Course Name						
CERAMIC MANUFACTURING						
Code	**Semester**	**Local Credits**	**ECTS Credits**	**Course Implementation, Hours/Week**		
				Theoretical	**Tutorial**	**Laboratory**
MET 485E	7	2	3	2	-	-

Department/Program	Metallurgical & Materials Eng.		
Course Type	Elective	**Course Language**	English
Course Prerequisites	None		

Course Category by Content, %	**Basic Sciences**	**Engineering Science**	**Engineering Design**	**General Education**
	-	80	20	-

Course Description	Introduction to ceramic materials. Types of ceramics. The properties and applications of traditional and advanced ceramics and refractories. The principles of crystal structures of ceramics. Descriptions, classifications and properties of natural and synthetic raw materials. The physical, chemical and mineralogical properties of raw materials and their determination techniques. The processing of natural raw materials. Synthesis of ceramic powders. The principles and technologies of shaping of ceramics. The production and properties of ceramic glazes. The calculations of ceramic body and glaze formulations. The principles and technology of ceramics drying. Sintering of ceramics. Mechanisms of powder sintering and firing technologies. Kilns and furnaces. Procedures for the quality control of ceramics. National and international standards. The presentation and discussion of student homeworks.
Course Objectives	1. To inform students about ceramic raw materials, their preparation, enrichment and/or production methods. 2. To teach students ceramic production steps and encourages them to acquire skills for studying effects of starting raw material features; shaping and sintering on microstructure and features
Course Learning Outcomes	Students who pass the course will be able to: 1.Understand ceramic raw materials (traditional and advanced-synthetic), 2.Understand processing and/or production of the ceramic raw materials, 3. Understand ceramic forming techniques, and choose the forming method due to product. 4. Know about firing and sintering processes and how to choose sintering method due to product., 5.Understand relation between raw materials, sintering process, and physical, chemical properties and microstructure of ceramic materials
Textbook	1. Principles of Ceramics Processing, 2nd Edition by James S. Reed,1995 2. Fundamentals of Ceramic Powder Processing and Synthesis, Terry A. Ring,1996
Other References	
Homework & Projects	Term project will be given to students for participation course. This project will be presented during course and counted as mid-term exam.
Laboratory Work	
Computer Use	
Other Activities	

Assessment Criteria	**Activities**	**Quantity**	**Effects on Grading, %**
	Midterm Exams		
	Quizzes	**1**	**10**
	Homework		
	Projects		
	Term Paper/Project	**1**	**40**
	Laboratory Work		
	Other Activities		
	Final Exam	**1**	**50**

COURSE PLAN

Weeks	Topics	Course Outcomes
1	Description of ceramic materials, relationship properties- microstructure-sintering process, brief history of ceramic materials, classification of ceramic materials; description of traditional ceramics and advanced ceramics	1
2	Description of ceramic raw materials, classification, traditional ceramic raw materials and their mineralogical structures,	1,2
3	Technical ceramic raw materials (synthetic ceramic raw materials), Oxide ceramic raw materials, Al_2O_3 production	1,2
4	Carbide ceramic raw materials production processes, production of SiC raw materials.	1,2
5	Nitride ceramic raw materials production processes, production of Si_3N_4 raw material-Student Presentations	1,2
6	Particle size reduction processes of ceramic raw materials, performing processes-granulation and spray drying- Student Presentations.	2
7	Ceramic forming processes- Student Presentations.	3
8	Ceramic firing and sintering processes- Student Presentations.	4,5
9	Physical, chemical, micro structural and mechanical change in ceramic materials after firing and sintering process-Student Presentations.	4,5
10	National and international standards for ceramic materials-Student Presentations	1-5
11	Student Presentations	1-5
12	Student Presentations	1-5
13	Student Presentations	1-5
14	Student Presentations- General Review	1-5

Relationship between the Course and Metallurgical & 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			
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**			
	CERAMICS AND GLASS			**X**
	POLYMERS			
	COMPOSITES			
	BIOMATERIALS			

1: Little, 2. Partial, 3. Full

Prepared by	**Date**	**Revision #**	**Signature**
Prof. Dr. Ömer Serdar Özgen	Sept. 2021		