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MIE Department  
Umass Amherst Campus

J. MacGregor Smith  
Spring 2004

## MIE 520 Course Description

TITLE: *Probability and Statistics*

INSTRUCTOR: *J. MacGregor Smith*

PURPOSE:

To provide an in-depth examination of the theory, methods, and algorithms of probability and statistics as they occur throughout mechanical and industrial engineering, physical, and human systems.

Some of the selected topics to be covered in the course include but are not limited to the following:

- *Descriptive Statistics*
- *Sample Spaces and Events*
- *Counting and Combinatorics*
- *Random Variables: Discrete and Continuous*
- *Binomial, Geometric, and Poisson Distributions*
- *Uniform, Exponential, Normal, Erlang, Gamma etc. Distributions*
- *Joint Random Variables*
- *Sampling Theory*
- *Estimation Theory and Confidence Intervals*
- *Hypothesis Testing*
- *Regression Analysis*

All of the above will be demonstrated in class and coupled with available PC-computer programs where appropriate. *Minitab* will be the primary software tool, but other languages and packages such as *MAPLE* may be used to best illustrate the concepts in the course.

REQUIREMENTS:

Homework, 2-midterm examinations and 1 final examination along with a possible term project are required by all students. Homework will account for 20% of your grade, the exams and term project will account for 80% to round out your total grade.

PREREQUISITES:

A basic course in multi-variable Calculus (Math 132-133, or equivalent) plus undergraduate standing or consent of the instructor.

TEXT and REFERENCES:

*Probability and Statistics*, by J. Devore, Duxbury Press, 6th edition, 2004. Various other references are available in the Graduate Physical Science Library.

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## 1. Tentative Outline of P&S Lectures

- *Probability and Statistics in MIE*
- *Populations, Samples, and Process*
- *Pictorial and Tabular Methods in Descriptive Statistics*
- *Measures of Location*
- *Measures of Variability*
  
- *Sample Spaces and Events*
- *Axioms, Interpretations and Properties of Probability*
- *Counting Techniques*
- *Conditional Probability*
- *Independence*
  
- *Random Variables*
- *Discrete Random Variables*
- *Expected Values of Discrete Random Variables*
- *Binomial Distribution*
- *Hypergeometric and Negative Binomial*
- *Poisson Distribution*
  
- *Continuous Random Variables*
- *Cumulative Distribution Functions*
- *Normal Distribution*
- *Gamma Distribution*
- *Other Continuous distributions*
  
- *Jointly Distributed RVs*
- *Expected Values*
- *Statistics and their distributions*
- *Distribution of the Sample Mean (CLT)*
  
- *Point Estimation*
- *Methods of Point Estimation*
  
- *Confidence Intervals*
- *Large-Sample Confidence Intervals*
- *Intervals based on a Normal Population Distribution*
  
- *Hypothesis Testing*
- *Tests about a Population Mean*
- *Tests about a proportion*
- *P-values*
  
- *Simple Linear Regression*
- *Estimating Model Parameters*