**MARSHALL UNIVERSITY**

**FORENSIC SCIENCE PROGRAM**

**FSC 612: FORENSIC MICROSCOPY**

**PROFESSOR:** Catherine Rushton, EdD **OFFICE HRS:** posted on office door

**DAY:** Mondays & Wednesdays **FACULTY OFFICE:** MUFSC

**TIME:**  8 – 10 (unless stated otherwise) **EMAIL:** rushton1@marshall.edu

**LOCATION:** Science Bldg rm 106 & Annex Classroom **CELL** **PHONE:** 304-633-2777

**SEMESTER:** Fall 2018 **DESK PHONE**: 304-691-8968

**Course Description:**

Introduction to various types of microscopy used in forensics, including scanning electron microscopy, light and fluorescence microscopy and polarizing microscopy.

**Course Goals:**

Introduction to Forensic Microscopy features analysis of trace evidence using scanning electron, light, and polarized light microscopy. Analysis of synthetic and natural fibers, human and animal hair, minerals, gunshot residue, toolmarks, etc, is featured in the laboratory section. Hands-on training is a primary course goal and is complemented by formal lectures.

**Textbooks:** McCrone, W.C., McCrone, L.B., and Delly, J.G. (2005). Polarized Light Microscopy. Chicago, IL: McCrone Research Institute.

Postek, M, et. al. (1980). Student Handbook for Scanning Electron Microscopy. Williston, VT: Ladd Research.

**Course Structure:** Lecture, laboratory, research project with paper, identification of unknowns, demonstrations, and hands-on exercises

**Assessment Plan:** Written examinations, written papers, project presentation

**Course Alignment:**

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| **Course Student Learning Outcomes** | **Practiced in this Course** | **Assessed in this Course** |
| Relate the parts of the polarized light microscope and their function to polarized light and its path through the microscope. | Label parts of PLM on worksheet; restate function of parts to neighbor; use premade slides to view path of light through PLM | PLM Exam |
| Distinguish between different categories of natural materials and synthetic materials. | In class exercises with both premade and student prepared slides; discuss similarities and differences with fellow students | PLM Exam |
| Analyze the variables used to identify an unknown material using a polarized light microscope. | In class practice exercises using student prepared slides of known materials to create a database of material | PLM Theory Questions and PLM Exam |
| Adapt decision tree to identify an unknown material from the database created by the student using the polarized light microscope. | Use database created in class to identify unknown materials assigned by teacher | PLM Unknown Paper |
| Relate the parts of the scanning electron microscope and their function to the electron beam and its path through the microscope. | Class discussion | SEM Theory Questions Paper and SEM Exam |
| Differentiate between the types of signals that are generated during primary beam and sample interaction. | Class discussion and in class exercises | SEM Theory Questions Paper and SEM Exam |
| Design a small research project utilizing the scanning electron microscope. | Small groups working on projects during class time | SEM Project Paper |

**Grading Policy:** SEM Exam 20%

SEM Project Paper & Presentation 20%

SEM Theory Questions 10%

Light M Exam 25%

PLM Unknown Paper 25%

**Grading Scale:** A = 90-100%

B = 80-89%

C = 70-79%

D = 60-69%

F = 59-0%

**Late Grading Policy:** Make-up exams will only be given for university accepted/ excused absences as defined by the Graduate College Handbook. Ten points will be deducted from a grade for every day a paper is late.

**Make-up Policy:** Make-up sessions will only be given for university accepted/ excused absences as defined by the Graduate College Handbook. Sessions will be at the convenience of the instructor.

**University Policies:** By enrolling in this course, you agree to the University Policies listed below. Please read the full text of each policy be going to [www.marshall.edu/academic-affairs](http://www.marshall.edu/academic-affairs) and clicking on “Marshall University Policies.” Or, you can access the policies directly by going to <http://www.marshall.edu/academic-affairs/?page_id=802>

Academic Dishonesty/ Excused Absence Policy for Undergraduates/ Computing Services Acceptable Use/ Inclement Weather/ Dead Week/ Students with Disabilities/ Academic Forgiveness/ Academic Probation and Suspension/ Academic Rights and Responsibilities of Students/ Affirmative Action/ Sexual Harassment

**Attendance Requirements:** Students enrolled in the Forensic Science Program are expected to attend all classes, laboratories, seminars, internship sessions, and presentations offered by guest speakers. Camtasia recordings may be available but only to those with excused absences. See Request for Excused of Absence.

