

**GAZİ UNIVERSITY**  
**ENGINEERING FACULTY**  
**DEPARTMENT OF MECHANICAL ENGINEERING**

**2019-2020 ACADEMIC YEAR SPRING SEMESTER**

# **ME 422 MECHANICAL ENGINEERING LABORATORY**

## **COURSE CONTENT**

Students are expected to perform experiments on statics, dynamics, strength of materials, material science, control and measurement areas of mechanical engineering. In accordance with the basic mechanical engineering subjects to be given, students in groups will perform the design, installation and calibration of the experimental setup and perform experiments for certain system parameters. A detailed report will be prepared and presented for each experimental study.

## **ATTENDANCE REQUIREMENT**

Participation in all experiments is mandatory. There will be no make-up experiments.

## **TEXTBOOK**

- J. P. Holman, Experimental Methods for Engineers, Seventh Edition, Mc-Graw Hill, 2001.

## **REFERENCE BOOKS**

- Cobb, G.W., Introduction to design and analysis of experiments, Springer, 1998.
- Montgomery, D.C., Design and analysis of experiment, 4th ed., John Wiley and Sons, 1997.
- Beckwith T.G. et al., Mechanical measurements, Addison-Wesley, 1995.

## **GUIDELINES**

1. 6(six) experiments will be held in total. Attendance and report submission for all experiments are mandatory. Otherwise, the student will fail the course.
2. Apart from these six experiments, students are required to design, conduct and finalize experiments throughout the semester on subjects they will be given. (Experiment topics will be announced later.)
3. While conducting the experiments, followings should be taken into consideration:
  - a. Only students will be present while conducting the experiments.
  - b. You should arrive to the laboratories on time, late arrivals will not be excepted to the experiments.
  - c. Each student is expected to conduct the experiments with the experimental group announced on the designated day and time.
  - d. Each student is expected to come to the laboratories with the relevant lab sheet. The student who does not have the relevant lab sheet will not be allowed to the experiment. Lab sheets can be downloaded from the announcements section of the departments website (<http://mf-mm.gazi.edu.tr/>).
  - e. You should not meddle with unrelated equipment found in the laboratory.
  - f. During the experiments, you should comply with all the rules set by responsible teaching assistant.

If you fail to comply any of the rules stated above you will also fail the course.

4. Prior to all experiments, a hand-written “preliminary report” about experiment to be held will be prepared. This preliminary report will be submitted to the responsible teaching assistant before the experiment begins. Students who does not submit the preliminary report will not be allowed in the experiment. Your preliminary report should include the followings:
  - Cover page
  - Contents
  - Nomenclature
  - Summary
  - Introduction
  - Theory and Data Acquisition
  - Experimental Setup
  - Experimental Procedure
5. The lab sheets should be read carefully and full understood before the experiment. Prior to all experiments, the responsible teaching assistant may ask questions about the experiment.
6. The students will be given an outline of how to perform the experiment (information about experimental setup, values to be measured and other considerations) will be explained and the students will be required to perform the experiment themselves.
7. Each student will prepare a **separate report** on the experiment and submit to the teaching assistant who conducted the experiment. The deadline for these reports **17:30 on the Monday following the experiment**. Reports that are not delivered in time **will not be evaluated**. Your report should include the following topics:
  - Measurements and required calculations
  - Discussion and conclusion
  - Relevant tables
  - Relevant figures
  - Experimental setup
  - Results
  - References (If any)
  - Appendices (If any)

## RESPONSIBLE TEACHING ASSISTANTS AND LABORATORIES

<b>EXPERIMENT 1</b>	<b>: Investigation of the Effect of Cutting Speed on Surface Roughness</b>
<b>T.A.</b>	: <i>Büşra ARSLAN</i> (Office: Eklemeli İmalat Laboratuvarı)
<b>LABORATORY</b>	: Otomatik Kontrol Laboratuvarı
<b>EXPERIMENT 2</b>	<b>: Modulus of Elasticity and Rigidity Determination in Materials with Bending and Torsion Tests</b>
<b>T.A.</b>	: <i>Ece YILDIRIM</i> (Office: Otomatik Kontrol Laboratuvarı)
<b>LABORATORY</b>	: Mekanik ve Mukavemet Laboratuvarı
<b>EXPERIMENT 3</b>	<b>: Forced Vibration of an Undamped One-Degree-of-Freedom System Due to Harmonic Excitation</b>
<b>T.A.</b>	: <i>Oğuz Faik SEVEN</i> (Office: Mekanizmalar ve Makine Dinamiği Laboratuvarı)
<b>LABORATORY</b>	: Mekanizmalar ve Makine Dinamiği Laboratuvarı
<b>EXPERIMENT 4</b>	<b>: The Forced Vortex Experiment</b>
<b>T.A.</b>	: <i>Murat ERBAŞ</i> (Office: Toz Metalurji Laboratuvarı)
<b>LABORATORY</b>	: Akışkanlar Mekaniği Laboratuvarı
<b>EXPERIMENT 5</b>	<b>: Determination of Drag Force on Cylindrical Surfaces</b>
<b>T.A.</b>	: <i>Yunus Emre GÖNÜLAÇAR</i> (Office: Mekanik ve Mukavemet Laboratuvarı)
<b>LABORATORY</b>	: Deneysel ve Sayısal Isı Transferi Laboratuvarı
<b>EXPERIMENT 6</b>	<b>: Heat Transfer by Natural Convection</b>
<b>T.A.</b>	: <i>Güven Hasret YILMAZ</i> (Office: Isıl Güç Laboratuvarı)
<b>LABORATORY</b>	: Akışkanlar Mekaniği Laboratuvarı

