

**United States Naval Academy
Mechanical Engineering Department**

EM375 Mechanical Engineering Experimentation

Catalog Description: EM375 Mechanical Engineering Experimentation **Credit:** 3 (2-2-3)

A design course that emphasizes the theory and practical considerations associated with contemporary experimental procedures, methods and design strategies. Topics include measurement error and its propagation, equation fitting and plotting, signal acquisition and validation, instrument response and elements of experimental design. Emphasis includes computer aided data reduction, modeling of a system and report writing.

Prereq: SM212, EM217, EM232.

Prerequisites: Strengths of Materials, Differential Equations, Dynamics

Textbooks: Wheeler, A.J, and Ganji, A.R., *Introduction to Engineering Experimentation*, Prentice-Hall, *Required*

Course Director: Assoc. Prof. C.P. Ratcliffe

Objectives¹:

1. To give students an introduction to engineering experimentation, data reduction and data analysis procedures used in mechanical engineering experiments. To develop students' report writing skills. (a, b, c)

Course Content:

No.	Topic or Subtopic	hrs.
1	Introduction	1
2	Statistics	5
3	Introduction to Mathcad	6
4	Equation fitting	2
5	Uncertainty and Error Propagation	6
6	1 st and 2 nd order measurement systems	8
7	Digital sampling and applied experimental methods	2
8	Project	10
9	Labs in support of topics 4, 5, 6, 7, 8	12
10	Report writing	1
11	Visiting lectures	2

Evaluation:

1. Quizzes YES
2. Homework YES
3. Exams YES
4. Laboratory Reports YES

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- 5. Oral Presentations NO
- 6. Design Reports/Notebooks YES
- 7. Prototypes/Demonstrations NO
- 8. Projects YES
- 9. any other evaluation tools used NO

Acquired Abilities²:

- 1.1 Students will demonstrate the ability to calculate probabilities based on the binomial and normal distribution (1, 2, 3)
- 1.2 Students will demonstrate the ability to determine confidence intervals for the statistics determined from measured data (1, 2, 3)
- 1.3 Students will demonstrate the ability to design experiments based on expected statistical outcomes (1, 2, 3)
- 1.4 Students will demonstrate the ability to use Mathcad for the reduction and analysis of experimental engineering data (1, 2, 3)
- 1.5 Students will demonstrate the ability to regress linear and nonlinear experimental data, and determine governing properties from the analysis (1, 2, 3, 4)
- 1.6 Students will demonstrate the ability to identify and categorize errors associated with instruments and measurements, and propagate these errors to the final result (1, 2, 3, 4)
- 1.7 Students will demonstrate the ability to interpret the dynamic performance of measurement systems (1, 2, 3, 4)
- 1.8 Students will demonstrate the ability to develop mathematical simulations based on subsystem, prototype and material testing, and use these simulations to predict the performance of full-size mechanisms (4, 6, 8)
- 1.9 Students will demonstrate the ability to communicate effectively by written report (4, 6, 8)

Date of Latest Revision: 11 SEP 2001

¹ Letters in parenthesis refer to the [Program Objectives](#) of the [Mechanical Engineering Program](#).

² Numbers in parenthesis refer to the evaluation methods used to assess student performance.