Course Name						
MECHANICAL PROPERTIES OF MATERIALS						
Code	**Semester**	**Local Credits**	**ECTS Credits**	**Course Implementation, Hours/Week**		
				Theoretical	**Tutorial**	**Laboratory**
MET344E	6	2	3	2	-	-

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

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

Course Description	Stress and strain concept. Elastic and plastic deformation. Mechanical tests. Plastic deformation mechanisms and Plastic forming processes,. Strengthening mechanisms, solid solution, strain hardening, strain aging, diffusionless transformation, dispersion and precipitation hardening. Metallurgical failures. Linear Elastic Fracture Mechanics. Fatigue types. Factors affecting fatigue strength. Crack initiation and propagation. Creep and stress rupture. Mechanical behaviours of ceramics polymers and composites. Mechanical properties of nanomaterials.
Course Objectives	1. To introduce basic stres-strain concepts and correlations between them, 2. To introduce which mechanical properties are used to determine mechanical behavours of materials under load, 3. To introduce loading conditions leading failure and failure criteria, 4. To correlate mechanical properties with internal structure
Course Learning Outcomes	Students who pass the course will be able to: 1. Stress – strain concept and correlations between them, 2. Mechanical properties and how to use them to determine mechanical behaviors of materials, 3. Knowledge on strengthening mechanisms, 4. Loading conditions on materials working under dynamic condition, 5. Effect of internal structure on performance of materials 6. Material behavior and failure mechanisms at elevated temperature. 7. Mechanical properties of ceramic, polymer, composite and nanomaterials.
Textbook	Kayalı, E.S., Çimenoğlu, H., Malzemelerin yapısı ve mekanik davranışları, İTÜ Kimya-Metalurji Fakültesi, Ofset Atölyesi, İstanbul 1986.
Other References	1. Ashby, M.F., Jones, D.R.H., Engineering Materials, An Introduction to their Properties and Applications, Pergamon Press, Oxford, 1983. 2. Dieter, G.E. Mechanical Metallurgy, McGraw Hill Book Company, London, 1988. 3. Meyers, M.A., Chawla, K.K., Mechanical Metallurgy, Prentice-Hall, Englewood Cliffs, New Jersey, 1984. 4. Courney, T.H., Mechanical Behaviour of Materials, McGraw Hill Publishing Company, Singapour, 1990.
Homework & Projects	Students will be given a homework assignment and a subject to be presented in the class. Homework assignments and 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**	**40**
	Quizzes		
	Homework	**1**	**10**
	Projects		
	Term Paper/Project		
	Laboratory Work		
	Other Activities	**1**	**10**
	Final Exam	**1**	**40**

COURSE PLAN

Weeks	Topics	Course Outcomes
1	Introduction to stress and strain concept, elastic and plastic deformation	1
2	Introduction to Mechanical tests. Hardness, tensile and impact tests	1,2
3	Plastic deformation mechanisms and yielding criteria	1,2
4	Plastic forming processes	2,3
5	Strengthening mechanisms and their effects to mechanical properties	2,3
6	Fatigue types. High and low cycle fatigue	2,4
7	Failures related to fatigue	2,4,5
8	Introduction to fracture mechanics and fracture tests	2,4,5
9	Plain strain fracture toughness, fatigue crack growth	2,4,5
10	Creep, stress rupture and stress relaxation concepts	2,6
11	Creep mechanism maps	2,6
12	Mechanical properties of ceramics and polymers	2,7
13	Mechanical properties of composites	2,7
14	Mechanical properties of nanomaterials	2,7

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)		**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)			
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			**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. E. SABRİ KAYALI PROF. DR. HÜSEYİN ÇİMENOĞLU	March 2013	