PROCESS METALLURGY						
Code	**Semester**	**Local Credits**	**ECTS Credits**	**Course Implementation, Hours/Week**		
				Theoretical	**Tutorial**	**Laboratory**
MET374E	6	2	4	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**
	-	20 %	80 %	-

Course description	This course is intended to serve as a comprehensive course in process engineering metallurgy for an upper undergraduate in the metallurgical engineering & materials science curriculum. Engineering aspects of mineral processing, including unit operations and flow sheets. Science and technology of metal extraction with applications to specific ferrous and non-ferrous metals. The course includes methods for reactors used in iron and steelmaking, non-ferrous metallurgy, handling and use of metallurgical by-products, project task, and scaling-up of some metallurgical reactors and processes.
Course objectives	The aim of this course is to develop an understanding of principles of metallurgical processes, reactor design, metallurgical reactions, and development of metallurgical processes. Many of the unique features of metallurgical systems have been described in sufficient detail and numerous illustrative examples have been included so that it should also be useful for future metallurgical engineers working in the development period of new processes and/or in the continuation of the current processes.
Course learning outcomes	The students who successfully pass this course gain knowledge, skill and competency in the following subjects; I. Describe and explain processes and reactors for extraction and manufacturing of metals and alloys II. Knowledge of structure and properties of metallurgical matters III. Basic transport phenomena approaches in the applications of metallurgical processing IV. Estimation of chemical and electrochemical reaction rates based on kinetic perspective V. Important considerations in reactor design and scaling-up studies VI. Environmental concerns both in current and future metallurgical processes
Textbook	• Engineering in Process Metallurgy, Guthrie R.I.L., Carreon Press Oxford, 1993. • Treatise on Process Metallurgy, Vol.1,2,3, Editor-in-Chief: Seetharaman S., Elsevier, 2014.
Other references	• Handbook of Extractive Metallurgy, Habashi F., Wiley-VCH, 1997. • Transport Phenomena in Materials Processing, Poirier D.R., Geiger G.H., The Minerals, Metals & Materials Society, 2016. • Transport Phenomena in Metallurgy, Geiger G.H., Poirier D.R., Addison Wesley Pub. Co., 1973. • Engineering Data on Mixing, Mezaki R., Mochizuki M., Ogawa K.; Elsevier Science, 1999. • Perry's Chemical Engineers' Handbook, Tilton J., 8th Ed., McGraw Hill, 2008.
Homework & projects	One group project
Laboratory work	None
Computer use	None
Other activities	None

Assessment criteria	**Activities**	**Quantity**	**Effects on grading, %**
	Midterm exams	**1**	**25 %**
	Quizzes	**-**	**-**
	Homework	**-**	**-**
	Projects	**-**	**-**
	Term Paper/Project	**1**	**30%**
	Laboratory Work	**-**	**-**
	Other Activities	**-**	**-**
	Final exam	**1**	**45 %**

COURSE PLAN

Weeks	Topics	Course outcomes
1	Process Metallurgy – An Argosy Through Time	1-6
2	Introduction to Metallurgical Processing	1-6
3	Classification of Metallurgical Reactors	1, 2, 3, 4
4	Structure and properties of molten metal and silicate slags	1, 2
5	Importance of Transport Phenomena in Metallurgical Processing	1, 3
6	Chemical and Electrochemical Reaction Kinetics	1, 4
7	Midterm exam	
8	Iron and Steel Technology	1-6
9	Electric Furnace Steelmaking	1-6
10	Non-ferrous process principles and product technologies (I)	1-6
11	Non-ferrous process principles and product technologies (II)	1-6
12	Process Concept for Scaling-Up and Plant Studies	1-6
13	Environmental aspects and the future of process Metallurgy	1, 6
14	Group projects	

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)		**X**	
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 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			
	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			
	COMPOSITES			

1: Little, 2: Partial, 3: Full

Prepared by	**Date**	**Signature**
Prof. Dr. Cüneyt ARSLAN Assoc. Prof. Dr. Güldem KARTAL ŞİRELİ	December, 2017	