

Course Name						
FUNDAMENTALS OF MATERIALS SCIENCE						
Code	Semester	Local Credits	ECTS Credits	Course Implementation, Hours/Week		
				Theoretical	Tutorial	Laboratory
MET 213E	3	2.5	3	2	1	-
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		
	-	80	20	-		
Course Description	A general introduction to materials science an emphasizing the importance of materials science for materials engineering, basic classification of material, atomic structure and bonding, bond types, crystal and amorphous structures, miller indices, directions and planes in crystalline structures, imperfections and defects, pure metal, alloy, solid solution concepts, diffusion, mechanical properties of materials and control of microstructure and related engineering standards, introduction to phase diagrams and eutectic alloys, enhancing physical properties by various methods and heat treatments, materials production methods and nowadays engineering materials, engineering materials in the perspective of ferrous alloys, non-ferrous alloys, ceramic, polymer and composites and emphasizing important materials, research topics for future materials.					
Course Objectives	1.To improve students analytical thinking by focusing structure-property- process relations. 2.Learning basic materials science knowledge and based on this infrastructure recognizing the nowadays engineering materials and their basic production routes, understanding their microstructure and performance relations, selection and safety criteria and related engineering standards. 3.To encourage students to understand and experience disciplinary engineering in problem solving.					
Course Learning Outcomes	The Student will 1.Understand structure-property-process relations in materials. 2.Classify engineering materials 3.Describe atomic bonds, orders, crystallography and the effects of bonding in materials 4.Describe basic materials properties and the effect of properties on materials 5.Explain elastic and plastic deformation mechanism and strengthening mechanisms. 6.Explain and select test methods to understand the mechanical properties of materials 7.Understand the effect of deformation on the micro structural features of materials 8.Select materials and processes					
Textbook	<ul style="list-style-type: none"> • Askeland, D.R., "The Science and Engineering of Materials", Chapman & Hall,1993 					
Other References	<ul style="list-style-type: none"> • Shackelford, J.F., "Introduction to Materials Science for Engineers", Prentice-Hill • Callister, W.D., "Fundamentals of Materials Science and Engineering: An Integrated Approach", 2nd Edition, Wiley Pub. • Ashby, M., Shercliff, H., Cebon, D., "Materials: Engineering, Science, Processing and Design" 					
Homework & Projects						
Laboratory Work						
Computer Use						
Other Activities						
Assessment Criteria	Activities	Quantity		Effects on Grading, %		
	Midterm Exams	1		35		
	Quizzes	-				
	Homework	3		15		
	Projects	-				
	Term Paper/Project	-				
	Laboratory Work	-				
	Other Activities	-				
	Final Exam	1		50		

COURSE PLAN

Weeks	Topics	Course Outcomes
1	Introduction to Materials Science and Engineering	1, 2
2	Atomic Structure	1, 2
3	Atomic and Ionic Layouts	2, 3
4	Imperfections In The Atomic Arrangement	3
5	Atom Movements In Materials	2, 3
6	Mechanical Properties, Fracture Mechanisms, MIDTERM	4, 5, 6
7	Strain Hardening and Annealing	5, 6
8	Principles of Solidification Strengthening and Processing	5, 6
9	Solid Solution Strengthening and Phase Equilibrium	5, 6
10	Dispersion Strengthening by Solidification	5, 6
11	Dispersion Strengthening by Phase Transformation and Heat Treatment	5, 6
12	Ferrous Alloys	7
13	NonFerrous Alloys	7

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)			
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)		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			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		X	
	COMPOSITES		X	

1: Little, 2. Partial, 3. Full

<u>Prepared by</u> Prof.Dr.Gültekin GÖLLER Assoc. Prof. Dr. İpek AKIN KARADAYI	Date December 2020	Signature
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