Mercer County Community College **Liberal Arts Division**

COURSE OUTLINE

MAT201	Probability & Statistics for Science & Engineering	4
Course Number	Course Title	Credits

4/Week	0/Week	0/Week	0/Week	15 Weeks
Class or Lecture	Laboratory Work Hours	Laboratory, Shop Studio or Clinic	Work Experience	Semester Length

Not Applicable	Not Applicable
Performance on an Examination/Demonstration	Telecourse

Required Materials:

Probability and Statistics for Engineers, By Walpole
Pulbisher: Pearson

Scientific or Graphics Calculator Required

Catalog Description:

Calculus based course designed for engineers, computer scientists and science majors. The study of probability, discrete and continuous probability distributions, random samples, estimation of parameters, confidence intervals, and testing of hypotheses.

Latest Review: Spring 2006

Prerequisites: MAT149 or MAT151 with a minimum C grade or appropriate College Level Math placement score

Co-requisites: None

Course Coordinator: Leslie S. Grunes

General Objectives

1. To present to the students in the physical sciences and computer sciences the different measures of central tendency and dispersion.

2. The knowledge of basic probability. The different statistical models and tests are dependent on the thorough understanding of probability.

3. Techniques in collecting sample data.

4. Methods of calculating statistics and drawing inferences concerning the population characteristics.

Specific Objectives

UNIT I Calculation of Statistics from Sample Data and Exploratory Data Analysis (2 weeks)

Raw data is given to the student. The student will be able to construct a frequency distribution table. The student will graph different frequency curves, e.g., histogram, ogive, and frequency polygon.

From a sample, the calculation of the measures of central tendency (mean, median, and mode) and the measures of dispersion (variance and standard deviation) will be presented.

The student will learn how to interpret plots of daa for any flows or trends. The two main techniques presented are stem-and-leaf displays and box plots.

UNIT II Probability

The "Fundamental Principle of Counting" will be discussed and applied to practical problems. Permutations and combinations will be defined and there will be many drills involving these notions. The connection between combinations and permutations will be covered.

Before the concept of probability is presented, there will be some mathematical preliminaries. The concept of sample space and events will be presented. The students will be able to combine events through the different mathematical operations of union, intersection, and complements.

The concept of probability will be presented from a mathematical view-point. The axioms of probability will be given. From these axioms, theorems will be stated and applied.

In most practical problems, the occurrence of previous knowledge will effect the structure of the sample space. This is the concept of conditional probability. The student will realize the importance and the uses of this concept.

In many situations the occurrence of one event does not depend on the occurrence of previous events. In this situation the events are independent. Independent events will be discussed and applied.

Bayes Theorem will be presented in class. The notion of prior distribution, data generating process and posterior distributions will be covered.

UNIT III Probability Distributions (5 weeks)

Random variable will be defined and probability distributions and cumulative distribution will be constructed for a given random variable. The differences between discrete and continuous random variables will be presented.

Expected values of random variable along with its properties will be discussed.

Student will know how to calculate the mean and variance of a probability distribution.

The standardized Random Variable Z, and Chebyshev's Inequality will be presented and applied.

Joint Probability distributions, Independence of Random Variables, and Moments of Conditional and Joint Distributions will be defined and exercises solved using these concepts.

The following discrete probability distributions will be presented and applied:

1. Binomial
2. Pascal or negative binomial
3. Multinomial
4. Hypergeometric
5. Poisson

The assumptions for the Poisson approximation of the binomial will be presented.

The following continuous random variables will be presented and applied.

1. Normal
2. Gamma
3. Exponential
4. Chi Square

Sampling distributions based on a random sample from a given population along with its mean and variance will be discussed.

Applications of the central limit theorem will be presented.

UNIT IV Inferences on Population Means and Variances
(5 weeks)

Not knowing the population mean in the normal distribution, the student will have to give an estimate from a random sample. He will calculate how many samples to take, so he can make a good estimate with some preassigned error. The calculation will be made from the Z distribution with known population variance and from the t distribution with unknown population variance.

The student will construct a confidence interval from sample data to see probability that the interval contains the parameter for a given error.

Test a hypothesis is the other important concept in estimating a parameter. The two types of errors will be presented. The α error the probability of falsely rejecting the null hypothesis, and the ß error--the probability of falsely not rejecting the null hypothesis when the alternative is true.

The student will test hypotheses concerning population means of a normal distribution using a Z test for known standard deviation and a t test for unknown standard deviation. Hypotheses concerning differences of means will also be tested.

Hypothesis will be tested concerning the variance from a normal distribution. The test is based on the Chi Square distribution.

Hypothesis will also be tested concerning the equality of two variances from two normal distributions with the same variance. The F ratio will be defined and the student will be able to use the F table. The test for the equality of two variances is based on the F test.

Method of Presentation

The concepts will be presented in class. The student will hand in homework regularly on these concepts.

Evaluation

Homework	10%
Four 2 hour tests	80%
Paper or Computer Project	10%

All examinations are open book and notes. The students will be tested on solutions of practical problems.