Spring 2024

FRSC 480-002: Forensic Microscopy

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NJIT New Jersey Institute of Technology

THE COLLEGE OF SCIENCE AND LIBERAL ARTS

THE DEPARTMENT OF CHEMISTRY AND ENVIRONMENTAL SCIENCE

FRSC 480: Forensic Microscopy

Spring 2024 Syllabus

M 11:30-3:50p (TIER 209)

W 12:15p-2:10p (FMH 305)

NJIT Academic Integrity Code: Students are asked to practice extra care and attention in regards to academic honesty, with the understanding that all cases of plagiarism (including using Artificial Intelligence such as ChatGPT), cheating, multiple submission, and unauthorized collaboration are subject to penalty. Students must properly cite and attribute all sources used for papers and assignments. Students may not collaborate on exams or assignments, directly or through virtual consultation, unless the instructor gives specific permission to do so. Posting an exam, assignment, or answers to them on an online forum (before, during, or after the due date), in addition to consulting posted materials, constitutes a violation of the University's Honesty policy. Likewise, unauthorized use of live assistance websites, including seeking "expert" help for specific questions during an exam can be construed as a violation of the honesty policy. All students should be familiar with the NJIT Academic Integrity Code.

COURSE INFORMATION

Course Description: Microscopy has been a scientific technique for centuries, and its application to forensic science is an invaluable tool. This course provides students with the basic knowledge and skills necessary to explore the application of microscopy to the forensic sciences. Sample handling and procedures are specific for the forensic student/practitioner. This course incorporates lectures and laboratory exercises organized in a format to engage each student in the analytical and investigative roles of different kinds of microscopes in the forensic professions. The general topics and techniques covered in this course include microscope nomenclature, alignment and focus, trace sample handling, and identification of unknown samples. Students will become familiar with the stereomicroscope, polarized light microscope, comparison microscope, scanning electron microscope, and others.

Number of Credits: 4

Prerequisites: CHEM 221

Course-Section and Instructor

Course-Section	Instrucuctors
FRSC 480-002	David Fisher (dfisher@njit.edu)
M 11:30a-3:50p (TIER 209)	Office: Tiernan 323A
W 12:15a-2:10p (FMH 305)	Office Hours: W: 11:15-12:15p & by appt

Required Textbooks (#1 can be accessed via the hyperlink below in the NJIT ebook database):

1) Petraco, Nicholas and Thomas A. Kubic, *Color Atlas and Manual of Microscopy for Criminalists, Chemists, and Conservators*, CRC Press, Taylor & Francis Group, BocaRaton, Florida, (2004).

2) Reffner, John A., and Brooke W. Kammrath, eds. *Solving Problems with Microscopy: Real-life Examples in Forensic, Life and Chemical Sciences*. John Wiley & Sons, 2023.

Recommended Textbooks:

3) Desiderio, Vincent, et.al., *Handbook of Trace Evidence Analysis*, Wiley & Sons, 2021.

Required Lab Manual:

4) Wheeler, B. (2021). *Practical Forensic Microscopy: A Laboratory Manual (**Second edition**)*. Wiley ISBN: 978-1-119-15449-5

and other readings as assigned.

Learning Outcomes: Upon completion of this course, students will:

- Identify and define foundational theories of light and optics used in forensic microscopy.
- Classify different microscopes and their uses in crime laboratories, including advantages and disadvantages.
- Describe the fundamental theories of light, illumination, image formation, and aberrations of optical lenses and their correction.
- Diagram and perform the logical sequences of sample recovery, preparation and analytical study of traces.
- Classify and communicate the microscopic analysis, examinations, and interpretations of forensic trace evidence.
- Evaluate and classify hair, fibers, and other traces using optical and polarized light microscopy.
- Demonstrate the effect of different lighting conditions on image quality.
- Document specimens using digital photography, including the proper use of a scale in digital images.
- Be able to use a comparison microscope in a mock firearms case.
- Have an understanding of how the scanning electron microscope (SEM) works.
- Be familiar with other types of microscopy.

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:

Class Participation/Attendance/Lab Safety	5%
Photomicrograph competition	5%
Quizzes	15%
Lab exercises (lab reports)	50%
Final Exam	25%

Your final letter grade in this course will be based on the following grading scale:

A	90-100	**C**	70-76
B+	87-89	**D**	60-69
B	80-86	**F**	<60
C+	77-79		

Attendance Policy: Attendance at classes will be recorded and is **mandatory**. Each class is a learning experience that cannot be replicated through simply "getting the notes." After two unexcused absences, each subsequent absence will result in your class participation score being lowered by one percentage point.

