

1. Course Number and Name

- a. **MENG 3351:** Measurement and Instrumentation, Spring 2022
- b. Section 010, MW 1:00 – 1:50 PM
- c. Section 01Z, R 2:00– 4:50 PM

2. Credits and Contact Hours

- a. **Credits:** 3
- b. **Contact Hours:** 2 hours/week (Classroom) 3 hours/week (Lab)

3. Instructor Information

- a. **Course Coordinator:** Mohammad Shafinul Haque, PhD
- b. **Instructor:** Mohammad Shafinul Haque, 325-486-5509, mohammad.haque@angelo.edu.
Office: VIN 281. For office hours see [faculty homepage](#).

4. Course Materials

- a. **Required Textbook:**
 - Figliola, R. S., and Beasley, D. E. (2019), Theory and Design for Mechanical Measurements, (7th Ed.) Wiley Publication.
- b. **Other Supplemental Materials:** Will be posted on Blackboard.

5. Technology Requirements

To successfully complete this course, you need to install Arduino IDE and MATLAB in your personal computer or laptop.

6. Specific Course Information

- a. **Catalog Description:** Fundamentals of mechanical engineering measurement instruments and theory including measurement principles, function, and application. Data acquisition, data analysis, statistical methods, and uncertainty analysis. A focus on measurement of force, stress, strain, pressure, and temperature. Analog and digital data acquisition system theory and practice.
- b. **Prerequisites and Corequisites:** Prerequisites: ENGR 2305 and MATH 3324.

7. Specific Goals for the Course

- a. Course Learning Outcomes:
 1. Apply basic measurement techniques.
 2. Determine different types of errors in measurement results, determine the cause of the error, how to reduce/eliminate those errors.
 3. Set up and perform experiments, collect data with various types of measurement systems.
 4. Perform experimental design using full factorial and orthogonal array.
 5. Basic measurement techniques for strain, temperature, pressure, and velocity.
 6. Application of Arduino IDE for controlling DAQ hardware and analyzing data.
- b. Course Learning Outcome Mapping to ABET Criterion 3 Student Outcomes:

Table 1: Course Learning Outcomes mapped to ABET Student Outcomes

ABET Student Outcomes	1	2	3	4	5	6
1. Solve Problems	X			X	X	
2. Design						X
3. Communication						
4. Ethics & Professionalism						
5. Teamwork			X			X
6. Experimentation		X	X	X		
7. Acquire New Knowledge						

8. Topics Covered

1. Basic Concepts of Measurement Methods
2. Static and Dynamic Characteristic of Signal
3. Measurement System Behavior
4. Design of Experiments
5. Electrical measuring device and data acquisition
6. Strain, Temperature, Pressure, and Velocity measurements

9. Course Delivery and Communications

9.1 Course Structure and Communication

This course has two significant components: two 50 minutes lectures per week and one 3 hours lab session per week. On-time attendance of lab sessions is REQUIRED. This is a face-to-face course with learning resources and supplemental materials posted in Blackboard.

For each lecture and lab, you are expected to have read the assigned textbook material and/or watch video and to be ready to engage with the lesson materials (through in-class exercises, discussions, and activities). You will be asked to provide feedback to your instructor before each lesson.

As your instructor, you can expect from me: 1) to be prepared with lecture and lab materials in a timely fashion, 2) to value your time by ending lectures as scheduled, 3) to ensure your safety in lab by having prepared materials and equipment beforehand, 4) to provide constructive feedback on your homework and lab report submissions, and 5) to be adaptive and responsive should scheduling challenges arise.

The value of the course to you will be highly dependent upon your preparation for class. We will be using both Blackboard, and email to communicate during this course. Lesson materials will be delivered via Blackboard.

9.2 Communication

Faculty will respond to email within 24 hours during working hours Monday through Friday. Weekend messages may not be returned until Monday.

Written communication via email: All private communication will be done exclusively through your ASU email address. Check frequently for announcements and policy changes. In your emails to faculty, include the course name and section number in your subject line.

Virtual communication: Office hours and/or advising may be done with the assistance of the telephone, Collaborate, Zoom, etc.

