PITT BUSINESS | Joseph M. Katz Graduate School of Business & College of Business Administration

BQOM 2139 Six Sigma Theory, Practice, and Certification
Course Syllabus

Academic Term	2141 (Fall 2013)
Course Number and Title	BQOM 2139 Six Sigma Theory and Practice
Course Record Number	28449
Course Section	1150
Dates Day and Time	Aug 26,2013 through December 13, 2013 Wednesday, 6:20 PM through 9:20 PM
Classroom	117 Mervis Hall
Instructor	James F. Kimpel Clinical Associate Professor of Business Administration 363 Mervis Hall jfkimpel@pitt.edu 412.624.2110 (office) 724.882.4080 (mobile)
Office Hours	Tuesday, 2:00 PM - 3:00 PM, Wednesday, 3:00 PM - 5:00 PM, and by appointment. It is important to me that you learn and receive the good grades you deserve. Accordingly, please see me should you have undue difficulty with the course.

Contents

This syllabus is divided into the following sections:

This syllabus is subject to change. Changes will be documented in the revision log section and discussed in class.

Course Description

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The course description is organized in four subsections: Introduction; Six Sigma Overview; Instructional Design; and Learning Objectives.

Introduction

BQOM 2039 Six Sigma Theory and Practice has been designed to provide you, the student, with:

- Strong theoretical knowledge of the Six Sigma Green Belt Body of Knowledge as defined by the American Society of Quality (ASQ) (Munro, Maio, Nawaz, Ramu, and Zrymiak, 2008, pp. 360-367).
- Practical, hands-on, experience with the Six Sigma DMAIC (Define, Measure, Analyze, Improve, Control) methodology by working with a team of MBA students and a Black Belt advisor on an actual Six Sigma project sponsored by an industry client partner.
- A Katz Six Sigma Green Belt Certificate for students earning an overall course grade of "B" or better.

A summary of learning objectives supporting these goals may be found in the subsection below titled "Learning Objectives."

Six Sigma Overview

Munro et al. (2008) comment, "Every company or organization (even so-called not-for-profits) must make money in some form or another to stay in business" (p. 2). To make money, an organization's revenue must exceed cost, and it must meet customer expectations regarding quality, delivery, and price. Brue and Howes (2006) note, "Six Sigma is a disciplined, data-driven approach to process improvement aimed at the near-elimination of defects from every product, process, and transaction. The purpose of Six Sigma is to gain break-through knowledge on how to improve processes to do things better, faster, and at lower cost" (p. 7).

A review of the literature surfaces four meanings, or definitions, of Six Sigma depending on the context.