Participation Grade: **You are expected to read the relevant chapter(s) and/or reading assignment prior to the lecture.** Students who participate in lecture by answering questions will receive points towards their class participation grade. Another component of your participation grade will be lab cleanliness. Students who do not clean up after lab, dispose of waste improperly, or do not follow safety rules will have points deducted from their participation grade.

Exams: There will be 5 quizzes throughout the semester (see syllabus for quiz dates) and one comprehensive final exam.
The final exam is cumulative and will test your knowledge of all the course material taught in the course.

Makeup Exam/Quiz Policy: There will normally be **NO MAKE-UP LABS or EXAMS** during the semester. In the event that a student has a legitimate reason for missing a lab or exam, the student should contact the Dean of Students office and present written verifiable proof of the reason for missing the lab or exam, e.g., a doctor's note, police report, court notice, etc. clearly stating the date AND time of the mitigating problem. The student must also notify the Instructor that the exam/lab will be missed. The lowest lab report grade will be dropped at the end of the semester, which will accommodate 1 missed lab.

Cellular Phones: All cellular phones and other electronic devices must be switched off during all class times, unless allowed by the instructor.

ADDITIONAL RESOURCES

Accommodation of Disabilities: **O**ffice of **A**ccessibility **R**esources and **S**ervices (***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 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/studentsuccess/disability-support -services/

Important Dates:

Date	Day	Event
Jan 16	T	First Day of Classes
Jan 22	M	Last Day to Add/Drop Classes
March 10-16	M-Sa	Spring Recess
April 1	M	Last Day to Withdraw
April 30	T	Last Day of Classes (Friday classes meet)
May 1-2	W-R	Reading Days
May 3-9	F-R	Final Exam Period

Course Outline

Week	Date	Topic	Assignment
1	Jan 17	Trace Evidence Intro; History of the Microscope; CES seminar (Bone Microscopy)	Petraco (Ch 1-2)
2	Jan 22 (lab)	Lab Safety; Lab Checkin; Camera Software	
	Jan 24	Basic Light Microscopy; Stereomicroscopy	Read Leica EZ4W manual
3	Jan 29 (lab)	**Expt 1A: Familiarization with the Stereomicroscope**	Lab Manual (Ch 1; Expt 1A)
	Jan 31	Atomic Force Microscopy; **QUIZ #1**	
4	Feb 5 (lab)	**Field Trip**	
	Feb 7	Comparison Microscope; Bullet examinations	Read Leica FS C Manual
5	Feb 12 (lab)	**Expt 11: Firearms Examinations; QUIZ #2**	Lab Manual (Expt 11)
	Feb 14	Compound Light Microscope; CES Seminar	Lab Manual (Ch 2)
6	Feb 19	AAFS Meeting (class will not meet)	**Shroud of Turin assignment**
	Feb 21	AAFS Meeting (class will not meet)	
7	Feb 26 (lab)	**Expt 2A-2B: Familiarization and Measurements**	Lab Manual (Expt 2A & 2B)
	Feb 28	Mounting Samples & Refractive Index (RI)	Petraco (Ch 3)
8	Mar 4 (lab)	**Expt 2C-2D: Mounting Techniques & RI**	Lab Manual (Expt 2C & 2D)
	Mar 6	Human Hair Examinations; **QUIZ #3**	Petraco (Ch5)
9	Mar 11 (lab)	**Spring Break**	
	Mar 13	**Spring Break**	
10	Mar 18 (lab)	**Expt 17B-C: Human Hair Experiments**	Lab Manual (Expt 17B-C)
	Mar 20	Animal Hair	Petraco (Ch6)
11	Mar 25 (lab)	**Expt 17A: Animal Hair Examination**	Lab Manual (Expt 17A)
	Mar 27	The Polarized Light Microscope; FRSC Summit for Def Bar	Read DM750P Manual
12	Apr 1 (lab)	**Expt 3A-3C: PLM; RI; Sign of Elongation; Birefringence**	Lab Manual (Expt 3A-3C)
	Apr 3	Fiber Examinations; **QUIZ #4**	Petraco (Ch 7-9)
13	Apr 8 (lab)	**Expt 20A: Natural Fibers**	Lab Manual (Expt 20A)
	Apr 10	FRSC Advisory Board Meeting; CES Seminar	
14	Apr 15 (lab)	**Expt 20B: Man-made fibers**	Lab Manual (Ch 20; Expt 20B)
	Apr 17	Microscopic Semen Examinations/Histopathology; **Quiz#5**	
15	Apr 22 (lab)	**Expt 28: Semen Microscopic Examinations**	Lab Manual (Expt 28)
	Apr 24	Scanning Electron Microscope (SEM); Guest speaker	
16	Apr 29 (lab)	**Photomicrograph competition; Lab check out**	
	TBA	FINAL EXAM; **Submit photos for competition**	See NJIT Final Exam schedule