IE 4260: Principles of Quality Control – 3 Credits
Course Syllabus - Fall 2019

Instructor: Dr. Celestine C. Aguwa, PhD.
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Time & Location: Tuesdays and Thursdays 5:30 PM to 6:45 PM & Location: 0150 MANO
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Office Hours: By appointment
Teaching Assistant: Egbe-Etu Emmanuel Etu <fw7443@wayne.edu>

Prerequisites:

Course Description:
This course is planned as an introductory, but comprehensive course in Statistical Quality Control and Quality Assurance, to provide students with some statistical procedures for monitoring the quality of a manufactured product and for controlling the quality of products shipped to consumers. Main topics that will be covered include control charts for variables and attributes data, process capability studies, and acceptance sampling procedures. Recent topics and trends in quality engineering such as Short Production Runs, EWMA charts, and Six Sigma will also be introduced. The pioneers of the field such as Deming, Juran, and Taguchi will be surveyed.

Basics: Quality assurance and management, quality costs, aims and objectives of statistical process control, chance and assignable causes of variation, statistical quality control, process control, rational subgroups, product control, importance of statistical quality control in industry.

Charts for variables: Theoretical basis and practical background of control charts for variables, 3 sigma limits, warning limits and probability limits, criteria for detecting lack of control, derivation of limits and construction and interpretation of X, R, and S charts and, group control charts and sloping control charts, natural tolerance limits and specification limits, process capability studies, OC and ARL curve for variable charts.

Control charts for attributes: Basis, construction and interpretation of NP chart, P chart, C chart, and U chart, OC and ARL curve for attribute charts.

Course Objectives:
One of the main objectives of this course is to help students become familiar with most widely used statistical techniques in the literature for quality control and improvement and develop an appreciation of problem solving in practice. An emphasis will be placed on utilizing Minitab as the primary illustrative software package for the course. In this course, it is aimed to prepare technically competent engineers in the areas of statistical process control, process capability analysis, statistical tolerance setting, and basic acceptance sampling procedures.

Course Learning Outcomes:
Upon completion of the course, students will be able to:
1. Acquire the fundamentals of statistical quality control methods and an appreciation of some practical approaches and solutions to some examples of real quality control problems.
2. Be able to select and apply appropriate statistical models to process control situations.
3. Create and interpret control charts for variables
4. Create and interpret control charts for attributes and explain the advantages and disadvantages of attributes versus variables control charts
5. Conduct and analyze a measurement system capability experiment and to estimate components of variability in measurement system.
6. Create and interpret control charts for small process shifts (cusum, EWMA, …)
7. Create and interpret control charts for auto correlated data, identify and analyze the sources and effects of autocorrelation on control charts.
8. Create and interpret control charts for multivariate variability
9. Demonstrate mastery of a statistical computing package such as Minitab
10. Develop abilities to identify, formulate, analyze, and solve quality control problems.
11. Enhance abilities to work on teams and present results in effective oral presentations and written reports.
12. Explain the statistical basis of the Schwartz control chart, including choice of sample size, control limits, and sampling interval.
13. Explain and analyze phase I and phase II use of control charts.
14. Investigate and analyze process capability and explain the differences between process capability and process potential
15. Know the different types of sampling procedures, their statistical basis, their properties, and their limitations and pitfalls.
16. Understand the statistical basis of control charts, process capability analysis, and acceptance sampling.
17. Understand the concepts of process capability and measurement system capability.
18. Understand the strategic importance of quality and the prevailing quality philosophy in use today.

**Textbooks:**

**Other Materials and Resources:**

**Grading:**
Your individual contributions to class discussion are valued and rewarded. This assessment is based on the quality of your individual input and your serious intention to contribute to class discussion. If you attend class on an infrequent basis or rarely contribute to class discussion, it is difficult to justify any class participation credit.

Tentative Grading:
Final grades will be based on the following:
1) Mid-term Exam 25%
2) Final Exam 25%
3) Homework/Quiz/Journal Article Review 20%
4) Group Project/ Special Topic 25%
5) Class Attendance and Participation 5%

**Homework Policy:**
Late homework assignments will not be accepted unless the instructor is coordinated with in advance. Homework assignments may be discussed in groups. If homework is done in a group, please submit individual results in each student’s writing. Homework assignments are due by midnight of their due dates. All homework assignments should be submitted to the grader or teaching assistant via Canvas. For every 24-hour period that an assignment is late a 10% penalty will be deducted from the assignment’s full grade.

There will also be assignments and projects that require team participation. Students will be assigned to teams by the instructor. All teams are encouraged to utilize the collaboration tools in Blackboard for communicating and managing their team activities. All students are expected to actively participate in the team assignments. An early warning to the instructor regarding any teammate who is not contributing will be appreciated so that the instructor can arrange to speak with the non-contributing student and address the problem.

