Course Name						
ENERGY MATERIALS						
Code	**Semester**	**Local Credits**	**ECTS Credits**	**Course Implementation, Hours/Week**		
				Theoretical	**Tutorial**	**Laboratory**
MET 366E	6	2	3	2	-	-

Department/Program	Metallurgical and Materials Engineering		
Course Type	Elective	**Course Language**	English
Course Prerequisites	None		

Course Category by Content, %	**Basic Sciences**	**Engineering Science**	**Engineering Design**	**General Education**
	-	40	40	20

Course Description	Introduction to Energy and its use and importance in Metallurgy and Materials Engineering, Materials for Energy Harvesting (solar energy materials, photovoltaic materials, battery materials for wind and nuclear power, thermoelectric materials, materials used in fuel cell technology and their manufacturing methods. Materials used in energy storage (batteries, capacitors, hydrogen storage and their applications). Materials for housing (lighting, heating and cooling). Materials used for energy efficiency in industry. Novel Materials for Energy Applications and R&D trends for energy materials. Energetic Materials (basic principles, manufacturing processes, applications).
Course Objectives	1. To describe materials used in various energy harvesting and storage industries and teach their manufacturing processes. 2. To explain the importance of energy efficiency, introduce the materials providing energy efficiency both in everyday life and industry and teach the novel studies for energy efficient materials.
Course Learning Outcomes	The student will 1. Identify the importance of energy for Metallurgical and Materials Engineering. 2. Learn the materials used in various energy harvesting industries such as solar, wind, nuclear, battery,hydrogen storage, capacitors and thermoelectric and manufacturing processes of these materials. 3. Learn the materials which prevent serious consumptions of energy in everyday life such as lighting, cooling and heating. 4. Know which materials are used for energy efficiency in industrial processes. 5. Identify the novel materials and technologies used in energy applications and the latest developments made for energy saving in materials science.
Textbook	Kreith F. ve Goswami D. Y., Handbook of Energy Efficiency and Renewable Energy, Taylor & Francis, 2007.
Other References	1. Martin F., Materials for Energy Systems, Concise Encyclopedia of Materials for Energy Systems, Elsevier, 2008. 2. Mezzane D., Luk'yanchuk I., Smart Materials for Energy, Communications and Securtiy, Springer, 2008. 3. Agrawal J. P., High Energy Materials Propellants, Explosives and Pyrotechnics, Wiley- Vch, 2010.
Homework & Projects	
Laboratory Work	-
Computer Use	-
Other Activities	-

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

COURSE PLAN

Weeks	Topics	Course Outcomes
1	Introduction to Energy and its use in Metallurgy and Materials Engineering	1
2	Energy Consumption And Emmission Levels in Metallurgical Prosesses	1, 2
3	Materials for Energy Harvesting (Materials for Wind and Nuclear Power)	1, 2
4	Materials for Energy Harvesting (Thermoelectric Materials)	1, 2
5	Materials for Energy Transformation (Fuel Cell Materials and Components)	1, 2
6	Materials for Energy Transformation (Fuel Cell Materials and Components)	1, 2
7	Materials for Energy Harvesting (Solar Energy Materials and Photovoltaic Materials)	1, 2
8	Materials for Energy Storage (Materials for Batteries and Capacitors)	1,2
9	Materials for Energy Storage (Hydrogen Storage Materials)	1, 2
10	Materials for Industrial Energy Efficiency	3,4
11	Guest Lecturer from Industry on Energy Materials and Energy Applications	3,4
12	Energetic Materials and their applications	5
13	Student Presentation	5
14	Student Presentation	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			
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			
	PROCESSING		**X**	
	COST/PERFORMANCE			**X**
	QUALITY/ENVIRONMENT			**X**
	DESIGN PROCESS OR PRODUCT			
MATERIAL CLASSES	**METAL**		**X**	
	CERAMICS AND GLASS		**X**	
	POLYMER		**X**	
	COMPOSITES		**X**	
	BIOMATERIALS			

1: Little, 2: Partial, 3: Full

Prepared by	**Date**	**Revision #**	**Signature**
Prof. Dr. Onuralp YÜCEL Prof. Dr. Sebahattin GÜRMEN Prof. Dr. Özgül KELEŞ	December 2020		