1. Course Information

Title:	MECH 201 Statics and Mechanics of Materials
KU Credits:	3
ECTS Credits:	6
Audience:	Required area course for Mechanical Engineering students
Prerequisite:	PHYS 101 and MATH 106; or consent of the instructor
Classes:	Tuesday and Thursday, 14:30-15:45, SNA B119
PS:	Friday, 10:00-11:15, SNA B119
DS:	---
Lab:	---
Instructor:	Assoc. Prof. Murat Sözer Koç University, College of Engineering, Mechanical Engineering Department Office: ENG 249 and KOLT Z06-C Phone: x1582, e-mail: msozer@ku.edu.tr, web: http://home.ku.edu.tr/~msozer/
Teaching Assistants:	Nazlı Köroğlu, ENG 106B and 255, x1852, nkoroglu17@ku.edu.tr
Office Hours:	Tuesday and Thursday, 16:00-17:30, Murat Sözer Wednesday, 13:00-16:00, Nazlı Köroğlu

KOLT Tutoring:
The following junior/senior students in MECH have already taken MECH 201 in previous years and received a well-deserved grade around A. Please stop by these peer-supported tutoring sessions to get help for understanding concepts, solutions of problems and etc. The following is the current schedule (the schedule will be finalized after the add-drop week), please refer to KOLT tutoring web page, http://kolt.ku.edu.tr/student for any update:

Day	Time	Cubicle #	Tutor
Tuesday	11:30 – 12:45	10	Haldun Balım
	13:00 – 14:15	2	Bilgehan Bali
	17:30 – 18:45	11	Hüseyin Cem Yumuk
Wednesday	17:30 – 18:45	10	Haldun Balım
Thursday	11:30 – 12:45	10	Haldun Balım
	13:00 – 14:15	1	Bilgehan Bali
	17:30 – 18:45	11	Hüseyin Cem Yumuk

2. Course Description

In the Catalogue:
Statics: force, moment, equilibrium of rigid bodies, moment of inertia of areas, structural analysis of trusses, frames and machines, internal forces and moments.
Mechanics of materials: normal and shear stresses and strains, mechanical properties of materials, axial load, torsion, bending, transverse shear, combined loadings, transformation of stresses, principal stresses and Mohr's circle, and beam deflection.

Course Overview: How can we analyze and design basic structures, frames and mechanical components subjected to loading? In this course, we will be addressing this question by studying (1) **statics** assuming that the objects are perfectly rigid, and (2) **mechanics of materials** assuming that the objects are deformable. Rigid body mechanics is divided into two areas: statics and dynamics. Statics will be studied in the first half of this course (MECH 201) and it deals with the equilibrium of bodies which are either at rest or move with a constant velocity, whereas dynamics (offered next semester in MECH 206) studies the accelerated motion of bodies. In the second half of this course, mechanics of materials will be studied which is essential to analyze internal stresses and strains in the deformable mechanical components. By integrating statics and mechanics of materials in a single course, students can see the interrelationship of the two subjects. Students will engage in engineering applications that intend to improve their mathematical skills and analytical thinking skills. A good grasp of course concepts and their application require previous knowledge from PHYS 101 (forces and moments in 3D space; free body diagrams) and MATH 106 (differential and integral calculus), so students are strongly advised to complete these courses before taking this course.

3. Course Content (Chapters)

---------- PART I: Statics ----------

1. General Principles (Newton's laws; SI units; dimensional homogeneity; significant digits).
2. Forces (2D and 3D forces; unit vectors; force components).
3. Moments (moment about a point; moment about an axis).
4. Equilibrium of a Rigid Body (support reactions; force and moment balance in 2D and 3D).
5. Structural Analysis (trusses, frames and machines; two-force members).
6. Moment of Inertia for an Area (integral approach and superposition)

---------- PART II: Mechanics of Materials ----------

7. Stress and Strain (normal and shear stresses and strains; bending moment; torque; factor of safety).
8. Mechanical Properties of Materials (tensile test; yield stress; ultimate tensile strength; modulus of elasticity; elasticity; plasticity; necking; toughness; elastic recovery; ductile and brittle materials; Poisson ratio).
9. Axial Load (elastic and plastic elongation; thermal expansion; strain in a composite).
10. Torsion (shear stress and strain due to torsion; power).
11. Bending (shear and bending diagrams; bending stress; tension and compression).
12. Transverse Shear (shear stress).
13. Combined Loadings (pressure vessels; superposition of axial load, torsion, bending, transverse shear and internal pressure; stresses on 2D and 3D elements).
14. Stress Transformation (2D Mohr's circle; principal normal stresses; max. shear stress).

