

FRSC 602-003: Forensic Chemistry

Fall 2025

INSTRUCTORS

	Dr. John Sivey	Dr. Mary Devadas
Office Location	SC 4301A	SC 3301B
Office Hours	Wed and Fri (11:00 – 11:30 AM) and by appointment	By Appointment
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INTENDED AUDIENCE

The intended audience for this course is Forensic Chemistry Track students enrolled in the Forensic Science MS program. We assume that all members of the class are interested in growing their skills pertaining to chemical analysis, instrumentation, and the associated forensic applications.

COURSE TIMES AND LOCATIONS

Wednesday and Friday, 9:00 – 10:50 AM in SC 5331

COURSE COMMUNICATION

We make every effort to reply to emails promptly (typically within one business day). Emails received on Fridays and on weekends can anticipate a reply by the following Monday. You are expected to check the course Blackboard site daily for important updates. Additional information may be communicated to you via your TU email account.

COURSE OVERVIEW

This is an advanced course in analytical chemistry emphasizing the theory of instrumental analyses and applications to forensic science. You will learn how professional scientists determine the organic and inorganic composition of solutions and materials in both “clean” and complex samples using a variety of analytical instruments. Topics to be examined include: spectrophotometry, electron microscopy, liquid chromatography, gas chromatography, mass spectrometry, and atomic spectroscopy. We will also cover important quality assurance considerations, including sample preparation techniques and advanced calibration strategies.

COURSE LEARNING OBJECTIVES

After completing this course, you should be able to:

1. Explain the operational theory of selected instrumental methods of analysis
2. Describe forensic applications of the instrumental methods discussed in class
3. Discuss the advantages and limitations of selected instrumental methods of analysis
4. Design analytical experiments to solve interdisciplinary problems in forensic chemistry
5. Apply appropriate computational and statistical tools to assess analytical data
6. Propose troubleshooting strategies for systematic errors associated with instrumental operations
7. Critically assess reports related to forensic chemistry from the peer-reviewed literature

REQUIRED MATERIALS

- Textbook: *Essential Methods of Instrumental Analysis*, by Frank M. Dunnivant and Jake W. Ginsbach, Wiley, 2024.
- Safety goggles, black ultra-fine-point permanent marker, and a bound composition notebook or a laptop/tablet for record keeping in lab
- Scientific calculator

ATTENDANCE POLICY

Attendance at laboratory sessions is **mandatory**. Attendance at all lecture sessions is expected. The course calendar delineates which class meetings are lecture sessions and which are laboratory sessions. Some material covered in class is not covered in the textbook. **All** material covered in class is “fair game” for exams. If you miss a class, be sure to contact a colleague to obtain copies of any missed material not otherwise available on Blackboard.

Out of respect for your busy schedules, we make it a priority to start class on time and to finish class on time. Please demonstrate mutual respect for all members of the class by arriving on time and remaining for the duration of each class. If an unavoidable circumstance requires you to arrive late or leave early, please inform the instructors (in advance, if possible) via email.

COPYRIGHT NOTICE

Unless otherwise noted, we retain the copyright to all course materials, including, but not limited to, lecture slides, videos, notes, practice problems, worksheets, assignments, answer keys, lab materials, protocols, methods, and exams. You may not (nor may you allow others to) repost, sell, or otherwise distribute these materials in any fashion at any time.

POLICY CONCERNING ELECTRONIC DEVICES

Cell phones must be in silent mode and remain stowed out of sight for the duration of each lecture and lab session. A laptop or tablet may be used for note taking (in lecture) and data analysis (in lab); however, any use of a laptop or tablet for non-course-related activities (e.g., messaging, web surfing, etc.) is strictly prohibited. Be sure to turn “off” all messaging apps or other notifications so that you can get the most out of your time in class. Your neighbors will appreciate your commitment to a distraction-free class environment. Students not adhering to this policy will be asked to leave, and an unexcused absence will be recorded.

TIPS FOR PARTICIPATING IN LECTURE SESSIONS

- Arrive at least 5 minutes early so that you can get settled and review your notes before class begins.
- We will post all slides following each class session, so you do not need to copy what is shown on the slides. You will, however, want to take notes on the explanations and discussions that supplement the slides because class sessions will not be recorded.
- We strongly encourage you to ask questions during class.