**Course Attendance: Attendance is Mandatory.** Students enrolled in the Forensic Science Program are expected to attend all classes, laboratories, seminars, internship sessions, and presentations offered by guest speakers.There will be point reductions for unexcused absences. You must fill out an Excused Absence form and submit it to Dr. Rushton for any class or seminar missed. The form can be found under the Student’s Only section of the website.

**Student Absence Form:** www.marshall.edu/forensics <Student Only> <Forms>

Completion of an Instructor-signed Student Absence Form is facilitated by the Student and sent on to the Program Director for all absences. This may occur BEFORE the absence (recommended) or on the first day of class upon return. Whether the absence is EXCUSED or UNEXCUSED will dictate whether the student will be granted make-ups and whether they will receive point or grade reductions. Completed Absence Forms will be placed in the student’s formal file. A Completed Absence Form is one bearing signatures of the student, instructor, and program coordinator. If the student is not able to attend class for any reason, a phone call or e-mail to the Instructor is required BEFORE class time as this is a standard employer practice.

**Excused Absences:** The Program Coordinator and Instructor must be notified of absences. Formal documentation is required for Excused Absences which may involve physician statements excusing the student from class, obituaries, or professional travel documentation. With an Excused Absence, the student may be asked to take an exam BEFORE the scheduled date. No exams, labs, or other formal exercises will be made up without an Excused Absence. Examples of Excused Absences include

* Personal Medical Emergency – Formal documentation is required from a licensed physician or appropriate healthcare provider
* Death in the Immediate Family – Documentation required
* Forensic Professional Travel – Documentation required. Marshall University Forensic Science Program, Marshall University, the West Virginia Policy Board for Higher Education are not liable for accidents or injuries incurred during trips within or out of the state.

**Unexcused Absences:** Any unexcused absence in which a student misses a lab or exam or other graded activity identified by the Instructor at the beginning of the semester will result in the deduction of one letter grade from the student’s final grade or a reduction of points as specified in the Course Syllabus. Any quizzes missed during an unexcused absence will result in a zero.

**Absences from Examinations:** Students are required to take all regular examinations when they are scheduled. If a student attends a course throughout the semester and is absent from the final examination without permission the instructor counts the examination as zero and reports a final grade of F. If the absence is the result of legitimate illness or some other valid reason beyond the control of the student the grade of I is reported and the student may take the examination at a later date. Only university approved excused absences will be considered when students are absent from exams.

**Professional Travel:** Often national, regional, and local forensic science meetings are scheduled during class time. It is not a policy of the Forensic Science Program to cancel classes for students to attend meetings. With the approval of all instructors class schedules may be changed to accommodate approved class travel. Marshall University Forensic Science Program, Marshall University, nor the West Virginia Policy Board for Higher Education is liable for accidents or injuries incurred during trips within or out of the state.

**FSC 612 FORENSIC MICROSCOPY 2018**

The SEM section will be taught in small groups at Science Building room 106. There are no switching groups for SEM projects. **Dates and times are subject to change.**

