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FRSC 475-002: Forensic Chemistry & Lab

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Chemistry: *Spring 2022 Course Syllabus*

NJIT Academic Integrity Code: All Students should be aware that the Department of Chemistry & Environmental Science (CES) takes the University Code on Academic Integrity at NJIT very seriously and enforces it strictly. This means that there must not be any forms of plagiarism, i.e., copying of homework, class projects, or lab assignments, or any form of cheating in quizzes and exams. Under the University Code on Academic Integrity, students are obligated to report any such activities to the Instructor.

COURSE INFORMATION

FRSC 475 Course Description: This course intends to develop students' abilities to properly conduct chemical analyses as applied to the law. Students will become familiar with the following topics: 1) selecting the appropriate methods and procedures for the analysis of evidence/samples; 2) appropriate recording and storage of experimental results and data; 3) appropriate reporting experimental results; 4) troubleshooting and maintaining analytical instrumentation and 5) providing expert testimony.

It will cover the analysis of **drugs of abuse, explosives, paint and coating examination, fire debris analysis, latent fingerprints, chemical kinetics and basics in the modern instrumental analysis** including mass spectrometry (MS), gas chromatography (GC), liquid chromatography (LC) and nuclear magnetic resonance (NMR). The course has two components: lecture plus lab work.

It will be to the student's advantage to continue to read and reread the chapters in their textbooks on laboratory techniques throughout the semester. There are also some practical aspects of chemical analysis that are best learnt during the lab sections. Students are encouraged to ask questions before it is too late and the mistakes have already been committed.

Number of Credits: 4

Prerequisites: CHEM 222

Course-Section and Instructors

Course-Section	Instructor
FRSC 475-002	Dr. Hao Chen Email: hao.chen.2@njit.edu Telephone: 973-596-8571 Office: York office 232

Lecture time: Tue 3:15-5:10 pm, FMH 313

Laboratory time: Thur 1:00-5:20 pm, Tiernan Hall Room 209

Note that we will use Webex (<https://njit.webex.com/meet/hc2018>) for our lectures and labs from Jan 18-31.

Office Hours: **With an appointment**

Please send an email to schedule an appointment.

If you need assistance and wish to discuss with your instructor, please email to schedule a meeting. I will be more than happy to help.

E-Mail: All E-mail to me should start with FRSC 475 in the subject so that it can be filtered appropriately. Any e-mail pertaining to your academic standing (i.e., grades) must be sent from your NJIT account. Anonymous e-mail will not be read.

Lab protocol will be distributed before each lab from instructor.

Reference Textbook: Forensic Chemistry, Suzanne Bell, Second Edition, Pearson Education Limited 2014, ISBN 10: 1-292-02044-X, ISBN 13: 978-1-292-02044-0

Secondary textbook: Forensic Chemistry- Fundamentals and Applications, Edited by Jay A. Siegel, Publisher: Wiley Blackwell, 2016, ISBN 978-1-118-89772-0.

Other required material:

- Hard-cover laboratory notebook
- Lab coat (white color, available online)
- Safety goggles (available at the NJIT Bookstore or Home Depot)
- Disposable nitrile gloves (available online or at Home Depot)
- Mask needs to be worn all the time during each lab (also keep social distancing)

The Department of Chemistry sells a limited amount of Personal Protective Equipment (PPE) kits that include the lab coat, goggles, and 20 pairs of gloves. **You are responsible of bringing your own PPE to the lab.**

POLICIES

All CES students must familiarize themselves with, and adhere to, all official university-wide student policies. CES takes these policies very seriously and enforces them strictly.

Grading Policy: The final grade in this course will be determined as follows: **Lecture 50%, Lab 50%**

Lecture grades	
Homework	10%
Exam I	15%
Exam II	15%
Term Paper	10%
Lab grades	
Attendance and Discussion Questions	5%
Quiz 1	5%
Quiz 2	5%
Laboratory reports	30%
Oral presentation	5%

Your final letter grade in this course will be based on the following tentative curve:

A	90-100	C	70-75
B+	86-89	D	60-69
B	80-85	F	<60
C+	76-79		

Laboratory reports will be an individual assignment, and each student will do an oral presentation on one of the

experiments at the end of the semester. In addition, quizzes will be given to each student.

