Atılım University
Department of Metallurgical and Materials Engineering

MATE 318 (previously MATE 403) 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	▪ 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.

Course Book	*Elements of X-Ray Diffraction*, B.D. Cullity, Prentice Hall (2001)
Other Sources	▪ *Encyclopedia of Materials Characterization*, C. R. Brundle, C.A. Evans and S.Wilson, Butterworth-Heinemann (1992) ▪ *Transmission Electron Microscopy and Diffractometry of Materials*, B.Fultz and J.Howe, Springer (2008)

Covered Topics

- Crystallography (3 h.)
- Scattering and Diffraction of X-rays (9 h.)
- ***Midterm I***
- Applications of X-ray Diffraction (10 h.)
- Electron and Neutron Diffraction (2 h.)
- Electron Microscopy (SEM and TEM) (6 h.)
- ***Midterm II***
- Spectroscopy (6 h.)
- Thermal Analysis Techniques (3 h.)
- Probe Microscopy and Nanoindentation (3 h.)

Grading Policy
Two Midterms (20% each), Final Exam (35%), Labwork + Assignments (20%), Attendance (5%)

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)	

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Course Learning Outcomes vs. Program Outcomes Correlation Table

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

	MATE 318 (prv. 403) Course Learning Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	Understanding of basic crystallography, scattering and diffraction.	4	4	3	3	3	2	2	3	2	2	1	1
CLO2	Understanding the x-ray, electron and neutron diffraction.	4	4	3	3	3	4	2	3	2	4	1	1
CLO3	Knowledge of the applications of the x-ray diffraction from phase determination to stress analysis.	5	5	4	3	3	5	2	3	4	4	1	1
CLO4	Learning the electron microscopy (SEM and TEM)	5	5	4	3	3	5	2	3	4	4	1	1
CLO5	Knowledge of the some of the spectroscopic techniques.	5	5	4	3	3	3	2	3	4	4	1	1
CLO6	Familiarity with thermal analysis, probe microscopy and nanoindentation.	5	5	4	3	3	3	2	3	4	4	1	1

Metallurgical and Materials Engineering Program Outcomes

PO1	Knowledge in mathematics, science, and Metallurgical and Materials Engineering, and an ability to apply the theoretical and applied knowledge gained in these areas to model and solve complex engineering problems and material systems.
PO2	Understanding of the science and engineering principles regarding the structure, properties, processing, and performance of material systems.
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, use and improve 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
PO7	Ability to function effectively in self-disciplinary and multidisciplinary teams; ability to work alone.
PO8	Ability to use Turkish to communicate effectively in oral and written means; knowledge of at least one foreign language, ability for effective report writing and understanding
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	Awareness of acting according to ethical principles, awareness of professional and ethical responsibilities; knowledge of standards used in engineering applications.
PO11	Knowledge on business life practices such as project management, risk management, change management; awareness of entrepreneurship, innovation, and sustainable development.
PO12	Recognition of the impact of metallurgical and materials engineering solutions on health, environment and security in global and societal context, recognition of the legal consequences of engineering solutions.