

Department of Mechanical Engineering
ME405– Mechanical Laboratory II
(Required)

Catalog Description: **ME 405 (1-2-2)**

Laboratory emphasizing the use of fundamental principles and instrumentation systems for the analysis and evaluation of mechanical components within a system.

Prerequisites: ME 343 – Mechanical Laboratory I
 ME 312 – Thermodynamics II

Co-requisite: ME 407 – Heat Transfer

Textbook(s) Materials Required:

1. J.P. Holman, Experimental Methods for Engineers, Seventh Edition, McGraw-Hill, 2001.
2. Dreizin, E.L., Mechanical Laboratory II Manual, NJIT, 2006,
http://web.njit.edu/~me/ME%20405%20II%20Experiments_Dreizin.html

Reference Materials (not required)

1. Beckwith, Marangoni and Lienhard, Mechanical Measurements, Fifth Edition, Addison-Wesley, 1993.
2. D. Beer, A Guide to Writing as an Engineer, 2nd Ed., Wiley ISBN 0-471-43074-9

Course Supervisor: Dr. E.L. Dreizin

Pre-requisite by topic

1. Instrumentation and measurement for mechanical engineering students.
2. Error analysis
3. First and Second Laws of Thermodynamics; property relations
4. Fundamentals of heat and mass transfer

Course Objectives¹:

1. To develop the students' skills in acquiring and processing experimental data (A, B)
2. To develop students' skills in analyzing experimental errors and assessing the accuracy of the engineering measurements (A, B, C)
3. To develop the students' skills in applying the principles of potential flows for describing and designing mechanical components, including pumps and turbines (A, B, C)
4. To develop students' skills in describing transient temperature measurements using analytical and numerical approaches (A, B, C)
5. To develop students' skills in analyzing pressure measurements and use such measurements to reconstruct the flow velocity profiles (A, B, C)
4. To develop students' skills in preparing written technical reports and oral presentations of their results (A, D, E)
5. To develop students' skills in working on an engineering project as a group (D, E)

Topics² :

1. Introduction to ME laboratory II (1.5 hrs)

2. Performance test of a centrifugal pump (6 hrs)
3. Performance test of a gear pump (6 hrs)
4. Performance test of an impulse turbine (Pelton wheel) (6 hrs)
5. Drag and pressure distribution on a cylinder (6 hrs)
6. Transient heat conduction in bodies of finite length (6 hrs)
7. Presentation/discussion of lab reports (4.5 hrs)
8. Review (3 hrs)

Evaluation Method:

1. Quizzes
2. Lab reports
3. Exam

Schedule: Laboratory sessions: 3 hours, per week

Professional Component: Engineering Science

Program Objectives Addressed: A, B, C, D, E

Course Outcomes³ :

Objective 1

Students will develop an ability to process experimental data using theoretical concepts of fluid mechanics, heat transfer, and thermodynamics (1, 2) (a, b, c, k)

Objective 2

Students will develop an ability to quantify and analyze experimental errors, separate between systematic and statistical errors, and determine the reliability of measurements (1, 2, 3) (a, b, c, e, h, k, m, n)

Objective 3

Students will learn using generic data processing software to process experimental data and describe the measurements using engineering models (1, 2) (a, b, j, k, n)

Objective 4

Students will learn how to characterize and test mechanical components including pumps and turbines (1, 2, 3) (b, c, d, e, g, o)

Objective 5

Students will demonstrate an ability to prepare comprehensive written technical reports and prepare oral presentations (2, 3) (a, b, c, d, e, g, h, j, k, m, n, o)

Prepared by: E.L. Dreizin **Date: September 18, 2006**

¹ Capital Letters in parenthesis refer to the Program Objectives of the Mechanical Engineering

Department. Listed in Sec 2 d Tables B-2-9, B-2-12. Table B-2-8 links Program Objectives with the ABET a-k Criterion.

² Topic numbers in parenthesis refer to lecture hours. (three hours is equivalent to 1 week)

³ Outcome numbers in parenthesis refer to evaluation methods used to assess the student performance. Lower case letters in parenthesis refer to ABET a-k outcomes.