University of Waterloo

Nanotechnology Engineering Program

NE226 – Characterization of Materials

Spring 2022

Course Description

This course will focus on characterization of materials properties, structure and composition using spectroscopy and microscopy techniques relevant to nanotechnology engineering. The emphasis will be on the fundamentals and applications of these techniques. The basic structure of the course is listed below:

- Atomic structure and electromagnetic spectrum.
- Absorption Spectroscopy (UV-Vis)
- Infrared and Raman Spectroscopy
- Energy-dispersive X-ray spectroscopy
- X-ray Diffraction and basics of crystal structure
- Light and Electron Microscopy
- Ellipsometry

This course is designed to expand the knowledge base of nanotechnology engineering theories and concepts in combination with a hands-on laboratory experience (Laboratory Characterization Methods - NE 226L). Students will draw specifically on information from Chemical Principles (NE 121), Introduction to Materials Science and Engineering (NE 125) and Physics for Nanotechnology Engineering (NE 131).

Instructors and Teaching Assistants Information

Instructor: Charles Dal Castel, PhD

Office: E6 3102

Office hours: By appointment.

e-mail: c2dalcas@uwaterloo.ca

Teaching Assistant: Zhuo Yu (z238yu@uwaterloo.ca)

Course Schedule and Locations

Lectures: Mondays and Wednesday, from 8:30 to 9:50 am in QNC 2502. May 2nd to July 20th.

There is no lecture on June 15th (midterms)

Makeup Lectures: Wednesdays, June 1st, June 29th, July 13th, from 11:30 am to 12:20 pm in QNC 2502.

Tutorials: Tuesdays May10th, May 24th, June 7th, June 28th, July 12th, and July 19th.

Check the schedule of classes for time and location of your tutorial section.

Notes:

- The expectation is for this course to have in person lectures. Copy of the slide deck will be posted on Learn after the lecture.
- Tutorials will be held in person. Attendance is not mandatory but . Focus will be on problem solving and covering material relevant to the subject.
- **Check the schedule carefully to determine what tutorial session you should attend.**

Reference books

1. Materials characterization: Introduction to microscopic and spectroscopic methods By Y. Leng
2. Physical principles of electron microscopy an introduction to TEM, SEM and AEM. By R.F. Egerton
3. Solid state chemistry and its application. By A.R. West
4. Optics. By E. Hecht

Evaluation Structure

Assessment	Date of Evaluation/Submission	Weighting
Tutorials	**Biweekly**	**30 (5 each)**
Midterm	**June 13th**	**30**
Final Exam	**TBD (week of July 26th)**	**40**

Fair Contingencies for Emergency Remote Teaching.

We are facing unusual and challenging times. The course outline presents the instructor's intentions for course assessments, their weights, and due dates in Spring 2022. As best as possible, we will keep to the specified assessments, weights, and dates. To provide contingency for unforeseen circumstances, the instructor reserves the right to modify course topics and/or assessments and/or weight and/or deadlines with due and fair notice to students. In the event of such challenges, the instructor will work with the Department/Faculty to find reasonable and fair solutions that respect rights and workloads of students, staff, and faculty.

University Required Statements

Academic integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check the Office of Academic Integrity for more information.]

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4. When in doubt, please be certain to contact the department's administrative assistant who will provide further assistance.

Discipline: A student is expected to know what constitutes academic integrity to avoid committing an academic offence, and to take responsibility for his/her actions. [Check the Office of Academic Integrity for more information.] A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate associate dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline. For typical penalties, check Guidelines for the Assessment of Penalties.

Appeals: A decision made or penalty imposed under Policy 70, Student Petitions and Grievances (other than a petition) or Policy 71, Student Discipline may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72, Student Appeals.

Note for students with disabilities: AccessAbility Services, located in Needles Hall, Room 1401, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with AccessAbility Services at the beginning of each academic term.

Turnitin.com: Text matching software (Turnitin®) may be used to screen assignments in this course. Turnitin® is used to verify that all materials and sources in assignments are documented. Students' submissions are stored on a U.S. server, therefore students must be given an alternative (e.g., scaffolded assignment or annotated bibliography), if they are concerned about their privacy and/or security. Students will be given due notice, in the first week of the term and/or at the time assignment details are provided, about arrangements and alternatives for the use of Turnitin in this course. It is the responsibility of the student to notify the instructor if they, in the first week of term or at the time assignment details are provided, wish to submit alternate assignment.

Counselling Services: The University of Waterloo can be a challenging environment. A meeting with a friendly and experienced counsellor can help you handle your stress and attain your goals. Counselling services provides a wide range of strategies to help you do your very best during your time at UWaterloo. Counselling Services can help you with Study Skills, Career Planning and

Personal Goals. For an appointment, call 519-888-4567, extension 32655 or go to Needles Hall, Room 2080. Their website is www.adm.uwaterloo.ca/infocs/