

# **Instrumentation, Measurements, & Statistics ENCP A361**

**Summer-2022**

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**Meeting Day:** Tuesday, Thursday, Saturday@10:00 AM-1:00 PM

**Meeting Location:** Penland Admin Bldg@223 and Lab 224

**Course Instructor:** Titan C. Paul, Ph.D.

Room: 219B, Penland Admin Building

Email: titanp@usca.edu

Phone: 803-641-3622

**Office Hours:** Tuesday, Thursday, Saturday 9:00 AM-10:00 AM

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**Prerequisite:** PHYS 212, ENCP 260 (Solid Mechanics) with C or better

**Textbook:** Experimental Methods for Engineers by J. P. Holman

Publisher: McGraw-Hill (8th Edition)

**Additional Material:** Instrumentation and Sensors for Engineering Measurements and Process Control, A. Shukla and J.W. Dally, College House Enterprises, LLC.

## **Topics Covered:**

1. Organizing and writing the laboratory report
2. Presentation of data and uncertainty analysis
3. Linear measurements
4. Electrical measurements
5. Measurement of dynamic systems
6. Linear regression and curve fitting
7. Organizing and making the technical oral presentation
8. Thermodynamic and heat transfer measurements.
9. Force, Stress, strain and torque measurements
10. Designing an experiment for measuring specified parameters

## **Course Objectives**

1. Students will demonstrate the ability to organize and write a laboratory report.
2. Students will demonstrate the ability to organize and give an oral presentation.
3. Students will demonstrate the ability to explain the operating principles of common instrumentation and interpret the output.
4. Students will demonstrate the ability to apply statistical skills in creating an experiment and interpret the results.

## **Grade system**

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<b>Grading scale</b>	
A	90-100
B+	85-89
B	80-84
C+	75-79
C	70-74
D+	65-69
D	60-64
F	0-59

**Oral Presentation:** 20% of total grade

**Quizzes:** 25% of total grade

**Design Project:** 15% of total grade

**Laboratory Report:** 40% of total grade

### **Quizzes**

There will be 8 closed book and closed note in class quizzes which will carry 25% of the final grade.

### **Class attendance**

Students must attend the scheduled laboratory sessions, sign the attendance sheet and complete all assignments. A student is responsible for ALL material and information covered during a class period. This includes changes to syllabus and/or material not covered in the book. I will NOT review class lectures during office visits for students who did not attend a lecture. If you are unable to attend any lab session you must report the instructor prior the class with valid documentation.

### **Lab attendance**

Students must participate the scheduled laboratory sessions and complete all assignments. If you are unable to attend any lab session you must report the instructor prior the class with valid documentation.

### **Behavior in the Lab**

In the lab class ***safety is the first concern***, be aware about the equipment safety. Equipment will set up before the class. If any equipment breaks down or not working please inform the instructor.

### **Lab report**

Lab report must be turn in specified due date. Usually following class after the lab class will be the lab report due date. No late submission is acceptable. **Plagiarism** on any lab report will result in a grade of zero and subjected to other university disciplines. Sample lab report and lab report rubric will be posted on blackboard.

### **Presentation**

There will be a final power point presentation on the lab topics which will carry 20% of final grade. Each student needs to present one experiment. Presentation rubric will be posted on blackboard. Final presentation will be on June 23, 2022.

### **Design Project:**

There will be a final experimental design project which will carry 15% of final grade. Students will work in a group of three students for the project. Detailed project requirements and outline will be posted on blackboard. Final project will be due on June 23, 2022.

**Academic Integrity:** You are expected to practice the highest possible standards of academic integrity. Any deviation from this expectation will result in failure of the course for all involved parties and will result in additional disciplinary measures. This includes improper citation of sources, using another student's work, and any other form of academic misrepresentation. Academic misrepresentation, or cheating, is defined as copying any work, sending 'help' via text or email for any exam, accessing any electronics during testing, etc.

**Instrumentation, Measurements, & Statistics ENCPA361**  
**Class topics**

May 26, Thursday	Introduction, Definition of terms, Calibration, Standards, Dimensions and Units, Generalized measurement system, Dynamic response, System response, Data reduction, Statistical analysis of experimental data, Probability distribution.
May 28, Saturday	Lecture on normal error distribution, Comparison of data with normal distribution. Discussion about the report writing. Data collection, perform analysis, and writing report <b>quiz#1</b>
May 31, Tuesday	Lecture on materials properties, hardness, stress & strain, <b>quiz#2</b>
June 2, Thursday	Lecture on strain measurement, torque and force measurements <b>quiz#3</b>
June 4, Saturday	Fundamentals of pressure measurements.
June 7, Tuesday	Fundamentals of temperature measurements, Temperature scale, Temperature measurement by mechanical and electrical effect, <b>quiz#4</b>
June 9, Thursday	Basic electrical measurements, voltage, current, resistance, kirchhoff's voltage law (KVL), kirchhoff's current law (KCL), <b>quiz#5</b>
June 11, Saturday	Lecture on fluid flow and general principle, <b>quiz#6</b>
June 14, Tuesday	Lecture on flow measurement, <b>quiz#7</b>
June 16, Thursday	Lecture on data acquisition system, <b>quiz#8</b>
June 18, Saturday	LabVIEW data acquisition system
June 21, Tuesday	Working on final design project, poster and presentation
June 23, Thursday	<b>Final presentation</b>

### Lab topics

May 31, Tuesday	<b>Lab#1:</b> Uncertainty and linear measurement
June 2, Thursday	<b>Lab#2:</b> Hardness test
June 4, Saturday	<b>Lab#3:</b> Strain measurement by using strain gage
June 7, Tuesday	<b>Lab#4:</b> Stress-strain measurement by using tensile tester
June 9, Thursday	<b>Lab#5:</b> Fundamental of pressure measurement
June 11, Saturday	<b>Lab#6:</b> Fundamental of temperature measurement
June 14, Tuesday	<b>Lab#7:</b> Basic electrical measurement
June 16, Thursday	<b>Lab#8:</b> Verification of Bernoulli's principle
June 18, Saturday	<b>Lab#9:</b> Fundamental of flow measurement
June 21, Tuesday	<b>Lab#10:</b> National Instrument (NI) myDAQ-University Kit