

**METU**  
**DEPARTMENT OF ENGINEERING SCIENCES**

**ES 221 MECHANICS I (STATICS)**

Description:	3 Credit hours. Principles of mechanics. Elements of statics in two and three dimensions, centroids, analysis of structures, Internal force diagrams. Moment of inertia.
Text:	Beer, F.P., Johnston, E.R. and Eisenberg, E. R, <u>Vector Mechanics for Engineers: Statics</u> , 7 <sup>th</sup> Edition in SI Units, Mc. Graw Hill. 2004
References	Hibbeler, R.C. Engineering Mechanics: Statics, 10th edition, Prentice Hall. 2004
Instructor:	Murat Dicleli, Ph.D., P.Eng., Professor and Chair Office: Engineering Building, Room 504 E-mail: <a href="mailto:mdicleli@metu.edu.tr">mdicleli@metu.edu.tr</a> Recitation Hours: Thursday: 10:40 — 11:30 (The link to access the recitations will be provided via oduclass.)
Prerequisite:	<b>MATH 119</b>

**Goals:**

To provide students with a thorough background in the fundamental principles of engineering mechanics under equilibrium for particles and rigid bodies. To introduce basic concepts of structural analysis and design.

**Grading Policy:**

Grade Distribution:

- Homeworks + Problem Sets: 10% (5% each)
- Two tests: 55%
- Final Exam: 35%

Calculation of letter grades:

- The letter grades may be calculated using an adjusted score based on the performance of the class.
- Online attendance and submitting the answers to the problem sets are important and will be taken into consideration when assessing the final grade.
- Official letter grades are as follows:

90-100	AA	65-69	DC
85-89	BA	60-64	DD
80-84	BB	50-59	FD
75-79	CB	< 50	FF
70-74	CC		

(The numeric limits of the letter grades may be adjusted based on the performance of the class)

**Make-up Exams, Online Attendance and Other Exam Related Issues:**

Make up exams will be given if and only if the student has a valid excuse that has to be proven and will be subject to the university policies. The make-up exams will be much more difficult than regular exams as the student taking the make-up exam has an advantage over the other students as he/she already knows the types of questions asked in the regular exam and their answers and has more time for preparation. Students who fail to take one of the exams including the final exam will receive NA. Online attendance and submitting the answers to the problem sets are very important and may affect the final grade in accordance with the discretion of the professor.

**Homework Policy:**

- Homeworks must be uploaded to oduclass on the due date and time. Late homeworks will not be credited.
- Use A4 size white or checkered paper and scan the paper to be uploaded in pdf format. (Usually, engineering calculations are presented on checkered papers)
- Write the problem statement
- Provide all necessary sketches neatly.

**Exams:**

Mid-term Exam 1: November 24, 2020 (Up to & including Chapter 4 - Moment of a force about a specified axis)

Mid-term Exam 2: December 22, 2020 (Up to Chapter 7)

Final Exam : Exact date and time will be determined by the university (Exam covers all the chapters)

