Course Name						
MECHANICAL PROPERTIES OF MATERIALS						
Code	**Semester**	**Local Credits**	**ECTS Credits**	**Course Implementation, Hours/Week**		
				Theoretical	**Tutorial**	**Laboratory**
MET 344E	6	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**
	-	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 stress-strain concepts and correlations between them, 2.To introduce which mechanical properties are used to determine mechanical behaviours 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 behaviours 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. 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

	Student Outcomes	Level of Contribution		
		1	**2**	**3**
1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering science and mathematics	**X**		
2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare as well as global, cultural, social, environmental and economic factors			**X**
3	An ability to communicate effectively with a range of audiences	**X**		
4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts		**X**	
5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	**X**		
6	An ability to develop and conduct appropriate experimentation, analyse and interpret data, and use engineering judgement to draw conclusions	**X**		
7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies		**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 AND GLASS		**X**	
	POLYMER	**X**		
	COMPOSITES		**X**	

1: Little, 2: Partial, 3: Full

Prepared by	**Date**	**Revision #**	**Signature**
Prof. Dr. Hüseyin ÇİMENOĞLU Prof. Dr. Murat BAYDOĞAN	December 2020		