Course Name						
CERAMIC MANUFACTURING						
Code	**Semester**	**Local Credits**	**ECTS Credits**	**Course Implementation, Hours/Week**		
				Theoretical	**Tutorial**	**Laboratory**
MET 485E	7	2	4	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	Principles of Ceramics Processing, 2nd Edition by James S. Reed,1995 Fundamentals of Ceramic Powder Processing and Synthesis, Terry A. Ring,1996
Other References	
Homework & Projects	1 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 (as a presentation)**	**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	I
2	Description of ceramic raw materials, classification, traditional ceramic raw materials and their mineralogical structures,	I-II
3	Technical ceramic raw materials (synthetic ceramic raw materials),Oxide ceramic raw materials, Al2O3 production	I-II
4	Carbide ceramic raw materials production processes, production of SiC raw materials.	I-II
5	Nitride ceramic raw materials production processes, production of Si3N4 raw material-Student Presentations.	I-II
6	Particle size reduction processes of ceramic raw materials, performing processes-granulation and spray drying.- Student Presentations.	II
7	Ceramic forming processes- Student Presentations.	III
8	Ceramic firing and sintering processes- Student Presentations.	IV-V
9	Physical, chemical, micro structural and mechanical change in ceramic materials after firing and sintering process-Student Presentations.	IV-V
10	National and international standards for ceramic materials-Student Presentations.	I-V
11	Student Presentations.	I-V
12	Student Presentations	I-V
13	Student Presentations	I-V
14	Student Presentations- General Review.	I-V

Relationship between the Course and Metallurgical & 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)			
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)		X	
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		X	
	QUALITY/ENVIRONMENT	X		
	DESIGN PROCESS OR PRODUCT		X	
MATERIAL CLASSES	**METAL**			
	CERAMICS			X
	POLYMERS			
	COMPOSITES			

1: Little, 2. Partial, 3. Full

Prepared by	**Date**	**Signature**
Prof. Dr. Filiz Çınar Şahin	March, 2013	