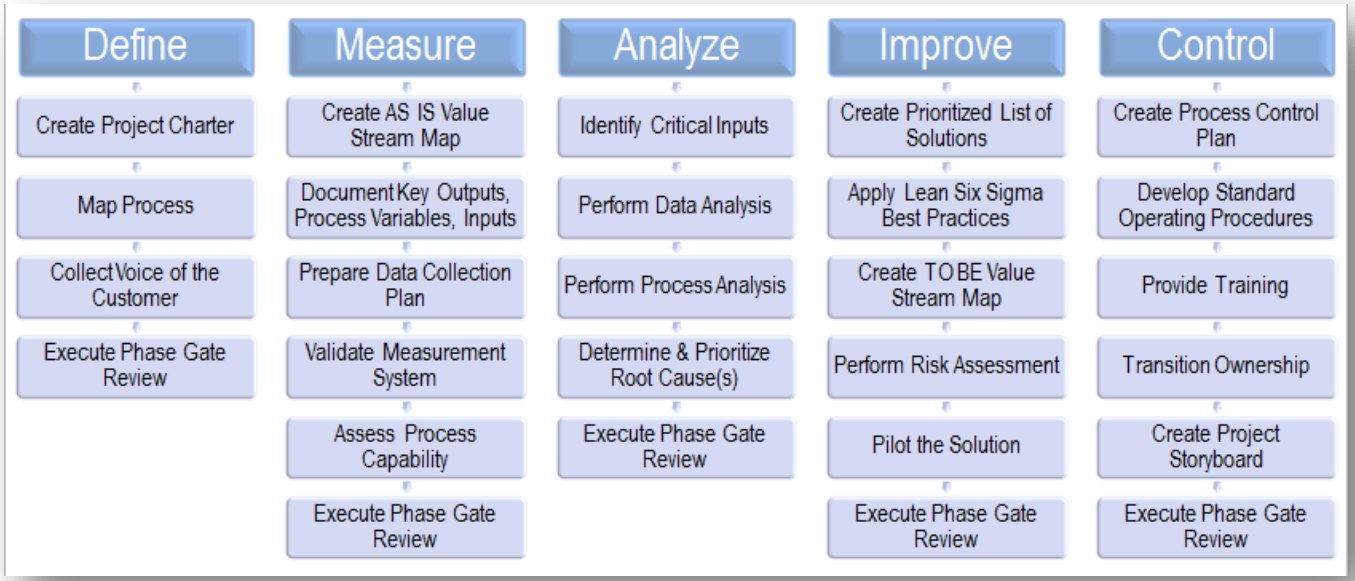
1. Six Sigma is a customer-based management philosophy that recognizes, "defects decrease satisfaction, customer loyalty and increase costs. Because the organization that provides goods and/or services of the highest value for the lowest cost is the most competitive, Six Sigma is a strategy for achieving critical results" (Brue & Howes, 2008, p. 6).
2. Six Sigma is, "a statistical measure of variation in a process. Sigma (the Greek letter σ) is the symbol in statistics for standard deviation, a measure of the variation in a distribution values …. Achieving a six-sigma level of quality means that processes are producing only 3.4 defects per million opportunities (DPMO)" (Brue & Howes, 2008, p. 6).
3. Six Sigma is a five-phase problem solving methodology known by the acronym DMAIC (define, measure, analyze, improve, control) (Munro et al., 2008, p. 5). The DMAIC methodology can be applied to a broad range of processes to eliminate the root cause of defects and their associated costs (Brue & Howes, 2008, p. 6).
4. Six Sigma is a set of nearly one hundred qualitative and quantitative tools for improving process quality, speed, and complexity (George, Rowlands, Price, and Maxey, 2005). A few such tools include affinity diagrams, Pareto analysis, SIPOC, VOC, measurement system analysis, Gage R&R, SPC, ANOVA, and DOE.

In short, "Six Sigma is a methodology for using tools to reduce variation and defects in order to deliver products and services that meet customer specifications" (Brue & Howes, 2006, p. 11).

How does Six Sigma work? As noted above, Six Sigma follows a five-phase DMAIC problem solving methodology. Brue & Howes (2006) describe the phases as follows.

1. "Define the projects, the goals, and the deliverables to customers (internal and external). Describe and quantify both the defect and the expected improvement.
2. Measure the current performance of the process. Validate data to make sure it is credible and set the baseline.
3. Analyze and determine the root cause(s) of the defects. Narrow the causal factors to the vital few.
4. Improve the process to eliminate defects. Optimize the vital few and their interrelationships.
5. Control the performance of the process. Lock down the gains." (p. 9)

Below is a graphical representation of the DMAIC methodology adapted from George et al., (2005, p. 1).



In conclusion, Six Sigma provides a balanced scorecard of results by enhancing the financial position of a company (typical ROI is 3x to 4x), satisfying customers (due to the focus on customers' requirements), increasing employee engagement (through giving employees a voice in decision making and a role in making changes), and improving quality (by reducing the variation in processes that lead to defects) (Brue and Howes, 2006, pp. 1-7). BQOM 2139 Six Sigma Theory and Practice promises a dynamic and engaging experience-based learning opportunity for MBA students who are equal to the challenge of applying the DMAIC methodology to a real-world project in partnership with an industry client.

Instructional Design

Following a brief introduction to Six Sigma, the course tracks the flow and phases of the DMAIC methodology. The graphic below provides a high-level timeline. Details can be found in the course outline and schedule.

Phase	Week 1		Week 2		Week 3		Week 4		Week 5		Week 6		Week 7		Week 8		Week 9		Week 10		Week 11		Week 12		Week 13		Week 14	
Overview of Six Sigma	O	O	O																									
Define Phase		D	D	D	D	D	D																					
Measure Phase								M	M	M	M	M	M	M	M	M												
Analyze Phase																	A	A	A	A								
Improve Phases																					I	I	I	I				
Control Phase																							C	C	C	C		

To integrate the goals of Six Sigma theory and practice, students will be grouped in teams of four to six and work under the mentorship of a Six Sigma Black Belt on an industry client field project. Teams may be comprised of both part-time and full-time students. It may be difficult for part-time students to attend client site visits given many part-time students are employed full-time. Where possible, technologies such as conference calling, web meetings, video conferring (Skype or ooVoo), etc. will be employed to allow part-time students to join client visits remotely. Additionally, the course outline and schedule has been structured to provide frequent in-class team breakout working sessions. Even with the in-class working sessions, teams will likely need to meet independently during evenings or weekends to ensure adequate time to review information and prepare project documentation/deliverables.

