Course Name						
MATERIALS CHARACTERIZATION METHODS						
Code	**Semester**	**Local Credits**	**ECTS Credits**	**Course Implementation, Hours/Week**		
				Theoretical	**Tutorial**	**Laboratory**
MET 337E	5	2.5	4	2	1	-

Department/Program	Metallurgical and Materials Engineering		
Course Type	Required	**Course Language**	English
Course Prerequisites	MET213E		

Course Category by Content, %	**Basic Sciences**	**Engineering Science**	**Engineering Design**	**General Education**
	-	100		

Course Description	Production and properties of x-rays. X-ray diffraction from crystals, direction and intensities of diffracted beams. Diffraction techniques. Phase and chemical analysis by x-rays. Specimen preparation and examination methods for optical microscopy. Structure analysis for ferrous and non-ferrous alloys. Principles of thermal analysis, differential thermal analysis, differential scanning calorimetry, thermogravimetric analysis
Course Objectives	1.To explain the principles of x-ray diffraction 2.To explain fundamentals of phase and crystal structure analyses by x-rays 3.To introduce specimen preparation techniques for optical microscopy 4.To explain the principles of microstructure analysis for ferro- and non-ferrous alloys 5.To explain the principles and use of thermal analysis techniques
Course Learning Outcomes	The student will 1.Do preparation specimen for optical microscopy 2.Do qualitative microstructure analysis for ferrous and non-ferrous alloys 3.Use x-ray diffraction methods 4.Do phase and chemical analysis by x-rays 5.Do thermal analysis for materials characterization
Textbook	1.B.D.Cullity, “Elements of X-Ray Diffraction”, Addıson-Wesley Publishing Inc., 1978. 2.G.F. Van Der Voort, “Metallography”, Mcgraw-Hill, 1984 3.Robert F. Speyer,’’Thermal Analysis of Materials’’, Marcel Dekker Ink. 1994
Other References	1.C.Suryanarayana, M.G. Norton, “X-ray diffraction a practical approach”, Plenum Press, 1998 2.A.E. Geçkinli, “Metalografİ”, 1.kısım, İTÜ yayını, 1989 3.Metals Handbook vol. 7-8, ASM.
Homework & Projects	
Laboratory Work	-
Computer Use	-
Other Activities	-

Assessment Criteria	**Activities**	**Quantity**	**Effects on Grading, %**
	Midterm Exams	**2**	**40**
	Quizzes		
	Homework		
	Projects		
	Term Paper/Project		
	Laboratory Work		
	Other Activities		
	Final Exam	**1**	**60**

COURSE PLAN

Weeks	Topics	Course Outcomes
1	Electromagnetic radiation, continuous and characteristic spectrum	3-4
2	Absorption of x-rays	3-4
3	Diffraction; the directions of diffracted beams	3-4
4	Diffraction; the intensities of diffracted beams	3-4
5	Diffraction techniques; Laue cameras, Debye-Scherrer camera, diffractometer	3-4
6	Phase and crystal structure analyses by x-ray diffraction	3-4
7	Specimen preparation, polishing and etching techniques for optical microscopy	1-2
8	Principles of structure analysis	1-2
9	Structure analysis for non-ferrous alloys	1-2
10	Structure analysis for steel and cast iron	1-2
11	Principles of thermal analysis	5
12	Differential thermal analysis, thermogravimetric analysis	5
13	Differential scanning calorimetry	5
14	Dilatometry	5

Relationship between the Course and Metallurgical and Materials Engineering Curriculum

	Student Outcomes	Level of Contribution		
		1	2	3
1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering science and mathematics			X
2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare as well as global, cultural, social, environmental and economic factors	X		
3	An ability to communicate effectively with a range of audiences	X		
4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts		X	
5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	X		
6	An ability to develop and conduct appropriate experimentation, analyse and interpret data, and use engineering judgement to draw conclusions			X
7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies		X	

1: Little, 2: Partial, 3: Full

Course relationships with major elements of the field and material classes

		Level of Contribution		
		1	2	3
MAJOR ELEMENT OF THE FIELDS	STRUCTURE			X
	PROPERTIES			X
	DESIGN EXPERIMENT/ANALYSE DATA			X
	PROCESSING	X		
	COST/PERFORMANCE	X		
	QUALITY/ENVIRONMENT	X		
	DESIGN PROCESS OR PRODUCT	X		
MATERIAL CLASSES	METAL			X
	CERAMICS AND GLASS			X
	POLYMER		X	
	COMPOSITES		X	
	BIOMATERIALS	X		

1: Little, 2: Partial, 3: Full

Prepared by	Date	Revision #	Signature
Assoc. Prof. Dr. Duygu Ağaoğulları Prof. Dr. Cevat Bora DERİN Prof. Dr. Murat Baydoğan	August 2021	1	