

**SOUTHERN CONNECTICUT STATE UNIVERSITY**  
**DEPARTMENT OF MATHEMATICS**  
**MATHEMATICS 221 – INTERMEDIATE APPLIED STATISTICS**

**1. Description**

- A. A treatment of statistics concentrating on techniques used in science and Industry. Topics include: probability, sampling distributions, estimation, hypothesis testing, regression analysis, and correlation. (4 Credits).
- B. This course differs from elementary statistics and mathematical Statistics in that:
  - i. The pace is faster than elementary statistics
  - ii. The course assumes a greater degree of mathematical background than elementary statistics,
  - iii. the course includes applications to scientific and industrial problems,
  - iv. the course has less theory than mathematical statistics.

**2. Credit**

- A. This course carries 4 semester-hours of college credit.
- B. This course does satisfy general education requirement in mathematics.
- C. This course is required in the Business Applications & Scientific Computing options of the Computer Science major.
- D. This course is an elective in other options of the Computer Science major and in the B.S. in Applications of Mathematics major.

**3. Prerequisites**

- A. MAT 120 or MAT 122 or appropriate mathematics placement.
- B. MAT 139 or MAT 150 recommended.

**4. Purpose**

- A. The goal of this course is to present and establish the statistical techniques useful in science and industry, to emphasize their proper use rather than the underlying theory. However, it is to be presented at an intermediate level of mathematical sophistication.
- B. This course is especially appropriate for anyone preparing for a career in or currently employed in the technological sciences, physical or natural sciences, or mathematical sciences, e.g. technician, engineer or technologist, computer scientist or applied mathematician.
- C. Mathematics 221 is nominally a sophomore level course. However, a qualified student would take this course when it best fits his/her situation. For students planning to take calculus, this course should be taken after completing at least

one semester of calculus. It should be taken before any course in the student's program that makes use of statistical techniques, and, ideally after the student has had some experience with data and uncertainty.

**5. Format**

- A. Lecture-recitation
- B. A scientific calculator (e.g. TI 55) is required.
- C. In order to attract people from industry it may be advisable to offer this course twice a week in the late afternoon.

**6. Outline**

- A. Preliminaries
  - 1. A brief discussion of descriptive statistics
  - 2. A brief discussion of sets and the algebra of sets
  - 3. Permutations and combinations
- B. Elementary Probability Theory
  - 1. The classical definition of probability of an event
  - 2. The postulates of probability
  - 3. Inclusion-Exclusion Theorems
- C. Probability Distribution
  - 1. Discrete and continuous random variables
  - 2. Mean of a distribution
  - 3. Standard deviation of a distribution
- D. Special Probability Distributions
  - 1. The binomial distribution
  - 2. The Poisson distribution
  - 3. The normal distribution
- E. Sampling Distributions
  - 1. The distribution of sample means
  - 2. The t distribution
  - 3. The chi-square distribution
  - 4. The F distribution
- F. Estimation and Confidence Intervals
  - 1. Population mean
  - 2. Difference between two population means
  - 3. Population proportion
  - 4. The difference between two population proportions

5. A population variance
6. The ratio between two population variances.

#### G. Hypothesis Testing

1. The null and alternative hypotheses including one-sided & two-sided testing.
2. Type I and Type II errors.
3. Confidence intervals and hypothesis testing
4. Hypotheses involving one population mean
5. Power curves and the calculation of Type II errors
6. Hypotheses involving two population means
7. Hypotheses involving population proportion
8. Hypotheses involving one population variance
9. Hypotheses involving two population variances

#### H. Curve fitting and Regression Analysis

1. Linear relationship, one independent variable
  - a. Linear mathematical models
  - b. Tests of hypotheses
  - c. Test for linearity of regression
2. Linear relationship, more than one independent variable

#### I. Correlation

1. A Simple correlation
  - a. Coefficient of correlation
  - b. The bivariate normal distribution
  - c. Statistical tests
  - d. Cause and effect
3. Multiple correlation
4. Coefficient of determination

#### J. Analysis of variance (Optional)

It is recommended that approximately 30% of the time be spent on items A-E  
It is recommended that approximately 40% of the time be spent on items F, G  
It is recommended that approximately 30% of the time be spent on items H, I

#### **Text:**

Recommended: J. Freund and I. Miller, Probability and Statistics for Engineers, Prentice Hall.

Romano, Albert. Applied Statistics for Science and Industry, Allyn and Bacon, 1977. This text does not cover the material of items A-E of the outline. This would have to be covered through supplementary materials.

**Waiver Policy**

A special waiver examination can be made when needed.

Topics are listed in item F.

**Prepared April 1, 1980 by Manthos and E.R. Sparks.**