The flow of the lecture topics will mirror the DMAIC methodology; providing just-in-time knowledge. To keep the work load manageable, and to allow time for in-class working sessions, lectures will focus first on providing a high level overview which frames the topic followed by deep dives into a small number of the most critical subject areas and tools within the higher level topic. Where appropriate, lectures will also include in-class labs that allow the students to immediately apply the learning. This “high level overview with selected deep dives” approach is preferred over attempting to cover a large body of knowledge in full detail and overwhelming the students with information. Further, each field project will be different and require different Six Sigma techniques/tools. Black Belt advisors will attend the class meetings with working sessions when they are not traveling for business. The Black Belt advisors will not only assist the team with the selection of appropriate elements of the Six Sigma Body of Knowledge, but also explain Six Sigma techniques/tools appropriate for the client project that may not have been included in the lecture.

Covering the Six Sigma Green Belt Body of Knowledge and completing a field project in one semester is aggressive. To maximize the probability of success the course outline and schedule assigns project deliverables at the end of class meetings. Project deliverables represent Six Sigma tools/techniques the team is expected to use during the lifecycle of the client project. The intent of the project deliverables is not only to provide hands-on experience-based learning with the DMAIC methodology, but also to add value to the client organization sponsoring the team’s Six Sigma project. Project deliverables typically build on one another; culminating in a Phase Gate Review presentation. Teams are encouraged to complete the deliverables before the start of class the following week. This, however, is not mandatory. Project deliverables for a DMAIC phase are due at the start of the class during which the teams will present their Phase Gate Review.

Even with the focus on timely completion of deliverables and milestone Phase Gate reviews, some client projects may require more than one semester to implement process changes and measure the results. In these instances, the team is expected to complete the Define, Measure, and Analyze phases, but only prepare deliverables that plan for the Improve and Control phases. In very rare occurrences, when a team cannot even prepare deliverables that plan for the Improve and Control phases, the team and Black Belt advisor must proactively meet with the course instructor to receive approval on a project scope change. The need to relax constraints should not come as a surprise to the team. An "eleventh hour" unplanned scope change request will be negatively viewed by the course instructor and will result in a lower grade on project deliverables.

Learning Objectives

The learning objective for the course will be identified by the following six levels of cognition based on Bloom's revised taxonomy (as cited in Munro et al., 2005, pp. 366-367). The levels in the table below proceed from the lowest level of cognition (Remember) to the highest level (Create).

Level	Description
Remember	Be able to remember or recognize terminology, definitions, facts, ideas, materials, patterns, sequences, methodologies, principles, etc. (Also commonly referred to as recognition, recall, or rote knowledge).
Understand	Be able to read and understand descriptions, communications, reports, tables, diagrams, directions, regulations, etc.
Apply	Be able to apply ideas, procedures, methods, formulas, principles, theories, etc., in job-related situations.
Analyze	Be able to break down information into its constituent parts and recognize the parts' relationship to one another and how they are organized; identify sublevel factors or salient data from a complex scenario.
Evaluate	Be able to make judgments regarding the value of proposed ideas, solutions, methodologies, etc., by using appropriate criteria or standards to estimate accuracy, effectiveness, economic benefits, etc.
Create	Be able to put parts or elements together in such a way as to show a pattern or structure not clearly there before; ability to identify which data or information from a complex set is appropriate to examine further or from which supported conclusions can be drawn.

Below are the learning objectives with the level of cognition from Bloom's taxonomy preceding each objective.

