



Course Outline

Instructor

- Prof. Derek Oliver
E2-390G EITC
(204) 474-9563
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Office Hours

- By appointment

Contact Hours

- 4 credit hours
- Lectures:
3 hours x 13 weeks = 39 hours
- Laboratories:
3 hours x 5 weeks = 15 hours

Prerequisites:

- Permission of the instructor.

Course Website:

<http://umanitoba.ca/umlearn>

Important Dates

- **Term Tests**
Tuesday, February 27th, 2018
(in class)
- **Voluntary Withdrawal Deadline**
March 16th, 2018
- **Spring Break**
February 19th–23rd, 2018
No classes or examinations
- **Good Friday**
March 30th, 2018
No classes or examinations

ECE 4860 T07 – Materials Characterization

Winter 2018

Course Objectives

This course introduces modern instrumental techniques for the characterization of materials. The topics examined include diffraction, spectroscopy, mass spectrometry, electron and scanning probe techniques. Emphasis is placed on basic principles, instrument operation, data analysis and sample preparation.

Course Content

The following topics will be covered:

- Foundations of quantitative & qualitative analysis including gravimetric techniques.
- Spectroscopic Techniques including IR, Raman, ICP-OES
- Diffraction-based techniques including XRD, SAXS/WAXS
- Mass Spectroscopic techniques including ICP-MS, LA-ICP-MS, SIMS
- Electron Probe techniques including Auger Spectroscopy, EPMA
- X-ray techniques including XRF and XPS
- Synchrotron techniques including EXAFS, XANES,
- Optical, Electron and Scanning-Probe Microscopies

Textbook

Materials Characterization - Introduction to Microscopic and Spectroscopic Methods, Y. Leng, Wiley, 2013. (ISBN: 9783527334636)

Requirements/Regulations

- Attendance at lectures and laboratories is essential for successful completion of this course. Students must satisfy each evaluation component in the course to receive a final grade.
- It is the responsibility of each student to contact the course co-ordinator (Derek Oliver) in a timely manner if he or she is uncertain about his or her standing in the course and about his or her potential for receiving a failing grade. Students should also familiarize themselves with the University's General Academic Regulations, as well as Section 3 of their Faculty Academic Regulations dealing with incomplete term work, deferred examinations, attendance and withdrawal.
- No programmable devices or systems (such as calculators, PDAs, iPods, iPads, cell phones, smart watches, wireless communication or data storage devices) are allowed in examinations unless approved by the course instructor.
- Students should be aware that they have access to an extensive range of resources and support organizations. These include Academic Resources, Counselling, Advocacy and Accessibility Offices as well as documentation of key University policies e.g. Academic Integrity, Respectful Behaviour, Examinations and related matters.

 [Supplemental Information](#)

Accreditation Details

Accreditation Units

- Mathematics: 0%
- Natural Science: 100%
- Complementary Studies: 0%
- Engineering Science: 0%
- Engineering Design: 0%

Attributes

- A1: A knowledge base for engineering
 A2: Problem analysis
 A3: Investigation
 A4: Design
 A5: Use of engineering tools
 A6: Individual and team work
 A7: Communication skills
 A8: Professionalism
 A9: Impact of engineering on society/
 environment
 A10: Ethics and equity
 A11: Economics and project
 management
 A12: Life-long learning

Competency Levels

- 1 - Knowledge (Able to recall information)
 2 - Comprehension (Ability rephrase information)
 3 - Application (Ability to apply knowledge in a new situation)
 4 - Analysis (Able to break problem into its components and establish relationships.)
 5 - Synthesis (Able to combine separate elements into a whole)
 6 - Evaluation (Able to judge the worth of something)

Grading Scale

Letter	Mark
A+	95–100
A	85–94
B+	80–84
B	70–79
C+	65–69
C	55–64
D	45–54
F	< 45

Note: These boundaries represent a guide for the instructor and class alike. Provided that no individual student is disadvantaged, the instructor may vary any of these boundaries to ensure consistency of grading from year-to-year.

Learning Outcomes

1. Express principles of quantitative and qualitative analysis in the context of the instrumental techniques considered.
2. Understand the physical basis for each of the instrumental techniques as well as the commonalities of each family of techniques.
3. Contrast the suitability of different techniques for different classes of material samples
4. For each laboratory project (3 of 11 possible instruments), construct a formal scientific laboratory report describing the methodology of the instrumental technique employed and the analysis performed on a set of samples.

Expected Competency Levels

Outcome	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
1	5	5	5						2			5
2	5	5	5									5
3	5	5	5						2			5
4	6	6	6				6	3	2			6

Evaluation

The final course grade will be determined from a student's performance in laboratories, periodic quizzes, 2 term tests, and a final examination. Students must complete all of the laboratories in order to be eligible to receive a passing grade.

Component	Value (%)	Method of Feedback	Learning Outcomes Evaluated
Laboratories	30	F, S	1, 2, 3, 4
Term Tests	20	F, S	1, 2, 3
Final Examination	50	S	1, 2, 3

* Method of Feedback: F - Formative (written comments and/or oral discussion), S - summative (numerical grade)

Academic Integrity

Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the *General Academic Regulations on Academic Integrity*, students are reminded that plagiarism or any other form of cheating in examinations, term tests, assignments, projects, or laboratory reports is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating by another student is also subject to serious academic penalty.

Retention of Student Work

Students are advised that copies of their work submitted in completing course requirements (i.e. assignments, laboratory reports, project reports, test papers, examination papers, etc.) may be retained by the instructor and/or the department for the purpose of student assessment and grading, and to support the ongoing accreditation of each Engineering program. This material shall be handled in accordance with the University's *Intellectual Property Policy* and the protection of privacy provisions of *The Freedom of Information and Protection of Privacy Act (Manitoba)*. Students who do not wish to have their work retained must inform the Head of Department, in writing, at their earliest opportunity.