CHS 3505C Forensic Microscopy, Fall Semester 2013

Strategy:

The course is an integrated program of lectures, laboratory exercises, self-instruction quizzes, and individual research projects, organized in a format to engage each registrant in the analytical and investigative roles of the light microscope in the forensic professions.

Aims of the course:

To introduce the power of the microscopic technique in all sciences

To develop the logical sequences of sample recovery, preparation and analytical study of trace evidence

To promote confidence and expertise in the examination of microscopic samples.

To demonstrate the interactions of light waves with biological, polymeric and crystalline substances

Teaching Staff:

Course Instructor: Mattheu Miller CH 330 Office hours: t, th 10:00 – 11:30 and by appointment

Assistants: Kristin Wegner & Jessica Kindell

Reference Text: Weekly reading assignments and references for various topics

Course grading scheme:

Weekly Quiz (take home/in-class) T1 - T10 each valued at 10 points 100 pts.

Laboratory exercise E1 – E10 each valued at various points 200 pts.

Written examinations:

#1. 09/23 one hour, 100 points. 100 pts.

#2. 10/28 one hour, 100 points. 100 pts.

#3 12/04 three hours 300 points. 300 pts.


Grades: A/-, B+/-, C+/-, and F.

Schedule:

Lectures Monday 09:30 – 10.20 hr BA2 207

Laboratory

Session A (0011) Monday / Wednesday 13.30 - 16.20 hr CH 307

Session B (0013) Monday / Wednesday 16.30 - 19.20 hr CH 307
**Tentative Lecture Topics:**

August 19  The Applications of Light Microscopy in Forensic Sciences.
         Designs of Light Microscopes mechanical and optical challenges.
         26  Forensic evidence sampling, preparation, and mounting.

September 02  Public Holiday.
         11  Properties of light waves, their interaction with materials, and image construction.
         16  A study of polarized light in forensic investigation.
         23  Written Examination #1 one-hour duration.
         30  Color – color systems, techniques for the analysis of color.

October 07  Interference effects in polarized light – color and birefringence.
         14  The forensic examination of particulates, Refractive Indices
         21  Immersion refractometry – dispersion and temperature dependence.
         28  Written examination #2 one hour duration.

November 04  The examination of natural and manmade textile fibers.
         11  Public Holiday
         18  Recording the microscopic image.
         25  Final lecture – submission date for the slide collection. A theory of image formation after Dr. Ernst Abbe.

December 04  TBA

**Public Holidays:**

02  September (Labor Day)
11  November (Veterans’ Day)
21/22 November (Thanksgiving).
**Tentative Laboratory Exercises weekly:**

| August | 19 | The design, construction, and alignment of the microscope.  
|        |    | *Demonstration: sample preparation methods.* |
|        | 26 | Optical parameters and measurements in microscopic analysis.  
|        |    | *Demonstration: Micrometry and DOF/FOV parameters.* |
| September | 2 | Wednesday Slide project |
|         | 09 | Refractive index measurements – identification by optical properties. |
|         | 16 | Double refraction: textile fibers and crystal optics.  
|         |    | *Demonstration: The Calcite Rhomb Experiment.* |
|         | 23 | Laboratory Examination: dimensional and optical measurements. |
|         | 30 | The polarized light analysis of crystalline samples exhibiting parallel, symmetrical and oblique extinction. Measurement of the extinction angles.  
|         |    | *Demonstration: identification of principal RI values in solids.* |
| October | 07 | The Analysis of Human hair samples-scale type and size, pigment distribution, cross-sectional evaluation. |
|         | 14 | Animal hair analysis – scale type, banding, proximal shape and pigmentation differences for species identification.  
|         |    | *Demonstration: Image recording in the microscope. (Repeated)* |
|         | 21 | The microscopy of textile fabrics and fibers – physical characteristics and optical properties.  
|         |    | *Demonstration: Herzog test in natural fibers.* |
|         | 28 | Laboratory Examination; the identification and analysis of trace evidence. |
| November | 04 | Research Project: Slide collection Review. |
| November | 11 | Demonstration of image formation in the microscope. (Abbe theory).  
|         |    | Research Project: Continuation of slide collection preparation. |
|         | 18 | Research project: Final preparation of slide collection. |
|         | 25 | Submission of Research Project |
Strategy:

The slide collection comprises twenty-five, permanently mounted, samples of common evidential materials, accompanied by a formal written explanation of their microstructure, dimensions and optical characteristics. This individual exercise is designed to test the candidate’s ability to conduct a well-executed examination of samples, meeting skill levels expected of a professional forensic analyst.

Methods and Procedures:

The samples should be mounted centrally upon a 75mm x 25 mm x 1mm standard glass slide with the appropriately cut cover glass of 0.17 mm thickness. The immersion medium must be either Meltmount™ (N_d=1.662) or Lens Bond Type J-91™ optical cement (N_d=1.552). A typed label detailing the student’s name, the sample type and origin, a sequence number in the slide series and the date shall be fixed to one end of the slide. The quality of the mount will be judged upon the sample selection, freedom from obvious contaminiates and included air bubbles, together with the neatness and the symmetry of the cover and the label. All must be submitted in a slide box bearing the candidate’s name.

The following samples are recommended as appropriate for study

- Human hairs: head, eyebrow, eyelash, arm, pubic
- Animal hairs: dog, cat, mouse, rat, rabbit, horse, cow
- Textile fibers: natural or mercerized cotton, acetate, triacetate, rayon, acrylic silk, sheep wool, silk, polyester, nylon
- Granular: glass, sands, pollens, paint pigments
- Cross sections: automobile paints, textile fibers, hairs

Forensic examination record:

The results of your professional microscopic analyses shall include the following:

A. Sketches of the mounted samples drawn to approximate scale at the optimum magnification used in the examination. Several sketches of birefringent substances should be included, showing the structure in bright field contrast, under crossed polars and with the insertion of a compensator. The magnification, contrast method, and dimensions of the sample should be included with the sketches.
B. A general description may be included in the introduction to each section, e.g. a review of the differences in hairs, their chemical nature, and the value of hair samples as evidence. Grading of the collection is based upon the detail recorded in the interpretation of microstructure, the correctness of the measurement of optical properties, dimensions and quality of the images. All slides will be examined by the instructor, and checked for the accuracy of the descriptions. Innovative measures are looked for in the collection.

C. The slide collection challenges each candidate in manipulative skills, in the interpretation of the microstructures and in the ability to research for information on the origins and processing of the samples. The study demands the same time management skills exercised by analysts in the profession, so regard this challenge as the first step on your career path.