IME 2620 - PROBABILITY & QUALITY FOR ENGINEERS

(12034)

Course Syllabus – Spring 2010

CEAS C-229 - MWF 8:30 –9:20 PM

2010-2011 WMU Catalog Description:

Introduction to probability and quality emphasizing applications in engineering. Topics include the use of discrete and continuous random variables, Goodness of Fit Tests, fitting of distributions, statistical process control and process capability. (This course is cross-listed with STAT 2620.)

Prerequisites: 1) IME 2610 - Engineering Statistics
2) MATH 2720 (or concurrent) - Differential and Integral Multivariate Calculus

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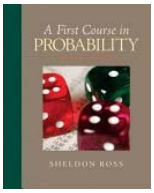
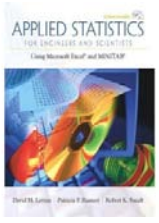
Course Webpage: http://homepages.wmich.edu/~butt/ime262

Textbooks:



Required:

1) *A First Course in Probability, 8th edition*
Sheldon Ross
Prentice Hall, 2010 (ISBN-10: 013603313X; ISBN-13:9780136033134)



Required:

2) *Applied Statistics for Engineers and Scientists using Microsoft Excel and MINITAB, 1st edition*
David M. Levine, Patricia P. Ramsey and Robert K. Smidt
Prentice Hall, 2001 (ISBN-10: 0134888014; ISBN-13:9780134888019)

Suggested:

3) *Student Solution Manual: Applied Statistics for Engineers and Scientists using Microsoft Excel and MINITAB, 1st edition*
David M. Levine
Prentice Hall, 2001 (ISBN-10: 0130286818; ISBN-13:9780130286819)

(*Note: Unlicensed photocopies of the textbook will not be allowed into lectures or the tests.*)

References: *Applied Statistics and Probability for Engineers, 4th edition*
Douglas C. Montgomery and George C. Runger
Wiley, 2007

Probability and Statistics for Engineers and Scientists, 2nd edition
Anthony J. Hayter, PWS Publishing, 2002.

Software: *MINITAB Statistical Software, Release 15*
Minitab, Inc., 2008

Oracle Crystal Ball, 2008
Oracle Corporation, 500 Oracle Parkway, Redwood Shores, CA 94065

Evaluation: Your final grade will be based on the following:

(1)	Assignments	25%
(2)	Best Test/Exam	30%
(3)	Second Best Test/Exam	25%
(4)	Worst Test/Exam	20%

Grading Scale:		
	93 - 100	A
	88 - 92	BA
	83 - 87	B
	78 - 82	CB
	73 - 77	C
	68 - 72	DC
	60 - 67	D
	Below 60	E

Objectives[1]: At the end of the semester, the student will be able:

1) To apply the basic rules and theorems of probability theory to engineering problems. {a, b, e, k}

2) To appropriately choose, define and/or derive probability distributions for use in engineering models. {a, b, e, k}

3) To develop functions of random variables that can be used in decision making. {a, b, e, k}

4) To construct and utilize basic quality models for the management, control, and improvement of systems and processes. {a, b, c, e, k}

Performance Criteria[2]:

The student should be able to:

Objective 1

1.1. Understand and apply basic probability concepts, such as the definitions of an element, set, sample space, event, probability, and conditional probability. [1, 2, 3]
1.2. Use counting rules and logic to assign probabilities to events. [1, 2, 3]
1.3. Apply probability axioms and theorems, such as Bayes' Theorem, to determine probabilities that help to solve engineering problems. [1, 2, 3]
1.4. Determine whether two, or more events, are mutually exclusive or statistically independent. [1, 2, 3]

Objective 2

2.1. Define a discrete random variable, and its associated *p.m.f.* and *c.d.f.* [1, 2, 3]
2.2. Define a continuous random variable, and its associated *p.d..f.* and *c.d.f.* [1, 2, 3]
2.3. Appropriately use named distributions, such as the Binomial and the Normal, to model and solve engineering problems. [1, 2, 3]
2.4. Determine the expectation and variance of a random variable from its distribution. [1, 2, 3]
2.5. Fit data to an appropriate distribution through statistical tests, such as Regression, Chi-Square Goodness of Fit tests and others. [1, 2, 3]

Objective 3

3.1 Derive a probability distribution for the function of a random variable, along with its associated expectation and variance. [1, 2, 3]
3.2 Properly utilize joint distributions to solve engineering problems. [1, 2, 3]
3.3 Define and interpret the covariance and the correlation coefficient associated with the joint distribution of two random variables. [1, 2, 3]
3.4 Employ the conditional distributions and expectations of jointly distributed random variables to make engineering decisions. [1, 2, 3]

Objective 4

4.1 Understand the fundamentals of quality and the methods used to control systems and processes. [1, 2, 3]
4.2 Comprehend the concept of statistical process control and be able to set up and interpret both variable and attribute control charts. [1, 2, 3]
4.3 Understand and apply lot-by-lot acceptance sampling. [1, 2, 3]
4.4 Conduct and interpret the results of a process capability analysis. [1, 2, 3]
4.5 Assess the adequacy of a measurement system. [1, 2, 3]
4.6 Understand the basic concepts underlying Six Sigma Methodologies [1, 2, 3]
4.7 Ability to take the Quality Engineer Certification (CQE) Exam from the American Society for Quality [1, 2, 3]

Academic Honesty Policy: You are responsible for making yourself aware of and understanding the policies and procedures in the Undergraduate and Graduate Catalogs that pertain to Academic Honesty. These policies include cheating, fabrication, falsification and forgery, multiple submission, plagiarism, complicity and computer misuse. [The policies can be found at http://catalog.wmich.edu under Academic Policies, Student Rights and Responsibilities.] If there is reason to believe you have been involved in academic dishonesty, you will be referred to the Office of Student Conduct. You will be given the opportunity to review the charge(s). If you believe you are not responsible, you will have the opportunity for a hearing. You should consult with your instructor if you are uncertain about an issue of academic honesty prior to the submission of an assignment or test."

