

**Tennessee Technological University**  
**Mathematics Department**

**MATH 4470-4480/5470-5480: Probability and Statistics I-II**

**I. COURSE DESCRIPTION FROM CATALOG:**

Topics include probability density and distribution functions, transformation of random variables, limiting/convergence distributions, concepts of estimation and testing hypotheses, and sufficient statistics. Lec. 3-3. Cr. 3-3.

**II. PREREQUISITE(S):**

MATH 4470: C or better in MATH 2110 or consent of instructor.  
MATH 4480: C or better in MATH 4470 or 5480.

**III. COURSE OBJECTIVE(S):**

To introduce calculus-based probability and statistical models.

**IV. TOPICS TO BE COVERED:**

**MATH 4470/5470 Topics**

**Chapter 1 Probability and Distributions**

- 1.1 Introduction
- 1.2 Set Theory
- 1.3 The Probability Set Function
- 1.4 Conditional Probability and Independence
- 1.5 Random Variables of the Discrete Type
- 1.6 Random Variables of the Continuous Type
- 1.7 Properties of the Distribution Function
- 1.8 Expectation of a Random Variable
- 1.9 Some Special Expectations
- 1.10 Chebyshev's Inequality

**Chapter 2 Multivariate Distributions**

- 2.4 Independent Random Variables
- 2.5 Extension to Several Random Variables

**Chapter 3 Some Special Distributions**

- 3.1 The Binomial and Related Distributions
- 3.2 The Poisson Distribution
- 3.3 The Gamma and Chi-Square Distributions
- 3.4 The Normal Distribution
- 3.5 The Bivariate Normal Distribution

**Chapter 4 Distributions of Functions of Random Variables**

- 4.1 Sampling distributions
- 4.2 Transformations of Variables of the Discrete Type
- 4.3 Transformations of Variables of the Continuous Type

Students with a disability requiring accommodations should contact the Office of Disability Services (ODS). 1  
An Accommodation Request (AR) should be completed as soon as possible, preferably by the end of the first week of the course. The ODS is located in the Roaden University Center, Room 112; phone 372-6119.

- 4.4 The Beta,  $t$ , and  $F$  Distributions
- 4.5 Extensions of the Change-of-Variable Technique
- 4.6 Distributions of the Order Statistics
- 4.7 The Moment-Generating-Function Technique
- 4.8 The Distributions of  $\bar{X}$  and  $nS^2 / \sigma^2$
- 4.9 Expectations of Functions of Random Variables
- 4.10 The Multivariate Normal Distribution

### **MATH 4480/5480 Topics**

#### **Chapter 5 Limiting Distributions**

- 5.1 Convergence in Distribution
- 5.2 Convergence in Probability
- 5.3 Limiting Moment-Generating Functions
- 5.4 The Central Limit Theorem
- 5.5 Some Theorems on Limiting Distributions

#### **Chapter 6 Introduction to Statistical Inference**

- 6.1 Point Estimation
- 6.2 Confidence Intervals for Means
- 6.3 Confidence Intervals for Differences of Means
- 6.4 Tests of Statistical Hypotheses
- 6.5 Additional Comments About Statistical Tests
- 6.6 Chi-Square Tests

#### **Chapter 7 Sufficient Statistics**

- 7.1 Measures of Quality of Estimators
- 7.2 A Sufficient Statistic for a Parameter
- 7.3 Properties of a Sufficient Statistic
- 7.4 Completeness and Uniqueness
- 7.5 The Exponential Class of Probability Density Functions
- 7.6 Functions of a Parameter
- 7.7 The Case of Several Parameters
- 7.8 Minimal Sufficient and Ancillary Statistics
- 7.9 Sufficiency, Completeness, and Independence

### **V. ADDITIONAL INFORMATION:**

Graduate credit is earned on the basis of additional work required by the instructor [per 2005-2006 TTU Graduate Bulletin], page 38.

### **VI. POSSIBLE TEXTS AND REFERENCES:**

*Introduction to Mathematical Statistics* by Robert V. Hogg and Allen T. Craig, 6<sup>th</sup> Edition

### **VII. ANY TECHNOLOGY THAT MAY BE USED:**

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