

MET-2240: MECHANICAL ENGINEERING LAB

Cuyahoga Community College

Viewing: MET-2240 : Mechanical Engineering Lab

Board of Trustees:

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Academic Term:

Fall 2023

Subject Code

MET - Mech Eng/Manuf Ind Eng Tech

Course Number:

2240

Title:

Mechanical Engineering Lab

Catalog Description:

Introduction to fundamental laboratory measurement techniques, data acquisition and analysis, and technical report writing in the form of engineering reports and executive summaries. Troubleshoot and correct hydraulic/electromechanical equipment and digital data acquisition hardware. Experiments are drawn from thermal sciences, dynamics, solid mechanics and materials science.

Credit Hour(s):

1

Lecture Hour(s):

0

Lab Hour(s):

2

Requisites

Prerequisite and Corequisite

MET-1601 Technical Statics.

Outcomes

Course Outcome(s):

Use modern engineering instruments and digital data acquisition hardware to measure force, displacement and temperature.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

- a. Apply the principles and good practice for measuring force, displacement, temperature, pressure, flow, and acceleration using modern engineering instruments and digital data acquisition hardware.
- b. Perform static and dynamic calibrations.
- c. Identify sources of measurement uncertainty and quantify measurement errors.
- d. Explain the basic concepts of mechanical engineering measurements and uncertainty analysis.
- e. Properly apply mechanical engineering measurements and uncertainty analysis.
- f. Understand the theory and compute the measurement of signal.

Course Outcome(s):

Apply principles and calculations to static and dynamic problems.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

- a. Apply the principles and good practice for measuring force, displacement, temperature, pressure, flow, and acceleration using modern engineering instruments and digital data acquisition hardware.
- b. Perform static and dynamic calibrations.
- c. Present methods and results professionally in laboratory reports and executive summaries.
- d. Understand the theory of statics and dynamics to apply to real life problems.
- e. Understand the theory of stress and strain and apply the appropriate calculations to given problems.

Course Outcome(s):

Present methods and results professionally in laboratory reports and executive summaries.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Written Communication: Demonstrate effective written communication for an intended audience that follows genre/disciplinary conventions that reflect clarity, organization, and editing skills.

Objective(s):

- a. Select appropriate instrumentation for engineering experiments.
- b. Perform static and dynamic calibrations.
- c. Present methods and results professionally in laboratory reports and executive summaries.
- d. Create a professional document in the proper lab report format.
- e. Communicate professionally through technical reports, memos, email and oral presentation.

Course Outcome(s):

Perform maintenance and troubleshooting of mechanical equipment.

Essential Learning Outcome Mapping:

Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

- a. Correctly calibrate and troubleshoot equipment error. Use a problem-solving process to troubleshoot equipment malfunctions.
- b. Calibrate the equipment to ensure correct measurements.
- c. Maintain equipment and machines to ensure correct functioning. Repair malfunctioning equipment.

Methods of Evaluation:

- A. Lab Participation
- B. Assignments
- C. Lab Reports

Course Content Outline:

- a. Concepts
 - i. Mechanical engineering measurements and uncertainty analysis
 - ii. Basic format and effective technical report writing
 - iii. Calibrations
 - iv. Signal measurement
 - v. Stress and strain measurement
 - vi. Preventive maintenance

- vii. Proper safety procedure for the laboratories, tools, and equipment
- viii. OSHA standard and Material Data Safety Sheets
- b. Skills
 - i. Determines the uncertainty (error) of a measurement device by comparing its measurement with the appropriate measurement standard
 - ii. Demonstrate random error and systematic error
 - iii. Demonstrate the format and contents for technical report
 - iv. Determines the uncertainty (error) of a measurement device by comparing its measurement with the appropriate measurement standard
 - v. Demonstrate professional societies and other organizations that establishing and maintaining codes and standards
 - vi. Demonstrate random error and systematic error
 - vii. Demonstrate the signal filtering
 - viii. Demonstrate the load cell and strain gauge
 - ix. Demonstrate the strain control/load control and displacement control
 - x. Demonstrate the difference between hydraulic and electromechanical equipment
 - xi. Demonstrate the basic concept of data acquisition systems
- c. Issues
 - i. Troubleshooting and correcting of hydraulic/electromechanical equipment and digital data acquisition hardware

Resources

Beckwith, Thomas G.; Marangoni, Roy D.; Lienhard, John H. *Mechanical Measurements*. 6th ed. Upper Saddle River, NJ., 2013.

Dieck, Ronald H. *Measurement Uncertainty: Methods and Applications*. 5th ed. The Instrumentation Systems and Automtion Society, 2017.

Figliola, Richard S., and Donald E. Beasley. *Theory and Design for Mechanical Measurements*. 7th ed. Wiley, 2020.

Kirk, Franklyn W., Thomas A. Weedon, and Philip Kirk. *Instrumentation and Process Control*. 7th ed. American Technical Publishers, 2019.

Morris, Alan S. and Reza Langari. *Measurement and Instruementation: Theory and Application*. 3rd ed. Academic Press, 2020.

Northrup, Robert B. *Introduction to Instrumentation and Measurements*. 3rd ed. Boca Raton, FL: CRC Press, 2014.

Nichola, J.V. and D. R. White. *Traceable Temperatures: An Introduction to Temperature Measurement and Calibration*. 2nd ed. Wiley, 2002,

R.K. Rajput. *Mechanical Measurements and Instrumentation (Including Metrology and Control Systems)*. S.K. Kataria & Sons, 2015.

Tse, Francis S., Lynn faulkner, and Ivan E. Morse. *Measurement and Instrumentation in Engineering Principles and Basic Laboratory Experiments*. CRC Press, 2018.
