Course Name						
MATERIALS CHARACTERIZATION METHODS						
Code	**Semester**	**Local Credits**	**ECTS Credits**	**Course Implementation, Hours/Week**		
				Theoretical	**Tutorial**	**Laboratory**
MET337E	5	2,5	4	2	1	0

Department/Program	Metallurgy and Materials Engineering			
Course Type	Required	**Course Language**	ENGLISH	
Course Prerequisites	MET 213E			
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	Students who pass the course will be able to; 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 charecterization
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	2X20=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 MIDTERM EXAM	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 MIDTERM EXAM	5
14	Dilatometry	5

Relationship between the Course and METALLURGICAL AND MATERIALS ENGINEERING **Curriculum**

	Program Outcomes	Level of Contribution		
		1	**2**	**3**
1	Ability to apply the knowledge of mathematics, science and engineering principles to solve problems in metallurgical and materials engineering (ABET:a)			X
2	Ability to characterize materials using standard and/or self designed experimental methods and to evaluate the results (ABET:b)			X
3	Ability to design a system or a process, taking into consideration of the desired specifications, quality, ethics and environment. (ABET:c)	X		
4	Ability to communicate both orally and in the written form and to take part in, and provide leadership of the teams in the elucidation of engineering problems; (ABET:d, g)			
5	Ability to define, formulate and solve engineering problems in the development, production, processing, protection and usage of engineering materials. (ABET:e)			X
6	An understanding of professional and ethical responsibilities(ABET:f)			
7	An understanding of current/contemporary issues and impact of engineering solutions in broad cultural, national and global levels;. (ABET:h, j)			
8	A comprehension of the nature of engineering progress closely linked with the development of new materials and production processes. An ability to engage in life-long learning and a recognition of its necessity (ABET:i)		X	
9	Ability to use essential tools and techniques of modern engineering in the development, production, processing, protecting of the existing and new engineering materials. (ABET:k)			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			
	QUALITY/ENVIRONMENT			
	DESIGN PROCESS OR PRODUCT	**X**		
MATERIAL CLASSES	**METAL**			X
	CERAMICS			X
	POLYMERS		X	
	COMPOSITES		X	

1: Little, 2. Partial, 3. Full

Prepared by	Date	**Signature**
Prof.Dr. Ömer Serdar Özgen, Prof.Dr. Cevat Bora Derin, Prof. Dr. Murat Baydoğan	December 2020	