STATEMENT ON DIVERSITY AND INCLUSION

The students, faculty, and staff at Towson University represent a diverse and vibrant community of learners and scholars. As a community, we value the unique contributions of each individual and promote active participation in all aspects of the learning process by each community member. We support Towson University’s goal of fostering a diverse and inclusive educational setting. We strive to create an educational environment built upon the principles of mutual respect and support. Toward this end, all participants in this course are expected to demonstrate respect for all other members of the class, both within and outside of the classroom. If you feel these expectations have not been met, please speak with us or with the designated diversity liaison, Dr. Cindy Zeller (czeller@towson.edu). For further information regarding diversity and inclusion policies, please see [Towson University’s Office of Inclusion and Institutional Equity](#), [the Fisher College of Science and Mathematics Diversity Action Plan](#), and the [Department Diversity Action Plan](#).

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

If you may need an accommodation due to a disability, please contact me privately as soon as possible to discuss your specific needs. A memo from Accessibility & Disability Services is required. It is your responsibility to present this paperwork in a timely fashion and to follow-up regarding accommodations that require our participation (e.g., testing accommodations). If you think accommodations might be appropriate, please contact [Accessibility & Disability Services](#) (Phone: 410-704-2638).

ACADEMIC INTEGRITY STATEMENT

The reputation of Towson University and the intrinsic value of your academic degree hinge on the personal integrity of each member of the TU community. The instructors assume a proactive role in preventing and reporting academic integrity violations; you are expected to do the same. Examples of academic integrity violations include (but are not limited to) all forms of: cheating, plagiarism, unauthorized collaborations, inappropriate use of artificial intelligence, alteration of graded assignments, forgery, falsification, lying, and facilitating academic dishonesty.

The penalty for academic integrity violations may include receiving a failing grade for the assignment or receiving an “F” as the final grade for the course. If you have questions regarding how best to avoid academic integrity violations, please consult with me.

For some activities in this course, collaboration with your colleagues and use of artificial intelligence (AI) tools is encouraged. Examples are provided below to clarify what types of collaboration and AI use are acceptable.

Acceptable Activities:

- Working in groups to determine the key concepts or general strategies that may be relevant to an assignment. Then, each member of the group works alone when writing their responses to ensure that your *individual* understanding of the assignment is expressed in your *individual* responses
- Answering a colleague’s question in a manner similar to how an instructor would answer the question (i.e., helping your colleague to understand the concepts *without* giving away the answers)
- Asking a colleague questions such as, “What resources did you find most helpful when approaching this problem?”
- Using AI to edit complete drafts of your writing or to help you brainstorm

Unacceptable Activities:

- Collaborating in *any* fashion on exams
- Sharing answers to an assignment
- Sharing Excel spreadsheets
- Asking a colleague questions such as, “Is this the answer you arrived at?”
- Using AI as a substitute for your own critical thinking, analysis, or writing

We encourage you to review the entire [Student Academic Integrity Policy](#).

EVALUATION AND GRADING

The evaluation items shown below will contribute to your final grade.

<i>Evaluation Item</i>	<i>Contribution to Final Grade</i>
Assignments (Dr. Sivey’s modules)	25%
Assignments and Final Presentation (Dr. Devadas’s modules)	15%
Exam 1 – Sept. 26 (Dr. Sivey)	20%
Exam 2 – Oct. 31 (Dr. Sivey)	20%
Exam 3 – Dec. 5 (Dr. Devadas)	20%

Exams: Exam dates are shown in the table above. **No make-up exams will be given.** If you miss an exam due to an unavoidable reason, the makeup exam will be an oral exam scheduled outside of regular class hours. During exams, students may not leave the room and must remain in their seats at all times prior to submitting their exam (exception: emergencies). Students not adhering to these policies will receive a grade of “zero” on the exam.

Assignments: Some assignments will be completed in class; others will be completed outside of class. For in-class assignments, **no make-up assignments will be given**. Assignments will often require you to synthesize your interdisciplinary knowledge of chemistry and apply it to understanding forensic applications and cutting-edge technologies. Grades for lab assignments will be reduced by up to 50% if you do not attend all lab periods associated with the assignment (excepting unavoidable absences).

