

Advanced Topics in Quality Systems / Engineering EMEN 5043

Course Syllabus & Tentative Content Outline

1. Course Description

An advanced study of methods, tools, techniques, and systems associated with advanced quality applications. Includes a survey of advanced process control technologies, control schemes, and measurement systems analysis. Prerequisite: EMEN 5042

2. Course Goals and Objectives

As a result of successfully completing this course, the student will be capable of describing and utilizing advanced quality systems, tools, and techniques for value creation in contemporary business models. Specific units of study associated with this course will include:

- a) Special purpose process control charts and methods;
- b) Measurement system analysis for continuous and discrete data applications, including both nondestructive and destructive testing devices and processes;
- c) Prevention Planning and Analysis Methods;
- d) Principles of Robust Product and Process Design, and Designing for Six Sigma
- e) Mistake-Proofing and Automated/Automatic Control Systems
- f) Principles of Standardization and ISO Requirements
- g) Overview of Statistical Reliability Methods
- h) Other Major Quality Tools (FMEAs, FMECAs, Fault Tree Analysis, Root Cause Analysis, Applications of the Problem-Solving and Quality Improvement Strategies)

3. Instructor

Steven Ouellette
Office : ECOT 533
e-mail : Steven.Ouellette@colorado.edu
Telephone (Day) : 303-492-4914

4. Textbooks / References

The readings and support material for this course will primarily consist of readings and materials provided to the students from the course website.

Additional support material will be provided from the following references:

1. *Quality Management*, Gitlow, Oppenheim, Oppenheim, and Levine, McGraw-Hill-Irwin, 2005 (Required textbook for EMEN 5042)
2. *Advanced Topics in Statistical Process Control*. Wheeler, SPC Press, 1995
3. *Six Sigma for Green Belts and Champions*, Gitlow & Levine, Prentice-Hall, 2005
4. *The Malcolm Baldrige National Quality Award*, Heaphy & Gruska, Addison-Wesley, 1995
5. *Measurement Systems Analysis Reference Manual*, Ford Motor Company, Chrysler Corporation, General Motors Corporation, 1995
6. *Advanced Quality Planning and Control Plan Reference Manual*, Ford Motor Company, Chrysler Corporation, General Motors Corporation, 1995
7. *Reliability Methods for Processes and Equipment*, Medlin, Luftig & Warren International, 1992
8. *Quality System Requirements – QS 9000 Reference Manual*, Ford Motor Company, Chrysler Corporation, General Motors Corporation, 1994
9. *Guidelines for a Practical Approach to Discrete Data Measurement Systems*, Luftig, Luftig & Warren International, 1992

Each of these references will be used in a content section(s) of the course as identified in Table I.

Software

For all of the statistical analyses presented and conducted, the student will make use of **MVPStats** and **Excel**.

Students who have taken EMEN 5005 (5830) or APPM 4570/5570, and/or EMEN 5042 with this instructor will already have purchased MVPStats. This software will be used in this course as well, and it is strongly recommended that students in this course who do not have this software should purchase it. If you do so, make certain you purchase the software by using the following url:

<https://mmm1921.dulles19-verio.com/mvppro/store/studentorder>

This link will take you to a site where you can buy the software for \$65.00, rather than the standard price of \$400.00 (an arrangement for students taking my courses). For on-campus students, it should be noted that many of the computer labs on the second floor of the Engineering building have MVPStats loaded.

5. Course Structure / Approach

The course topic outline which follows (Table I) identifies the proposed and tentative lecture topics that will be presented throughout the semester in order to allow the student to achieve the goals and objectives of the course.

For each topic covered, it will be the student's responsibility to:

- (a) have read any assigned material identified by the instructor *before* the corresponding lecture; and
- (b) attend the lecture, and participate in classroom discussions of the material presented (in a course of this type, this requirement should be considered an essential and indispensable attribute).

