

Quality Engineering

(Questions for Instructors **AND**

On Campus Students: please use bbinstructors-oc@umich.edu;
 Distance Learning Students: please use bbinstructors-dl@umich.edu;

Instructor: Pat Hammett

***Note: Available by appointment at UMTRI Office (UMTRI Building: Huron Parkway/ Baxter)**

Session	Date	Topic	Assignment
1		Course Introduction – Six Sigma Overview	
2		DMAIC Problem Solving Process – DEFINE PHASE	
3		MEASURE/ANALYZE: Measuring the Current State – Continuous Y (Yield, PPM Defective) and Stratification Analysis (Optional Review: Descriptive Statistics and Graphical Tools)	
4		Optional - Minitab Tutorial (Taped Module)	
5		MEASURE/ANALYZE – Attributes/Categorical Data (Yield, Rolled Yield, Tabulation, Check Sheets, and Pareto Analysis)	
6		MEASURE/ANALYZE: Process Maps and Qualitative Analysis (Process Map, Cause and Effect, P-Diagram)	
7		Optional - Minitab Measure Phase (Taped Module)	Ex 1 Due
8		Process Stability – Variable SPC Charts	
9		Process Stability – Attributes Charts and Process Control	
10		Optional - Minitab SPC Charts (Taped Module)	Ex 2 Due
11		Process Capability Analysis - Normal	
12		Process Capability – Non-normal Distributions	
13		Optional – Minitab Process Capability (Taped Module)	Case 1 Due
14		Hypothesis Testing – Two Groups (F-test, t-test, 2 proportion test)	
15		ANOVA – Robust Operating Windows	
16		Optional - Minitab Hypothesis Tests (Taped Module)	Ex 3 Due
		FALL BREAK	
17		Measurement System Analysis – I (Gage R&R)	
18		Optional - Minitab Gage R&R (Taped Module)	Case 2 Due
19		Measurement System Analysis – II	
20		IMPROVE - Countermeasures	
21		Exam Review (Optional – Taped Module)	Ex 4 Due
22		CONTROL – Methods of Control and Visual Control Methods	
23		EXAM I (In Class)	Exam I
24		Optional – Simple Regression/Correlation (Taped Module)	
25		Multiple Regression/Stepwise Regression	
26		Binary Logistic Regression Analysis	
27		Optional - Minitab Regression (Taped Module)	

Session	Topic	Assignment
28	Principles of Design of Experiments (DOE)	
29	DOE – 2k Factorial	
30	Optional - Minitab 2k DOE (Taped Module)	Ex 5 Due
31	DOE – Fractional Factorial Designs, 3k Factorial, 2k w/Center Points	
32	Other Experiments (Mixed Level Experiments) and MultiVari Studies Optional - Minitab Fractional DOE (Taped Module)	Ex 6 Due
Thanksgiving Break		
33	Nonparametric Hypothesis Testing and Verification Studies	
34	Reliability Analysis	
35	Optional – Nonparametric and Reliability Analysis (Taped Module)	Case 3 Due
36	Tolerance Analysis and Adjustment	
37	Designing Quality In – Preventative Methods (FMEA and TPM)	
38	Exam Review (Optional – Taped Module)	Ex 7 Due
39	DMAIC Roadmap and Course Summary	
ON CAMPUS FINAL: Time TBD		Final Exam

Course Web Page: ctools.umich.edu

Lecture Notes:

All lecture notes, homework sets, solutions, and tutorials are available on the course web page.

Course Text Book:

The course lecture notes have been developed from a variety of sources and created such that a textbook is **NOT** required. Of note, many of the statistical tools and concepts covered are available through numerous web resources. Still, some may prefer a reference book and thus several are listed below. NOTE: No lectures, exercises, or case studies directly come from these references. Thus, it is **NOT** recommended to purchase these books unless you actually plan to use them for background reference. Please note that the Quick Reference Guides have less information, but are much more economical and user-friendly. Off Campus students with book allowances from their employers may wish to purchase the Breyfogle book or similar. Finally, the Minitab help feature is very good and provides an excellent reference for additional information on the use of various tools.