Submitting Assignments: Unless indicated otherwise, all assignments must be submitted as **pdf files** using links provided on Blackboard. Other file types (e.g., Word documents) will *not* be accepted. It is your responsibility to ensure that all files are uploaded properly onto Blackboard before the deadline. We recommend viewing any uploaded assignments in Blackboard to confirm that the file appears as you intended.

Late Policy: Assignments designed to be completed in class will not be accepted if late; no make-ups for such assignments will be permitted. Other assignments submitted late will be assessed a 10% late fee per calendar day (deducted from the total points available on the assignment) or, if more than two (2) calendar days late, will receive a grade of zero. Early submissions are encouraged. Technological issues (e.g., Internet service disruption) are not valid reasons for missing submission deadlines. Do not wait until the last minute to submit assignments.

Final Course Grade: The grading scale is shown below. There is no “curve” for this course; as such, you are not in competition with your colleagues.

Overall Average	Course Grade
≥ 93.0	A
90.0 – 92.9	A-
85.0 – 89.9	B+
80.0 – 84.9	B
70.0 – 79.9	C
< 70.0	F

COURSE TOPICS

<i>Topics*</i>	<i>Approximate Exam Coverage</i>		
	<i>#1</i>	<i>#2</i>	<i>#3</i>
Fundamentals of calibration, figures of merit, quality assurance, and quality control			
Spectrophotometry (UV-vis)			
Noise and signal-to-noise ratios			
Advanced calibration methods			
Fundamentals of chromatography			
High-performance liquid chromatography (HPLC)			
Sample preparation			
Theory of liquid-liquid extraction			
Gas chromatography (GC)			
Mass spectrometry and tandem mass spectrometry (including LC-MS)			
Atomic spectroscopy (ICP-MS, ICP-OES)			
Fluorescence and Vibrational Spectroscopy			
Electron Microscopy			
Energy Dispersive X-Ray Spectroscopy			
Photoelectron Spectroscopy			
X-ray Diffraction			

* Forensic applications will be incorporated throughout the topics shown in this table.

LABORATORY POLICIES

- *Required clothing:* **Closed-toe shoes** are mandatory. Shoes must **completely** cover the entire foot. Shorts are not permitted. No exposed skin is permitted from the shoulders to the toes. Students lacking appropriate clothing will not be allowed to conduct experimental work.
- *Safety goggles:* Approved safety goggles must be worn whenever anyone in the lab is working with chemicals or glassware.
- *Nitrile gloves:* Wearing nitrile gloves while handling concentrated acids (≥ 1 M), concentrated bases (≥ 1 M), and organic solvents is required. Please remove gloves as soon as you are finished transferring the acid, base, or organic solvent. Gloves should not be worn while touching faucets, doorknobs, computers, or other common-use items. Gloves should not be worn in the hallway.
- *Cleanliness:* Cleanliness is a prerequisite for a safe and professional laboratory. In addition to posing significant safety hazards, an unclean or cluttered laboratory calls into question the quality of any data generated therein (If your lab bench is sloppy, how can others trust that your results aren't?). Students are required to keep their lab bench, assigned equipment (e.g., balances), and communal areas clean.
- *Food/Drinks:* Eating, drinking, and chewing gum are prohibited in the laboratory.
- *Be aware of your neighbors:* You will be working in close proximity to your fellow students in this laboratory. Walk slowly and avoid turning around abruptly so as to minimize bumping into others. If you see your neighbor doing something in a dangerous or inappropriate manner, say something to this neighbor and/or alert your instructor.
- *Waste disposal:* Many chemicals **cannot** be safely (or legally) disposed of down the drain. All chemicals must be disposed of as directed. If in doubt, please ask.
- *Accidents:* Notify the instructor **immediately** in the event of any accident or injury (regardless of how minor it may seem).
- *Personal electronics:* The use of cell phones is **not** permitted during laboratory (or lecture). Some chemicals in the laboratory can harm your cell phones. Please turn all cell phones off (or place on silent mode) and keep cell phones stowed at all times.
- *Laboratory notebook:* The proper recording of measurements and observations is central to any laboratory science. For all FRSC 602 laboratory experiments, you are required to record all data and pertinent observations. Method details should also be recorded when such details are not available elsewhere (e.g., in the lab handouts). Recording method details is particularly important during experiments in which you design the experimental methods.