Attendance and laboratory notebook usage: Attendance to all laboratory sessions is **mandatory**. A missed laboratory session without an excused absence will result in a grade of zero (0) for that experiment. A second unexcused absence will result in a grade of zero (0) for the course lab component. An excused absence must be obtained from the instructor before the relevant lab. An excused absence will only be granted for verifiable documented reasons of serious illness or family emergency.

Safety and cleanliness: **Wear facial mask at all time, due to the pandemic of COVID-19**. Wear your safety goggles at all times while in the laboratory. Clothing that covers your legs and shoulders is required. No shorts or skirts. Everyone will be required to wear lab coats and gloves during all experiments. Closed shoes must be worn at all times. Food or drinks are not allowed in the lab. Turn off cell phones and do not use them in the lab. Properly dispose of waste materials. Clean up your workspace at the end of each lab session and wash your hands prior to leaving the laboratory.

Laboratory reports: Each lab report is due one week after the end of each experiment. The format of the laboratory report can be found below, and the exact rubric used for grading will be circulated to the students via email.

Laboratory reports must be submitted on Canvas in .doc, .docx, or .pdf format, and will be checked for plagiarism by Turnitin.

Oral presentation: Each student will present one of the lab experiments during a 15-20 minutes presentation during the last lab session of the semester. These presentations will occur on Webex, and the student will need to submit their presentation ahead of time and present it online. This presentation will be worth 5% of the final grade. Detailed assignment information and grading rubric will be provided during the semester.

Syllabus modification: Any modification of this syllabus will be distributed in class and via e-mail.

Cellular Phones: All cellular phones and other electronic devices must be switched off during all lab times. Such devices must be stowed in bags during exams or quizzes.

ADDITIONAL RESOURCES

Chemistry Tutoring Center: Located in the Central King Building, Lower Level, Rm. G12. Hours of operation are Monday - Friday 10:00 am - 6:00 pm. For further information please click [here](#).

Accommodation of Disabilities: Office of Accessibility Resources and Services (*formerly known as Disability Support Services*) offers long term and temporary accommodations for undergraduate, graduate and visiting students at NJIT.

If you are in need of accommodations due to a disability please contact Chantonette Lyles, Associate Director at the Office of Accessibility Resources and Services at [973-596-5417](tel:973-596-5417) or via email at lyles@njit.edu. The office is located in Fenster Hall Room 260. A Letter of Accommodation Eligibility from the Office of Accessibility Resources Services office authorizing your accommodations will be required.

For further information regarding self-identification, the submission of medical documentation and additional support services provided please visit the Accessibility Resources and Services (OARS) website at:

- <http://www5.njit.edu/studentssuccess/disability-support-services/>

Important Dates (See: Spring 2022 Academic Calendar)

January	18	Tuesday	First Day of Classes
May	3	Tuesday	Last Day of Classes
May	6	Friday	Final Exams Begin
May	12	Thursday	Final Exams End
May	14	Saturday	Final Grades Due

Tentative Course Schedule

	Lecture Topic	Lab Topic
1	Introduction	Lab #1: TLC ink analysis
2	MS, LC/MS, GC/MS, UV and IR	Lab #2: Plastic film by FT-IR
3	Drugs of abuse	Lab #3: Car paint analysis by FT-IR
4	Explosives	Lab #4: TLC-MS analysis of drinks
5	Paint and coating examination	Lab #5: MS analysis of drug in urea
6	Fire debris analysis	Lab #6: MS analysis for explosives
7	Latent fingerprint	Lab #7: Analysis of Controlled Dangerous Substances by LC/MS
8	Chemical Kinetics	Lab #8: Blood Alcohol Analysis by GC
		Lab #9: Arson (Fiber Debris) Analysis by GC

Term Paper requirement

The term paper should review a novel forensic chemistry research paper published no earlier than 2019 in a forensic journal such as **Journal of forensic sciences, Science & Justice, and Forensic Chemistry, etc.** You are assigned to assess the merit, novelty, and validity of the work presented in the paper. *Hint: it is easier to review a well written paper than a poorly written one.* Your term paper should be structured as followed:

1. **Abstract** a one paragraph summary of your critique that should appear on the title page.
2. **Introduction** provide information regarding why the research is important and interesting. Should contain merit and broader implications (What good will come from this research?). Should also describe broader implications (can this research be used for other problems?).
3. **Novelty** present competing methods and explain the novelty of the presented method (is it better, faster, cheaper, easier?).
4. **Validation** critically assess the paper (are the goals accomplished? are the conclusions adequately and unambiguously supported by the results? how did the authors convince you that the results are accurate?).
5. **Conclusion** summarize the three previous sections, the conclusion and the three previous sections should end in a summary.
6. **Literature Cited**

Laboratory report format and guidelines

Laboratory reports are an important part of science education. Students in chemistry and biology will be expected to write professional laboratory report. Therefore, in this course you will be introduced to several of the major components of writing a laboratory report. It is my hope that this course will give you an advantage in upper level courses.

The format

Clarity of expression, correct grammar, spelling and paragraphing are expected. The lab report will consist of the following and must be in the order below: All components will be in paragraph form and must be double typed double spaced in Times New Roman 11-point font with 1" margins. Do not list anything. Data and results must be put in tables. Schemes and figures must be prepared using a proper software such as Biovia (free), ChemSketch (free), ChemDoodle (free), or ChemDraw. They can also be neatly written down in ink.

Tables

They must be numbered using Roman Numerals: (I, II, III----etc) Figures & Graphs should be numbered using alpha numerals (1, 2, 3-----etc).

Introduction: Objective and Theory

The introduction must contain a discussion of the basic principles the lab is illustrating. This must be in your own words and not a paraphrase of the published experiment in your lab manual. You must cite statements of fact not ordinarily known using the following method: [#] at the end of the sentence containing the information. Do not include extraneous facts that do not pertain directly to the objective of the lab. Any equations used should be included along with a discussion of how they will be used.

Procedures and observations

Writing a procedure for a chemical experiment involves using a formal and stylized writing approach. The experimental section will consist of a short paragraph that includes a sentence that refers the reader to some source for the procedure. Details from the published procedure and any experimental hints or tips that may aid the reader in understanding and repeating the experiment should be included. All reagents used must be reported in as the quantity you actually used (in parentheses, followed by the number of moles). All products used must be reported in as the quantity you actually used (in parentheses, followed by the number of moles) and % yield.

Results

The results section should contain tables, graphs and illustrations.

- Tables should be numbered using ROMAN NUMERALS. (Table I, Table II, Table III...)
- Graphs and illustrations should be numbered using ALPHANUMERICS (Figure1, Figure 2, Figure 3...)
- Label the x and y axes of your graphs with an informative label and include the units. For instance for a mass spectrum the x axis would be "mass/charge ratio (m/z)" while the y axis might be "relative ion intensity (counts)".
- All tables, graphs and illustrations should have an informative title: "Table I – Experimental Melting Points"
- All raw data that is used to perform calculations must be put in a table.

Calculations

Show all equations you used to calculate your result. For instance, if you are calculating percent error you must first include the equation for percent error as follows:

$$\% \text{ error} = \left\{ \left[\frac{|ExpVal - AccptVal|}{AccptVal} \right] \right\} 100$$

- This can be typed (good time to learn how to use the equation writer in MSWord) or neatly handwritten in ink.
- Follow with the actual calculation (can be neatly hand written in ink) using correct significant figures and units.
- If your lab requires repetitive calculations, you only need to include one of these calculations in your report.

- Percent yield calculations: Refer to General Chemistry 1 notes on limiting reactant, theoretical yield and percent yield calculations. Show all steps for full credit.

Discussion (400 and 1200 words)

This is an important part of your laboratory report. In this section you will do the following:

- Restate your final results: "The two inks were found to come from the same source-----"
- If possible compare your results to expected or literature values.
- Explain the meaning of your results:
 - Did you achieve your goal? Why or why not.
 - Did your results match literature values? Report literature value and % error.
 - If your value was too high, explain why. Be specific.
 - If your value was too low, explain why. Be specific.
 - Discuss how this laboratory relates to chemistry. Explain what principles and concepts it illustrates.
 -

Conclusion

Provide a global conclusion regarding your experimental results. This section should be 100 – 250 words.