I. Overview of Six Sigma and the Organization

A. Remember & Understand: Six sigma and organizational goals
B. Remember & Understand: Lean principles in the organization

II. Define Phase

A. Apply & Analyze: Process Management for projects
B. Understand & Apply: Project management basics
C. Understand & Apply: Management and planning tools
D. Analyze: Business results for projects
E. Understand & Apply: Team dynamics and performance

III. Measure Phase

A. Analyze: Process analysis and documentation
B. Understand & Apply: Probability and statistics
C. Apply, Analyze, Evaluate, & Create: Collecting and summarizing data
D. Analyze and Evaluate: Measurement system analysis
E. Analyze & Evaluate: Process capability and performance

IV. Analyze Phase

A. Analyze & Evaluate: Variation and process inputs
B. Analyze & Evaluate: Data through charts and graphs

V. Improve & Control Phases

A. Understand & Apply: Design of experiments (DOE)
B. Understand, Apply, and Analyze: Statistical process control (SPC)
C. Evaluate & Create: Implement and validate solutions
D. Understand & Apply: Assist in developing a control plan to document and hold the gains, and assist in implementing controls and monitoring systems. (Apply)

In addition to the cognitive learning objectives above, students will also understand and apply project management techniques and presentation skills. Lean principles will be incorporated throughout the course.

Course Prerequisites

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The following courses are prerequisites.

- BQOM 2401 Statistical Analysis

Course Text Books

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The following textbook is required for the course. A copy of the text will be placed on reserve in the Katz Business Library.

- Munro, R. A., Maio, M. J., Nawaz, M. B., Ramu, G., & Zrymiak, D. J. (2008). *The Certified Six Sigma Green Belt Handbook*. Milwaukee: ASQ Quality Press. ISBN: 978-0-87389-698-6.

The following textbook is recommended, but not required for the course. Copies may be purchased on-line.

- George, M. L., Rowlands, D., Price, M., & Maxey, J. (2005). *The Lean Six Sigma Pocket Toolbook.* New York: McGraw-Hill. ISBN: 0-07-144119-0

Course Method of Evaluation

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This section is organized in seven subsections: Grading Scale & Distribution; Course Requirements; Class Attendance; Client Site Visit; Six Sigma Project Deliverables & Phase Gate Presentations; Quizzes; and Exams.

Grading Scale & Distribution

Following are guidelines for final letter grades, percentage grades, and grade distribution (i.e. percentage of students scoring within a given letter and percentage grade range). No graders will be used in this course. Every effort will be made to provide grades within one week following the due date.

Letter Grade	Percentage Grade	Grade Distribution
A +	100.00% - 97.00%	30%-40%
A	96.99% - 92.00%	
A -	91.99% - 90.00%	
B +	89.99% - 87.00%	55% - 60%
B	86.99% - 82.00%	
B -	81.99% - 80.00%	5% - 15%
C+	79.99% - 77.00%	
C	76.99% - 72.00%	
C -	71.99% - 70.00%	
D	69.99% - 60.00%	
F	59.99% - 00.00%	

Course Requirements

Requirement	Percent of Final Grade
Class Attendance	5%
Client Site Visit	5%
Six Sigma Project Deliverables	35%
Quizzes (the one lowest quiz grade will be dropped)	15%
Mid-Term Exam	20%
Final Exam	20%
Total	100%

Class Attendance

You are expected to attend class and to be prepared for class by completing the assigned readings or exercises defined in the course outline and schedule. Regular attendance will be taken. If you miss class, for any reason, you may earn credit for attendance by submitting a brief outline of the chapters covered during the missed class. A brief outline includes the bold section headers with a summary of the key concepts of the sections. Earning attendance credit is capped at four missed classes. If you miss more than four classes, for any reason, you may not earn credit for attendance.

The grading scale will be:

Grading	Percent
Present	100%
Absent	0%

Client Site Visit

The course is designed with a strong experienced-based learning component where a team of MBA students apply the Six Sigma methodology to a real-world problem for a client. Accordingly, each student is expected to make a minimum of one client site visit during the term.

The grading scale will be:

Grading	Percent
One, or more, client site visits.	100%
No client site visit.	0%

Six Sigma Project Deliverables & Phase Gate Presentations

Project deliverables represent Six Sigma tools/techniques the team is expected to use during the lifecycle of the client project. The intent of the project deliverables is not only to provide hands-on experience-based learning with the DMAIC methodology, but also to add value to the client organization sponsoring the project. Project deliverables typically build on one another; culminating in a Phase Gate Review presentation. Each client project, however, will be different and therefore may require different deliverables. A team is free to prepare more deliverables than required by the course outline and schedule. If a team determines a deliverable is not required for their project, they must justify the non-use in the Phase Gate Review presentation. Further, it is strongly recommended the team discuss the non-use of a deliverable with the instructor before the Phase Gate Review presentation.

