Appendix 1: Syllabus and other course information

Instructor
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Meeting Times and Places
Lectures: Monday, 9:10 am to 1:40 pm, HS57
Lab Group 1: Tuesday and Thursday, 9:10 am to 1:40 pm, HS55
Lab Group 2: Wednesday and Friday, 9:10 am to 1:40 pm, HS55

Course Description
Electron Microscopy is a comprehensive course on the fundamentals of specimen preparation, microscope operation and the production of micrographs 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 summer session during lecture and lab periods. In a nutshell, you will learn about the principles in lecture and apply them during lab.

Lectures and Lecture Exams: I will present three or four one-hour lectures each Monday, for a total of eleven lectures. They will be in a PowerPoint format. I will post abbreviated versions of the lectures on D2L for you to print and bring to class, if you so desire. There will be two one-hour lecture exams, administered during a laboratory period. We will discuss the exact dates and times on the first day of class.

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

1. In depth knowledge of the *procedures and protocols* necessary for specimen preparation for both TEM and SEM- enough knowledge to enable you to modify protocols according to the application.
2. Ability to operate both the TEM and SEM at the level I deem appropriate.
3. Basic knowledge of the design and mechanics of scope operation for both microscopes.
4. Ability to convert raw images collected from the microscopes (either photographic negatives or digital files) into a publishable form via imaging software.

Course Materials: There is no assigned textbook. Dr. Kostman and I have assembled a lab manual (posted on D2L) that contains pertinent information needed to learn the assigned tasks. Print it out and bring it to every lab session.

The Laboratory: Note that you will attend the Tuesday/Thursday section or Wednesday/Friday section of the lab but **not both and not either**. Both sections will cover the same material, but in a different sequence, in order to minimize congestion on the instruments.

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 to 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 any of the items for grading. Feel free to give pointers and work together, but each of you have to do your own work.

Time Commitment: Each of you will receive about 8 hours a week of direct, hands-on instruction on how to perform the various techniques and how to use the instumentation associated with both SEM and TEM. THAT IS AN INSUFFICIENT AMOUNT OF TIME TO PERFORM WELL IN THIS CLASS. To do well, you will have to schedule additional time to practice the skills I have shown you. Sign up sheets are on the doors of each of the instrumentation rooms.

Lecture and Lab Schedule-Electron Microscopy Summer 2012

Monday June 11 *Course business and quick lab tour* *Lecture 1. What, Why and History of EM* *Lecture 2. Fixation, Fixatives and Dehydration*	
Tuesday, June 12– Laboratory Group 1 Lab 1: SEM sample preparation: fixation, CPD and sputter coating	**Wednesday, June 13 -- Laboratory Group 2** Lab 3: TEM sample preparation: fixation, embedding and block trimming
Thursday, June 14 -- Laboratory Group 1 Lab 2: SEM setup, operation and image collection	**Friday, June 15 -- Laboratory Group 2** Lab 4. Thin sectioning and grid staining, TEM alignment

Monday, June 18 *Lecture 3. Resins, embedding, sectioning and staining for TEM* *Lecture 4. Vacuum systems* *Lecture 5. TEM design and image formation*	
Tuesday, June 19 -- Laboratory Group 1 Lab 3: TEM sample preparation: fixation, embedding and block trimming	**Wednesday, June 20 -- Laboratory Group 2** Lab 5: TEM photography
Thursday, June 21 -- Laboratory Group 1 Lab 4. Thin sectioning and grid staining, TEM alignment **Lecture Exam I** (Lectures 1-5)	**Friday, June 22 -- Laboratory Group 2** Lab 1: SEM sample preparation: fixation, CPD and sputter coating **Lecture Exam I** (Lectures 1-5)