In addition, you are encouraged to review the materials at http://osc.wmich.edu and www.wmich.edu/registrar regarding the WMU Code of Honor and general academic policies on such issues as diversity, religious observance, student disabilities, etc.

Attendance Policy: Attendance is mandatory. The student will receive a score of zero for any item not submitted because of absence. (This includes the assignments, tests, and the final exam.) Extreme circumstances will be considered on an individual basis, however, arrangements must be made prior to the due date, and supporting documentation is necessary.

Assignments: All assignments have equal weight, unless stated otherwise. Assignments are to be turned in at the beginning of lecture on the day the assignment is due. Assignments will be posted on the course webpage. ***Late assignments will not be accepted!*** You are welcome to answer any questions using software, unless I have specified otherwise. If you use software to solve a problem you must submit sufficient documentation to illustrate your approach to the problem, along with the appropriate output to justify your results. ***You will receive a score of zero for each assignment that you fail to turn in at the specified time.***

Tests: The tests will be administered during the lecture period on the days indicated in the schedule. You are responsible for the material up to the day of the test. During each test you are allowed to have a calculator and one 8½" x 11" sheet of paper with anything you want written on the paper (you can use both sides of the sheet of paper). You will have the entire class period to complete each test.

Final Exam: The day and time are listed in the schedule. During the exam you are allowed to use a calculator, the required textbooks, and two 8½" x 11" sheets of paper with anything you want written on the paper (you can use both sides of each sheet of paper). You will have 2 hours to complete the final.

Schedule: Please note that the topic schedule is a guide only, sometimes we will spend a little longer on one topic and a little less on another. The test and final exam times will occur on the dates listed, however, content of the tests may be altered based on the material covered prior to test time.

Dates		Topics	Book: Chapter.Section
January	10	Introduction to Probability, Quality & Six Sigma	SR: 1.1-1.4, supplement
	12	Combinatorial Analysis	SR: 1.4 - 1.5
	14	Axioms of Probability	SR: 2.1 - 2.5
	17	MLK Day --- NO CLASS	
	19	Conditional Probability& Independent Events	SR: 3.1 - 3.2, 3.4
	21	Conditional Probability & Bayes Theorem	SR: 3.3, 3.5
	24	Review of Discrete Random Variables	SR: 4.1 - 4.5
	26	Bernoulli, Binomial & Poisson	SR: 4.6 - 4.7
	28	Geometric, Negative Binomial, & Hypergeometric	SR: 4.8.1 - 4.8.3
February	2	Expected Value of Sums of RV &Properties of CDF	SR: 4.9 - 4.10
	4	Review of Continuous Random Variables, Uniform	SR: 5.1 - 5.3.
	7	Normal	SR: 5.4
	9	Exponential & Poisson Process	SR: 5.5, 9.1
	11	**TEST 1**	
	14	Other Continuous Distributions	SR: 5.6
	16	Distribution of a Function of a Random Variable	SR: 5.7
	18	Joint Distribution Functions	SR: 6.1
	21	Joint Distribution Functions: Independent Variables	SR: 6.2 - 6.3
		(*IIE Regional Conference – Purdue University (Feb. 19 – 21)*	
	23	Conditional Distributions: Discrete	SR: 6.4
	25	Spirit Day--- NO CLASS	
	28	***SPRING BREAK February 28 – March 4***	
March	7	Conditional Distributions: Continuous	SR: 6.5
	9	Joint Probability Distribution of Functions of R.V.	SR: 6.7
	11	Expectations of Sums of Random Variables	SR: 7.1 - 7.2
	14	Covariance, Variance of Sums & Correlations	SR: 7.4
	16	Conditional Expectation	SR: 7.5 - 7.6
	18	Limit Theorems	SR: 8.1 - 8.2
	21	Fitting Distributions	supplement
	23	Fitting Distributions	supplement
	25	Control Charts: Attributes (np & p)	DL: 6.3
	28	**TEST 2**	
	30	Control Charts: Attributes (c & u)	DL: 6.4 - 6.5
April	1	Control Charts: Variables (R & s)	DL: 7.1 - 7.3
	4	Control Charts: Variables (X)	DL: 7.4 - 7.5
	6	Control Charts: CUSUM	DL: 7.6
	7	Control Charts: EWMA	DL: 7.6
	8	Process Capability & MINITAB	DL: 7.7 - 7.8
	11	Gage Control (R & R)	supplement
	13	Review of Simple Regression & Multiple Regression	DL: 12.1-12.10, 13.1-13.4
	15	Regression: Model Building & Transformations	DL: 13.6 - 13.10
	18	Factorial Designs Involving Two or More Factors	DL: 11.1-11.2
	20	Fractional Factorial Designs	DL: 11.3
	22	Taguchi Approach	DL: 11.4
April	**28**	**FINAL EXAM (Thursday) 8:00 am – 10:00 am**	

SR = *A First Course in Probability, 8th edition*
by Sheldon Ross

DL = *Applied Statistics for Engineers and Scientists using Microsoft Excel and MINITAB, 1st edition*
by David M. Levine, Patricia P. Ramsey and Robert K. Smidt