glass	Ref. 4, Ch. 4; Ref. 10, Ch.2,4
11/25	**Happy Thanksgiving!**	
11/27	Overview of Polymers	Ref. 1, Ch. 1
12/2	Forensic Analysis of Paper, Fibers, & Polymers	Ref. 5, Ch. 6
12/4	Chemistry & Forensic Analysis of Soil	Ref. 4, Ch. 11
TBA	**Final Exam**	

BIBLIOGRAPHY:

Baden, M. M.; Hennessee, J. A. *Unnatural Death: Confessions of a Medical Examiner*, Ballantine Books, New York, 1989.

Bell, S. *Forensic Chemistry*, Pearson Prentice Hall, Upper Saddle River, New Jersey, 2005. ISB.N: 0-13-147835-4

Beveridge, A., Fung, T., MacDougall, D., "Use of Infrared Spectroscopy for the Analysis of Paint Fragments" in *Forensic Examination of Glass and Paint*, B.Caddy, editor, Taylor and Francis, 2001.

Bono, J. P. *Drug Abuse Handbook Chapter 1, Criminalistics: Introduction to Controlled Substances*, Taylor & Francis.

Brewer, W. E.; Galipo, R. C.; Morgan, S. L.; Habben, K. H. "Confirmation of volatiles by solid-phase microextraction and GC/MS," *J. Anal. Toxicol*. **1997**, *21*(4), 286-290.

Caddy, B. *Forensic Analysis of Glass and Paint Analysis and Interpretation*, Taylor & Francis, 2001.

Christian, D. R. *Forensic Investigation of Clandestine Laboratories*, CRC Press.

Davis, G. *Forensic Science*, American Chemical Society, Washington, DC, 1986.

Dwyer, J.; Kocieniewski, D.; Murphy, D; Tyre, P. *Two Seconds Under the World: Terror Comes to America (The Conspiracy behind the World Trade Center Bombing*, Crown Publishers, Inc., New York, 1994.

Emsley, J. *The Elements of Murder: A History of Poison*, Oxford University Press, USA, 2006. ISBN: 978-0192806000.

Evans, C. *The Casebook of Forensic Detection*, John Wiley & Sons, New York, 1996.

Fisher, D. *Hard Evidence*, Bantam DoubleDay Dell Publ. Group, NY, 1995.

Gerber, S. M., Ed., *Chemistry and Crime; From Sherlock Holmes to Today's Courtroom*, American Chemical Society, Washington, DC, 1984. ISBN: 978-0841207851.

Gerber, S. M., Saferstein. R., Eds., *More Chemistry and Crime; From Marsh Arsenic Test to DNA Profile*, American Chemical Society, Washington, DC, 1984. ISBN: 978-0841234062.

Ho, M. H. *Analytical Methods in Forensic Chemistry*, Ellis Horwood, Ltd., London, 1990.

Houck, M., Siegel, J. *Fundamentals of Forensic Science*, Elzevier/Academic Press 2006.

Hunt, S. M. *Investigation of Serological Evidence: A Manual for Field Investigators*, Charles C. Thomas Publ. Ltd., London, 1984.

James, S. H., Nordby, J. J. *Forensic Science, An Introduction to Scientific and Investigative Techniques,* (CRC Press, 2003).

Johll, M. *Investigating Chemistry; A Forensic Science Perspective*, W.H. Freeman and Co., New York, NY, 2007. ISBN: 978-0-7167-6433-5.

Khan, J., Kennedy, T. J., Christian, Jr., C. *Basic Principles of Forensic Chemistry*, Humana Press, 2008. ISBN: 978-1-934115-06-0

Lowry, W. T. *Forensic Toxicology: Controlled Substances and Dangerous Drugs*, Plenum Publ. Co., NY, 1979.

Maples, W. R.; Browning, M. *Dead Men Do Tell Tales*, Bantam DoubleDay, NY, 1994.

Meloan, C. E., James, R. E., Saferstein, R. *Laboratory Manual for Criminalistics*, Pearson Prentice Hall, Upper Saddle, NJ, 2007. ISBN: 0-13-221657-4.

Robertson, J. *Forensic Examination of Fibres,* (Ellis Horwood , 1992).

Saferstein, R. *Criminalistics: An Introduction to Forensic Science,* 9th. ed. Pearson Prentice Hall, Upper Saddle River, New Jersey, 2006. ISBN: 0-13-221655-8.

Saferstein, R. *Forensic Science Handbooks I, 2nd Ed,* Pearson Prentice Hall, Upper Saddle River, New Jersey, 2002.

Saferstein, R. *Forensic Science Handbooks II,* Pearson Prentice Hall, Upper Saddle River, New Jersey, 2005.

Saferstein, R. *Forensic Science Handbooks III,* Pearson Prentice Hall, Upper Saddle River, New Jersey, 2005.

Tebbett, I., Ed., *Gas Chromatography in Forensic Science*, Ellis Horwood, Ltd., London, 1993.

Terry, I. M.; Robertson, J. C. *Instrumental Data for Drug Analysis*, CRC Press, Boca Raton, FL, 1991.

Wecht, C.; Curriden, M.; Wecht, B. *Grave Secrets*, Penguin books USA, Inc., New York, 1996.

Widmark, E. M. P. *Principles and Applications of Medico-Legal Alcohol Determination*, translated from original 1932 ed., Biomedical Publications, Davis, CA, 1981.

Yinon, J., Ed., *Forensic Applications of Mass Spectrometry* (Modern Mass Spectrometry), CRC Press, Boca Raton, FL, 1995.

READING REFERENCE ASSIGNMENTS:

You may access the electronic versions of all the texts listed below through ForensicnetBase via the Crestman Library website. To access this service go to http://library.cedarcrest.edu then click on "full text" from the top menu. Next Scroll down to the FORENSICnet.Base tab *FSC 507 Forensic Chemistry Fall 2008* and click on it. You must be on campus to use this feature. Other required readings will either be distributed in class or posted on e-College.

1) James Robertson, *Forensic Examination of Fibres*, 2nd Edition, (Ellis Horwood , 1999).
2) *Drug Abuse Handbook, 2nd Ed*., Chapter 1, Criminalistics: Introduction to Controlled Substances, Joseph P. Bono, Taylor & Francis, 2008.
3) Donnell R. Christian, *Forensic Investigation of Clandestine Laboratories*, (CRC Press)
4) Richard Saferstein, *Forensic Science Handbook* I (2nd Ed, 2002) (Prentice Hall).
5) Richard Saferstein, *Forensic Science Handbook* II (2005), (Prentice Hall).
6) *Drug Abuse Handbook*, 2nd Ed., Chapter 5, Alcohol, Alan Wayne Jones, (Taylor & Francis, 2008).
7) *Practical Bomb Scene Investigation*, James T. Thurman, Chapter 6, Explosion Theory and Dynamics, (Taylor & Francis, 2006).
8) *Practical Fire and Arson Investigation*, 2nd Ed., David Redsicker and John J. O'Connor, Chapter 4, Chemistry and Behavior of Fire, (CRC Press, 1997).
9) *Techniques of Crime Scene Investigation*, Barry Fisher, 7th Ed., Chapter 11, Arson and Explosives (CRC Press, 2004).
10) Brian Caddy, *Forensic Analysis of Glass and Paint Analysis and Interpretation*, (Taylor & Francis, 2001).