

ROWAN UNIVERSITY  
Department of Mathematics

Syllabus  
**Math 01.505 - Probability and Mathematical Statistics**

**CATALOG DESCRIPTION:**

Math 01.505 Probability and Mathematical Statistics      3 s.h.

This course is an introduction to the theory and application of mathematical statistics. After a brief introduction to the concepts of descriptive and inferential statistics, the emphasis is on probability theory and its applications. Topics covered include sample spaces, random variables, Chebyshev's Theorem, discrete and continuous probability distributions, mathematical expectation, hypothesis testing, and multivariate distributions. Other than on the recommendation of the advisor, this course should not be chosen if a correspondingly similar course has been part of the student's undergraduate study.

**OBJECTIVES:**

Students will learn the distinction between descriptive and inferential statistics and the value of the theory of probability in the mathematical development of inferential statistics. They will study discrete and continuous random variables in enough depth to understand the Central Limit Theorem. They will understand the value of moment generating functions and be able to recognize many discrete and continuous probability distributions. Finally, students will gain skills in combinatorics and using probability distributions to help in evaluating series and definite integrals. In view of the many recommendations that an introduction to probability and statistics be given to high school students, it is essential that teachers acquire a sound understanding of the mathematical bases of both descriptive and inferential statistics. This course assumes the student has had both an introductory course in applied statistics and courses in calculus. With this background from undergraduate studies the student is ready for this first course in mathematical statistics.

**CONTENT:**

1. Descriptive Statistics

- 1.1 Measures of Central Tendency
- 1.2 Measures of Dispersion
- 1.3 Least Squares method for fitting a line.

2. Elementary Probability

- 2.1 Axiomatic Approach
- 2.2 Combinatorics
- 2.3 Probability Theorems
- 2.4 Bayes's Theorem

3. Discrete Probability Distributions

### 3.1 Discrete Random Variables

3.2 Expected Values

3.2 Binomial Distribution

3.3 Hypothesis Tests for Small Sample Binomial Populations

3.4 Geometric Distribution

3.5 Hypergeometric Distribution

3.6 Poisson Distribution

3.7 Moment Generating Functions

## 4. Continuous Probability Distributions

### 4.1 Continuous Random Variables

4.2 Expected Values

4.3 Uniform Distribution

4.4 Gamma Distribution

4.5 Normal Distribution

4.6 Beta Distribution

4.7 Heuristic Approach to Central Limit Theorem

4.8 Confidence Interval Estimation

4.9 Moment Generating Functions.

## 5. Multivariate Probability Distributions

### 5.1 Multivariate Distributions

5.2 Marginal and Conditional distributions

5.3 Independent Random Variables

5.4 Expected values for a function of random variables

5.5 Covariance and Correlation

5.6 Conditional Expectations

### **TEXTS:**

Mendenhall, Wackerly, and Schaeffer, MATHEMATICAL STATISTICS with APPLICATIONS, PWS-KENT Publishing Co., Boston, 1990

Hogg and Tannis, PROBABILITY AND STATISTICAL INFERENCE, Macmillan Publishing Co., New York, 1988

Freund and Walpole, MATHEMATICAL STATISTICS, Prentice Hall, Englewood Cliffs, NJ, 1987

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