

Course name	ECE 53900 Foundations of Adv. Engineering I
Credit and contact hours	(3 cr.) Class 3
Course coordinator's name	Sarah Koskie
Textbook	None
Course information	<p>ECE 59500 Foundations of Adv. Engineering I. P:ECE 27000 and ECE 30200 or graduate standing. Several mathematical tools applied in the engineering discipline are discussed. Statistical methods, including construction of confidence interval and hypothesis testing, as well as regression and regression analysis, are discussed. Discrete tools are discussed; these include logic and mathematical reasoning, combinatorics, groups and finite fields. Applications of some of these tools in engineering problems are introduced. Decision Theory including Bayes Theorem, applying Bayes Theorem to form decision, utility function, expectation of utility, loss function and risk, applying regression to estimate loss</p> <p>Prerequisites/ Co-Requisite ECE 27000 and ECE 30200 or graduate standing</p> <p>Required, Elective, or Selected Elective: EE Elective, CE Elective</p>
Goals for the course	<p>Upon successful completion of the course, students should be able to</p> <ol style="list-style-type: none"> 1. Solve advanced combinatorics and counting problems that occur in Engineering and Computing fields. [1, 6] 2. Analyze logic and theoretical statements and hypothesis. Construct and design mathematical proofs. [1, 6] 3. Apply finite fields to construct liner error correction codes. [1] 4. Compute confidence intervals to estimate population mean and variances. [1, 6] 5. Analyze and design statistical test, apply test to determine validity of hypothesis. [1, 6] 6. Model and construct Bayesian decision problems. [1, 6] 7. Construct utility and risk functions. [1, 6] 8. Utilize Decision trees and Bayes Theorem to solve decision problems. [1, 6]
List of topics to be covered	<ol style="list-style-type: none"> 1. Combinatorics, Counting, Recurrence Relations, Relations 2. Logic, Mathematical Reasoning, Mathematical Induction, Construction of Proofs, Recursive Definitions 3. Groups, Polynomials, Finite Fields, Coding Theory and other engineering applications of fields and groups

	<ol style="list-style-type: none"> 4. Review Central Limit Theorem, Normal Distribution, Student's t-distribution 5. Confidence Intervals for large and small sample sizes, Selecting Sample Size, Hypothesis Testing 6. Chi-squared Distribution, F-distribution for variance, Confidence Intervals for variance, Hypothesis Testing 7. Least squares, Regression, and Inferences 8. Decision theory introduction – basics 9. Bayesian Probability and applications to decision theory 10. Decision Trees, Utility Functions and Expected Utility, Loss Functions and Risk, Posterior Probability 11. Decision Theory and Hypothesis Testing 12. Using Regression for Inference 13. Two tests and one final exam, quizzes and homework
Syllabi approved by	Brian King
Date of approval	08/20/2019