4. Class Schedule (tentative)

Day	Date	Chapter
1	Sept. 18	1
2	Sept. 20	2
3	Sept. 25	2
4	Sept. 27	3
5	Oct. 02	3
6	Oct. 04	4
7	Oct. 09	4
8	Oct. 11	5
9	Oct. 16	5
10	Oct. 18	6
11	Oct. 23	6
12	Oct. 25	7
13	Oct. 30	7
14	Nov. 01	11.1-2

Day	Date	Chapter
15	Nov. 06	8
16	Nov. 08	8
17	Nov. 13	9
18	Nov. 15	9
19	Nov. 20	10
20	Nov. 22	10
21	Nov. 27	11.3-4
22	Nov. 29	11.3-4
23	Dec. 04	12
24	Dec. 06	12
25	Dec. 11	13
26	Dec. 13	13
27	Dec. 18	14
28	Dec. 20	14

5. Required Readings

Textbook: Statics and Mechanics of Materials, Russell C. Hibbeler, Prentice Hall, **5th ed. in SI units**, 2018.
ISBN-10: 1292177918, ISBN-13: 9781292177915
(Chapters 1-14; excluded sections: 4.7-8, 10.4-5, 11.5, 12.3, 14.5-11.)
It comes with **an access code** to Online course supplementary material.

6. Course Page on Learning Management System

The following items are available in **Blackboard** system at https://ku.blackboard.com

lecture notes	discussion forums
lecture videos	instant feedback
practice quizzes (not to be graded, for your own practice)	announcements and reminders
online quizzes (to be graded; Blackboard & Pearson)	updated grades
previous years' exams (problems & solutions of 2002-2011)	e-book
practice exams	textbook resources (question bank)

7. Assessment Methods (AMs)

1.	Attendance (class & PS)	2%	Can get up to 5% (BONUS); see **Course Requirements** for detail.
2.	HWs	4%	See **Assignment Format/Schedule** for detail.
3.	DP (Bridge Competition)	2%	See **Assignment Format/Schedule** for detail.
4.	Quizzes (paper based)	8%	In-class and in-PS; no make-up; the worst two will be excluded.
5.	Quizzes (online)	8%	No make-up.
6.	Midterm Exam 1	20%	Chapters 1-7, November 11, 10:00-13:00, ENG Z50.
7.	Midterm Exam 2	20%	Chapters 8-12, December 03, 19:00-22:00, ENG Z50.
8.	Final Exam	36%	Cumulative: chapters 1-14, December 28, 15:00-18:00, SOS B10 and SOS B21.

8. Assignment Format/Schedule for HWs & DPs:

HWs:

- Must be kept in a single MECH 201 **notebook** (or a dossier);
- name and ID of the student must appear on the cover of the notebook/dossier;
- the solutions of the exercise problems must be in **order (and preferably one solution per page)**;
- **meet with KOLT tutors** periodically (for 15-minute scheduled meeting, please follow e-mails) to get qualitative feedback (non-graded feedback; just to inform you about your solution procedures and completeness);
- **submit your notebook to TAs** (twice a semester: after chapters 1-7, and 8-14); HWs will be evaluated by the TAs;
- no late submission is allowed;
- **grading system is out of 4**:
  4 if almost full and correct,
  1-3 if partially correct,
  0 if mostly missing or incorrect;
- see the Blackboard system for the HW **schedule**;
- in both HWs, **team work is allowed and encouraged**;
- however **each individual student must understand the solution very well** and be able to answer related questions during the scheduled visits.

