Course Name						
DEFORMATION PROCESSES OF MATERIALS						
Code	**Semester**	**Local Credits**	**ECTS Credits**	**Course Implementation, Hours/Week**		
				Theoretical	**Tutorial**	**Laboratory**
MET487E	7	2	3	2	-	-

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

Course Category by Content, %	**Basic Sciences**	**Engineering Science**	**Engineering Design**	**General Education**
	-	50	50	-

Course Description	Description of plastic forming processes, Relationships between stress and strain, Mohr circle and yield criteria. Plastic deformation mechanisms and strain hardening. Factors affecting plastic deformation. Annealing furnaces employed in plastic forming operations. Forging, rolling, extrusion. Wire drawing and tube forming. Sheet forming operations.
Course Objectives	1. To define plastic forming processes and their basic principles. 2. To define microstructural changes of materials with the effect of plastic forming processes and the effect of these changes on mechanical properties. 3. To give an ability to apply knowledge to decide convenient plastic forming process for engineering materials.
Course Learning Outcomes	Students who pass the course will be able to: 1. Understand the basic principles of elastic deformations and the elastic constants, 2. Use the Holloman equation, Tresca and Von Mises yielding criteria, 3. Interpret of the relationships between mechanical properties of a material subjected to different strengthening mechanisms, 4. Understand the basic principles of forging, rolling, extrusion, wire drawing and tube forming processes and calculate the required force for these processes to perform for a particular material, 5. Understand the basic principles of sheet forming and sketch of forming limit diagrams.
Textbook	Kayalı, E.S. Ensari, C., Metallere Plastik Şekil Verme İlke ve Uygulamaları, , İTÜ Kimya-Metalurji Fakültesi, Ofset Atölyesi, İstanbul 1991.
Other References	• Dieter, G.E., Mechanical Metallurgy, McGraw Hill Book Company, London, 1988. • Kayalı, E.S., Çimenoğlu, H., Plastik Şekil Verme İlke ve Uygulamaları Problemleri ve Çözümleri, Bilim Teknik Yayınevi, İstanbul, 1985. • Schey,J.A., Introduction to Manufacturing Processes, McGraw Hill Book Company, New York, 1987.
Homework & Projects	Students will be given a subject and this will be presented in the class. Presentation subjects may be used as a source for exams.
Laboratory Work	
Computer Use	
Other Activities	

Assessment Criteria	**Activities**	**Quantity**	**Effects on Grading, %**
	Midterm Exams	**2**	**30**
	Quizzes		
	Homework		
	Projects		
	Term Paper/Project		
	Laboratory Work		
	Other Activities	**1**	**20**
	Final Exam	**1**	**50**

COURSE PLAN

Weeks	Topics	Course Outcomes
1	Introduction	I
2	Stress-strain relationships	I
3	Stress-strain relationships	I
4	Basic principles of plastic deformation	II
5	Strengthening mechanisms	III
6	Strengthening mechanisms	III
7	Factors affecting plastic deformation	III
8	Annealing furnaces employed in plastic deformation	IV
9	Forging	IV
10	Rolling	IV
11	Extrusion	IV
12	Wire drawing	IV
13	Tube forming	IV
14	Sheet forming methods	V

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)			
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)			
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		**X**	
	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

Prepared by	**Date**	**Signature**
PROF.DR. HÜSEYİN ÇİMENOĞLU PROF. DR. MURAT BAYDOĞAN	December 2020	