Course Name						
INTRODUCTION TO ELECTROMETALLURGY						
Code	**Semester**	**Local Credits**	**ECTS Credits**	**Course Implementation, Hours/Week**		
				Theoretical	**Tutorial**	**Laboratory**
MET 477E	7	2	3	2	-	-

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

Course Category by Content, %	**Basic Sciences**	**Engineering Science**	**Engineering Design**	**General Education**
	-	40	60	-

Course Description	Introduction to Electrometallurgy, Electrochemical principles, Electrolytic conduction, Molar conductivity, Transport numbers, Chemical changes in electrolysis, Examples of electrolysis, Electrode reactions, Stoichiometry of electrolysis (Faraday's Laws), Concentration changes in aqueous electrolytes, Galvanic cells, Electrochemical series, Redox half-cells, Kinetics of electrode reactions, Potentiometric cells, Reversible conditions, Standard Hydrogen Electrode, Potentials and thermodynamics of cells, Decomposition potential, Overpotential, Anodic oxidation, Cathodic reduction, Eh-pH diagrams, Technological applications; Leaching, Precipitation, Metal extraction and refining, Electrowinning of metals, Fused salt electrolysis of aluminum and magnesium, Electroplating, Electrochemical polishing, Batteries, Fuel cells.
Course Objectives	It is the aim of this course to teach the following topics with in-depth analysis of the chemical principles, beneath the related subjects, and with numerous example problems covering the subject materials in the field of electrometallurgy. To describe the principles and practice of electrometallurgical and other electrochemical processes, which are, or could be, used in the production of metals.
Course Learning Outcomes	Upon completion of this course, a student should be able to: 1. have a detailed knowledge and understanding of some of the existing electrometallurgical processes, having learned the underlying principles, 2. have developed skills in analysing those existing processes which they can also use to conceive and conceptually design novel processes, and 3. be aware of sources of further relevant information
Textbook	Fundamental aspects of Electrometallurgy, Konstantin Ivanovich Popov, Stojan S. Djokić, Branimir N. Grgur, Kluwer Academic/Plenum Publishers, 2002, New York.
Other References	1. Electrochemistry, Rieger P.H., Prentice-Hall, 1982, New Jersey, U.S.A. 2. Industrial Electrochemistry, Pletcher D., Chapman and Hall, 1982, New York. 3. Chemical Metallurgy, Moore J.J., Butterworths and Co., 1981, London. 4. Electrochemical Method, Bard A.J. and Faulkner L.R., John Wiley and Sons, Inc., 1980, New York. 5. Experimental Approach to Electrochemistry, Selley N.J., John Wiley and Sons, Inc., 1977, New York. 6. Principles of Extractive Metallurgy, Rosenqvist, T., McGraw-Hill, Inc., 1974, New York
Homework & Projects	Each student will prepare a Term Paper related to contemporary P/M engineering applications and present it during last two weeks the semester. According to number of students enrolled to the course this work is either performed individually or as in groups and will be decided by lecturer.
Laboratory Work	-
Computer Use	-
Other Activities	-

Assessment Criteria	**Activities**	**Quantity**	**Effects on Grading, %**
	Midterm Exams	**1**	**20**
	Quizzes	**1 (MIN)**	**15**
	Homework	**1**	**15**
	Projects		
	Term Paper/Project		
	Laboratory Work		
	Other Activities		
	Final Exam	**1**	**50**

COURSE PLAN

Weeks	Topics	Course Outcomes
1	Introduction to Electrometallurgy, Electrochemical principles, Electrolytic conduction, Molar conductivity, Transport numbers	1,2
2	Chemical changes in electrolysis, Examples of electrolysis, Electrode reactions	1,2
3	Stoichiometry of electrolysis (Faraday's Laws), Concentration changes in aqueous electrolytes	1,2
4	Galvanic cells, Electrochemical series, Redox half-cells	1,2
5	Kinetics of electrode reactions, Potentiometric cells, Reversible conditions	1,2
6	Standard Hydrogen Electrode, Potentials and thermodynamics of cells	1,2
7	Decomposition potential, Overpotential	1,2
8	Anodic oxidation, Cathodic reduction	1,2
9	Eh-pH diagrams	1,2
10	Technological Applications; Leaching, Precipitation	1-3
11	Metal extraction and refining, Electrowinning of metals	1-3
12	Fused salt electrolysis of Aluminum and Magnesium	1-3
13	Electroplating, Electrochemical polishing, Corrosion of iron	1-3
14	Batteries, Fuel cells	1-3

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			
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			
	POLYMER			
	COMPOSITES			
	BIOMATERIALS			

1: Little, 2: Partial, 3: Full

Prepared by	**Date**	**Revision #**	**Signature**
Prof. Dr. Cüneyt ARSLAN Prof. Dr. Sebahattin GÜRMEN	December 2020		