## Instrumentation and Experiment Design

Course Code: ME 403 Course Period: Autumn Course Type: Core Credits: 3 Theoric: 2 Practice: 0 Laboratory Hour: 2 ECTS: 6 Prerequisite Courses: Fluid Mechanics Laboratory [1] Solid Mechanics Laboratory [2] Course Language: English Courses given by: Koray K. Şafak [3] Onur Cem Namlı [4]

Nezih Topaloğlu [5] Course Objectives: By the end of the course, the students will gain experience in designing and assembling a laboratory setup, performing an experiment to solve an engineering problem, apply statistical analysis of experimental data and evaluate the results.

Course Content:

Concepts of measurement methods and instrumentation. Characteristics of signals. Measurement system behavior. Probability, statistics and uncertainty analysis as applied to measurement systems. Analog measurements. Signal conditioning. Sampling, digital devices, and data acquisition. Experiments on measurements and instrumentation. Design of an experiment related to ME.

Prerequisite(s): Senior standing.

Course Methodology:

1: Lecture, 5: Lab, 7: Teamwork

Course Evaluation Methods:

A: Exam, D: Report, E: Presentation

Learning Outcomes	Program Outcomes	Teaching Methods	Assessment Methods
1) The ability to select, implement and integrate sensors, amplifiers, signal conditioning and data acquisition systems.	6, 10	1, 5	A, D
<ol> <li>The ability to calibrate and modulate signals and perform statistical and uncertainty analyzes.</li> </ol>	3, 6	1	A
3) The ability to design and assemble an experimental setup for measuring relevant parameters/variables of an engineering problem	4, 6, 7, 9, 14	7, 4	D, E

COURSE CONTENT						
Week	ek Topics					
1	INTRODUCTION	TEXTBOOK				
2	BASIC CONCEPTS OF MEASUREMENT SYSTEMS	TEXTBOOK				
3	STATIC AND DYNAMIC CHARACT. OF SIGNALS	TEXTBOOK				
4	MEASUREMENT SYSTEM BEHAVIOR	TEXTBOOK				
5	ANALOG ELECTRICAL DEVICES AND MEASUREMENTS	TEXTBOOK				

6	ANALOG ELECTRICAL DEVICES AND MEASUREMENTS	TEXTBOOK
7	DATA ACQUISITION SYSTEMS, LAB: ELECTRICAL MEASUREMENTS	TEXTBOOK
8	DATA ACQUISITION SYSTEMS	TEXTBOOK
9	MIDTERM	TEXTBOOK
10	STATISTICAL ANALYSIS OF EXPERIMENTAL DATA	TEXTBOOK
11	STATISTICAL ANALYSIS OF EXPERIMENTAL DATA	TEXTBOOK
12	UNCERTAINTY ANALYSIS, LAB: DATA ACQUISITION	TEXTBOOK
13	UNCERTAINTY ANALYSIS	TEXTBOOK
14	PROJECT PRESENTATIONS, REPORT SUBMISSION	TEXTBOOK

RECOMMENDED SOURCES							
Textbook	Figliola, R.S. and Beasley D.E., <i>Theory and Design for Mechanical Measurements</i> , 4th ed., Wiley, 2006						
Additional Resources							

ASSESSMENT							
IN-TERM STUDIES	NUMBER	PERCENTAGE					
Mid-term	1	15					
Lab performance	2	10					
Demonstration of setup	1	10					
Interim reports	2	10					
Project presentation	1	15					
Project final report	1	15					
Total		75					
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		25					
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		75					
Total		100					

COURSE'S CONTRIBUTION TO PROGRAM								
No	lo Program Learning Outcomes		Contribution					
		NA	1	2	3	4	5	
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied knowledge in these areas in complex engineering problems.	X						
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.	x						
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.	x						
4	Ability to devise, select, and use modern techniques and tools needed for analyzing and solving complex problems encountered in engineering practice; ability to employ information technologies effectively.	x						
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating complex engineering problems or discipline specific research questions.	x						
6	Ability to work efficiently in intra-disciplinary and multi- disciplinary teams; ability to work individually.	x						
7	Ability to communicate effectively in Turkish, both orally and in writing; knowledge of a minimum of one foreign language; ability to write effective reports and comprehend written reports, prepare design and production reports, make effective presentations, and give and receive clear and intelligible instructions.	x						
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.	x						
9	Consciousness to behave according to ethical principles and professional and ethical responsibility; knowledge on standards used in engineering practice.	X						

10	Knowledge about business life practices such as project management, risk management, and change management; awareness in entrepreneurship, innovation; knowledge about sustainable development.	X			
11	Knowledge about the global and social effects of engineering practices on health, environment, and safety, and contemporary issues of the century reflected into the field of engineering; awareness of the legal consequences of engineering solutions.	X			
12	Ability to work professionally in both thermal and mechanical systems areas, including design and realization.	x			
13	Ability to verify and validate numerical solutions to engineering problems.	x			

## ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Including the exam week: 14x Total course hours)	14	4	56
Hours for off-the-classroom study (Pre-study, practice)	14	6	84
Mid-terms	1	5	5
Final examination	1	10	10
Total Work Load			155
Total Work Load / 25 (h)			6.2
ECTS Credit of the Course			6