HW	Chapter	**Exercises** (from our textbook which is **5th ed. in SI units**) (for those of you with an older version of the textbook, the following **exercises are given in HW 2018 menu of the Blackboard**)
1	1	08, 10, 12, 18, 19
2	2	08, 23, 60, 77, 92
3	3	36, 43, 53, 66, 84
4	4	22, 27, 33, 37, 39
5	5	18, 22, 49, 54, 55
6	6	76, 77, 81, 85, 87
7	7	17, 19, 59, 63, 83
8	8	05, 14, 15, 18, 24
9	9	30, 34, 39, 56, 59
10	10	13, 14, 18, 29, 32
11	11	03, 08, 35, 87, 93
12	12	10, 14, 15, 25, 29
13	13	27, 42, 49, 50, 53
14	14	30, 33, 38, 55, 67

Design Projects (DP):

Design Project (DP)	Chapter	Project (details and schedule will be supplied)
1	5	Bridge competition

9. Course Requirements

- You are expected to know the policies and expectations about attendance to class and PS and rules of conduct.
- **Please be on time** when entering the classroom.
- **Turn your mobile phones off**, or put them in silent mode and do not use it at all (**placed in your pocket or bag**).
- You are required to attend at least two thirds (= 67%) of both classes and PS's. Otherwise, you receive grade F.
- **Attendance grade (out of 2%)** is calculated as follows: (medical report or a similar excuse will not affect the grading):

Full attendance to both class & PS:	5%
1+1 days of absence (1 day for classes and 1 day for PSs)*:	4%
2+2 days of absence:	3%
3+3 days of absence:	2%
4+4 or more days of absence:	0%

*Example: If you are absent for *3 days* in classes, but present in all PSs, it will be considered as *3 days* absent → 2%.

10. Course Aims and Student Learning Outcomes (SLO)

Course Aims	SLO #	At the end of this course, the students will be able to …
Comprehension of **concepts** related to statics and mechanics of materials	**1.1**	Determine the conditions for equilibrium of rigid bodies
	1.2	Identify types of joints between rigid bodies (pin, roller, fixed, ball-and-socket, etc.), special equilibrium situations (two-force members), and if static indeterminacy exists
	1.3	Understand the concepts of mechanical properties (yield stress, ultimate tensile stress, modulus of elasticity, modulus of rigidity, modulus of resilience, modulus of toughness and Poisson's ratio), elasticity and plasticity, stress and strains
Competency in **mathematical calculations** by modeling and solving engineering problems	**2.1**	Formulate and solve the equations of equilibrium by determining the unknown support reactions (forces and moments) and drawing free body diagrams,
	2.2	Calculate internal forces and moments in structural members and frames under combined loadings (axial load, torsion, bending, transverse shear and internal pressure)
	2.3	Solve principal in-plane stresses and maximum shear stress by calculating components of stress tensor and transforming coordinate system
Competency in **analytical thinking** skills by **analyzing** internal stress distribution	**3.1**	Analyze internal stress distribution in basic structures, frames and mechanical components
	3.2	Present analysis results in graphical means such as transverse shear and bending moment diagrams along the longitudinal axis of a beam
	3.3	Expose to structural problems where the conventional solution methods are limited or they do not yield an accurate result; refer to advanced methods and solution techniques
Application skills in designing basic structures, frames and mechanical components	**4.1**	Design parts by selecting proper material, dimensions and factor of safety
	4.2	Use MATLAB to analyze stress distributions in mechanical systems with high number of components and unknowns which is not feasible to solve them manually
	4.3	Conduct a tensile test to determine the mechanical properties (strength, stiffness and toughness) of wires; and use strain gages to measure internal strains and stresses

