ECTS COURSE INFORMATION FORM

Faculty	**Faculty of Engineering**	
Program	**B.Sc. in Civil Engineering**	**Required**
	B.Sc. in Computer Engineering	**Elective**
	B.Sc. in Electrical-Electronics Engineering	**Elective**
	B.Sc. in Industrial Engineering	**Elective**
	B.Sc. in Mechanical Engineering	**Required**

Course Code	STM 203			
Course Title in English	Strength of Materials			
Course Title in Turkish	Mukavemet			
Language of Instruction	English			
Type of Course	Flipped Classroom			
Level of Course	Undergraduate			
Course Category (by % of Content)	Basic Science	Basic Engineering	Engineering Design	General Education
		100	**-**	-
Semester Offered	Spring			
Contact Hours per Week	Lecture: 3 hours	Recitation: 1 hour	Lab: -	Other: -
Estimated Student Workload	157 hours			
Number of Credits	6 ECTS			
Grading Mode	Standard Letter Grade			
Pre-requisites	STAT 102			
Expected Prior Knowledge	None			
Co-requisites	None			
Registration Restrictions	Only Undergraduate Students			
Overall Educational Objective	To acquire a basic knowledge and understanding of important concepts of axial, torsional, bending and combined loading conditions to compute normal and shear stresses, strains and deformations of simple structural elements, which are aimed to be safe under external loads.			
Course Description	This course provides a comprehensive introduction to some fundamental aspects of normal and shear stress, allowable stress in design. Deformation and strain. Hooke's law. Mechanical properties of materials. Stress and elastic deformation under axial load. Principal of superposition. Torsional deformation of circular shafts. Torsion formula and power transmission. Shear and bending moment diagrams. Flexure formula and stress calculations in bending. Transverse shear force and associated shear stress in beams. Thin walled pressure vessels. Combined stress due to bending, torsion, shear and axial load. Stress and strain transformation. Principle stresses and strains. Mohr's circle. Failure theories, and fatigue. Elastic curve, method of integration, statically indeterminate beams and method of superposition. Introduction to buckling of columns.			
Course Description in Turkish	Bu derste; mukavemetin temel kavramları şu konu başlıklar altında kapsamlı bir şekilde incelenmektedir: Normal ve kayma gerilmesi, Emniyet gerilmesi, Şekil değiştirme ve gerinim, Hook kanunu, Malzemelerin mekanik özellikleri, Eksenel yükleme durumunda gerilme ve şekil değiştirme, Süperpozisyon ilkesi, Dairesel kesitli şaftların burulması, Burulma formülleri ve güç iletimi, Kesme kuvveti ve eğilme momenti diyagramları, Eğilmede gerilme formülü ve normal gerilme hesapları, Düz çubuklarda kayma gerilmesi hesapları, İnce cidarlı basınçlı kaplarda gerilmeler. Gerilme ve Gerinim dönüşüm formülleri, asal gerilmeler ve gerinmler, Mohr dairesi. Kırılma teoriler; yorulma. Elastik eğri, integrasyon methodu, hiperstatik sistemler, süperpozisyon ilkesi. Kolonların burkulmasına giriş.			

Course Learning Outcomes and Competences	Upon successful completion of the course, the learner is expected to: 1. apply normal and shear stress and strain, and their relations to analyze and solve structural members under axial and torsional loadings; 2. analyze normal and shear stresses in bending and transverse shear loadings; 3. apply stress equations to compute combined stresses due to the bending, torsion, shear and axial loads; 4. apply stress and strain transformation equations or Mohr's circle method to determine principal stresses, strains and their orientations for given stress and strain state, compute maximum shear stress, strain and their orientations; 5. apply method of integration to determine elastic curve of a beams and deflection at a point; solve statically indeterminate beams by method of superposition 6. write an essay by giving examples from complex engineering structures in the field of civil and mechanical engineering and discuss assumptions involved for simplifications and solution strategies by using simple and cantilever beam methods.

