Course Name

Mechanical Behaviour Of Materials

Code	Semester	Local Credits	ECTS Credits	Course Implementation, Hours/Week		
				Theoretical	Tutorial	Laboratory
MET410E	8	3	5	3	-	-

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
	-	% 60	% 40	-

Course Description

Analysis of stress and strain, structure-property relationships, plastic deformation of crystalline and amorphous materials, plasticity of polycrystalline materials, strengthening mechanisms, mechanical properties of materials, fracture, introduction to fracture mechanics, fracture toughness, fatigue, factors affecting fatigue behaviour of materials, creep, creep mechanisms and creep resistant materials, mechanical properties of polymers and ceramics, friction and wear.

Course Objectives

1. To define mechanical properties and explain its importance on the basis of materials selection and design criteria
2. To teach relationships between mechanical properties and structure.
3. To define failure mechanisms such as fracture, fatigue, creep and wear and their causes and affecting factors.

Course Learning Outcomes

Students who pass the course will be able to:

I. Understand the mechanical properties of materials, experimental determination of these properties, and their importance.
II. Interpret structure property relationships,
III. Working conditions leading to fracture, fatigue, creep and wear dominated failure mechanisms,
IV. Interpret the mechanical properties of ceramic and polymer materials,
V. Interrelationships between mechanical properties.

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**	**30**
Quizzes		
Homework	**1**	**10**
Projects		
Term Paper/Project		
Laboratory Work		
Other Activities	**1**	**10**
Final Exam	**1**	**50**

COURSE PLAN

Weeks	Topics	Course Outcomes
1	Introduction	I
2	Atomic structure and crystalline structure	I
3	Stress-strain relationships	I-II
4	Dislocations and their importance for plastic deformation	II
5	Strengthening mechanisms	II
6	Plasticity of polycrystalline materials	II
7	Fracture and fracture toughness	III
8	Fatigue and fatigue mechanisms	III
9	Failure prevention criteria	III
10	Creep and creep mechanisms	III
11	Estimation of long term creep behavior from short term tests	III
12	Mechanical properties of ceramics and polymers	IV
13	Mechanical properties of ceramics and polymers	IV
14	Friction and wear	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)			
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 and surface treatment 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	04.05.2010	