IE748: Quality Engineering  
Spring 2014  
Room 130 Park Shops

**Time/Place:** MW 10:15-11:30 / 130 Park Shops  
**Prerequisite:** ST515 or equivalent, Fluency in a computer programming language or spreadsheet.

Instructor- Yahya Fathi  
Office: 436 Daniels Building  
Phone: (919) 515-6417  
email: fathi@ncsu.edu

Office hours: MW 2:00-3:30 p.m. (or by appointment)  
Special office hours for EOL students: MW 9:00-9:30 a.m.

Teaching Assistant: Farid Alborzi  
Office: 418 Daniels  
Phone: (919) 515-0337  
email: falborz@ncsu.edu

Office hours:


**Course (catalog) description:** Introduction to basic concepts of quality engineering. Statistical process control (SPC) methods; concept of parameter design and statistical as well as analytical techniques for its implementation, tolerance analysis and design, components of cost of poor quality and an introduction to quality management.

**Course objectives:** By the end of the course the students will be able to:
- identify and outline the key statistical techniques used in quality engineering
- evaluate the capability of a manufacturing process to meet the required design specifications
- evaluate the propagation of error in linear and nonlinear environments
- design and implement a factorial experiment, and determine optimum settings for the controllable parameters
- apply the principles of robust design to determine an optimum set of values for the controllable parameters of a manufactured product and/or a manufacturing process
- design appropriate control charts and interpret the results
- Design effective sampling plans for inspection/acceptance

**Topics covered (No. of classes) | Reading**
---|---
1. Introduction to quality engineering (1) | Ch.1
2. Review of probability and statistics (2) | Ch.2 and Ch.3
3. Quality loss functions/Process capability (1) | Ch.4 (sec.4.1&4.2)
4. Design of experiments/Orthogonal arrays (4) | Ch.4 (sec.4.3,4.4,4.5), [B7:Ch.3]
5. Tolerance Analysis -- linear and nonlinear (4) | [B8:7.7], [A1], [A2], [A3], [A4]
6. Parameter Design (4) | [A5], [A6], [A7], [A8]
7. Control Charts (6) | Ch.5 and Ch.6
8. Introduction to sampling plans (4) | Ch.7, [A10]
References

Books (B)
5. *Introduction to Quality Engineering*, by G. Taguchi, Unipub 1986.

Articles (A)
Grading Policy:

- Midterm exam: 35%
- Final Exam: 35%
- Homework: 30%

Students are allowed to freely discuss the homework assignments with each other and consult other sources as they see fit. However, upon completion of this consultation, each student is required to independently write his/her own answer to the homework assignments without any further assistance from external sources. STUDENTS ARE NOT ALLOWED TO WORK TOGETHER IN EXAMS AND QUIZES.

In accordance with the university policies, the plus/minus grading scale will be used. Information regarding this policy may be found at the web site: [http://www.ncsu.edu/provost/academic_policies/](http://www.ncsu.edu/provost/academic_policies/)

University policy on academic integrity: Please read the university policy on academic integrity found in the Code of Student Conduct. You may find it at the web site [http://www.ncsu.edu/provost/academic_policies/](http://www.ncsu.edu/provost/academic_policies/). In accordance with this policy, it is my understanding and expectation that the student’s signature on each test or assignment means that the student neither gave nor received unauthorized aid for that test or assignment.

Students with Disabilities: Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with Disability Services for Students at 1900 Student Health Center, Campus Box 7509, 515-7653. [http://www.ncsu.edu/dso/](http://www.ncsu.edu/dso/)

For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulations (REG 02.20.01).

Course Evaluation: Online class evaluations will be available for students to complete during the last 2 weeks of the term.

Students will receive an email message directing them to a website where they can login using their Unity ID and complete evaluations. All evaluations are confidential; instructors will never know how any one student responded to any question, and students will never know the ratings for any particular instructors.

Evaluation website: [https://classeval.ncsu.edu/](https://classeval.ncsu.edu/)

Student help desk (email address): classeval@ncsu.edu

More information about ClassEval: [http://www.ncsu.edu/UPA/classeval/](http://www.ncsu.edu/UPA/classeval/)

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<thead>
<tr>
<th>Lec. #</th>
<th>Date</th>
<th>Topic</th>
<th>Reading*</th>
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<tbody>
<tr>
<td>1</td>
<td>Jan 6</td>
<td>Introduction/ Review Probability</td>
<td>Ch. 2</td>
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<td>2</td>
<td>Jan 8</td>
<td>Review Statistics</td>
<td>Ch. 3</td>
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<td>3</td>
<td>Jan 13</td>
<td>Introduction to Quality Engineering (HW#1 due)</td>
<td>Ch. 1, B4: Ch. 1, 2</td>
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<td>4</td>
<td>Jan 15</td>
<td>PCA/Quality loss function</td>
<td>4.1, 4.2</td>
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<td>5</td>
<td>Jan 20</td>
<td>NO CLASS. MLK Day: University closed.</td>
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<td>6</td>
<td>Jan 22</td>
<td>Introduction to design of experiments (DOE)</td>
<td>4.3</td>
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<td>7</td>
<td>Jan 27</td>
<td>DOE: Orthogonal arrays</td>
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<td>8</td>
<td>Feb 3</td>
<td>Conclude DOE</td>
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<td>9</td>
<td>Feb 5</td>
<td>Tolerance analysis (TA), linear</td>
<td>B8:7.7</td>
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<td>10</td>
<td>Feb 10</td>
<td>TA, nonlinear: Taylor series</td>
<td>A1, A2</td>
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<td>11</td>
<td>Feb 12</td>
<td>TA, nonlinear: simulation</td>
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<td>Feb 17</td>
<td>TA, nonlinear: discretization / orthogonal arrays</td>
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<td>Feb 19</td>
<td>Intro to Parameter Design (PD)</td>
<td>A5, A6</td>
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<td>14</td>
<td>Feb 24</td>
<td>PD: A nonlinear programming model</td>
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<td>15</td>
<td>Feb 26</td>
<td>PD: A case study</td>
<td>A5, A6</td>
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<td>16</td>
<td>Mar 3</td>
<td>PD: Design of Experiment</td>
<td>A7, A8</td>
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<td>17</td>
<td>Mar 5</td>
<td><strong>Midterm Exam</strong></td>
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<td><strong>March 10 through 14: Spring break. NO CLASSES.</strong></td>
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<td>Mar 17</td>
<td>Exam review</td>
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<td>Mar 19</td>
<td>Xbar-chart</td>
<td>5.1, 5.2</td>
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<td>20</td>
<td>Mar 24</td>
<td>Xbar-chart</td>
<td>5.2</td>
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<td>S-chart and R-chart</td>
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<td>Mar 31</td>
<td>p-chart and np-chart</td>
<td>5.4</td>
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<td>April 2</td>
<td>c-chart and u-chart</td>
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<td>24</td>
<td>April 7</td>
<td>Other control chart rules</td>
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<td>25</td>
<td>April 9</td>
<td>Single control chart plans</td>
<td>7.1, 7.2</td>
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<td>26</td>
<td>April 14</td>
<td>Single sampling plans</td>
<td>7.3</td>
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<td>27</td>
<td>April 16</td>
<td>Double and multiple sampling plans</td>
<td>7.4</td>
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<td>28</td>
<td>April 21</td>
<td>Sequential testing plans</td>
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<td>29</td>
<td>April 23</td>
<td>Review and concluding remarks</td>
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* Chapter and section numbers refer to the textbook unless specified otherwise.

**Final Exam:** Monday May 5, 2014, 8:00 – 11:00 a.m.