The course requirements are constituted by two components: a series of homework assignments (one assignment following each major Unit), and a final examination. The final grade for the course will be assigned on the basis of the following weighting:

- Final Examination 30%
- Homework Assignments (7) 70%

Each homework and the final will be graded by percentage correct. The final grade will be given according to the following scale:

Low	High	Grade
93	100	A
90	92.999	A-
87	89.999	B+
83	86.999	B
80	82.999	B-
77	79.999	C+

73	76.999	C
70	72.999	C-
67	69.999	D+
63	66.999	D

Specifically, for purposes of illustration, the final grade will be calculated by assigning the weighted averages of the scores received

e.g. Final Exam : 88% = B+

Homework Assignment 1: 91% = A-

Homework Assignment 2: 81% = B-

Homework Assignment 3: 92% = A-

Homework Assignment 4: 87% = B+

Homework Assignment 5: 90% = A-

Homework Assignment 6: 88% = B+

Homework Assignment 7: 97% = A

Homework average = 89.43%

Final Exam = 88%

Final Score = $(89.43 \times .70) + (88 \times .30) = 89\% = B+$

The final grade earned, therefore, would be B+.

6. Lecture Topics, References, Reading Assignments, & Associated Discussion Points

Table I

Primary Lecture Topic	Content Reviewed, Key Discussion Points, and Significant Case Studies	Web Site Presentations & Materials to Be Downloaded / Printed Out
Introduction to the Course & Course Requirements	<ul style="list-style-type: none"> * Syllabus * Content Outline * Homework Assignments * Examination * Suggested Support References 	N.A.
Special Purpose Process Control Charts and Methods	<ul style="list-style-type: none"> * Process Control Charts for Trend Analysis <ul style="list-style-type: none"> -Cusum Charts -EWMA Charts 	<ul style="list-style-type: none"> * Primary PowerPoint Presentation * Ref. 2; Chaps. 13-14
Measurement Systems Analysis (MSA)	<ul style="list-style-type: none"> * Principles of Measurement <ul style="list-style-type: none"> - Precision - Accuracy * MSA Principles and Methods for Continuous (Variables) Data Measurement Systems <ul style="list-style-type: none"> - Non-Destructive Applications - Destructive Testing Applications * MSA Principles and Methods for Discrete (Attribute) Data Applications <ul style="list-style-type: none"> - Cohen's Kappa - Light's Extension - Fleiss' Extension 	<ul style="list-style-type: none"> * Primary PowerPoint Presentation * Ref. 5 & 9

Primary Lecture Topic	Content Reviewed, Key Discussion Points, and Significant Case Studies	Web Site Presentations & Materials to Be Downloaded / Printed Out
Principles of Robust Product & Process Design; Designing for Six Sigma	<ul style="list-style-type: none"> * Robust Design Principles * Optimization & Variation Transmission * Tooling Design * Raw Materials and Components Effects * Process Settings and Operational Methods 	<ul style="list-style-type: none"> * Primary PowerPoint Presentation * Ref. 6
Mistake-Proofing & Automatic Control Systems	<ul style="list-style-type: none"> * Types of Errors * Mistake-Proofing Techniques (Poke-Yoke) * Dangers Associated with Automatic Control Systems <ul style="list-style-type: none"> - Autocorrelation - Run Tests * Adjustment Charts & the Taguchi Loss Function 	<ul style="list-style-type: none"> * Primary PowerPoint Presentation * Ref 2; Chap. 12
Principles of Standardization and ISO Requirements	<ul style="list-style-type: none"> * PDSA Principles * Features of Standardization * Defining and Writing Effective SOPs * ISO 9000 – History and Current Status / Requirements 	<ul style="list-style-type: none"> * Primary PowerPoint Presentation * Ref. 8
Overview of Statistical Reliability Methods and Tools	<ul style="list-style-type: none"> * Reliability Definitions <ul style="list-style-type: none"> - Reliability & Maintainability - Failure - Lifetime and Infant Mortality 	<ul style="list-style-type: none"> * Primary PowerPoint Presentation * Ref. 7

