



Faculty of Engineering
Department of Mechanical Engineering
COURSE OUTLINE

Mech 472 – Introduction to Electron Microscopy

Term – Spring 2015

Instructor	Office Hours
Dr. Rodney Herring	Days: Tuesdays, Wednesdays, Friday afternoons
Phone: 250-721-8934	Time: 9 am to 5 pm
E-mail: rherring@uvic.ca	Location: EOW 337

Prerequisites: Mech 285

LECTURE DATE(S)

Section: A / CRN 22126	Days: Monday, Thursday	Time: 2:30 pm – 3:20 pm	Location: HHB 116
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TA Name	E-mail	Office
Jose Gomez	jcagomez@uvic.ca	EOW 239

Required Text	Optional Text
Title: Transmission Electron Microscopy	Let's Familiar Ourselves with SEM/TEM
Author: D.B. Willians and C.B. Carter	Author: Not Available
Publisher/Year: Springer (2 nd Edition)/2009	Publisher/Year: Hitachi High-Technologies Corporation/2009
Reference Materials: personally generated information; published literature; information from the internet	

COURSE OBJECTIVES:

MECH 472 is a new elective for students who desire to learn about electron microscopes and their associated methods of microscopy, measurements, and interpretation of images in materials and nanoscale objects in more detail than possible with traditional light microscopes, with the aim of using them effectively in the design of an Engineering component. This course is designed for students who are considering to conduct research for their career as electron microscopes are being used by research institutions in industry, government and academia.

This course covers the structures of the two types of electron microscopes, i.e., Scanning Electron Microscopes (SEM) and Scanning Transmission Electron Microscopes (STEM), as well as, their associated methods of microscopy such as bright field and dark field imaging. As well, students learn the methods to measure compositions and the states of atoms and ions in materials, valuable knowledge necessary to conduct research in engineering, the physical sciences and the life sciences.

LEARNING OUTCOMES: At the successful completion of this course, the student will have demonstrated the ability to:

1. Obtain a basic understanding of the structure and engineering of microscopes in terms of their voltages, electron sources, type of lens and detectors.
2. Learn the basic electron microscopy methods associated with the type of microscope governed by the design of their lenses and detectors configurations.
3. Learn that while the imaging properties of electron microscopes, such SEM, TEM and STEM, are classified into different types of microscopy, their optical principles for imaging are common.
4. Learn how to determine the composition and state of atoms and ions existing in the many types of materials using Energy Dispersion X-ray Spectroscopy and electron energy loss spectroscopy.
5. Learn the importance of understanding electron diffraction necessary to measure the atomic structure and understand the contrast of structures seen in images.
6. Learn how to use electron imaging and diffraction methods to characterize defects such as dislocations and stacking faults that exist in materials and to determine many of the properties of materials such as their strength, electronic, optical and magnetic properties.

Graduate Attributes

Successfully completing this course will contribute to the following CEAB Graduate Attributes:

1. Knowledge Base for Engineering	1, 2, 3, 4, 5, 6	Assignments, Exams
2. Problem Analysis	5, 6	Assignments, Exams
3. Design	1, 2, 3	Assignments, Exams
4. Use of Engineering Tools	1, 3, 4	Assignments, Exams
5. Investigation	-	-
6. Communication	-	-
7. Individual and Teamwork	-	-
8. Professionalism	-	-
9. Impact of Engineering on Society and the Environment	-	-
10. Ethics and Equity	-	-

Weight & Date(s) of Assessments:	Weight	Date (2015)
Assignments: 2	% 40	February 9; March 27
Mid-terms: 2	% 60	February 16; April 3

ASSIGNMENTS

Two problem sets of 53 and 23 questions each will be distributed over the course of the term via the MECH 472 CourseSpace site. The assignment problems will be predominantly written answers and hand calculations. Assignment hardcopy submissions are to be made to the MECH 472 dropbox located opposite ELW A136.

Assignment #	Modules	Start	Due (5 pm)
1	SEM Microscopes and Microscopy Methods	January 5	February 9
2	TEM Microscopes and Microscopy Methods	February 13	March 27

The final grade obtained from the above marking scheme for the purpose of GPA calculation will be based on the percentage-to-grade point conversion table as listed in the current Undergraduate Calendar.

COURSE LECTURE NOTES

Unless otherwise noted, all course materials supplied to students in this course have been prepared by the instructor and are intended for use in this course only. These materials are NOT to be re-circulated digitally, whether by email or by uploading or copying to websites, or to others not enrolled in this course. Violation of this policy may in some cases constitute a breach of academic integrity as defined in the UVic Calendar.

Assignment of E grade and supplemental examination for this course will be at the discretion of the Course Instructor. The rules for supplemental examinations can be found in the current Undergraduate Calendar.

Calendar, (2015) <http://web.uvic.ca/calendar2015-09/FACS/UnIn/UARe/Atte.html>

Accommodation of Religious Observance (AC1210)
<http://web.uvic.ca/calendar2015-09/GI/GUPo.html>

Discrimination and Harassment Policy (GV0205)
<http://web.uvic.ca/calendar2015-09/GI/GUPo.html>

GENERAL INFORMATION

Note to Students:

Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the Chair of the Department by email or the Chair's Secretary to set up an appointment.

Attendance

Students are expected to attend all classes in which they are enrolled. An academic unit may require a student to withdraw from a course if the student is registered in another course that occurs at the same time....

An instructor may refuse a student admission to a lecture, laboratory, online course discussion or learning activity, tutorial or other learning activity set out in the course outline because of lateness, misconduct, inattention or failure to meet the responsibilities of the course set out in the course outline. Students who neglect their academic work may be assigned a final grade of N or debarred from final examinations.

Students who do not attend classes must not assume that they have been dropped from a course by an academic unit or an instructor. Courses that are not formally dropped will be given a failing grade, students may be required to withdraw and will be required to pay the tuition fee for the course." UVic

Faculty of Engineering, University of Victoria Standards for Professional Behaviour

"It is the responsibility of all members of the Faculty of Engineering, students, staff and faculty, to adhere to and promote standards of professional behaviour that support an effective learning environment that prepares graduates for careers as professionals...."

You are advised to read the Faculty of Engineering document Standards for Professional Behaviour which contains important information regarding conduct in courses, labs, and in the general use of facilities.

<http://www.uvic.ca/engineering/current/undergrad/index.php#section0-23>

Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult the Undergraduate Calendar for the UVic policy on academic integrity.

Policy on Academic Integrity

<http://web.uvic.ca/calendar2015-09/FACS/UnIn/UARe/PoAcI.htm>