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| **DATE** | **TOPIC** |
| August 21  Annex classroom  8 – 10 am | Relate the parts of the scanning electron microscope and their function to the electron beam and its path through the microscope.  *Defend identification of unknown samples using polarized light microscopy.*  *Explain the three main types of information that a scanning electron microscope can identify regarding a sample.*  *Analyze the relationship between the light microscope and the scanning electron microscope.*  *Label the parts of the electron microscope and explain the functions of each part.*  Differentiate between the types of signals that are generated during primary beam and sample interaction.  *Analyze the relationship between accelerating voltage and atomic number.*  *Differentiate between the types of signals that are generated during primary beam and sample interaction.*  *Characterize a particle of gunshot residue.*  Design a small research project utilizing the scanning electron microscope. |
| August 23  Science Bldg Rm 106 | Group 1 (8-9:30 am)  Group 2 (9:30 -11 am) |
| August 28  Science Bldg Rm 106 | Group 3 (8- 9:30 am)  Group 4 (9:30 -11 am) |
| August 30  Science Bldg Rm 106 | Group 1 (8-9:30 am)  Group 2 (9:30 -11 am) |
| September 4 | No class – Labor Day |
| September 6  Science Bldg Rm 106 | Group 3 (8- 9:30 am)  Group 4 (9:30 -11 am) |
| September 11  Science Bldg Rm 106 | Group 1 (8-9:30 am)  Group 2 (9:30 -11 am) |
| September 13  Science Bldg Rm 106 | Group 3 (8- 9:30 am)  Group 4 (9:30 -11 am) |
| September 18  Science Bldg Rm 106 | Group 1 (8-9:30 am)  Group 2 (9:30 -11 am) |
| September 20  Science Bldg Rm 106 | Group 3 (8- 9:30 am)  Group 4 (9:30 -11 am) |
| September 25  Annex classroom  (8-10am) | SEM Project Presentations  SEM Review  SEM Theory Questions DUE – 11:59 pm via email |
| September 27  Annex classroom | SEM Exam  SEM Project Paper DUE – 11:59pm via email |
| October 2 | PLM Introduction  Relate the parts of the polarized light microscope and their function to polarized light and its path through the microscope. (worksheet)  *Explain the purpose of Kohler Illumination and perform on polarized light microscope.*  *Label parts of a polarized light microscope and explain the functions of each part.*  *Center the objectives.* |
| October 4  Annex Classroom | *Calibrate the ocular scale for each objective using a stage micrometer.*  *Measure materials using the ocular scale and calculate measurement into micrometers.*  *Measure materials using the ocular scale and calculate measurement into micrometers.*  *Differentiate between a spherical aberration and a chromatic aberration.*  *Differentiate between the six different crystal system* |
| October 9  Annex Classroom | Analyze the variables used to identify an unknown material using a polarized light microscope  *Rearrange Snell’s Law to show that velocity is inversely proportional to refractive index.*    *Differentiate between the six different crystal systems.*  *Analyze a known sample’s refractive index using the Becke line*  *Describe the principles of polarized light, ways to create polarized light, and ways to utilize it for identification of a material.* |
| October 11  Annex Classroom | *No polars (size, shape, surface, homogeneity, cross-section)*  *Polarized light (color, pleochroism, refractive index)*    *Analyze the relationship between pleochroism, refractive index, relief, extinction, interference color, and sign of elongation.*  *Calculate the thickness, retardation or birefringence for several samples using the Michel-Levy chart.*  *Discuss how two overlapping anisotropic materials effects light vibration.*  *Crossed polars (isotropic, anisotropic, extinction, retardation, birefringence, sign of elongation, interference color)* |
| October 16  Annex Classroom | Exercises |
| October 18  Annex Classroom | Natural Fibers |
| October 23  Annex Classroom | **PLM Theory Questions DUE via email by 11:59 pm**  Distinguish between different categories of natural materials and synthetic materials.  *Differentiate between natural and man-made fibers and list examples of each.*  *Differentiate between the structures of hardwoods and softwoods for all three viewing planes of each.*  *Outline method for acetolysis of pollen grains and identify key structures.*  *Differentiate between a human hair and an animal fur fiber*  *Explain the growth cycle of a hair or fur fiber.* |
| October 25  Annex Classroom | Adapt decision tree to identify an unknown material from the database created by the student using the polarized light microscope. |
| October 30  Annex Classroom | **Unknowns** |
| November 1  Annex classroom | **Unknowns** |
| November 6  Annex classroom | **Unknowns** |
| November 8  Annex classroom | **Unknowns** |
| November 13  Annex classroom | **Final Exam** |
| November 15  Annex classroom | TBD |
| November 17 | **PLM Unknown Paper – DUE – 11:59pm via email** |
| November 20  Annex classroom | No class - Thanksgiving |
| November 22 | No class - Thanksgiving |