Course Name						
MATERIALS CHEMISTRY						
Code	**Semester**	**Local Credits**	**ECTS Credits**	**Course Implementation, Hours/Week**		
				Theoretical	**Tutorial**	**Laboratory**
MET 228E	4	2	3	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**
	30	50	20	

Course Description	This course provides introductory information to explain the material properties via their place in the periodic table. General approach to the surface properties of solids, the synthesis of inorganic materials through the gas, solution and solid reactions, and fundamental properties of materials such as thermal, optic, magnetic, etc by means of the bonding structure of materials, coordination chemistry and common electrochemical behavior of materials.
Course Objectives	The scope of lecture is to give: • the general explanation of material properties in the periodic table. • the idea behind the construction of periodic table. • the influence of chemical bonding types and complex structures of materials to material properties • solubility rules, acids, bases, pH, buffers, ligand exchange, redox reactions • the examination of amorphous solids, glass, slags, boron and metal borides, metal carbides and metal nitrides, metal oxides, intermetallics, transition metals by taking the structure of materials into account. • the electrical conductivity, optical and thermal properties of materials • the synthesis of inorganic materials through the gas, solution and solid reactions, • the electrochemical behaviors and properties of metals
Course Learning Outcomes	Students who pass the course will have knowledge on; I. the fundamental principles that underlie materials chemistry, elements and compounds, chemical formulas and reactions and relation between Periodic table and location of elements II. the influence of chemical bonding types and complex structures of materials to their properties III. the structure of materials, the complex compounds IV. inorganic molecules, liquids and solutions V. structural solid state chemistry VI. the chemistry of inorganic surfaces VII. synthesis of inorganic material VIII. electrochemical behavior of materials
Textbook	The Inorganic Chemistry Of Materials, Paul J. van der PUT, Prenum Press, NY, ISBN 0-306 45731-8-2007 • Course Hand outs
Other References	Materials Chemistry, Bradley D. Fahlman, Published by Springer, ISBN 978-1-4020-6119-6 (HB) and ISBN 978-1-4020-6120-2 2008 Harry L Allcock Introduction to Materials Chemistry, 2008, John&Wiley, ISBN 978-0-470-29333-1
Homework & Projects	
Laboratory Work	
Computer Use	
Other Activities	

Assessment Criteria	**Activities**	**Quantity**	**Effects on Grading, %**
	Midterm Exams	**1**	**20**
	Quizzes	**4**	**20**
	Homework	**2**	**20**
	Projects		
	Term Paper/Project		
	Laboratory Work		
	Other Activities		
	Final Exam	**1**	**40**

COURSE PLAN

Weeks	Topics	Course Outcomes
1	**The Technology of Materials,** The role of chemistry in Materials science, Fundemantal Principles that underlie materials chemistry	I - VIII
2	**The Periodic Table,** Fundemantal Principles that underlie materials chemistry, Introduction to elements and compunds, chemical formulas and reactions	I
3	**The Chemical Bond,** Electrons in Atomic Shells, Orbitals: Molecular Orbital and Valence Bond Models, The Coordinative Bond in Complexes Bonding in Ionic Compounds,	I, II, III
4	**Inorganic Molecules**, **Liquids and Solutions**, solubility rules, acids, bases, pH, buffers Ligand Exchange, Redox Reactions,	I, IV
5	**Structural Solid State Chemistry,** Crystal Chemistry, Amorphous Solids, Glass, Slags,Boron and, Metal Borids, Carbides and Nitrides, metal Oxides, Intermetallics, Transition metals,	I, III, IV,V
6	**Structural Solid State Chemistry**, Intrinsic Properties, Electron Conductivity,Dielectric Properties, Ion Conductivity, Magnetic, Mechanical, Optical, Chemical, Thermal Properties	I, III, IV,V
7	**Structural Solid State Chemistry**, Intrinsic Properties, Electron Conductivity,Dielectric Properties, Ion Conductivity, Magnetic, Mechanical, Optical, Chemical, Thermal Properties	I, III, IV,V
8	**Solid State Reactions,** Types of Reactions of Solids,The Chemistry of Oxide, Sulfide and others,	I, III, IV,V
9	**The Chemistry of Inorganic Surfaces,** Surface Chemistry,Inorganic Colloids, Converting Solids by Reaction with a Gaseous Recactant, Chemical Vapor Deposition,	IV, VI
10	**The Chemistry of Inorganic Surfaces,** The Pyrolylise, Powder Synthesis, High-Temperature Corrosion Surface Modification by Immobilization of Molecules	IV, VI
11	**Synthesis of Inorganic Material,** Inorganic Synthesis, Solid State Reactions Synthesis from Liquids, Preparation from Melts,	II, VII
12	**Synthesis of Inorganic Material,** Hydrothermal Processes, Sol-Gel Method, A Gas-Phase Techniques, Physical Vapor Deposition, Chemical Vapor Deposition, Plasma Synthesis	II, VII
13	**Electrochemical behavior of materials,** material and water interaction, Eh-pH, corrosion, electrochemical reduction and dissolution	I, VIII
14	**Different types of materials and Materials in Advanced Technology**	

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)			
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)			
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)			
7	An understanding of current/contemporary issues and impact of engineering solutions in broad cultural, national and global levels;. (ABET:h, j)			
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			x
	PROPERTIES			x
	DESIGN EXPERIMENT/ANALYSE DATA			
	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. Servet TİMUR	December 2020	