



MATE 318
Materials Characterization
Course Information

Code	Course Name	Term	Theory + Recit. + Lab.	Credits	ECTS
MATE 318	Materials Characterization	6	2 + 0 + 2	3	5.5
Pre-requisite Course(s)		MATE 202			
Course Type	Compulsory	Language of the Course		English	

Course Catalogue Description

Fundamentals of crystallography, scattering and diffraction, properties of X-rays and electron beams, X-ray diffraction, crystal structure determinations, intensities of diffracted beam, lattice parameter measurement and phase diagram determinations, electron and neutron diffraction, SEM and TEM, spectroscopy, miscellaneous materials characterization techniques.

Course Objectives	<ul style="list-style-type: none"> To get students familiar with the various structural characterization methods for solids. To teach students the basics of crystallography, scattering and diffraction. To teach x-ray, electron and neutron diffraction. To teach students the various applications of x-ray diffraction from phase determination to stress analysis. To get students familiar with some of the major spectroscopic techniques used in Materials Engineering. To introduce thermal analysis techniques, probe microscopy and nanoindentation.
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Course Book	<i>Elements of X-Ray Diffraction</i> , B.D. Cullity, Prentice Hall (2001)
Other Sources	<input type="checkbox"/> <i>Encyclopedia of Materials Characterization</i> , C. R. Brundle, C.A. Evans and S.Wilson, Butterworth-Heinemann (1992) <input type="checkbox"/> <i>Transmission Electron Microscopy and Diffractometry of Materials</i> , B.Fultz and J.Howe, Springer (2008)

Covered Topics

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| <ul style="list-style-type: none"> • Crystallography (3 h.) • Scattering and Diffraction of X-rays (8 h.) • Midterm I • Applications of X-ray Diffraction (11 h.) • Electron and Neutron Diffraction (2 h.) | <ul style="list-style-type: none"> • Electron Microscopy (SEM and TEM) (5 h.) • Midterm II • Spectroscopy (6 h.) • Thermal Analysis Techniques (4 h.) • Probe Microscopy and Nanoindentation (3 h.) |
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Attendance Requirement: A first time taker has to attend at least 70% of the lectures.

Grading Policy

First time taker: Two Midterms (18% each), Final Exam (36%), Assignments & Quizzes (18%), Attendance and Class Participation (10%)

Second or more taker: Two Midterms (20% each), Final Exam (40%), Assignments & Quizzes (20%)

Contribution to Professional Component

Mathematics and Basic Sciences	
Basic Occupational Courses (Engineering)	
Expertise/Field Courses (Engineering Design)	X
Courses on Communication and Management Skills (Social Sciences)	

Course Learning Outcomes vs. Program Outcomes Correlation Table

MATE 318 Course Learning Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7.a	PO7.b	PO8.a	PO8.b	PO9	PO10	PO11.a	PO11.b	PO11.c	PO12.a	PO12.b
CLO1	Understanding of basic crystallography, scattering and diffraction of x-rays, electrons and neutrons.	5	5	2	1	3	2	3	3	2	2	2	2	1	1	1	1	1
CLO2	Knowledge of the applications of the x-ray diffraction from phase determination to stress analysis.	5	5	2	1	3	2	3	3	2	2	2	2	1	1	1	1	1
CLO3	Learning the electron microscopy (SEM and TEM)	5	5	2	1	3	2	3	3	2	2	2	2	1	1	1	1	1
CLO4	Knowledge of the some of the spectroscopic techniques.	5	5	2	1	3	2	3	3	2	2	2	2	1	1	1	1	1
CLO5	Understanding of common thermal analysis techniques, probe microscopy and nanoindentation.	5	5	2	1	3	2	3	3	2	2	2	2	1	1	1	1	1

Scale: "5"=very strong; "4"= strong; "3"= medium; "2"=some; "1"= poor; "-"= NA

Metallurgical and Materials Engineering Program Outcomes

PO1	Knowledge of mathematics, science, and Metallurgical and Materials Engineering, and an ability to apply the theoretical and applied knowledge gained in these areas to solve complex engineering problems and model material systems.
PO2	Understanding of the science and engineering principles regarding the structure, properties, processing, and performance of material systems; integration and application of the gained knowledge from these four areas for the purpose of solving material selection and design problems.
PO3	Ability to detect, identify, formulate, and solve complex engineering problems; ability to select and use appropriate analysis and modeling methods for this purpose.
PO4	Ability to design and select material for a system, component, product or a process under realistic conditions and constraints to meet desired needs; ability to apply modern design and material selection methods for this purpose.
PO5	Ability to select and use the techniques, skills, and modern engineering tools necessary for Metallurgical and Materials Engineering practice; ability to effectively use information technology.
PO6	Ability to design and conduct experiments, collect data and use statistical and computer methods to analyze and interpret results for the investigation of complex engineering problems or Metallurgical and Materials Engineering specific research subjects.
PO7	Ability to function effectively in self-disciplinary and multidisciplinary teams (7.a); ability to work alone (7.b).
PO8	Ability to communicate effectively in oral and written means; ability for effective report writing and understanding written reports, ability to prepare design and production reports, make effective presentations, give and take clear and understandable instructions (8.a); knowledge of at least one foreign language (8.b).
PO9	Recognition of the need for, and an ability to engage in, life-long learning; ability to access information, follow developments in science and technology
PO10	Knowledge of acting according to ethical principles, professional and ethical responsibilities and standards used in engineering applications.
PO11	Knowledge on business life practices such as project management, risk management, change management (11.a); awareness of entrepreneurship and innovation (11.b); knowledge on sustainable development (11.c).
PO12	Knowledge of the impacts of Metallurgical and Materials Engineering practices on health, environment and security in global and societal context, knowledge of contemporary issues that interest engineering (12.a); recognition of the legal consequences of engineering solutions (12.b).

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