10. Professionalism

Professional engineering standards apply in this class. You are expected to demonstrate a behavior consistent with the conduct of an individual practicing in the engineering profession. You are expected to: (1) come prepared for class; (2) respect faculty and peers; (3) demonstrate responsibility and accountability for your own actions; (4) demonstrate sensitivity and appreciation for diverse cultures, backgrounds, and life experiences; (5) offer and accept constructive criticism in a productive manner; (6) demonstrate an attitude that fosters professional behavior among peers and faculty; (7) be punctual to class meetings; (8) maintain a good work ethic and integrity; and (9) recognize the classroom as a professional workplace.

11. Graded Material

11.1 *Class attendance, Participation, Timeliness and Teamwork*

You are expected to meet every class meeting on time and prepared. Attendance will be taken. Should you find it necessary to miss a class for any reason, you are expected to notify your instructor as early as the absence is known—preferably before the absence. It's important that you communicate clearly your instructors.

Your online assignments will be due at the time specified on Blackboard. Any assignments submitted in hard copy are due at the beginning of class on the due date. Your instructor may assess penalties for late work.

11.2 *Homework*

Problem sets will be due weekly and will be based on the previous week's lecture and lab topics. Check Blackboard for specific due dates.

11.3 *Quiz*

There will be quizzes and short questions on assigned reading materials that are due before class.

11.4 *Exams*

This course will have three exams and a final exam.

Exams will not be open textbooks or notes, but you are allowed to bring a formulae sheet. **The mid-term exams will have two parts one during class time (conceptual/multiple choice) and the second part (application) over the day.** Details will be discussed closer to the exam time.

Make-up exams will only be given for extenuating circumstances unless prior arrangements with the instructor are agreed upon. Proof, such as a doctor's note or another official document, may be required for unexcused absences during an exam.

11.5 *Lab report*

The lab reports are due the following week. The lab report should be prepared strictly following the report template. One lab report per group is required.

11.6 *Projects*

There will be a group project where the student must design and use instruments (Arduino) to produce the final product and a final project in which the student will build and analyze a measurement system. The project must have basic four steps measurement, data acquisition (DAQ), analysis, justification.

11.7 Grades: Weighting and Letter Grades

Table 2 presents the grade weighting

Table 2: Grade Weighting

Item	Percent
Homework & Quiz	(10+5) %
Exam 01	20%
Exam 02	20%
Final Exam	20%
Group Project	12%
Lab Report	13%
Total	100%

The instructor will determine letter grades for the course using his professional judgment, and the following standards as described in the [University Catalog](#):

A = excellent work, B = good work, C = average work, D = poor work, F = failing work

Table 3: Grading Scale

Letter Grade	Number Grade
A	≥ 90
B	[80 – 90)
C	[70 – 80)
D	[60 – 70)
F	< 60

12. Classroom and University Policies and Student Support

12.1 General Policies

All students are required to follow the policies and procedures presented in the [Angelo State University Student Handbook](#)¹ and [Angelo State University Catalog](#)².

12.2 Student Disability Services

ASU is committed to the principle that no qualified individual with a disability shall, on the basis of disability, be excluded from participation in or be denied the benefits of the services, programs or activities of the university, or be subjected to discrimination by the university, as provided by the Americans with Disabilities Act of 1990 (ADA), the Americans with Disabilities Act Amendments of 2008 (ADAAA) and subsequent legislation.

Student Disability Services is located in the Office of Student Affairs and is the designated campus department charged with the responsibility of reviewing and authorizing requests for reasonable accommodations based on a disability. It is the student's responsibility to initiate such a request by contacting an employee of the Office of Student Affairs, in the Houston Harte University Center, Room 112, or contacting the department via email at ADA@angelo.edu. For more information about the

application process and requirements, visit the [Student Disability Services website](#)³. The employee charged with the responsibility of reviewing and authorizing accommodation requests is:

Dallas Swafford
Director of Student Disability Services
Office of Student Affairs
325-942-2047
dallas.swafford@angelo.edu
Houston Harte University Center, Room 112

12.3 Title IX at Angelo State University

The University prohibits discrimination based on sex, which includes pregnancy, sexual orientation, gender identity, and other types of Sexual Misconduct. Sexual Misconduct is a broad term encompassing all forms of gender-based harassment or discrimination including sexual assault, sex-based discrimination, sexual exploitation, sexual harassment, public indecency, interpersonal violence (domestic violence and/or dating violence), and stalking. As a faculty member, I am a Responsible Employee meaning that I am obligated by law and ASU policy to report any allegations I am notified of to the Office of Title IX Compliance.

