**Biology 350/550**

***Electron Microscopy***

**Course Description and Syllabus**

**Fall 2016**

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**Office Hours:**

I am happy to meet with you anytime that I am free, and I will make every effort to be available. I encourage you to make appointments, as it ensures that I will available. It is easiest to communicate with me via e-mail, as I move around the building and campus quite a bit during the day.

**Course Description**

Electron Microscopy is a comprehensive course on the bare essentials of specimen preparation, with the main focus being on microscope operation and the production of micrographs/photographic plates from both the Transmission Electron Microscope (TEM) and the Scanning Electron Microscope (SEM). Both the theory and practice(s) of Electron Microscopy will be covered over the course of the semester during lecture and lab periods. In a nutshell, you will learn about the principles of electron microscopy in lecture and how to apply them during lab.

**Course Objectives**

By the end of this semester, you should possess the following skills/knowledge:

1. Ability to operate both the TEM and SEM at a level I deem appropriate.

2. Basic knowledge of the design and mechanics of scope operation for both microscopes.

3. Ability to convert raw data collected from scopes (negatives or digital images) into a publishable form.

4. Basic knowledge of some of the specimen preparation steps involved in preparing specimens for both the TEM and SEM. We will have some time for you to practice the steps, but we won’t run through a full specimen preparation due to time constraints, so some steps will be by demonstration only. You will be free to prepare specimens for the SEM and TEM if you wish to do so.

**Liberal Education**

How does this course fit into your overall liberal education experience at UW Oshkosh? First and foremost, Electron Microscopy is not something that can be mastered in one semester. What I will provide is an understanding of EM that will allow you to adapt protocols and procedures to new situations in the future. Your critical thinking skills, identified as an important learning outcome, will be developed in the process. Your writing skills and your ability to synthesize information will be honed during the two lecture exams, which will be essay in format.

**Course materials**

All lectures will be via Powerpoint. The handouts of figures that I will refer to during selected lectures will be posted on D2L, as well as any information you need for lab.

**The Laboratory:** What will happen in lab? Below I have given you an outline of the topic to be covered in lab each week. During lab, I will use a combination of lecture and demonstration to show you a technique. Once I am finished with the demo, we will then devote the remainder of the lab time to practicing the technique(s), with myself present to guide you along. I must stress here that attending lab is critical to success in the course.

In extreme circumstances, I may be willing to let you make up a missed lab, but if it does not involve a serious illness, accident, or family emergency, you will be out of luck and have to rely on the help of your classmates. Note that you will attend either the Tuesday or Thursday section of the lab but **not both**. Both sections will be covering the same topics at the same time. If you need to attend a different section for just one session due to a conflict please let me know.

**Cooperation:** During the course of the lab sessions and other times, you will be working very closely with the other members of the class. I encourage you to help each other out when it comes of mastering the techniques, as this is a great way of learning them yourself. What I do not want, however, are group efforts when it comes to producing negatives and final photographic plates. Feel free to give pointers, but each of you have to do your own work.

**Time Commitment:** One last comment I will make is about how to succeed in this class. Considering the amount of work, I deem it impossible to complete the assigned objectives during class time alone. You will have to come in at other times if you want to do well. I do restrict use of the scopes without my supervision until I have officially checked you out: once I have done so, you can use them anytime of the day or night. All other equipment may be used without a formal "checkout", as long as you feel comfortable using it.

Since this is a very hands-on course, much of your grade will depend upon the time and effort you put into learning the techniques and operating the microscopes. If you put in the effort, you will do well. I am not expecting perfection. With this in mind, the grading is weighted heavily towards my assessment of your performance of various tasks related to specimen preparation, scope operation, and production of final images. There will be two lecture exams, one at mid-term and one at the end of the semester to test your understanding of the concepts. For credit in Biology 550, in addition, there will be a project and project write-up-I will provide more details in a separate document.

**Grading Break Down**

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| --- | --- | --- |
| **Graded Item**  | **Due Date**  | **Points Possible**  |
| Trimmed TEM block | Oct. 7 | 10 |
| Stained LM slide | Oct. 14 | 10 |
| TEM Checkout and Operation | Nov. 4 | 50  |
| Exam 1  | Oct. 19 | 100  |
| Prepared SEM specimen | Nov. 18 | 30 |
| SEM Checkout and Operation | Dec. 2 | 50  |
| Exam II  | Dec. 14 | 100  |
| SEM photographic plates  | Dec. 16 | 200  |
| TEM photographic plate  | Dec. 16 | 200  |
| **Total**  | **750** |
| Grad project (if enrolled in 550)  | Dec. 16 | 100  |
| **Grad Total**  | **850** |

**Fall 2016 Lecture/Lab Schedule of Events**

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| --- | --- | --- |
| **Lecture and Lab Schedule-Electron****Week of**  | **Lecture Topic**  | **Lab Exercise(s)**  |
| Sept. 7 | Introduction, History of EM  | No labs  |
| Sept. 14 | Fixation | TEM fixation demo; embedding and block trimming demo |
| Sept. 21 | Dehydration, Infiltration | Ultramicrotomy thick sectioning/staining demo/TEM Operation |
| Sept. 28 | Resins, Knives, Sectioning | Ultramicrotomy thin sectioning/staining grids/TEM Operation |
| Oct. 5 | TEM Design and Systems | TEM Operation/SEM Demo |
| Oct. 12 | TEM Image Formation | TEM Operation-taking pictures and developing negatives/TEM practice |
| Oct. 19 | **Exam I-lectures 1-6** | SEM specimen preparation/SEM Operation/TEM practice |
| Oct. 26 | SEM sample preparation | SEM operation/collection of digital images/TEM checkouts |
| Nov. 2 | SEM design/systems/imaging | SEM operation/image optimization |
| Nov. 9 | SEM design and systems | SEM practice |
| Nov. 16 | Vacuum Systems | Scanning and digitizing images for publication, making plates for SEM and TEM |
| Nov. 23 | Thanksgiving week…no lecture, no labs | Open lab on Tuesday |
| Nov. 30 | Photography and digital imaging  | Open lab/SEM checkout |
| Dec. 7 | EM applications, other microscope types | Open lab |
| Dec. 14 | **Exam 2-lectures 7-12** | Open lab |