Course Name						
Static and Dynamic Strength of Materials						
Code	**Semester**	**Local Credits**	**ECTS Credits**	**Course Implementation, Hours/Week**		
				Theoretical	**Tutorial**	**Laboratory**
MET244E	**4**	3	3,5	3	-	-

Department/Program	Metallurgical and Materials Engineering Department			
Course Type	Required	**Course Language**	English	
Course Prerequisites	None			
Course Category by Content, %	**Basic Sciences**	**Engineering Science**	**Engineering Design**	**General Education**
	%20	% 40	% 40	-
Course Description	Basic definitions and principles of statics, scalar and vector quantities, moment concept, resultant forces, forces acting on beams and frames, single and distributed forces. Shear force and moment diagrams. Basic definitions and principles on strength of materials. Stress and strain concept. Normal and Shear stress. Elastic constants, elastic and plastic deformation, failure criteria, safety factor for design, principal stress and strain. Plane stress and plane stress concept. Mohr circle for stress and strain. Combined stresses. Moment of inertia, Torsion, Bending. Stresses acting on pressure vessels and columns, Strain-Based and Stress based fatigue strength. Fatigue crack growth, Static and dynamic fracture toughness, Damage tolerance			
Course Objectives	1. To define force, moment and equilibrium concepts, 2. To teach relationships between moment-stress and strain in torsion and bending, 3. To define stress, strain and strain energy concepts, 4. To define the stress acting on pressure vessels and columns, 5. To define failure mechanisms in dynamic conditions,			
Course Learning Outcomes	Students who pass the course will be able to: I. Understand the definitions of force, moment, stress and equilibrium, II. Calculate the load or stress acting on a system to maintain the equilibrium. III. Draw and interpret shear force and moment diagrams, IV. Understand basic definitions of strength of materials, V. Draw and interpret Mohr circle of stress and strain for various loading conditions, VI. To understand the importance of moment of inertia for materials in resisting of external forces VII. To calculate and interpret the stresses on pressure vessels and columns VIII. To understand fatigue life, fracture toughness and fatigue crack growth concept, IX. To understand damage tolerance concept			
Textbook	1. V.D. da Silva, Mechanics and Strength of Materials, Springer, 2006.			
Other References	1. F. P. Beer, E.R. Johnston, Jr. “Mechanics of Materials, McGRaw Hill, 1992, 2. A.Y. Aköz, N. Eratlı, Statik-Mukavemet, Beta, 2000. 3. R.L. Mott, Statics and Strength of Materials, Prentice – Hall, 2010. 4. A. Liu, “Mechanics and Mechanisms of Fracture, An Introduction”, ASM International, 2005.			
Homework & Projects	Students will be given 5 homeworks on the course subjects Homework 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	**5**	**20**
	Projects		
	Term Paper/Project		
	Laboratory Work		
	Other Activities		
	Final Exam	**1**	**40**

COURSE PLAN

Weeks	Topics	Course Outcomes
1	Definition of basic principles of statics, force, moment and equilibrium concept	I
2	Static equilibrium and Free body diagram	I, II
3	Resultant forces and moment	I, II
4	Forces acting on beams, single and distributed forces	I, II, III
5	Definition of basic principles of strength, normal and shear stresses	IV
6	Elastic constants, elastic and plastic deformation, safety factor	IV
7	Mohr circle and stress and strain	V
8	Torsion	VI
9	Bending	VI
10	Combined stresses	VI
11	Stress acting on pressure vessels and columns	VII
12	Stress based and strain based Fatigue life	VIII
13	Fracture toughness and fatigue crack growth	VIII
14	Damage Tolerance	IX

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)		**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)		**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)	**X**		
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			
	POLYMERS			
	COMPOSITES			

1: Little, 2. Partial, 3. Full

Prepared by	Date	**Signature**
Assoc. Prof. Dr. Murat BAYDOĞAN	March, 2013	