Project deliverables associated with the Six Sigma DMAIC methodology will be assigned at the end of class as identified in the course outline and schedule. Teams are encouraged to complete the deliverables before the start of class the following week. This, however, is not mandatory. Project deliverables for a DMAIC phase will be incorporated into a Phase Gate Review presentation. There will be three graded presentation as identified in the course outline and schedule. Each presentation will be graded by the instructor and the black belts on a 100% scale. Each presentation will have equal weight. A grading rubric for each presentation will be posted in CourseWeb and reviewed during class ahead of the presentation. All team members will receive the same score for the presentation.

Teams will typically consist of four to six students. It is important that your group form a collaborative working relationship. If a member of your team communicates they will not participate, or fails to respond to group collective efforts to complete the assignment, first try to resolve the problem within your group. If the team cannot find a solution, then work with your Black Belt advisor; and finally come to the instructor if a mutually agreeable way forward cannot be found.

Quizzes

Open book/notes quizzes (typically five questions; a mix of multiple choice and true/false) will be assigned online in CourseWeb at the end of class as identified in the course outline and schedule. The quiz will cover the assigned readings for the class and materials presented in class lectures or labs. Quizzes are due by the start of the next class. Late quizzes will receive a score of zero.

Quizzes will be graded on a 100% scale and will have equal weight. Partial credit will be given. For example:

Question	Percent
1	20%
2	20%
3	20%
4	20%
5	20%
Total	100%

Quizzes will be presented as a group of questions (rather than as individual questions). You will have three attempts to complete each quiz correctly. The intent of the quizzes is not only to ensure you are learning the course material but also to provide an opportunity to improve your overall course grade.

Exams

Closed book/notes exams will be given as identified in the course outline and schedule. Exams are not cumulative. You will be permitted to use a calculator and the instructor will give you a page of formulas to use during the exam.

In general, there will be no make-up exams. However, in the event an exam is missed due to either a preapproved absence by the instructor, or due to an illness documented by a physician's note, arrangements will be made to make-up the missed exam.

Course Outline and Schedule

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Date	Session	Preparation for Session	Session Topic / Lesson Plan	Project Deliverables Assigned After Session
Aug-28	1	Read Syllabus Read Chapters 1 & 5	Six Sigma Overview & Define Phase Lecture: Course Introduction & Syllabus Review Lecture: Chapter 1 Six Sigma & Organizational Goals Lecture: Chapter 5 Project Management Basics Breakout: Project Teams	Create Problems Statement Create Project Charter
Sep-4	2	Quiz 01 Chapter 1 & 5 Read Chapter 2, 4, 6 & 7	Lecture: Chapter 2 Lean Principles in the Organization Lecture: Chapter 7 Business Results for the Organization Lecture: Chapter 4 Process Management for Projects Lecture: Chapter 6 Management & Planning Tools Lab: ACE Manufacturing Breakout: Define Phase	Map Process Collect Voice of the Customer Prepare Define Phase Gate Review
Sep-11	*No Class – MBA Professional Development Days*			
Sep-18	3	Quiz 02 Chapter 2, 4, 6 & 7 Read Chapter 8	Lecture: Chapter 8 Team Dynamics and Performance Lab: Affinity Diagram, Multi-Voting, Pairwise Comparison Open: Open Session to Account for Lost Time Breakout: Defined Phase	
Sep-25	4	Quiz 03 Chapter 8 Read Chapter 10	Presentation 1: Define Phase Gate Review Measure Phase Lecture: Chapter 10 Process Analysis & Documentation Lab: Value Stream Mapping Breakout: Measure Phase	Create AS IS Value Stream Map Document Key Outputs, Process Variables, & Inputs
Oct-2	5	Quiz 04 Chapter 10 Read Chapter 11 & 12	Lecture: Chapter 11 ~~Probability and~~ Statistics Lecture: Chapter 12 Collecting and Summarizing Data Lab: Run Chart & Histogram Breakout: Measure Phase	Prepare Data Collection and Analysis Plan
Oct-9	6	Quiz 05 Chapter 11 & 12 Read Chapter 14	Lecture: Chapter 14 Measurement System Analysis Lab: Gage R&R Open: Open Session to account for lost time Breakout: Measure Phase	Validate Measurement System