Primary Lecture Topic	Content Reviewed, Key Discussion Points, and Significant Case Studies	Web Site Presentations & Materials to Be Downloaded / Printed Out
	<ul style="list-style-type: none"> - MTBF/MTTR *Reliability Engineering <ul style="list-style-type: none"> -Weibull Analysis -Growth Analysis * The Reliability Roadmap <ul style="list-style-type: none"> - Improving Processes for Added Capacity <ul style="list-style-type: none"> ~ TPM ~ TAU - New Equipment Purchasing Methods <ul style="list-style-type: none"> ~ Reliability Modeling ~ Design Specifications for Productivity 	
Additional Valuable Quality Tools & A Comparison of Quality Programs	<ul style="list-style-type: none"> * FMEAs & FMECAs *Control Plans * Fault Tree Analysis * Root Cause Analysis *Prevention Planning and Analysis <ul style="list-style-type: none"> - Defining Process Control - Process Control Methods; On Line vs. Off-Line -Steps in Performing PPA Analyses * The Malcolm Baldrige Award * The Deming Prize * Six Sigma & BPE 	<ul style="list-style-type: none"> * Primary PowerPoint Presentation Ref. 1, Chap. 20 Ref. 3 & 4

UNIVERSITY PROVISIONS AND REQUIREMENTS

1. If you qualify for accommodations because of a disability, please submit a letter to the instructor from Disability Services in a timely manner so that your needs may be addressed. Disability Services determines accommodations based on documented disabilities. For further information, see www.Colorado.EDU/disabilityservices, contact 303-492-8671, or visit Willard 322.
2. Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or class attendance. Students for whom religious observances conflict with class schedules should contact the instructor no later than two weeks before the potential conflict to request special accommodations. See full details at http://www.colorado.edu/policies/fac_relig.html.
3. Students and faculty each have responsibility for maintaining an appropriate learning environment. Students who fail to adhere to such behavioral standards may be subject to discipline. Faculty have the professional responsibility to treat all students with understanding, dignity and respect, to guide classroom discussion and to set reasonable limits on the manner in which they and their students express opinions. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender variance, and nationalities. See policies at <http://www.colorado.edu/policies/classbehavior.html> and at http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code
4. Academic Honesty & Plagiarism: The development of the Internet has provided students with historically unparalleled opportunities for conducting research swiftly and comprehensively. The availability of these materials does not, however, release the student from citing sources where appropriate; or applying standard rules associated with avoiding plagiarism. Specifically, the instructor will be expecting to review papers written by students drawing ideas and information from various sources (cited appropriately), presented generally in the student's words after careful analysis, synthesis, and evaluation. An assembly of huge blocks of other individuals' existing material, even when cited, does not constitute an appropriate representation of this expectation. Uncited, plagiarized material shall be treated as academically dishonest. If the student is confused as to what constitutes plagiarism, he/she should review the CU Honor Code on this topic, and / or refer to either or both of the following excellent sources:

<http://www.georgetown.edu/honor/plagiarism.html>

<http://www.northwestern.edu/uacc/plagiar.html>

Information on the CU Honor Code can be found at <http://www.colorado.edu/policies/honor.html> and at <http://www.colorado.edu/academics/honorcode/>

Students agree that by taking this course all required papers may, at the discretion of the instructor, be subject to submission for a Textual Similarity Review to Turnitin.com for the detection of plagiarism. All submitted papers will be added as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers in the future.

5. The University of Colorado Policy on Sexual Harassment applies to all students, staff and faculty. Sexual harassment is unwelcome sexual attention. It can involve intimidation, threats, coercion, or promises or create an environment that is hostile or offensive. Harassment may occur between members of the same or opposite gender and between any combination of members in the campus community: students, faculty, staff, and administrators. Harassment can occur anywhere on campus, including the classroom, the workplace, or a residence hall. Any student, staff or faculty member who believes s/he has been sexually harassed should contact the Office of Sexual Harassment (OSH) at 303-492-2127 or the Office of Judicial Affairs at 303-492-5550. Information about the OSH and the

campus resources available to assist individuals who believe they have been sexually harassed can be obtained at: <http://www.colorado.edu/sexualharassment/>

6. Appropriate Classroom Laptop Use: Although having a laptop in class opens up new learning possibilities for students, sometimes students utilize it in ways that are inappropriate. It is easy for your laptop to become a distraction to you and to those around you. Therefore, please refrain from instant messaging, e-mailing, surfing the Internet, playing games, writing papers, doing homework, etc. during class time. Acceptable uses include taking notes, following along with the instructor on PowerPoint, and other directed class activities, as well as working on assigned in-class activities, projects, and discussions that require laptop use.