Alabama A&M University

MECHANICAL ENGINEERING DEPARTMENT

Spring, 2023

COURSE: ME 313L **Experimental Mechanics Lab** 1 Credit
Schedule: 2:00-4:50 W, Room: ETB 118 (Labs:251 &163)

INSTRUCTOR: Mohamed A. Seif, Ph.D., P.E.
Room: ETB 308
Phone: #5011, Email: mohamed.seif@aamu.edu

OFFICE HOURS: 11:00 – 2:00 M, W & 7:30 – 9:30 T, Th, Other times by appointment.

TEXTBOOK: Lab Manual and Instructor Handouts (www.dr-seif.com)

REFERENCES:
- Figliola RS, Beasley DE, Theory and Design for Mechanical Measurements. John Wiley & Sons, Inc., New York, 1995.
- Gere JM, Timoshenko SP, Mechanics of Materials. PWS Publishing Company, Boston, 1997.
- Eaton JK, Eaton L, Labtutor: A Friendly Guide to Computer Interfacing and LabView Programming. Oxford University Press, 1995.

COURSE DESCRIPTION: Lect. 0, Lab 3, 1 credit. Introduction to experimental stress analysis; measurement of tensile, compressive, bending and shear stresses; impact and hardness tests; vibration measurements, modal analysis; structural dynamics; Strain Gages. Prerequisite: ME 231 Strength of Materials.

COURSE OBJECTIVES

1. Familiarize the student with laboratory testing equipment used in experimental mechanics
2. Use laboratory equipment to demonstrate the mechanical behavior of common engineering materials
3. Develop computer-based models to describe the behavior of different Materials
4. Analyze experimental data and correlate experimental results to theoretical models
5. Enhance technical report writing and data presentation skills

Relationship to Program Objectives

This course primarily serves students in the department. Report writing and data presentation skills are developed by the preparation of technical reports. These skills combined with hands-on experimental mechanics skills and experience with numerical techniques, contribute towards the knowledge base needed to successfully practice the profession of mechanical engineering.

Relationship to Program Outcomes:

Outcomes a - k	Explanation	Evidence
a. An ability to apply knowledge of mathematics, science and engineering	Students are required to apply knowledge of Mathematics, Statics, Dynamics, and Mechanics of Materials to set-up and perform experiments.	Laboratory reports, exams
b. An ability to design and conduct experiments as well	The main focus of the course is on the ability to design and conduct experiments and to analyze and interpret experimental and numerical data.	Laboratory reports, exams

as to analyze and interpret data		
c. An ability to design a system, component or process to meet desired needs	Students are designing experiments to test the behavior of materials under different loading conditions and designing experiments to test behavior of dynamic systems.	Laboratory reports
d. An ability to function on multidisciplinary teams	Students learn to work in teams of three to four students per team. All experiments including the final laboratory reports are done in teams.	reports are prepared to identify the collaborative efforts
e. An ability to identify, formulate and solve engineering problems	The students learn to identify, formulate and solve engineering problems in mechanics and then test and verify their design through hands-on experiments.	Laboratory reports, exams
f. An understanding of professional and ethical responsibility	Students are exposed to ethical and professional responsibility issue through team work and by meeting requirement demands (laboratory design, reports, presentation) under given time constraints	Laboratory reports, Oral presentation
g. An ability to communicate effectively	**N/A**	
h. The broad education necessary to understand the impact of engineering solutions in a global/societal context	The impact of solid, practical and hands-on knowledge in conducting and designing experiments in various Industrial and societal discipline (Automotive, Space, Medicine) are emphasized.	Lecture notes
i. A recognition of the need for and an ability to engage in lifelong learning	N/A	
j. A knowledge of contemporary issues	**N/A**	
k. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice	Students use numerical tools such as MATLAB, EXCEL and Minitab and modern experimental devices such as sensors, data acquisition boards and mechanical and dynamic components in setting-up and conducting experiments	Laboratory reports

POLICIES:

1. **Grades**:

2 tests @ 15 points each	30
Labs	50
Final	20
Total	100

2. **Scale**:

A = 90 - 100

B = 80 - 89

C = 70 - 79
D = 60 - 69
E = 50 - 59

3. **Attendance**: Full attendance is expected. Absence will affect borderline grades.
4. **Lab Reports:** Reports are due on the week following the week in which the lab is assigned. **No late reports will be accepted.**
5. **Makeup**: No makeup exams/Labs allowed for unexcused absences. For health related absences, on provision of the medical excuse, a make up exam may be arranged at the discretion of the instructor and with an Official University Excuse.
6. Honesty is expected in all work. Any indication of dishonesty will prove fatal with "F" grade in the final grade of the course.

STYLES OF LEARNING AND TEACHING: We all have different strengths and weaknesses as learners, as well as habitual or preferred ways of receiving and processing information. Your instructors may also be accustomed to approaching specific subjects or materials in certain ways. Our objective is always to inform and stimulate, as well to encourage independent learning. Please feel free to talk with me at any time during the semester concerning ways in which I might help you to address your individual learning needs. Students with disabilities are encouraged to meet with me early in the semester to discuss accommodations.

COURSE OUTLINE

Week	TOPICS (Subject to Minor Changes)
1	- Introduction - Addressing uncertainty, Stress, Strain, and Deflection
2	- Statistical analysis of data
3	**Experiment #1**: Uni-axial stress-strain relationships – Tension Test
4	**Experiment #2:** Torsion Test and determination of the modulus of rigidity
5	**Experiment #3:** V-Notch Shear Test.
6	**Experiment #4:** Hardness Testing of Metals
7	**Test #1** **Experiment #5:** Modulus of Elasticity using Strain Gage – Flexure
8	**Experiment #6:** Poisson's Ratio using Strain Gage – Flexure
9	**Experiment #7:** Principal Strains and Stresses – Flexure
10	**Experiment #8:** Natural Frequencies of Structures
11	**Experiment #9:** Impact Test
12	**Test #2** **Experiment #10:** Fatigue Testing of Metals
13	**Experiment #11:** Ultrasonic Testing
14	**Review**
15	**Final Exam**