Date	Session	Preparation for Session	Session Topic / Lesson Plan	Project Deliverables Assigned After Session
Oct-16	7	Quiz 06 Chapter 14 Read Chapter 15 & 19	Lecture: Chapter 15 Process Capability and Performance Lecture: Chapter 19 Process Control Charts Lab: SPC Breakout: Measure Phase	Assess Process Capability Evaluation Prepare Measure Phase Gate Review
Oct-23	8		Exam 01: Define & Measure Phases (Session 1 - 7)	
Oct-30	9		Presentation 2: Measure Phase Gate Review Analyze Phase Lecture: Analyze Phase Overview Lab: Interrelationship Diagram Breakout: Analyze Phase	Identify Critical Inputs Perform Data Analysis
Nov-6	10	Quiz 07 Analyze Phase Read Chapter 18	Lecture: Chapter 18 Design of Experiments Lab: DOE Breakout: Analyze Phase	Perform Process Analysis Determine & Prioritize Root Cause(s)
Nov-13	11	Quiz 08 Chapter 18 Read Chapter 20 & 21	Improve & Control Phases Lecture: Chapter 20 Implement and Validate Solutions Lecture: Chapter 21 Control Plan Lab: Tampering Breakout: Improve & Control Phases	Prepare Final Project Presentation
Nov-20	12	Quiz 09 Chapter 20 & 21	Tour: Philips Respironics (Lean Manufacturing)	Prepare Final Project Presentation
Nov-27	*No Class – Thanksgiving Break*			
Dec-4	13		Presentation 3: Final Project Presentation	
Dec-11	14		Exam 02: Analyze, Improve & Control Phases (Sessions 9 – 11)	

Course Policies

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Disabilities

If you have a disability for which you are, or may be, requesting an accommodation, you are encouraged to contact both your instructor and Disability Resources and Services (DRS), 140 William Pitt Union, (412) 648-7890/(412) 383-7355 (TTY), as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course.

Accessibility

Blackboard is ADA Compliant and has fully implemented the final accessibility standards for electronic and information technology covered by Section 508 of the Rehabilitation Act Amendments of 1998. Please note that, due to the flexibility provided in this product, it is possible for some material to inadvertently fall outside of these guidelines.

Academic Civility and Integrity

Students in this course will be expected to comply with the University of Pittsburgh's Policy on Academic Integrity Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. This may include, but is not limited to, the confiscation of the examination of any individual suspected of violating University Policy. Furthermore, no student may bring any unauthorized materials to an exam, including dictionaries and programmable calculators.

Technology may be used to verify and validate all submitted work for authentication; any violations will be reported and managed within the MBA Program and university's academic integrity guidelines.

Classroom Decorum

Please maintain the classroom decorum by observing the following guidelines:

1. Arrive on time and be ready to work at the start of class; leaving early only if it is absolutely necessary.
2. Bring all necessary material to class. This includes calculator, textbook, lecture notes, and assigned homework.
3. Laptop computers will be needed to perform statistical calculations in MS Excel. However, in other instances, computers will only be allowed open if instructed to do so; all other times your computers should be closed. Do not surf, check e-mail, or play games during class.
4. Turn your cell phones/smart phones off unless you are expecting a telephone call regarding a medical emergency. In this event, please sit near an exit and leave quickly so that others are not disturbed by the call. Cell phones/smart phones cannot be used as calculators. Do not text during class. MP3 players, iPod, and similar forms of technology are not required and cannot be used during classroom lectures. Store such devices away and out of sight.
5. Avoid eating foods during class that are noisy, crunch, or so fragrant that those around you will be annoyed or want your food!
6. Do not disturb students near you with either personal conversation or unwanted behavior.

Technology in the Classroom

Laptop computers will be needed to perform statistical calculations in MS Excel. However, in other instances, computers will only be allowed open if instructed to do so; all other times your computers should be closed. Additionally, when a guest speaker is presenting, you will be expected to have your computer closed.

Classroom Recording

To ensure the free and open discussion of ideas, students may not record classroom lectures, discussion and/or activities without the advance written permission of the instructor, and any such recording properly approved in advance can be used solely for the student's own private use

Email

During the semester, the instructor may need to communicate outside of class. Please make sure that your campus provided email account is correctly set, tested, and operational. In the event you rely upon a different primary email account, please make sure that your campus email has been configured to forward class email to an email account you check regularly.

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Course Syllabus Revision Log

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Revision	Date	Description
00	23-Aug-2013	Initial release.