Relationship of the Course with the Student Outcomes	Level	Learning Outcome(s)	Assessed by
Student Outcomes	N=None S=Supportive H=High		Exam, Project, HW, Experiment, Presentation, etc.
(1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	H	1,2,3,4,5, 6	Exams, Digital Platform, Assay
(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			
(3) an ability to communicate effectively with a range of audiences			
(4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts			
(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			
(6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions			
(7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies			

Prepared by and Date	Assoc. Prof. Dr. Ali Çınar / December 2019	
Semester	Spring 2019-2020	
Name of Instructors	Assoc. Prof. Dr. Ali Çınar / Prof. Dr. Seyyit Ümit Dikmen	
Course Contents	Week	Topic
	1.	Deformable body. Normal and Shear Stress. Average Normal and Shear Stress. Allowable Stress Design
	2.	Deformation. Normal and Shear Strain
	3.	Mechanical Properties of Materials. Stress Strain Diagram. Tension and Compression Test. Ductile and Brittle Materials. Hooke's Law. Strain Energy for a particle
	4.	Saint-Venant's Principle. Elastic Deformation of an Axially Loaded Member. Principle of Superposition. Stress Concentration
	5.	Torsional Deformation of a Circular Shaft. Power Transmission. Angle of Twist. Stress Concentrations in Torsion
	6.	Shear and Bending Moment Diagrams. Bending Deformation of a Beam. Flexure Formula

	7.	Unsymmetrical Bending and Stress Concentrations in Bending
	8.	Transverse Shear in Straight Members. Shear Stress Formula and its Applications. Shear Flow in Build-Up and Thin-Walled Members
	9.	Thin Walled Pressure Vessels. Combined stress due to bending, torsion, shear and axial Load
	10.	Plane Stress. General Equations of Plane Stress Transformation. Principle Stresses. Maximum shear stress. Mohr's Circle
	11.	Plane Strain. General Equations of Plane-Strain Transformation. Principal Strains. Maximum shear strain. Mohr's Circle. Generalized Hooke's Law. Failure Theories; Introduction to Fatigue
	12.	Elastic Curve. Integration method
	13.	Method of Superposition and Statically Indeterminate Beams. Method of superposition
	14.	Introduction to buckling of columns
	15.	Final Exam/Project/Presentation Period
	16.	Final Exam/Project/Presentation Period

Required/Recommended Readings	Mechanics of Materials, 9th Ed., R.C. Hibbeler, SI Edition, Contributions by K.S. Viyaj Sekar, Pearson, 2014.
Teaching Methods	Lectures/contact hours using "flipped classroom" as an active learning technique
Homework and Projects	-
Laboratory Work	-
Computer Use	-
Other Activities	
Assessment Methods	Type of Assessments — Number — Ratio (%) Midterm Exams — 2 — 50 (each contributing 25 %) Final Exam — 1 — 30* HW in Digital Platform — 5 — 5 (each contributing 1 %) Write assay / team of 4 — 1 — 5 Flipped Classroom Practice — 28 — 5* Small quiz after watching the videos — 18 — 5* Total — 100 * Final exam will cover learning outcomes 1 to 5, and will be held in week 14 during evening hours. Solving problems during each class contributing 5 % of the total grade, watching the videos and taking test afterward contributing 5% of the total grade.
Course Administration	**Instructor's office and phone number:** 5th Floor 395-3682 **Office hours:** Monday, Wednesday 10:00 – 11:30; **Email address:** Ali.Cinar@mef.edu.tr **Rules for attendance:** Classroom practice contributes to 5% of the final grade. **Missing a midterm**: Provided that proper documents of excuse are presented, each missed midterm by the student will be given the grade of the final exam. No make-up will be given. **Missing a final**: Faculty regulations. **A reminder of proper classroom behavior, code of student conduct**: YÖK Regulations **Statement on plagiarism**: YÖK Regulations http://www.mef.edu.tr/icerikler/files/lisans_onlisans_yonetmelik%20(1.pdf)

ECTS Student Workload Estimation

Activity	No/Weeks	Hours			Calculation	Explanation
	No/Weeks per Semester (A)	Preparing for the Activity (B)	Spent in the Activity Itself (C)	Completing the Activity Requirements (D)		
Lecture	14	2	4	0.5	91	A*(B+C+D)
Digital HW	5	1	1		10	
Midterm(s)	2	10	1		22	A*(B+C+D)
Writing Essay	1	2	5	5	12	A*(B+C+D)
Final Examination	1	20	2		22	A*(B+C+D)
Total Workload					157	
Total Workload/25					6.28	
ECTS					**6**	