Reference TEXTBOOKS:

- Breyfogle, F.W., **Implementing Six Sigma**, Wiley-Interscience
- Montgomery (2009). **Design and Analysis of Experiments, 7th Edition**, Wiley.
- Montgomery (2009). **Introduction to Statistical Quality Control, 6th Edition** Wiley.
- Doane & Seward (2007). **Applied Statistics in Business & Economics**, McGraw-Hill

QUICK REFERENCE GUIDES (LOW COST OPTIONS):

- Rath and Strong, Six Sigma Pocket Guide, 2000. ISBN: 0-9705079-0-9
- Rath and Strong, Six Sigma Advanced Tools Pocket Guide, 2004. ISBN: 0-07-143411-9
- George, Rowlands, Price, and Maxey (2005). The Lean Six Sigma Pocket Toolbook.

Useful Web Sites:

Six Sigma: www.isixsigma.com
 Statistics Material: <http://www.itl.nist.gov/div898/handbook/>
<http://davidmlane.com/hyperstat/index.html>
<http://statpages.org/>

Recommended Pre-Course Reading:

- “What is Six Sigma”, Don Lynch (on Course Web page)
- www.isixsigma.com – SEARCH ON “New to Six Sigma?” – READ Series of Articles.

Software: Minitab 16 Software (Minitab 13-15 also are fine though some menus may appear different than those shown in lecture) or equivalent software (SPSS, STAT SOFT, SAS). www.e-academy.com/minitab or call 1-877-616-0662). Students may rent Minitab software for the semester or login to CAEN via remote desktop connection for a University copy (Requires a valid umich.edu account). See instructions on course website.

Course Grading

Assignment	Points	% of Grade
Multiple Choice Exercises (7)	80	20%
Case Studies (3)	100	25%
Exam I	100	25%
Final Exam	120	30%
Total	400	100%

Homework: (all homework must be submitted electronically – see instructions on assignments).

- **Online Test Exercises:** These exercises consist of multiple choice questions based on lecture material. They are administered through the course webpage. Each student should complete their own exercises. Note1: you cannot re-take a test exercise, so make sure you have considered your answers before submitting. Note2: You may print out a copy of the questions and work on them off-line prior to submitting your answers. Exercises must be submitted by **11:59 PM** on their assigned due date.

Ex #	Topics	Points
#1	DMAIC, PPM, DPMO, Stratification Analysis	10
#2	SPC: Variable and Attributes	10
#3	Process Capability: Normal/ Non-Normal	13
#4	Measurement Systems Analysis	10
#5	Regression Analysis	12
#6	Design of Experiments	15
#7	Reliability Analysis/ Tolerance Analysis	10

- **Case Study Assignments:** These assignments must be submitted using a single report file. Acceptable file submittal formats: (Adobe PDF or MS Word) – For format issues on page lengths, headings, suggestions: See “Case Study Report Requirements”.

Case #	Topic	Points
#1	Basic Quality Tools/ Process Stability	30
#2	Process Capability and Hypothesis Testing	30
#3	Regression Analysis	40

- Case Study Assignments should be completed in teams of 2 or 3. Teams of 4 may be allowed provided a request is made in advance to the instructor. Off campus students may elect to do the case studies as an individual, but we would prefer that you work in teams (e.g., virtual teams if you are the only person at your work site taking the course).
- Case Studies must be submitted by **11:59 PM** on their assigned due date

Case Study and Exercise Submittal Policies:

- All assignments submitted electronically must be posted by **11:59 PM** of the assigned due date. Off campus students may post their assignments per University guidelines related to distance learning students.
- For on-line multiple choice exercises, no late homework submittals will be accepted.
- For case study reports, teams may turn in **one** case study four calendar days after it is due with no penalty.
 - If you turn in an assignment **after** the late date or have more than one late assignment, the maximum score possible for that assignment will be 10 points.
- Case studies are considered a critical component of this course and students **are expected** to complete all case study reports. Failure to complete a case study will result in an **additional loss of 20 points** (beyond a 0 for the assignment) AND a lowering of your final grade.

Optional Problem-Solving / Minitab / Excel Help Sessions:

Weekly problem solving sessions shall be available to review the use of Minitab software to complete assignments. These are completely optional, though some students find them helpful to better learn the capabilities of Minitab. All sessions will be available via videotape through course website. Note: the first problem solving session will contain a Minitab tutorial.

Grading: Based on past performances, final grades will *likely* be based on a straight scale. However, adjustments may be made based on overall class performance on exams.