Course Description
Quality management is essential for a successful business that delivers products that meet or exceed customers’ expectations. It also forms the basis of an efficient business that minimizes waste and operates at high levels of productivity. While the application areas of quality control are typically thought of as being related to manufacturing, (including processes related to ordering, accounting, record keeping and customer satisfaction) principles of quality control and improvement are applicable to all types of service industries such as health care, education and software development. In this class, students will be exposed to contemporary applications of quality control and improvement in different sectors. We will cover statistical process control techniques such as control charts, and learn how to analyze process capability. We will also learn about the role of experiment design in quality improvement.

Course Objective
The main objective of this class is to develop and encourage quality consciousness among the students. The subjects covered will make students fluent in the language and techniques of modern quality control and its applications.

Topics Covered

<table>
<thead>
<tr>
<th>Topics</th>
<th>Weeks</th>
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<tbody>
<tr>
<td>• Introduction to Quality Control: Eight Dimensions of Quality</td>
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<tr>
<td>• Definition of Quality and Quality Improvement</td>
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<td>• Managerial Aspects of Quality Improvement and Supply Chain Quality</td>
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<tr>
<td>• Statistical Modeling of Process Quality</td>
<td>2-3</td>
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<td>• Discrete and Continuous Probability Distributions for Statistical Process Control</td>
<td>4-5</td>
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<tr>
<td>• Inferences about Process Quality</td>
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<td>• Sample Statistics and Sampling Distributions</td>
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<td>• The Central Limit Theorem</td>
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<td>• Review of Statistical Hypothesis Testing</td>
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<tr>
<td>• Statistical Process Control</td>
<td>6-7</td>
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<tr>
<td>• Chance and Assignable Causes of Variation</td>
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<td>• Introduction to Control Charts</td>
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<td>• Rational Subgrouping</td>
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<td>• Patterns on Control Charts and Sensitizing Rules</td>
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<td>• Control Charts for Variables</td>
<td>8-9</td>
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<tr>
<td>• Control Limits for Process Mean and Variation</td>
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<td>• Average Run Length</td>
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<td>• Control Charts for Individual Measurements</td>
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<td>• Control Charts for Attributes</td>
<td>10-11</td>
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<tr>
<td>• Control Limits for Number of Defects and Defects per Unit</td>
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<tr>
<td>• Differences between Attributes and Variable Control Charts</td>
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</table>
- Process and Measurement System Capability Analysis
- Measures of Gauge Capability
- Signal to Noise Ratio

- Experiment Design for Quality Improvement
- Factorial Experiment Design
- Analysis of Variance
- Residual Analysis
- Fractional Factorial Experiment Design

- Acceptance Sampling
- Case Study: The MotoTech Manufacturing Company: Process Control and Improvement

**Student Learning Outcomes:**
- Students will be able to identify challenges and opportunities related to quality control and improvement.
- Students will be able to identify and implement appropriate statistical process control tools to address quality control challenges.
- Students will be able to apply core statistical knowledge for analyzing samples collected for quality control.
- Students will be able to analyze process and gauge capability using appropriate metrics.
- Students will be familiar with basic acceptance sampling concepts for quality control.
- Students will be able to analyze the experiment results for quality improvement.
- Students will be able to describe technical results to senior managers and other stakeholders.

**Prerequisites**
Exposure to statistical concepts such as Regression and Statistical Inference will be helpful.

**Required Course Text**

**Recommended Text**

**Other readings**
There will be a few case studies to read for this class, these are freely available online and will also be made available via Moodle.

**Final Exam**
Your attendance at the final exam is required.

**Grade Determination**

<table>
<thead>
<tr>
<th>Type of assignment</th>
<th>%</th>
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<tr>
<td>In-Class Activities</td>
<td>5</td>
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<tr>
<td>HW</td>
<td>20</td>
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<tr>
<td>Projects (1)</td>
<td>20</td>
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<tr>
<td>Exams (2)</td>
<td>55</td>
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Using the overall weighted average accumulated on all assignments, exams, projects, quizzes, the final course grade will be determined as follows:

- $97 \leq A^+ \leq 100$
- $93 \leq A < 97$
- $90 \leq A^- < 93$
- $87 \leq B^+ < 90$
- $83 \leq B < 87$
- $80 \leq B^- < 83$
- $77 \leq C^+ < 80$
- $73 \leq C < 77$
- $70 \leq C^- < 73$
- $67 \leq D^+ < 70$
- $63 \leq D < 67$
- $60 \leq D^- < 63$
- $F < 60$

**Assignment Information**

In this course, the primary methods to determine each student’s mastery of the material will be homework, activities, projects and exams. Grading will be very particular on assignments so that careless mistakes are not overlooked; in this way you will not be surprised by the standards applied at project and exam time. Assignments are due at the time specified in person or via Moodle; any assignment received after its due date will be deducted 20% per day late.

**Academic Integrity Policy:**

Dishonesty is unfair to everyone, especially those who do their work honestly. Academic integrity will be fully prosecuted through the student conduct system. All work turned in with your name is assumed to be only your own work (including homework assignments and cases). If what you turn in duplicates others, then it is cheating (regardless of who copied who). Please review the Code of Student Conduct ([http://policies.ncsu.edu/policy/pol-11-35-01](http://policies.ncsu.edu/policy/pol-11-35-01)), if any academic misconduct is suspected I will follow due procedure. Your signature on any test or assignment indicates, "I have neither given nor received unauthorized aid on this test or assignment."