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**Outline (Tentative)**

**Topic:**

**Date:**

<b>1- General Principles</b> ( <i>Textbook: 1. Introduction</i> )	<b>Week 1-13/10</b>
<b>2- Force Vectors</b> ( <i>Textbook: 2. Statics of Particles</i> )	Week 1
Scalars and Vectors, Vector Operations, Vector Addition of Forces	Week 1
Addition of a System of Coplanar Forces, Cartesian Vectors	Week 1
Cartesian Vectors, Addition and Subtraction of Cartesian Vectors	Week 1
Position Vectors, Force Vector Directed Along a Line,	<b>Week 2-20/10</b>
Dot Product	Week 2
<b>3- Equilibrium of a Particle</b> ( <i>Textbook: 2. Statics of Particles</i> )	
Condition for the Equilibrium of a Particle, Free Body Diagram	<b>Week 3-27/10</b>
Coplanar Force Systems	Week 3
Coplanar Force Systems	Week 3
Three Dimensional Force Systems	Week 3
<b>4- Force System Resultants</b> ( <i>Textbook: 3. Rigid Bodies: Equivalent System of Forces</i> )	
Moment of a force — Scalar Formulation	<b>Week 4-03/11</b>
Cross Product	Week 4
Moment of a Force — Vector Formulation	Week 4
Principle of Moments, Moment of a Force about a Specified Axis	Week 4
Moment of a Couple, Equivalent System, Resultants of a Force and Couple	<b>Week 5-10/11</b>
Further Reduction of a Force and Couple System, Reduction of Simple Dist. Loading	Week 5
<b>5- Equilibrium of a Rigid Body</b> ( <i>Textbook: 4. Equilibrium of Rigid Bodies</i> )	
Conditions for Rigid Body Equilibrium,	<b>Week 6-17/11</b>
<u>Equilibrium in Two Dimensions</u> ; Free Body Diagrams, Equations of Equilibrium	Week 6
Two and Three Force Members, <u>Equilibrium in Three Dimensions</u> ., Free Body	Week 6
Equations of Equilibrium, Constraints for a Rigid Body	Week 6
<b>Mid-Term Exam 1</b>	<b>24/11</b>
<b>6- Structural Analysis</b> ( <i>Textbook: 6. Analysis of Structures</i> )	
Simple Trusses, Method of Joints,	<b>Week 8-01/12</b>
Zero Force Members, Method of Sections	Week 8
Method of Sections, Frames	<b>Week 9-08/12</b>
Frames	Week 9
<b>7- Internal Forces</b> ( <i>Textbook: 7. Forces in Beams and Cables</i> )	
Internal Forces Developed in Structural Members	<b>Week 10-15/12</b>
Shear and Moment Equations and Diagrams	Week 10
Shear and Moment Equations and Diagrams	Week 10
Relations between Distributed Load Shear and Moment	Week 10
<b>Mid-Term Exam 2</b>	<b>22/12</b>
<b>8- Center of Gravity and Centroid</b> ( <i>Textbook: 5. Centroids and Centers of Gravity</i> )	
Center of Gravity and Center of Mass for: a System of Particles, for a Body,	<b>Week 12-29/12</b>
Center of Gravity and Center of Mass for: a Body	Week 12
Composite Bodies	Week 12
<b>9- Moment of Inertia</b> ( <i>Textbook: 9. Moments of Inertia</i> )	
Moment of Inertia, Parallel Axis Theorem, Radius of Gyration	<b>Week 13-05/01</b>
Moment of Inertia by Integration	Week 13
Moment of Inertia for Composite Areas	Week 13
<b>General Problem Solution Session for Final Exam Preparation</b>	<b>Week 14-12/01</b>

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**Homeworks**

**Due Date**

HW1	2.1, 2.5, 2.26, 2.37	29/10	(Thursday)
HW2	2.43, 2.58, 2.75, 2.87, 2.108	12/11	(Thursday)
HW3	3.1, 3.21, 3.46, 3.70	19/11	(Thursday)
HW4	4.2, 4.51, 4.69, 4.73	10/12	(Thursday)
HW5	6.15, 6.31, 6.62, 6.82	17/12	(Thursday)
HW6	7.6, 7.7, 7.29, 7.30	07/01	(Thursday)

**Problem Sets**

**Due Date**

Set 1	20/10 (Tuesday)
Set 2	27/10 (Tuesday)
Set 3	03/11 (Tuesday)
Set 4	10/11 (Tuesday)
Set 5	17/11 (Tuesday)
Set 6	24/11 (Tuesday)
Set 7	08/12 (Tuesday)
Set 8	15/12 (Tuesday)
Set 9	22/12 (Tuesday)
Set 10	05/01 (Tuesday)
Set 11	12/01 (Tuesday)

**Additional Study Problems**

- 1- 2.2, 2.11, 2.37, 2.41
- 2- 2.46, 2.57, 2.73, 2.95, 2.111
- 3- 3.4, 3.16, 3.37, 3.77, 3.98
- 4- 4.3, 4.34, 4.45, 4.70, 4.81
- 5- 6.11, 6.33, 6.44, 6.93, 6.118
- 6- 7.11, 7.12, 7.25, 7.31, 7.32, 7.75
- 7- 5.1, 5.4, 5.5, 5.25, 5.32
- 8- 9.1, 9.31, 9.41, 9.42