Journal Article Review
The objective of the article review presentations is to allow students to study a wide range of real world applications that rely on the principles of quality control. You may work in teams depending on class size. Each team or individual is required to select and analyze an article from referred journals that describe a
practical application of quality control. Each team will make a fifteen-minute presentation at the beginning of class and submit overheads of presentation & names of team members.

Article Review (5–8 slides):
1. Problem Context
2-3 Model Structure
   - Decision Variables, Objectives, Constraints, and System Scope
4-5 Model Usage -
   - What issues did it address?
   - What was its impact?
   - Who were the model users?
6. Implementation Issues & Concerns if discussed in paper
7-8. Your lessons learned
   - The analogies could relate to potential use of model or to implementation issues

Exams:
The course final grades (Subject to change)
A = 94% +, A - = 90%+, B + = 85%+, B = 83%+, B - = 80%+, C+ = 77%, C = 73%+, C - = 70%+, D + = 65%+, D = 60 %+, D - = 55%+, E = Less than 55%.

Midterm and final exam dates is specified on the syllabus. No makeup exam will be offered except for students who have medical emergencies that can be supported by a letter from a doctor.

Projects:
For the group project you are expected to work in teams. Choose a case study (preferably one that you are familiar with). Carry an analysis of an existing process and then use the tools that are covered in this class to suggest process improvement.

Written Project Requirements:
The written project reports must be typed or computer printed (laser quality only). The length of the written report is strictly limited to 10 pages but exhibits up to 5 additional pages may be appended. Each report/presentation slide must include the following information, but not necessarily in this order:
1)  Introduction
2)  Problem statements / Motivation
3)  Target Problem description
5)  Literature reviews
6)  Objective(s)
7)  Proposed Methodology
8)  Validation and/or evaluation
9)  Conclusion and recommendation
10)  Bibliography/References (Report ONLY)

Oral Presentation Requirement
Each team will make a weekly update including but not limited to timeline, presentations slides and report, and submit overheads of presentations with names of team members. Each project team is expected to make a presentation of 15 minutes. Reports must be submitted on the day of the presentation. Each group member must be actively involved in the oral presentation. The presentations will be graded for clarity, content, and organization.

Attendance Policy: All students are expected to attend all lectures, quizzes, and examinations with enthusiasm. Class attendance and participation count as part of your grading (see grading schedule)
and information on study skills workshops, tutoring and supplemental instruction (primarily in 1000 and 2000 level courses).

2. The Writing Center is located on the 2nd floor of the Undergraduate Library and provides individual tutoring consultations free of charge. Visit http://clasweb.clas.wayne.edu/writing to obtain information on tutors, appointments, and the type of help they can provide.

Class Recordings: Students need prior written permission from the instructor before recording any portion of this class. If permission is granted, the audio and/or video recording is to be used only for the student’s personal instructional use. Such recordings are not intended for a wider public audience, such as postings to the internet or sharing with others. Students registered with Student Disabilities Services (SDS) who wish to record class materials must present their specific accommodation to the instructor, who will subsequently comply with the request unless there is some specific reason why s/he cannot, such as discussion of confidential or protected information.

Academic Dishonesty – Plagiarism and Cheating: Academic misbehavior means any activity that tends to compromise the academic integrity of the institution or subvert the education process. All forms of academic misbehavior are prohibited at Wayne State University, as outlined in the Student Code of Conduct (http://www.doso.wayne.edu/student-conduct-services.html). Students who commit or assist in committing dishonest acts are subject to downgrading (to a failing grade for the test, paper, or other course-related activity in question, or for the entire course) and/or additional sanctions as described in the Student Code of Conduct.

1. Cheating: Intentionally using or attempting to use, or intentionally providing or attempting to provide, unauthorized materials, information or assistance in any academic exercise. Examples include: (a) copying from another student’s test paper; (b) allowing another student to copy from a test paper; (c) using unauthorized material such as a "cheat sheet" during an exam.

2. Fabrication: Intentional and unauthorized falsification of any information or citation. Examples include: (a) citation of information not taken from the source indicated; (b) listing sources in a bibliography not used in a research paper.

3. Plagiarism: To take and use another’s words or ideas as one’s own. Examples include: (a) failure to use appropriate referencing when using the words or ideas of other persons; (b) altering the language, paraphrasing, omitting, rearranging, or forming new combinations of words in an attempt to make the thoughts of another appear as your own.

4. Other forms of academic misbehavior include, but are not limited to: (a) unauthorized use of resources, or any attempt to limit another student’s access to educational resources, or any attempt to alter equipment so as to lead to an incorrect answer for subsequent users; (b) enlisting the assistance of a substitute in the taking of examinations; (c) violating course rules as defined in the course syllabus or other written information provided to the student; (d) selling, buying or stealing all or part of an un-administered test or answers to the test; (e) changing or altering a grade on a test or other academic grade records.

