

**Topics in Probability and Statistics**  
**Math 8670**

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1.0 Course Description

- 1.1 (3 credit hours) A variable topics course in probability and/or statistics. Topics covered will vary from one offering to the next. Topics to include one or more of the following: reliability theory with applications in engineering and science, advanced probability and statistical models, theory of parametric estimation and applications, advanced probability theory.

The purpose of the course is to offer at least one graduate level course in probability and statistics which would be of interest to mathematicians, engineers and scientists.

- 1.2 The course is intended primarily for graduate students in mathematics, but could also be taken, depending upon the particular offering/topics chosen that semester, by graduate students in engineering and science.
- 1.3 Prerequisites: Math 4740/8746 or Stat 3800/8805 or instructor's permission.

2.0 Objectives

- 2.1 Performing objectives
- a) The student will learn some advanced methods and concepts from various areas in probability and statistics.
  - b) The student will demonstrate knowledge of the mathematical foundations of various statistical methods.
  - c) The student will demonstrate knowledge of applications.

3.0 Content and Organization

- 3.1 A list of topics will be given for the reliability theory and its applications.
- a) Introduction to reliability theory, failure models
  - b) Lifetime distributions: Weibull, gamma, lognormal, other distributions
  - c) Notions of aging: IFR, IFRA, NBU, NBUE distributions
  - d) Coherent systems, minimal path and cut sets
  - e) Non-repairable systems, independent components
  - f) Component importance measures
  - g) Bounds on system reliability
  - h) Statistical inference in life data analysis
  - i) Censored data/Kaplan Meier estimator

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- j) Renewal processes and reliability
- k) Availability models, repairable systems
- l) Accelerated life-testing, stress strength models
- m) Survival analysis and regression models
- n) Multivariate dependence models

4.0 Teaching Methodology

- 4.1 The course will be taught primarily by a class lecture format. When appropriate, handouts will be given.
- 4.2 The course is to be taught in two weekly class meetings of 75 minutes each.

5.0 Evaluation

- 5.1 Student evaluations will be based upon assigned homework and exams. Exams will be a combination of in-class and take-home types. Extra projects may be given for extra credit.
- 5.2 The final grade for the course will be based upon a combination of homework and exams, weighted approximately as follows:  
  
Homework: 30%  
Exams: 70%
- 5.3 Grading for the course is based upon an obtained percentage of total points according to the scale below:

- 97-100% = A+
- 93-96% = A
- 90-92% = A-
- 87-89% = B+
- 83-86% = B
- 80-82% = B-
- 75-79% = C+
- 70-74% = C
- 67-69% = C-

6.0 Resource Material

6.1 Textbooks

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Hoyland and Rausand, *System Reliability Theory: Models and Statistical Methods*, John Wiley and Sons, 1994.

Mann, Schafer and Singpurwalla, *Methods for Statistical Analysis of Reliability and Life Data*, John Wiley and Sons, 1997.

6.2 Other suggested reading materials

Wolsterholme, *Reliability Modeling, A Statistical Approach*, Chapman and Hall, CRC, 1999.

Lawless, *Statistical Models and Methods for Lifetime Data*, John Wiley and Sons, 1982.

Barlow and Proschan, *Statistical Theory of Reliability and Life Testing, Probability Models*, SIAM, 1996.