Course Name						
IRON & STEEL MAKING						
Code	**Semester**	**Local Credits**	**ECTS Credits**	**Course Implementation, Hours/Week**		
				Theoretical	**Tutorial**	**Laboratory**
MET 479E	7	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**
	-	60	40	-

Course Description	Introduction to iron and steel making processes. Iron and steel industry in the world and Turkey. Raw materials and metallurgical pretreatments. Production of metallurgical coke. Iron ore and characterization. Sintering and pelletizing of iron ore. Production of molten (pig) iron. Blast furnace and auxiliaries Principles of pig iron production at the blast furnace. Reduction thermodynamics of iron oxides. Bosh and heart reactions. Slag formation. Techniques for increasing blast furnace productivity. Basic principles of steel production and history processes. Steel production in basic oxygen converter. Steel production in electric arc furnaces. Deoxidation, gas purging and other ladle treatments. Principles and technologies of ingot and continuous casting methods. Alternative and new iron production processes. Production of sponge iron. Smelting reduction processes.
Course Objectives	1.Understanding the basic principles and applications of steelmaking. 2.Understanding the raw materials and the effects of its properties on production 3.Understanding the basic principles of productivity and applications 4.Understanding the basic principles of the steel product quality development and applications
Course Learning Outcomes	The student will 1. Understand the principles and processes of steel production. 2. Understand the principles and applicability of straight and productive use of raw materials. 3. Understand and apply the principles of environment-friendly production 4. Understand the principles and the applications of improving the steel quality 5. Design new steel production processes
Textbook	Lecture notes
Other References	1. Bisvas, A. K., Principles of Blast Furnace Ironmaking, Theory and Practice, Cootha Publishing House, 1981. 2. J. G. Peacey, W. G. Davenport Mcgill University, Montreal, Canada, The Iron Blast Furnace Theory and Practice, 1989 3. A. Babich, D. Senk, H.W. Gudenau, K. Th. Mavrommatis, Ironmaking, Textbook, Rwth Aachen University. 4. Mc. Ganon, H. E., The Making, Shaping and Treating of Steel, United States Steel, 10. Ed., Pittsburg 1985. 5. Alexander Babich, Dieter Senk, Coke in The Iron and Steel Industry, Department of Ferrous Metallurgy (Iehk), Rwth Aachen University, Germany 6. F.T.Mahi, C.L.Nassaralla, Iron Production, Encyclopedia Of Materials: Science And Technology, 2001, Pages 4296-4301. 7. Yongxiang Yanga, Kalevi Raipalab And Lauri Holappac, Ironmaking, Treatise on Process Metallurgy, 2014, Pp. 2-88 8. Toshihiko Emi, Steelmaking Technology for The Last 100 Years: Toward Highly Efficient Mass Production Systems for High Quality Steels, Isij International, Vol. 55 (2015), No. 1, Pp. 36–66 9. J. Madiasd, Electric Furnace Steelmaking, Treatise on Process Metallurgy, Pp.271-300.
Homework & Projects	Homework about the steel production by evaluation of the various raw materials in the environment-friendly processes and alternative processes. Preparation of personal homework and written reports about steel production.
Laboratory Work	-
Computer Use	-
Other Activities	Visit to some industrial plants

Assessment Criteria	**Activities**	**Quantity**	**Effects on Grading, %**
	Midterm Exams	**2**	**40**
	Quizzes		**-**
	Homework	**1**	**5**
	Projects		
	Term Paper/Project	**1**	**5**
	Laboratory Work	**-**	
	Other Activities		**-**
	Final Exam	**1**	**50**

COURSE PLAN

Weeks	Topics	Course Outcomes
1	Introduction to iron and steel making processes.	1,2,3,4,5
2	Raw materials and metallurgical pre-treatments. Production of metallurgical coke	1,2,3,4,5
3	Iron ore and characterization. Sintering of iron ore.	1,2,3,4,5
4	Pelletizing of iron ore. Tests for detecting the properties of agglomeration products	1,2,3,4,5
5	Production of molten (pig) iron. History. Blast furnace and facilities. Principles and production of pig iron at the blast furnace.	1,2,3,4,5
6	Reduction of iron oxides. Bosh and heart reactions. Slag formation. techniques for increasing blast furnace productivity.	1,2,3,4,5
7	Reduction of iron oxides. Bosh and heart reactions. Slag formation. techniques for increasing blast furnace productivity.	1,2,3,4,5
8	Basic principles of steel production and history of production processes. Steel production in basic oxygen converter.	1,2,3,4,5
9	Steel production in electric arc furnaces. Applications.	1,2,3,4,5
10	Deoxidation and secondary metallurgy treatments. Casting technologies.	1,2,3,4,5
11	Alternative technologies, production of sponge iron. Smelting reduction processes. New technologies	1,2,3,4,5
12	Techno economic analysis of iron and steel industry in the world and Turkey.	2,3,4,5
13	Analysis of steel production methods in terms of strategies of steel and raw materials.	1,2,3,4,5
14	Presentation of studies, Discussion and general consideration of lecture	1,2,3,4,5

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		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			
	COMPOSITES			
	BIOMATERIALS			

1: Little, 2: Partial, 3: Full

Prepared by	Date	Revision #	Signature
Assoc. Prof. Dr. Cevat Fahir Arısoy	December 2020		