

Department	06 Applied Sciences and Mechatronics
Course title	Characterization techniques of materials at the nanoscale
Hours per week (SWS)	4
Number of ECTS credits	6
Course objective	<p>The underlying objective of this lecture is to provide knowledge in the field of nanoscale material characterization to study thin films, nanostructures, nanoparticles, molecules, proteins, cells, etc. The lecture is dedicated to present the most common techniques for the characterization of nanomaterials (structure, composition and surface) to support recent emerging technologies. It focuses on the physical understanding of the theoretical concepts and the principles of some of the most relevant micro/nanocharacterization techniques which are associated to crystallography, chemical composition and surface analysis of nanoparticles/nanostructures/thin films.</p> <p>In addition to the theoretical teaching section of the principles, concepts and operation of each characterization method, this course will be accompanied with remote lab courses where students will be able to apply the knowledge they acquired in the course to manipulate remotely characterization systems and do measurements on real samples.</p>
Prerequisites	Basics in mathematics, physics, especially solid state physics
Recommended reading	
Teaching methods	seminaristic teaching with exercises
Assessment methods	written exam, 90min
Language of instruction	English
Name of lecturer	Azza Hadj Youssef
Email	azza.hadi.youssef@inrs.ca
Link	
Course content	<p>The discussion of each characterization technique will involve:</p> <ul style="list-style-type: none"> - Explanation of the main characteristics of the technique, physics of the method and its operation principles to obtain experimental results. - Introduction of specific examples of the research applied to use these techniques in a comparative mode with the techniques presented in previous lectures /select some of the measured properties of nanomaterials measured using the technique. - Definition of the advantages and limitations but also the complementarity between the characterization techniques. - Definition of the area of expected applications and possible relation to the properties studied by each technique to help the student understand how to select the best technique to solve the characterization problems. - If possible, the lecture will indicate the techniques available at HMU. <p>Studied techniques:</p> <ul style="list-style-type: none"> - Scanning probe microscopy (AFM, STM) - Raman spectroscopy/SERS - X-ray diffraction (XRD) - Reflection high energy electron diffraction (RHEED) - Selected Area Electron Diffraction (SAED) - Scanning Electron Microscopy (SEM) - X-ray Photoelectron Spectroscopy (XPS) - Ellipsometry - Dynamic light scattering (particle size) <p>Course Learning Outcomes:</p> <ul style="list-style-type: none"> - Understand the principals of the most techniques to characterize nanomaterials and learn about their functionalities. - Evaluate and examine the different functionalities and application of the technique. - Become familiar with the advantages and limitations of several experimental techniques and for which studies and applications they might be beneficial. - Provide students with an overview of the arsenal of existing and emerging techniques and guidelines to determine the appropriateness of each for specific challenges

Remarks

only in summer 2022