Industrial and Entrepreneurial Engineering & Engineering Management

IEE 2622 Statistical Quality Control

General description:

Methods of applying statistics and probability theory to control processes.
Application of computer programs to analyze quality control problems.

Prerequisites: IEE 2610 Minimum grade of D
Credits: 2

Textbooks:

- Required: Probability and statistics for engineers Richard L. Scheaffer, Madhuri S. Mulekar and James T. McClave, Brooks/Cole
- Software: MINITAB Statistical Software, release 17, Minitab, Inc.
- References: Introduction to Statistical Quality Control, Douglas C. Montgomery, Wiley
- Engineering Statistics, Douglas C. Montgomery, George C. Runger, and Norma F. Hubele, Wiley

Grading policy:

Workshops	10%
Project	10%
Homework	25%
Test	25%
Final exam	30%

Letter grades will be decided as follows: 90-100 A
85-90 BA
80-85 B
75-80 CB
70-75 C
65-70 DC
60-65 D
Below 60 E

Objectives:

By the end of the semester the student should be able to:

1. To appropriately choose, define and/or derive continuous probability distributions for use in engineering models.
2. To construct and utilize basic quality models for the management, control, and improvement of systems and processes.

Description of objectives:

Objective 1
Appropriately use named continuous distributions, such as the Lognormal and the Weibull, to model and solve engineering problems.
Determine the expectation and variance of a random variable from its distribution.
Fit data to an appropriate distribution through statistical tests, such as Regression, Chi-Square Goodness of Fit tests and others.
2.6 Understand the role of the Central Limit theorem and the sampling distributions in the development of Quality Control Charts

Objective 2
Understand the fundamentals of quality and the methods used to control systems and processes.
Comprehend the concept of statistical process control and be able to set up and interpret both variable and attribute control charts.
Understand and apply lot-by-lot acceptance sampling.
Conduct and interpret the results of a process capability analysis.
4.6 Understand the basic concepts underlying Six Sigma Methodologies.

Relationship of Course Objectives to Performance Criteria and Student Learning Outcomes:

Objectives	Performance criteria
To appropriately choose, define and/or derive probability distributions for use in engineering models.	K1: Selects appropriate tools throughout the design process.
To appropriately use statistical tools and decision making.	A1: Applies appropriate statistical techniques.
To construct and utilize basic quality models for the management, control, and improvement of systems and processes.	B1: Gathers and uses data to assess processes and products.

Academic Integrity:

"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.

General Policies:

Workshops:
The workshops will take place on the class dates indicated in the schedule. The workshop assignments are to be solved by the students during the class period and will be due at the end of the class, unless otherwise directed by the instructor or graduate assistant. All workshops have equal weight. You will receive a score of zero for each workshop that you fail to turn in at the specified time. Most workshops will be completed in teams. Only one copy of the workshop should be handed in from each team, with all names appearing on at least the first page. You will be allowed to drop your lowest workshop grade (including a missed assignment).

Project:
The project will be assigned on the date specified in the schedule. You will receive a score of zero if the project is not turned in at the beginning of the lecture on the day the project is due.

Homework:
Homework will be posted on the course webpage. All the homework has equal weight, unless stated otherwise. Homework are to be turned in at the beginning of lecture on the day the homework is due. Late homework will not be accepted. You will receive a score of zero for each homework that you fail to turn in at the specified time. Grade appeals are considered within 7 days only. You will be allowed to drop your lowest homework grade (including a missed homework).

Tests:
The test 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 the test you are allowed to have a calculator and one 8" x 11" sheet of paper with anything you want written on the paper (you can use both sides of the sheet of paper).

Final Exam:
The day and time are listed in the schedule. The final exam is cumulative and you are responsible for the material up to the day of the exam. During the exam you are allowed to use a calculator, the required textbooks, and two 8" x 11" sheets of paper with anything you want written on the paper (you can use both sides of the sheet of paper). You will have 2 hours to complete the final.

Class Policies:

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. Personal or professional activities, e.g., part or full time jobs, travel, etc., DO NOT constitute an excuse for absences, lateness or a major circumstance for a make-up or substitution of an assessment activity. Students who anticipate the necessity of being absent from class due to the observation of a major religious observance must provide notice of the date(s) to the instructor, in writing, by the second class meeting.

Class participation is extremely important and expected. Discussion boards are very valuable to demonstrate your participation and ability to communicate with the whole class.

Every student, regardless of location/means that he/she uses to take the class, is responsible for all material discussed, distributed, or assigned in class, the syllabus or Blackboard.

The instructor responds through e-mail. However, please do not expect responses to same day or last minute electronic or voice-mails. Also if the instructor is out of town he/she will not be able to submit timely responses to electronic or voice-mails.

The use of cell phones, beepers and pagers in or during class is prohibited. Be sure all such devices are silenced upon entering the class. Always be on time to class. Please be courteous with respect to your fellow classmates and your instructor. Thank you!

Tentative schedule:

Week	Topic	Topic description	Homework (HW) or Project (P)
8	Introduction	Syllabus	Q-HW1 posting
	Continuous distributions	Normal distribution Standard normal distribution Normal probability plot Lognormal distribution Fitting a lognormal distribution	
9	Continuous distributions	Gamma distribution Weibull distribution Fitting a Weibull distribution	
	Goodness of fit tests	Definition and purpose Chi-square test Using MINITAB to perform a Chi-square test	Q-HW1 due Q-HW2 posting
10	Goodness of fit tests	Kolmogorov-Smirnov test Anderson Darling (AD) test Using MINITAB to perform the AD test Other goodness of fit methods	
	Sampling Distributions	Quality control charts: Description Sampling distribution of the mean Central limit theorem X, S control chart X, R control chart Average Run Length	Q-HW2 due Q-HW3 posting
11	Sampling Distributions	Quality control chart: Interpretation Binomial distribution: Review Sampling distribution of a proportion p-chart np-chart Average Run Length	Q-P posting
	Sampling Distributions	Poisson distribution: review Sampling distribution of the Poissonic mean c-chart u-chart Average Run Length	Q-HW3 due Q-HW4 posting
12	Sampling Distributions	Process capability Workshop: Use of quality control charts	
	Q-Test	Weeks 8, 9, 10, 11	Q-HW4 due Q-HW5 posting

13	Time Dependent charts Lot sampling methods	CUSUM EWMA Acceptance sampling	 Q-HW5 due Q-HW6 posting
14	Multivariate control charts Quality Management terms	T 2 chart Multivariate EWMA chart Workshop: Use of multivariate control charts Lean Manufacturing Six sigma Theory of constraints	Q-P due Q-HW6 due
	Q-Final exam		