Students are encouraged to report any incidents of sexual misconduct directly to ASU's Office of Title IX Compliance and the Director of Title IX Compliance/Title IX Coordinator at:

Michelle Boone, J.D.
Director of Title IX Compliance/Title IX Coordinator
Face to face: Mayer Administration Building, Room 210
325-942-2022, michelle.boone@angelo.edu

You may also file a report online 24/7 at www.angelo.edu/incident-form⁴

If you are wishing to speak to someone about an incident in confidence you may contact the *University Health Clinic and Counseling Center* at 325-942-2173 or the *ASU Crisis Helpline* at 325-486-6345.

For more information about Title IX in general you may visit www.angelo.edu/title-ix⁵.

12.4 Observance of Religious Holy Day

A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. See ASU Operating Policy 10.19 Student Absence for [Observance of Religious Holy Day](#)⁶ for more information.

12.5 Incomplete Grade Policy

It is a policy that incomplete grades be reserved for student illness or personal misfortune. Please contact faculty if you have a serious illness or a personal misfortune that would keep you from completing course work. Documentation may be required. See ASU Operating Policy 10.11 Grading Procedures for more information.

12.6 Required Use of Masks/Facial Coverings

As a member of the Texas Tech University System, Angelo State University has adopted the mandatory [Facial Covering Policy](#)⁷ to ensure a safe and healthy classroom experience. Current research on the COVID-19 virus suggests there is a significant reduction in the potential for transmission of the virus from person to person by wearing a mask/facial covering that covers the nose and mouth areas. Therefore, in compliance with the university policy students in this class are required to wear a mask/facial covering

before, during, and after class. Faculty members may also ask you to display your daily screening badge as a prerequisite to enter the classroom. You are also asked to maintain safe distancing practices to the best of your ability. For the safety of everyone, any student not appropriately wearing a mask/facial covering will be asked to leave the classroom immediately. The student will be responsible to make up any missed class content or work. Continued non-compliance with the Texas Tech University System Policy may result in disciplinary action through the Office of Student Conduct.

12.7 Student Conduct Policies

12.7.1 Academic Integrity

Students are expected to maintain complete honesty and integrity in all work. Any student found guilty of any form of dishonesty in academic work is subject of disciplinary action and possible expulsion from ASU.

The College of Science and Engineering adheres to the university's [Statement of Academic Integrity](#).

12.7.2 Plagiarism

Plagiarism is a serious topic covered in ASU's [Academic Integrity policy](#)⁸ in the Student Handbook. Plagiarism is the action or practice of taking someone else's work, idea, etc., and passing it off as one's own. Plagiarism is literary theft.

In your discussions and/or your papers, it is unacceptable to copy word-for-word without quotation marks and the source of the quotation. It is expected that you will summarize or paraphrase ideas giving appropriate credit to the source both in the body of your paper and the reference list.

Papers are subject to be evaluated for originality via Turnitin. Resources to help you understand this policy better are available at the [ASU Writing Center](#)⁹.

12.7.3 Copyright Policy

Students officially enrolled in this course should make only one printed copy of the given articles and/or chapters. You are expressly prohibited from distributing or reproducing any portion of course readings in printed or electronic form without written permission from the copyright holders or publishers.

13. Course Outline

The course outline is presented in Table 4. Detailed reading and homework assignments along with updates to this schedule will be provided via Bb. The following schedule may be modified as the semester progresses.

Table 4: Course Lecture Schedules

Week	Lecture	Date	Topic	Textbook Chapter	Homework/Due
Module 01 – (Ch. 2,6-7) Electrical Measurements and DAQ					
	01	Jan 17	No Class		
01	02	Jan 19	Syllabus and Signal Concepts	Ch 2.1 – 2.3	
	LAB 01	Jan 20	Lab Intro, Group formation, Project	Ch 1.0	

