Course Name						
ENVIRONMENT & ETHICS IN METALLURGICAL & MATERIALS PROCESSING						
Code	**Semester**	**Local Credits**	**ECTS Credits**	**Course Implementation, Hours/Week**		
				Theoretical	**Tutorial**	**Laboratory**
MET 446E	8	2	4	2	-	-

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

Course Category by Content, %	**Basic Sciences**	**Engineering Science**	**Engineering Design**	**General Education**
	-	20	60	20

Course Description	Metallurgy sector is usually considered as the primary source of heavy metal emission, one of the most important parameters of environmental pollution, which realizes during the numerous steps of metal production processes. It is possible to minimize the dangers and hazards of metallurgical production processes to the environment by the design of zero-waste processes, transforming wastes into re-usable materials, recycling the metallic scrap material, and developing energy-efficient technologies. This course covers all aspects of metallurgical wastes and sources of pollutions in metallurgical processes. The ways to minimize these wastes, waste management, recycling processes and developing energy efficient processes along with legal and ethical responsibilities will be taught. In the course, the importance of ethical responsibilities over legal responsibilities will be emphasized
Course Objectives	1.Toxicological & Ecological effects of metal and compounds 2.Design of zero-waste processes 3.Transforming metallic wastes into re-usable materials 4.Recycling of metallic scraps 5.Minimization of hazardouss metallurgical processes by means of developing energy-efficient technologies imposing the concept of environment and environmental protection by giving required engineering knowledge
Course Learning Outcomes	The student will 1.General concepts such as; environment, environmental protection, toxicology, pollution, recycling, waste water, solid wastes, ecology, and ethical responsibilities of engineers. 2.Solid wastes (primary and secondary) produced during metallurgical operations, and solid, liquid, and gaseous wastes form during the production of important metals, 3.Fundamental principles and technologies of waste management, 4.The role of engineering ethics in designing zero-waste processes 5.Minimization of the damages caused by the metallurgical processes to the environment, through process optimization and new designs such as; recycling of metallic scrap, development of energy efficient techniques, 6.Indirect environmental pollution related with the energy utilization in metallurgical production processes, recycling of metals, energy saving and environmental protection concepts of recycling, 7.Consciousness and affection alone are not adequate to protect the environment, unless this concern turns into action supported by the engineering knowledge and ethics.
Textbook	1.Resource recovery and recycling from metallurgical wastes [electronic resource] / by S. Ramachandra Rao Amsterdam ; London : Elsevier, 2006 2.Industrial waste treatment handbook / Frank Woodard, Boston : Butterworth-Heinemann, c2001 3.Handbook of Solid Waste Disposal : 4.Materials And Energy Recovery / Joseph L. Pavoni, John E. Heer, Jr., D. Joseph Hagerty., Steel industry and the environment, International Iron and Steel Institute ,Brussels : the Institute ; Paris : the Programme, 1997 5.Türkiye'de katı atık yönetimi ve geri kazanım / Kızıltan Yüceil Environmentally conscious materials and chemical processing / edited by Myer Kutz Hoboken, N.J. : John Wiley, 2007
Other References	1.The eco-design handbook : a complete sourcebook for the home and office / Alastair Fuad-Luke London : Thames & Hudson, c2004 Recycle Of Aluminum, 2.Heavy Metals in the Environment edited by Bibudhendra Sarkar, 2002, NY, ISBN: 0-8247-0630-7 3.Dust control handbook / Vinit Mody, Raj Jakhete. Park Ridge, N.J., U.S.A. : Noyes Data, c1988 4.Symnposium books Recycling ve Metallurgical Scraps
Homework & Projects	Students who attend this course are required to prepare term homework and present their work. The homework is generally about a prevention and/or minimization and/or recycling of a metallurgical waste. With this homework, students are encouraged to
Laboratory Work	-
Computer Use	During the course, PowerPoint presentations are utilized to visualize data.
Other Activities	-

Assessment Criteria	**Activities**	**Quantity**	**Effects on Grading, %**
	Midterm Exams	**MIN 1**	**25**
	Quizzes		
	Homework		
	Projects		
	Term Paper/Project	**1**	**25**
	Laboratory Work		
	Other Activities		
	Final Exam	**1**	**50**

COURSE PLAN

Weeks	Topics	Course Outcomes
1	Introduction, general concepts of environment, environmental protection, toxicology, pollution, recycling, and engineering ethics,	1,2,3,4,5,6,7
2	Discussion on selected topic (Toxicology, wastewater treatment, metallurgical wastes etc.),	1,2,3,4,5,6,7
3	Discussion on selected topic (the importance of recycling, environmental pollution, ethical approaches in selection of recycling technologies etc.)	1,2,3,4,5,6,7
4	Group presentations and discussion I	1,2,3,4,5,6,7
5	Group presentations and discussion II	1,2,3,4,5,6,7
6	Group presentations and discussion III	1,2,3,4,5,6,7
7	Group presentations and discussion IV	1,2,3,4,5,6,7
8	Group presentations and discussion V	1,2,3,4,5,6,7
9	Group presentations and discussion VI	1,2,3,4,5,6,7
10	Group presentations and discussion VII	1,2,3,4,5,6,7
11	Group presentations and discussion VIII	1,2,3,4,5,6,7
12	Group presentations and discussion IX	1,2,3,4,5,6,7
13	Group presentations and discussion IX	1,2,3,4,5,6,7
14	Group presentations and discussion XI	1,2,3,4,5,6,7

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, analyze 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 AND GLASS	X		
	POLYMER		X	
	COMPOSITES	X		
	BIOMATERIALS			

1: Little, 2: Partial, 3: Full

Prepared by	Date	Revision #	Signature
Assoc. Prof. Dr. Mehmet Şeref Sönmez Asst. Prof. Dr. Cevat Fahir Arısoy	December 2020		