



Dumlupınar University

Faculty of Engineering
Materials Science and Engineering

131918135	Material Characterization				
Semester	Course Code	Course Name	L+P	Credit	ECTS
8	131918135	Material Characterization	3	3	5

Language of Instruction:

Turkish

Course Level:

Faculty

Work Placement(s):

No

Department / Program:

Materials Science and Engineering

Course Type:

Zorunlu

Goals:

The purpose of this course is to have a theoretical materials characterization background for analysing structural, chemical and surface properties of materials.

Teaching Methods and Techniques:

The content of this course includes background for spectroscopy, electromagnetic radiation, material-electron interaction, x-ray, electron microscopies and microscopies with atomic resolution.

Prerequisites:

Course Coordinator:

Associate Prof.Dr. Hilmi Yurdakul

Instructors:

Associate Prof.Dr. Hilmi Yurdakul

Assistants:

Recommended Sources

Textbook	:	1.Materials Characterization: Introduction to Microscopic and Spectroscopic Methods Oct 28, 2013 by Yang Leng
Resources	:	2.Materials Characterization Techniques Dec 22, 2008 by Sam Zhang and Lin Li
Documents	:	3.Elements of X-Ray Diffraction (3rd Edition) Feb 15, 2001 by B. D. Cullity and S. R. Stock
Assignments	:	C. R. Brundle, A. A. Evans, S. Wilson, Encyclopedia of Materials Characterization, Butterworth-Heinemann, 1992, D. A. Skoog, D. M. West, F. J. H
Exams	:	Web sayfasına PDF formatında yüklenecektir
	:	Ders sırasında verilecektir

Course Category

Mathematics and Basic Sciences	:	25	Education	:	
Engineering	:	25	Science	:	25
Engineering Design	:		Health	:	
Social Sciences	:		Field	:	25

Course Content

Week	Topics	Study Materials	Materials
1	To understand the importance of characterization in Materials Science		
2	Electromagnetic spectrum and definition of X-rays		
3	The generation of X-rays and its interaction with matter		
4	Theoretical X-ray intensity calculations as a consequence of interaction through crystalline materials.		
5	Introduction to electron microscopies		
6	The working principles of scanning electron microscope		
7	The imaging forming mechanisms in scanning electron microscopy		
8	The fundamentals of spectroscopic techniques in electron microscopy		
9	Energy dispersive X-ray spectroscopy (EDXS)		
10	Wavelength dispersive X-ray spectroscopy (WDXS)		
11	Principles of electron backscattered diffraction (EBSD)		
12	EBSD applications		
13	Transmission electron microscopy (TEM) based imaging, diffraction and spectroscopic techniques		
14	Atomic force microscope (AFM) and its applications		
15	Introduction to thermal analysis		
16	Thermal analysis techniques (DTA, TG, Dilatometer etc.)		

Recommended Optional Programme Components

131915125 Crystallography and X-Ray

131915503 Malzeme Biliminde Elektron Mikroskopları

131917605 Nanoscopic Analysis of Materials

Course Learning Outcomes

No	Learning Outcomes
C01	The student gets an experience on instruments based on material-electron interaction
C02	The student understand fundamentals of spectroscopy having x-ray sources and discussion of its output
C03	The student use of image-analysis knowledge on microscopy techniques to control ceramics process according to microstructure-properties relation
C04	The student gets experience on materials characterization
C05	Forming knowledge-database to consider the results arising in materials science

Program Learning Outcomes

No	Learning Outcome
P01	Engineering graduates with sufficient theoretical and practical background for a successful profession and with application skills of fundamental scientific knowledge in the engineering practiced
P03	Engineering graduates with the necessary technical, academic and practical knowledge and application confidence in the design and assessment of machines or mechanical systems or industrial pro
P02	Engineering graduates with skills and professional background in describing, formulating, modeling and analyzing the engineering problem, with a consideration for appropriate analytical solutions in
P05	Ability of designing and conducting experiments, conduction data acquisition and analysis and making conclusions
P06	Ability of identifying the potential resources for information or knowledge regarding a given engineering issue
P04	Engineering graduates with the practice of selecting and using appropriate technical and engineering tools in engineering problems, and ability of effective usage of information science Technologies
P10	Engineering graduates with well-structured responsibilities in profession and ethics
P08	Ability for effective oral and official communication skills in Turkish Language and, at minimum, one foreign language
P07	The abilities and performance to participate multi-disciplinary groups together with the effective oral and official communication skills and personal confidence
P13	Having enough level of general culture (Mother language, foreign languages, history etc.)
P12	Consciousness for the results and effects of engineering solutions on the society and universe, awareness for the developmental considerations with contemporary problems of humanity
P11	Engineering graduates who are aware of the importance of safety and healthiness in the project management, workshop environment as well as related legal issues
P09	Engineering graduates with motivation to life-long learning and having known significance of continuous education beyond undergraduate studies for science and technology

Assessment		
In-Term Studies	Quantity	Percentage
Mid-terms	0	%20
Quizzes	0	%0
Assignment	0	%20
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	0	%60
Total		%100

ECTS Allocated Based on Student Workload			
Activities	Quantity	Duration	Total Work Load
Course Duration	16	3	48
Hours for off-the-c.r.stud	16	3	48
Assignments	1	1	1
Presentation	1	1	1
Mid-terms	1	30	30
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	30	30
Total Work Load			158
ECTS Credit of the Course			5

Course Contribution To Program														
Contribution: 1: Very Slight 2:Slight 3:Moderate 4:Significant 5:Very Significant														
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	
All	4	5	5	3	4	5	3	5	5	5	4	5	4	
C01	4	5	4	3	4	5	3	5	5	5	4	5	3	
C02	4	3	4	5	4	4	5	4	4	4	4	5	3	
C03	4	3	5	5	5	4	5	4	4	4	4	5	3	
C04	4	4	4	5	5	4	4	3	3	4	4	5	4	
C05	4	5	4	4	5	5	4	3	3	3	4	5	4	