Course Name						
MATERIALS CHARACTERIZATION LABORATORIES						
Code	**Semester**	**Local Credits**	**ECTS Credits**	**Course Implementation, Hours/Week**		
				Theoretical	**Tutorial**	**Laboratory**
MET 339E	5	1	3	-	-	2

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**
	-	20	80	

Course Description	Metallographic sample preparation 1-2, Metallography of non-ferrous metals and worked materials, Metallography of iron based materials, and quantitative metallurgy, Analysis of factors that affect the X-ray diffraction pattern, Qualitative phase analysis with X-ray diffraction, NDT tests as liquid penetration, magnetic powder, ultrasonic and radiographic methods, Ceramic raw material preparation, Granulation, Plasticity determination, Semi-wet shaping, Sintering, Characterization of ceramics, Sample analysis with electron microscope.
Course Objectives	It is primarily aimed in this course to show experimentally to the students the subject material they learned theoretically in courses such as materials science, metallography, analysis of factors that affect the X-ray diffraction pattern, powder materials, ceramics, etc. It is also the purpose of this course to direct the students' knowledge to be exploited in the design and applications. Students will gain an understanding about the basic concepts of production processes and the relationships between the parameters and processes, and the correlation between structure, property, and performance of a given material, and ability to analyze the results. Moreover, oral and written communication skills of the students are intended to be improved by the conversations held before, during, and after the experiments for discussing the preparation of experiments and their results, and by preparing a formal written report.
Course Learning Outcomes	1.It is the aim of this course to show experimentally to the students the subject material they learned theoretically in courses such as materials science, metallography, factors effects the X-ray diffraction pattern, powder materials, ceramics, etc. 2.It is also the purpose of this course to guide the students' knowledge to be used in the design and applications of materials. 3.Learning of the material characterization methods by comparing the well known methods with newly developed techniques. 4.Getting information about materials selection and design according to their manufacturing techniques and applications areas. 5.Moreover, oral and written communication skills of the students are intended to be improved by holding conversations before, during, and after the experiments to discuss the setting up the experiments and their results, and by preparing a formal written report.
Textbook	Metallurgy Laboratory Pamphlet and other resources defined for each experiment.
Other References	
Homework & Projects	
Laboratory Work	9 Experiments
Computer Use	USE OF WORD AND EXCEL, DATA EVALUATION PROGRAMMS
Other Activities	**LABOROTORY ORIENTATION (LAB SECURITY)**

Assessment Criteria	**Activities**	**Quantity**	**Effects on Grading, %**
	Midterm Exams		
	Quizzes	**9**	**20 (Quiz / Experiment)**
	Homework		
	Projects		
	Term Paper/Project		
	Laboratory Work	**9 (Exp)**	**60 (Written Report/Experiment)**
	Other Activities		**20 (Participation In The Experiments)**
	Final Exam		

COURSE PLAN

Weeks	Topics	Course Outcomes
1	Registration	1
2	Introduction to metallurgical laboratories and laboratory security.	1
3	Metallographic sample preparation - 1&2	1-5
4	Metallography of non-ferrous metals and worked materials, Metallography of iron based materials, and quantitative metallurgy	1-5
5	Analysis of factors that affect the X-ray diffraction pattern	1-5
6	Qualitative phase analysis with X-ray diffraction	1-5
7	Liquid penetration, magnetic powder, ultrasonic and radiographic methods	1-5
8	Experiments of ceramic and powder materials I / Preparation of powder blends and mixtures	1-5
9	Experiments of ceramic and powder materials II / Treatments before forming the ceramic materials, sintering	1-5
10	Experiments of ceramic and powder materials III / Characterization	1-5
11	Sample analysis with electron microscope	1-5
12	Make-up experiments	
13	Make-up experiments	
14	Make-up experiments	

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			X
	POLYMER		X	
	COMPOSITES		X	
	BIOMATERIALS	X		

1: Little, 2: Partial, 3: Full

Prepared by	Date	Revision #	Signature
Faculty Members	December 2020		