A suitable laboratory notebook must be permanently bound with consecutively numbered pages (hand numbering is permissible) or an electronic equivalent. Writing notes on scrap paper for later recording is never acceptable.
- *Working in groups:* For some labs, you may have the opportunity to work in groups while performing the experiment. All group members are responsible for understanding and contributing to all components of the experiment, as well as for recording all methodological details and all raw data.
- *Pregnant students:* Pregnant students should consult their health care provider for advice on whether or not to perform experiments in the laboratory. Students are encouraged to provide their provider with a list of the chemicals that they might be exposed to while in lab. If a student is advised against performing laboratory work, the instructor will make appropriate accommodations for the student. Any accommodations will comprise a workload that is approximately equivalent to the regularly scheduled laboratory workload. These accommodations may include:

- Performing “dry” experiments only in a place free from exposure to ongoing “wet” experiments
- Performing “wet” experiments at a later date
- Receiving an incomplete grade in the course pending completion of experimental work
- *Additional tips:*
 - Never work in the laboratory without the knowledge and consent of your instructor.
 - If you do not know how to use a piece of equipment or an instrument, please ask the instructor before proceeding.
- *Accountability:* Your instructors reserve the right to reduce your grade for violations of lab policies, including (but not limited to) failure to wear goggles at all times, improper waste disposal, failure to keep your lab bench and assigned equipment clean, rowdy/disruptive behavior, use of cell phone, or failure to maintain proper laboratory records.

LABORATORY FEE

This course has a [lab fee](#) that is used to offset the costs of chromatography columns, vials, syringe filters, reference standards, chemicals, solvents, glassware, and plastic ware.

SYLLABUS SUBJECT TO CHANGE

Although we strive to adhere to the syllabus in its current form, all information, schedules, due dates, and policies outlined herein are subject to change. Any changes (including those potentially resulting from a University-wide emergency) will be announced via email and/or via Blackboard.

Course calendar on next page

COURSE CALENDAR

Date	Activity	Assignment Due ^a
Aug 27	Lecture – Drs. Sivey and Devadas	
Aug 29	Lecture – Dr. Sivey	
Sept 3	Lecture – Dr. Sivey	QA/QC Case Study
Sept 5	Lecture – Dr. Sivey	
Sept 10	Lecture – Dr. Sivey	
Sept 12	Lecture – Dr. Sivey	HPLC Simulator
Sept 17	LAB: High-performance liquid chromatography – Dr. Sivey	
Sept 19	LAB: High-performance liquid chromatography (cont.) – Dr. Sivey	
Sept 24	Lecture – Dr. Sivey	
Sept 26	EXAM 1 – Dr. Sivey	
Oct 1	Lecture – Dr. Sivey	HPLC Lab Worksheet
Oct 3	Lecture – Dr. Sivey	
Oct 8	Lecture – Dr. Sivey	
Oct 10	Lecture – Dr. Sivey	
Oct 15	LAB: Gas chromatography-mass spectrometry – Dr. Sivey	
Oct 17	FALL BREAK – No class meeting	
Oct 22	LAB: Gas chromatography-mass spectrometry (cont.) – Dr. Sivey	
Oct 24	Class Discussion of Journal Article – Dr. Sivey	
Oct 29	Lecture – Dr. Sivey	GC Lab Worksheet
Oct 31	EXAM 2 – Dr. Sivey	
Nov 5	Lecture – Dr. Devadas	
Nov 7	Lecture – Dr. Devadas	
Nov 12	LAB: Electronic and Vibrational Spectroscopy – Dr. Devadas	
Nov 14	LAB: Electronic and Vibrational Spectroscopy (cont.) – Dr. Devadas	
Nov 19	LAB + Lecture – Dr. Devadas	
Nov 21	Lecture – Dr. Devadas	
Dec 3	Lecture – Dr. Devadas	Spectroscopy Lab Worksheet
Dec 5	EXAM 3 – Dr. Devadas	
Dec 10	Presentations – Final exam day beginning 8:00 am – Dr. Devadas	

^a Unless indicated otherwise, all assignments must be submitted as a pdf file on Blackboard by 11:59 PM on the date indicated.