## EXPERIMENT GROUPS

GROUP 1E	
151152002	AHMET AKGÜL
151152003	KAAN SARP BAKIŞOĞLU
151152005	ÖMER FARUK BAŞKAYA
151152007	NAZIM BURAK BOZTEPE

GROUP 3E	
151152013	MESUT HOCAOĞLU
151152014	EMRE KANKILIÇ
151152017	İREM KILIÇASLAN
151152018	ALPEREN KOCAKAPLAN

GROUP 5E	
151152024	TAMER YAVAŞ
151152025	ATA EMRE YILDIZ
151152026	ENGİN CAN YÜCEGÖĞ

GROUP 2E	
151152008	BARTU BÜYÜKÖZTÜRK
151152009	BURAK COŞKUN
151152010	YUNUS METE ÇAKIROĞLU
151152012	ENES GÜLBAYAZ

GROUP 4E	
151152019	KORHAN KÖYÜK
151152020	TUNCAY KUTLU
151152021	BEKİR BATUHAN SAĞOL
151152022	ENES ŞAHİN

GROUP 6E	
161152015	BERAT KARA
161152018	EMİN SALİH SAN
161152750	EMRE KIZILBOĞA

## SCHEDULE

EXPERIMENT 1. Investigation of the Effect of Cutting Speed on Surface Roughness							
HOUR	13 MARCH	20 MARCH	27 MARCH	3 APRIL	10 APRIL	17 APRIL	24 APRIL
15:30	G1E	G2E	MIDTERM WEEK	G3E	G4E	G5E	G6E

EXPERIMENT 2. Modulus of Elasticity and Rigidity Determination in Materials with Bending and Torsion Tests							
HOUR	13 MARCH	20 MARCH	27 MARCH	3 APRIL	10 APRIL	17 APRIL	24 APRIL
15:30	G6E	G1E	MIDTERM WEEK	G2E	G3E	G4E	G5E

EXPERIMENT 3. Forced Vibration of an Undamped One-Degree-of-Freedom System Due to Harmonic Excitation							
HOUR	13 MARCH	20 MARCH	27 MARCH	3 APRIL	10 APRIL	17 APRIL	24 APRIL
15:30	G5E	G6E	MIDTERM WEEK	G1E	G2E	G3E	G4E

EXPERIMENT 4. The Forced Vortex Experiment							
HOUR	13 MARCH	20 MARCH	27 MARCH	3 APRIL	10 APRIL	17 APRIL	24 APRIL
15:30	G4E	G5E	MIDTERM WEEK	G6E	G1E	G2E	G3E

EXPERIMENT 5. Determination of Drag Force on Cylindrical Surfaces							
HOUR	13 MARCH	20 MARCH	27 MARCH	3 APRIL	10 APRIL	17 APRIL	24 APRIL
15:30	G3E	G4E	MIDTERM WEEK	G5E	G6E	G1E	G2E

EXPERIMENT 6. Heat Transfer by Natural Convection							
HOUR	13 MARCH	20 MARCH	27 MARCH	3 APRIL	10 APRIL	17 APRIL	24 APRIL
15:30	G2E	G3E	MIDTERM WEEK	G4E	G5E	G6E	G1E

## GUIDELINES

Test reports should be prepared in a standard format which can be clearly understandable. It is sufficient to comply the following format:

- Report should be handwritten,
- One side of the paper should be used,
- Pages must be numbered starting from the title page. Figures, tables and equations should also be numbered,
- The preliminary report should be arranged as follows:
  - Cover page
  - Contents
  - Nomenclature
  - Summary
  - Introduction
  - Theory and Data Acquisition
  - Experimental Setup
  - Experimental Procedure
- The main report should be arranged as follows:
  - Measurements and required calculations
  - Discussion and conclusion
  - Relevant tables
  - Relevant figures
  - Experimental setup
  - Results
  - References (If any)
  - Appendices (If any)

**Note 1:** Prior to all the experiments, a hand-written preliminary report will be prepared containing the relevant experimental procedure and theory mentioned above. This preliminary report will be submitted to the responsible teaching assistant before the experiment begins. Student who does not submit the preliminary report will not be allowed into the experiment.