	03	Jan 24	Current Measurement	Ch 6.1-6.2	
02	04	Jan 26	Voltage Measurement	Ch 6.3-6.4	
	LAB 02	Jan 27	Lab1- Mechanical Measurements	(Theory)	
	05	Jan 31	Signal Conditioning: Amplifiers	Ch 6.6	HW 01
03	06	Feb 02	Signal Conditioning: Special Circuits	Ch 6.7	
	LAB 03	Feb 03	Lab1- Mechanical Measurements	(Experiment)	
	07	Feb 07	Signal Conditioning: Filters	CH 6.8-6.9	
04	08	Feb 09	Sampling Concepts	Ch 7.1-7.2	
	LAB 04	Feb 10	Lab2- Electrical Control System	(Theory)	Submit Lab report 01
	09	Feb 14	Sampling Concept	Ch 7.2	HW 02
05	10	Feb 16	Voltage measurement	Ch 7.3-7.5	
	LAB 05	Feb 17	Lab2- Electrical Control System (P1)	(Experiment + Theory)	
	11	Feb 21	Data Acquisition (Analog)	Ch 7.6-7.8	
06	12	Feb 23	Data Acquisition (Digital)	Ch 7.8-7.10	
	LAB 06	Feb 24	Lab3 - Electrical Control System (P2)	(Experiment)	Submit Lab report 02
	13	Feb 28	Exam 1 –Module 01	Ch – 2,6,7	HW 03
			Module 02 – (DOE, Ch 11) Design of Experiments & Strain Measurement		
07	14	Mar 02	Experimental Design	Hand out	
	LAB 07	Mar 03	Lab 3 – Variable Frequency Drive	(Theory)	
	15	Mar 07	Taguchi Design	Hand out	
08	16	Mar 09	Orthogonal Array		
	LAB 08	Mar 10	Lab 4 – Variable Frequency Drive (P1)	(Experiment + Theory)	Submit Lab report 03
	17	Mar 21	Resistance Strain Gauge	Ch 11.1-11.3	HW 04
09	18	Mar 23	Gauge Circuit	Ch 11.4-11.5	
	LAB 09	Mar 24	Lab 4 – Variable Frequency Drive (P2)		
10	19	Mar 28	Signal Conditioning	Ch 11.6	

	20	Mar 30	Optical Strain Measurement	Ch 11.7	
	LAB 10	Mar 31	Lab5 – Design of Experiments	(Theory)	Submit: Lab 4 Report
	21	Apr 04	Exam 2 – Module 02	DOE, Ch -11	HW 05
Module 3 – (Ch 8 -9) Temperature, Pressure, and Velocity Measurement					
11	22	Apr 06	Electrical Resistance Thermometer	Ch 8.1-8.4	
	LAB 11	Apr 07	Lab5 – Design of Experiments	(Experiment)	
	23	Apr 11	Electrical Resistance Thermometer	Ch 8.4	
12	24	Apr 13	Thermoelectric Measurement	Ch 8.5	Submit: Lab5 report
	LAB 12	Apr 14	Lab6 – PLC System	(Theory)	
	25	Apr 18	Radiative Temperature Measurement	Ch 8.6-8.7	HW 06
13	26	Apr 20	Pressure Transducers	Ch 9.1-9.3	
	LAB 13	Apr 21	Lab6 – PLC System	(Theory)	
	27	Apr 25	Pressure Transducers	Ch 9.4-9.5	
14	28	Apr 27	Pressure Transducers	Ch 9.4-9.5	
	LAB 14	Apr 28	Final Project Display		Submit: Lab6 report
	29	May 02	Pressure Measurement in Moving Fluids	Ch 9.6-9.8	
15	30	May 04	Pressure Measurement in Moving Fluids	Ch 9.6-9.8	
	LAB 15	May 05	No Labs		HW 07
Final Exam					

*Schedule subject to change. Any changes will be announced on Blackboard and via email.

14. End Notes

¹ <http://www.angelo.edu/student-handbook/>

² <http://www.angelo.edu/catalogs/>

³ <http://www.angelo.edu/services/disability-services/>

⁴ <http://www.angelo.edu/incident-form>

⁵ <http://www.angelo.edu/title-ix>

⁶ <http://www.angelo.edu/content/files/14206-op-1019-student-absence-for-observance-of>

⁷ <http://www.texastech.edu/downloads/ttus-policy-face-coverings.pdf>

⁸ <http://www.angelo.edu/student-handbook/community-policies/academic-integrity.php>

⁹ http://www.angelo.edu/dept/writing_center/academic_honesty.php