Student Disability Services: If you have a documented disability that requires accommodations, you will need to register with Student Disability Services for coordination of your academic accommodations. The Student Disability Services (SDS) office is located at 1600 David Adamany Undergraduate Library in the Student Academic Success Services department. SDS telephone number is 313-577-1851 or 313-577-3365 (TTD only). Once you have your accommodations in place, I will be glad to meet with you privately during my office hours or at another agreed upon time to discuss your needs. Student Disability Services’ mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University. Please refer to the SDS website for further information about students with disabilities and the services we provide for faculty and students: http://studentdisability.wayne.edu/

Students who are registered with Student Disability Services and who are eligible for alternate testing accommodations such as extended test time and/or a distraction-reduced environment should present the required test permit to the professor at least one week in advance of the exam. Federal law requires that a student registered with SDS is entitled to the reasonable accommodations specified in the student’s accommodation letter, which might include allowing the student to take the final exam on a day different than the rest of the class.

Course Drops and Withdrawals: In the first two weeks of the (full) term, students can drop this class and receive 100% tuition and course fee cancellation. After the end of the second week there is no tuition or fee cancellation. Students who wish to withdraw from the class can initiate a withdrawal request on Pipeline. You will receive a transcript notation of WP (passing), WF (failing), or WN (no graded work) at the time of withdrawal. No
withdrawals can be initiated after the end of the tenth week. Students enrolled in the 10th week and beyond will receive a grade. Because withdrawing from courses may have negative academic and financial consequences, students considering course withdrawal should make sure they fully understand all the consequences before taking this step. More information on this can be found at:

http://reg.wayne.edu/pdf-policies/students.pdf

**Deferred Grade:** A grade of 'I' can only be assigned if all of the following criteria are met:
1. the student IS NOT currently failing the class and,
2. there is NOT a substantial quantity of work yet to be completed,
3. there is no extra work required of the instructor beyond the normal duties of grading the paper/exam,
4. there is no need for the student to attend the class in subsequent terms.
The final decision to assign an incomplete grade rests with the instructor. An 'I' grade MUST be made up within one year of assignment of the grade.

**Course Schedule:**

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<tr>
<th>#</th>
<th>Days (Tue &amp; Thurs)</th>
<th>Topic</th>
<th>Assignment/Comment</th>
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<tbody>
<tr>
<td>1</td>
<td>8/29/2019</td>
<td>Introduction and Class logistics</td>
<td>Strategic goals and expectations</td>
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<tr>
<td>3</td>
<td>9/10/2019 &amp; 9/12/2019</td>
<td>Ch2: The DMAIC Process</td>
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<td>5</td>
<td>9/24/2019 &amp; 9/26/2019</td>
<td>Ch4: Inferences about Process Quality</td>
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<td>6</td>
<td>10/1/2019 &amp; 10/3/2019</td>
<td>Ch5: Methods and Philosophy of Statistical Process Control</td>
<td>Article review - TBD</td>
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<td>7</td>
<td>10/8/2019 &amp; 10/10/2019</td>
<td>Ch5: Methods and Philosophy of Statistical Process Control</td>
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<td>8</td>
<td>10/15/2019 &amp; 10/17/2019</td>
<td>Ch6: Control Charts for Variables</td>
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<td>9</td>
<td>10/22/2019 &amp; 10/24/2019</td>
<td>Midterm Project Presentation (Oct 22)</td>
<td>Mid-term exam (Oct 24)</td>
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<td>10</td>
<td>10/29/2019 &amp; 10/31/2019</td>
<td>Ch7: Control Charts for Attributes</td>
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<td>12</td>
<td>11/12/2019 &amp; 11/14/2019</td>
<td>Ch9: Cumulative Sum and Exponentially Weighted Moving Average Control Charts</td>
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<td>16</td>
<td>12/10/2019 &amp; 12/12/2019</td>
<td>Final Project Presentation (Dec 10); Final Exam (Dec 12)</td>
<td>Classes end: 12/9</td>
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<td>Study Day: 12/10</td>
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<td>Exam Week: 12/11 – 12/17</td>
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<td>17</td>
<td>12/17/2019</td>
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Note that no cellphone use including but not limited to calls/receive and texting is permitted in class. No cellphones during all exams. Note that the schedule is subject to change.

All homework and exams material should have only your access ID (no names and/or signatures that may identify you)

Naming files template:
Home work – hw1_<access ID>
Project – proj_<group_1>
Journal article – article_< group_1>
Special topic – specialtopic_<group_1>!