**Note 2:** A hand-written main report containing the relevant topics mentioned above will be prepared after the experiment. This report will be submitted to the teaching assistant who conducted the experiment and till 17:30 on the Monday following the experiment. Students who fail to comply with the deadline will fail also fail the course.

**Note 3:** The preliminary report and the main report will be combined by the responsible teaching assistant and combined report will be graded as the experimental report.

**Cover Page:** On the cover page, the name of the experiment, the number of the experiment, the name of the student who prepared the report and the student ID, the date of the experiment and the report submission date, the group number and the names and student ID's of all the members of the group, the name of the teaching assistant who conducted the experiment and the name of the laboratory where the experiment was conducted must be written. When preparing the cover page, the format given on the last page should be followed exactly.

**Contents:** In this section, the contents of the report should be indicated by page numbers and titles.

**Nomenclature:** All symbols and units within the report should be described in this section. Latin (a, b, ...) and Greek letters ( $\alpha$ ,  $\beta$ , ...) must be in alphabetical order.

**Summary:** A brief description of the important features of the experiment is presented in this section with 50-100 words.

**Introduction:** The introduction is the part where the outline of the experimental procedure is drawn. Therefore, information given in introduction should be brief. Thus, the reader will have remembered the subject or gained proximity to the subject. Moreover, in the introduction section,

the importance of the experiment and the intended results should be stated. Finally, the features of the experiment and other complementary information are given. No results should be stated in the introduction.

**Theory and data acquisition:** The theoretical basis of the calculations and comparisons is given in this section. How to obtain the final statements starting from the basic relations and the assumptions must be explained. Equations must be numbered.

**Experimental setup:** Descriptions and properties of the devices used in the experiment are given in this section. Device schematics added to this section should be titled and explained thoroughly. Adding only the schematics of the devices and stating 'the devices used in the experiment are seen in Figure 2' is not enough.

**Experimental procedure:** Experimental procedure should be explained in detail and clearly in this section. While explaining you can refer to the device schematics by specifying their numbers.

**Measurement and required calculations:** The measurement should be presented as tables and/or graphs. The results are usually two parts: The results obtained when the theoretical relations are applied to the experiment and the results obtained in the experiment. If possible, deviations, mean deviations, distribution curves should be indicated in the tables. When the tables are prepared, instead of calculating for each measurement, the calculations for one instance to be selected as an example and explained in detail, and only the final results of the calculations for the other measurements should be given.

**Discussion and conclusion:** In the discussion section, attention should be paid to how close the objectives stated in the introduction have been achieved. How the objectives were achieved, if not reached, in what circumstances and why they were not reached should be clearly stated. If there is a clear difference between the goal and the result, the possible errors that are overlooked should be investigated before placing the cause on the nature and assumptions of the measurement. With a sentence the result should be clearly stated.

**Tables:** All values that will be presented as tables will be placed in this section. Each table must be numbered and named.

**Figures:** Graphics, pictures, schematic representations of devices are given in this section. All schematics should be numbered and named. If there are more than one drawing on the same chart, it should be written which data each curve corresponds to.

**References:** The references (book, article, thesis) used during the experiment and mentioned in the report should be indicated in the format given below.

Books : Author, title, edition number, publisher, year, pages used

Articles : Article author, title, published journal, volume no., number no., page no., year.

Thesis : Thesis author, title, degree, university, department, year.

**Appendices:** Documentation which are deemed unnecessary to be included in the main report should be included in this section. For example, obtaining special equations and detailed solution steps of these equations must be explaining in detail.

**Sample cover page given below:**

\* Information about the person and experiment will be written in the sections written in red.

\*\* The name of the experiment will be written with a 24-point Cambria font, while the rest will be centered with a 12-point Cambria font.

GAZİ UNIVERSITY  
ENGINEERING FACULTY  
DEPARTMENT OF MECHANICAL ENGINEERING

ME 422 MECHANICAL ENGINEERING LABORATORY

**EXPERIMENT #: 1**

# INVESTIGATION OF THE EFFECT OF CUTTING SPEED ON SURFACE ROUGHNESS

**PREPARED BY**  
"STUDENT ID"  
"NAME-SURNAME"

**DATE OF THE EXPERIMENT**  
"DATE"

**GRUP #: "..."**

**OTHER MEMBERS OF THE EXPERIMENTAL GROUP**  
"STUDENT ID" "NAME-SURNAME"  
"STUDENT ID" "NAME-SURNAME"  
"STUDENT ID" "NAME-SURNAME"

**RESPONSIBLE TEACHING ASSISTANT**  
"TITLE-NAME-SURNAME"