Monday, June 25 *Lecture 6. Optimizing TEM operating conditions* *Lecture 7. Photography and digital imaging* *Lecture 8. SEM specimen preparation*	
Tuesday, June 26 -- Laboratory Group 1 Lab 5: TEM photography	**Wednesday, June 27- - Laboratory Group 2** Lab 2: SEM setup, operation and image collection
Thursday, June 28 -- Laboratory Group 1 Lab 6: Scanning and digitizing images for publication, making plates for SEM and TEM	**Friday, June 29 -- Laboratory Group 2** Lab 6: Scanning and digitizing images for publication, making plates for SEM and TEM

Monday July 2 *Lecture 9. SEM Design and signals produced* *Lecture 10: Optimizing SEM operating conditions* *Lecture 11: Other microscopies (LSCM, SPM, AFM, LV/HR SEM, EPMA, HV TEM, UHV TEM)*	
Tuesday, July 3 -- Laboratory Group 1 **Open lab** – *Sign up for instruments*	**Wednesday, July 4 -- Laboratory Group 2** **Open lab** - *No classes, 4th of July holiday*
Thursday, July 5 -- Laboratory Group 1 **Open lab** - *Sign up for instruments* **Lecture Exam II** (Lectures 6-9) **Final plates due by 5:00 p.m., Friday**	**Friday, July 6 -- Laboratory Group 2** **Open lab** - *Sign up for instruments* **Lecture Exam II** (Lectures 6-9) **Final plates due by 5:00 p.m., Friday**

Grading

Because 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, but I do expect you to do your best. 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, graduate students will conduct an independent research project.

Graded Item	Due Date	Points Possible
Lecture Exam 1	~June 21, 22	100
Lecture Exam II	~July 5, 6	100
TEM photographic plate (10 images @ 20 pts each)	Friday, July 6	200
SEM photographic plate (10 images @ 20 pts each)	Friday, July 6	200
Biology 350 Total		**600**
Grad project (if enrolled in Bio 550)		100
Biology 550 Total		**700**

Grading Scale:

93-100 = A	90-92 = A-	87-89 = B+	83-86 = B	80-82 = B-	77-79 = C+
73-76 = C	70-72 = C-	67-69 = D+	63-66 = D	60-62 = D-	< 60 = F

Additional information on the grading criteria for each above item:

1. Lecture Exam I. I will discuss the format in lecture and post some sample questions on D2L.

2. Lecture Exam II. I will discuss the format in lecture and post some sample questions on D2L.

3. TEM: You will be required to turn in ten TEM images assembled onto two plates (i.e. five images per plate). Please see the file labeled "Instructions for making plates" on D2L.

I encourage you to shoot at least 20 negatives and then pick your best to turn in. At least **two** of the images must be taken at a magnification above 50,000X. The other eight images may be at any magnification. When I grade the images, I will look for focus, if the amount of contrast is sufficient, if the image is actually of some cell or tissue (i.e there has to be some biological content), and the overall quality of the image.

4. SEM: You will be required to turn in ten SEM images assembled onto two plates (i.e. five images per plate). Please see the file labeled "Instructions for making plates" on D2L.

I encourage you to shoot at least 20 images and then pick your best to turn in. At least **two** of the images must be taken at a magnification above 10,000X. The other eight images may be at any magnification. When I grade the images, I will look for focus, if the amount of contrast is sufficient, if the image is actually of some interesting structure (some non-biological specimens are allowed; talk to me), and the overall quality of the image.

Academic dishonesty

Students are referred to the University of Wisconsin Oshkosh Student Discipline Code as detailed in specific provisions of Chapter 14 of the State of Wisconsin Administrative Code. Any student(s) found in violation of any aspect of the above Code (as defined in sections UWS 14.02 and 14.03) will receive a sanction as detailed in UWS 14.05 and 14.06. Examples of violations include: looking at another student's exam or answer sheet and copying the answers during and exam, talking or whispering to another student during an exam and receiving text messages during an exam on an electronic device. Sanctions range from a grade of zero for the assignment in question to an oral reprimand to expulsion from the University of Wisconsin Oshkosh. Students have the right to request a hearing and to appeal sanctions (as defined in UWS 14.08-14.10).