ACADEMIC AFFAIRS

Course Number: ENGR 411   Department: Engineering & Sci. Transfer

Course Title: Probability & Statistics   Semester: Spring   Year: 2001

Objectives/Competencies

Course Objective	Competencies
1. Statistics and Data Analysis	1. Define the role of probability. 2. Measures of location: The sample mean and median. 3. Measures of variability 4. Explain the difference between discrete and continuous data.
2. Probability	1. Define sample space. 2. Counting sample points. 3. Find the probability of an event. 4. Explain additive rules. 5. Explain conditional probability. 6. Explain multiplicative rules. 7. Explain Bayes' rule.
3. Random Variables and Probability Distributions	1. Define the concept of a random variable. 2. Explain discrete probability distributions. 3. Explain continuous probability distributions. 4. Explain empirical distributions

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	5. Explain joint probability distributions.
4. Mathematical Expectation	1. Calculate the mean of a random variable. 2. Calculate the variance and covariance. 3. Find the means and variances of linear combinations of random variables. 4. Explain Chebyshev's Theorem.
5. Some Discrete Probability Distributions	1. Explain discrete uniform distributions. 2. Differentiate between binomial and multinomial distributions. 3. Explain hypergeometic distribution. 4. Explain negative binomial and geometric distributions. 5. Explain Poisson Distribution and the Poisson Process.
6. Some Continuous Probability Distributions	1. Explain continuous uniform distributions. 2. Explain normal distributions. 3. Calculate the areas under the normal curve. 4. Describe the applications of the normal distribution. 5. Perform normal approximation to the binomial. 6. Explain gamma and exponential distributions. 7. Describe the applications of the exponential and gamma distributions. 8. Calculate the Chi-Squared distribution.
7. Functions of Random Variables	1. Perform Transformation of variables. 2. Explain the difference between moments and moment-

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	generating functions.
8. Random Sampling, Data Description, and Some Fundamental Sampling Distributions.	1. Define random sampling. 2. Describe some important statistics. 3. Explain data displays and graphical methods. 4. Explain sampling distribution. 5. Explain sampling distributions of means. 6. Explain sampling distribution of S2. 7. Explain t-Distributions 8. Explain F-Distributions.
9. One- and Two-Sample Estimation Problems	1. Explain statistical inference. 2. Estimating the mean. 3. Calculate the standard error of a point estimate. 4. Calculate tolerance limits. 5. Estimating the difference between two means. 6. Estimating the difference between two proportions. 7. Estimating the ratio of two variances. 8. Explain Bayesian Methods of Estimation. 9. Explain maximum likelihood estimation.
10. One- and Two-Sample Tests of Hypotheses (Continuous and Discrete Data)	1. Define statistical hypotheses. 2. Testing a statistical hypothesis. 3. Perform one- and two-tailed tests. 4. The use of P- values in decision making. 5. Tests concerning a single mean (variance known). 6. Relationship to confidence interval.

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	7. Explain the choice of sample size for testing means. 8. Perform graphical methods of comparing means. 9. Perform one- and two-sample tests concerning cariances. 10. Test for independence. 11. Test for homogeneity. 12. Testing for several proportions.
11. Simple Linear Regression and Correlation	1. Introduction to linear regression. 2. Perform simple linear regression. 3. Explain the properties of the Leas Squares Estimators. 4. Analysis of variance approach. 5. Test of linearity of regression.
12. Multiple Linear Regression	1. Estimating the coefficients. 2. Compute linear regression model using matrices. 3. Explain properties of the least squares estimators. 4. Explain sequential method for model selection. 5. Study of residuals and violation of assumptions.
13. One-Factor Experiments: General	1. Perform analysis of variance technique. 2. Explain the strategy of experimental design. 3. Perform one-way analysis of variance: completely randomized design. 4. Tests for the equality of several variances. 5. Perform single degree of freedom comparisons. 6. Perform multiple comparisons. 7. Comparing treatments with a control.

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	8. Comparing a set of treatments in blocks. Randomized complete block.
14. Factorial Experiments	1. Explain the two-factor analysis of variance. 2. Perform graphical analysis in the two-factor problem. 3. Perform three-factor experiments. 4. Choice of sample size.
15. Statistical Quality Control	1. Explain nature of the control limits. 2. Explain purposes of the control chart. 3. Perform control charts for variables. 4. Perform control charts for attributes.