11. Program-Course Alignment

Program Learning Outcomes (PLOs) (Mechanical Engineering)			Student Learning Outcomes (SLOs)	Contribution of SLOs to the Acquisition of PLOs**
Engineering Program	1	Learn advanced mathematics and natural sciences, and gain the ability to apply this knowledge towards modeling and solution of engineering problems,	1.1, 1.2, 1.3	4
	2	Gain the ability to identify, formulate and solve complex engineering problems,	2.1, 2.2, 2.3	4
	3	Gain the ability to design a component, process, system, or product to meet desired needs under realistic constraints and conditions, addressing economic, environmental, sustainability, producibility, ethical, social, political, health and security issues,	3.1, 4.1	4
	4	Gain the ability to select and use necessary techniques, and modern engineering and information technology tools for engineering applications and practice,	3.1, 4.1, 4.2	2
	5	Gain the ability to design and conduct experiments, collect data, analyze and interpret data for engineering applications,	4.2, 4.3	2
	6	Gain the ability to function in intra-disciplinary and multi-disciplinary teams,	---	0
	7	Gain the ability to effectively communicate in Turkish and English by oral, written, and graphical means,	3.2	3
	8	Recognize the need for and ability to engage in life-long learning and to reach the most recent information in science and technology,	3.3	3
	9	Recognize and understand professional and ethical responsibility,	---	0
	10	Understand project management, risk management, and change management concepts; as well as awareness of the importance of innovation and entrepreneurship for sustainable economic development,	---	0
	11	Understand impact of engineering solutions in a global and societal context, including health, environment, safety and legal issues,	---	0
Mechanical Engineering	12	Gain breadth in mechanical engineering with required area courses, and provides depth in an area of specialization through 2 area elective and 6 free electives courses,	ALL	4
	13	Gain advanced mathematical foundation, including differentiation and integration, multi variable calculus, linear algebra, differential equations, probability and statistics,	1.1, 2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 4.2	4
	14	Gain knowledge of physics based on strong mathematics and chemistry foundation,	1.1, 1.2, 1.3, 2.2, 3.1	5
	15	Gain knowledge of and ability to use modern computational tools to model and solve mechanical engineering problems,	4.2	2
	16	Design and build apparatus and conduct experiments for static, dynamic, mechanic, thermal/heat, fluid, manufacturing and control systems to meet desired needs subject to realistic constraints.	4.3	2

**Scale: 0 = Non-applicable, 1 = Negligible, 2 = Limited, 3 = Moderate, 4 = Significant, 5 = Very Significant.

12. Learning Activities (LAs)

1. Lectures (slides, solved problems, in-class discussions),
2. video-recorded lectures,
3. in-class exercises (individual and group),
4. clicker problems (short in-class exercises with instant feedback),
5. homeworks (end-of-chapter exercises),
6. online practices (multiple choices, fill in the blanks, and numerical answers),
7. quizzes (online and paper-based),
8. problem solving sessions (weekly),
9. group studies (for general review; practicing for quizzes and exams; KOLT tutors support whenever needed),
10. review for exams,
11. exams (two midterm exams and one final exam),
12. design projects,
13. laboratory experiments (measuring mechanical properties; use of strain gages).

13. Course Alignment Table

Student Learning Outcomes (SLOs)	Assessment Methods (AMs)	Learning Activities (LAs)	Course Content (Chapter #)
1.1	3, 6	1-11	4, 5
1.2	3, 6	1-11	4
1.3	3, 6, 7	1-11	7, 8
2.1	3, 6, 7	1-11	1-5
2.2	3, 6, 7, 8, 9	1-11	9-13
2.3	3, 9	1-11	14
3.1	3, 4, 6, 8, 9	1-11	9-13
3.2	3, 4, 6, 8, 9	1-11	11
3.3	4	12	5, 6
4.1	3, 4, 7, 8, 9	1-12	7, 8, 13, 14
4.2	3, 4	5, 12	5, 13, 14
4.3	5	13	8, 13, 14

14. Course Load (Expected Studying Time)

Item	Approximate studying time [hours] per week	Approximate studying time [hours] per semester (= 14 weeks)
Lecture	2 * 1.25 = 2.50	35.00
Problem Solution Session (PS)	1.25	17.50
Review of class notes and PS	1.00	14.00
Reading the textbook and examples	2.00	28.00
HW + Online quizzes	3.50	49.00
Weekly sub-total	10.25	
Design Projects		6.50
Preparing for and taking Midterm Exam 1		12.00
Preparing for and taking Midterm Exam 2		12.00
Preparing for and taking Final Exam		18.00
Total		192.00

European Credit Transfer System (ECTS) = 192.00/30 = 6.40 → 6

15. Academic Dishonesty

The students are expected to submit their own work in **all quizzes and exams**. Therefore they cannot not exchange any information. All forms of information transfer between students, and getting help from someone else will be considered as cheating. That means, you **cannot** …

- exchange papers,
- use a solution manual,
- work together, or
- let others do your work (even partially).

For a complete rules set forth in the Student Code of Conduct by VPAA, please refer to the following link:
http://vpaa.ku.edu.tr/sites/vpaa.ku.edu.tr/files/Koc%20University.pdf

16. Other:

Format of Exams: Allowed material: **textbook** (i.e., open-book exam) and **calculator**.
Needed tools: **For each class and PS**, bring your **pencil**, **eraser, calculator**, and **notebook**.