Course Name						
Environment & Metallurgical Engineering						
Code	**Semester**	**Local Credits**	**ECTS Credits**	**Course Implementation, Hours/Week**		
				Theoretical	**Tutorial**	**Laboratory**
MET 421	7	3	**5**	3	0	0

Department/Program	Metallurgical & Materials Engineering			
Course Type	Elective	**Course Language**	Turkish	
Course Prerequisites	None			
Course Category by Content, %	**Basic Sciences**	**Engineering Science**	**Engineering Design**	**General Education**
		20 %	**80 %**	

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.
Course Objectives	4. Toxicological & Ecological effects of metal and compounds 5. Design of zero-waste processes 6. Transforming metallic wastes into re-usable materials 7. Recycling of metallic scraps 8. Minimization of hazardous 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	Students who pass the course will be able to: I. General concepts such as; environment, environmental protection, toxicology, pollution, recycling, waste water, solid wastes, ecology, etc., II. Solid wastes (primary and secondary) materialize during metallurgical operations, and solid, liquid, and gaseous wastes form during the production of important metals, III. Fundamental principles and technologies for the beneficiation of wastes, IV. Design of processes with zero-waste, V. 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, VI. Indirect environmental pollution related with the energy utilization in metallurgical production processes, recycling of metals, energy saving and environmental protection concepts of recycling, VII. Consciousness and affection alone are not satisfactory to protect the environment, unless this concern turns into action supported by the engineering knowledge and skills
Textbook	Resource recovery and recycling from metallurgical wastes [electronic resource] / by S. Ramachandra Rao Amsterdam ; London : Elsevier, 2006 Industrial waste treatment handbook / Frank Woodard, Boston : Butterworth-Heinemann, c2001 Handbook Of Solid Waste Disposal : 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 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	The eco-design handbook : a complete sourcebook for the home and office / Alastair Fuad-Luke London : Thames & Hudson, c2004 Recycle Of Aluminum, Recycling ve Metallurgical Scraps konulu sempozyum kitapları Dust control handbook / Vinit Mody, Raj Jakhete. Park Ridge, N.J., U.S.A. : Noyes Data, c1988
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	NONE
	NONE
Computer Use	During the course, PowerPoint presentations are utilized to visualize data.
Other Activities	NONE

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, etc.,	**I -VII**
2	Toxicology of metals, toxicological effecting mechanisms of metal compounds depending on their structures and types,	**II**
3	Water and waste water standards, water recycling, waste water formation in metallurgical plants,	**I -,III**
4	Waste water beneficiation, technologies for the recovery,	**I ,IV**
5	Solid wastes (primary and secondary) materialize during metallurgical operations,	**III,IV,V**
6	Stack gases of Electric Arc Furnaces and primary metal production processes, and methods for their beneficiation,	**III,V**
7	Assessing and discussing the ethics of the environmental impact of red mudd, cyanide waste solution dams, etc. and solid waste collection systems such as İzaydaş,	**IV, VI,VII**
8	Investigating the economical, technological and environmental aspects of metal recycling, -case study: non ferrous metals scrabs	**V,VI,VII**
9	Investigating the economical, technological and environmental aspects of metal recycling, -case study: ferrous scrabs	**V,VI,VII**
10	,Investigating the economical, technological and environmental aspects of metal recycling, -case study: electronic scrap, aluminum cans household ware, alt autos	**V,VI,VII**
11	Gaseous wastes form in metallurgical operations, minimization techniques, precautionary measures	**II, V,**
12	Gaseous wastes form in metallurgical operations, minimization techniques, precautionary measures	**II,V**
13	Presentation, discussion, and evaluation of student projects,	**I - VII**
14	Presentation, discussion, and evaluation of student projects,	**I - VII**

Relationship between the Course and Metallurgical and 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)			X
7	An understanding of current/contemporary issues and impact of engineering solutions in broad cultural, national and global levels;. (ABET:h, j)			X
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 and surface treatment 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			**X**
	CERAMICS	**X**		
	POLYMERS		**X**	
	COMPOSITES	**X**		

1: Little, 2. Partial, 3. Full

Prepared by	Date	**Signature**
Prof. Dr. İsmail DUMAN and Prof. Dr. Servet TİMUR	30.06.2009	