**Class Attendance**

Refer to [http://policies.ncsu.edu/regulation/reg-02-20-03](http://policies.ncsu.edu/regulation/reg-02-20-03). Attendance will not be explicitly collected to determine your grade. However, to receive grades for the in class participation and presentations you must be present.

**Pronoun Clause**

In an effort to affirm and respect the identities of transgender students in the classroom and beyond, please contact me if you wish to be referred to using a name and/or pronouns other than what is listed in the student directory.

**Accommodations for Disabilities**

Any student in this course, who has a disability which may prevent him/her from fully participating in class activities, should contact the instructor personally. Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with the Disability Resource Office at Holmes Hall, Suite 304, 2751 Cates Avenue, Campus Box 7509, 919-515-7653. For more information on NC State’s policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation (REG02.20.01). [https://policies.ncsu.edu/regulation/reg-02-20-01](https://policies.ncsu.edu/regulation/reg-02-20-01)

**Non-Discrimination Policy**

NC State University provides equality of opportunity in education and employment for all students and employees. Accordingly, NC State affirms its commitment to maintain a work environment for all employees and an academic environment for all students that is free from all forms of discrimination. Discrimination based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or
Sexual orientation is a violation of state and federal law and/or NC State University policy and will not be tolerated. Harassment of any person (either in the form of quid pro quo or creation of a hostile environment) based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation also is a violation of state and federal law and/or NC State University policy and will not be tolerated. Retaliation against any person who complains about discrimination is also prohibited. NC State's policies and regulations covering discrimination, harassment, and retaliation may be accessed at http://policies.ncsu.edu/policy/pol-04-25-05 or https://oied.ncsu.edu/equity/policies. Any person who feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact the Office for Institutional Equity and Diversity at 919-515-3148.

**Students in Stress/Distress**

As members of the NC State Wolfpack community, we each share a personal responsibility to express concern for one another and to ensure that this classroom and the campus as a whole remains a safe environment for learning. Occasionally, you may come across a fellow classmate whose personal behavior concerns or worries you. When this is the case, I would encourage you to report this behavior to the NC State Students of Concern website: http://studentsofconcern.ncsu.edu. Although you can report anonymously, it is preferred that you share your contact information so they can follow-up with you personally.

**Requirements for Credit-Only (S/U) Grading**

In order to receive a grade of S, students are required to take all exams and quizzes, complete all assignments, and earn a grade of C- or better. Conversion from letter grading to credit only (S/U) grading is subject to university deadlines. Refer to the Registration and Records calendar for deadlines related to grading. For more details, refer to http://policies.ncsu.edu/regulation/reg-02-20-15. Please note that courses at 500 level and above cannot be taken for credit only.

**Requirements for Auditors (AU)**

Information about and requirements for auditing a course can be found at: http://policies.ncsu.edu/regulation/reg-02-20-04.

**Policies on Incomplete Grades**

If an extended deadline is not authorized by the instructor or department, an unfinished incomplete grade will automatically change to an F after either (a) the end of the next regular semester in which the student is enrolled (not including summer sessions), or (b) the end of 12 months if the student is not enrolled, whichever is shorter. Incompletes that change to F will count as an attempted course on transcripts. The burden of fulfilling an incomplete grade is the responsibility of the student. The university policy on incomplete grades is located at http://policies.ncsu.edu/regulation/reg-02-50-3.

**Electronically Hosted Course Components**

Students may be required to disclose personally identifiable information to other students in the course, via electronic tools like email or web-postings, where relevant to the course. Examples include online discussions of class topics, and posting of student coursework. All students are expected to respect the privacy of each other by not sharing/using information outside the course.

**Class Evaluations**

Online class evaluations will be available for students to complete during the last two weeks of class. 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.
Polices, Regulations, and Rules (PRR): Students are responsible for reviewing the PRRs which pertain to their course rights and responsibilities. These include:

- http://oied.ncsu.edu/oied/policies.php (Office for Institutional Equity and Diversity)
- http://policies.ncsu.edu/regulation/reg-02-50-03 (Grades and Grade Point Average)
The Department strives to provide an environment conducive to learning and believes strongly in the Code of Student Conduct (POL 11.35.01). The portion below, extracted from POL 11.35.01, is specific to academic misconduct:

8 ACADEMIC MISCONDUCT
All members of the University community, students, faculty and other employees, have the responsibility to report academic misconduct to the appropriate authority. Faculty members must undertake a threshold responsibility for such traditional safeguards as examination security and proctoring and should clearly communicate their academic expectations in the course syllabus. The use of the Pack Pledge, “I have neither given nor received unauthorized aid on this test or assignment,” on all syllabi, assignments, examinations, or other academic evaluations is encouraged. Similarly, faculty members should familiarize themselves with the procedures for addressing academic misconduct. The procedures for reporting academic misconduct can be found in NCSU REG11.35.02 - Student Discipline Procedures.

Definitions regarding academic misconduct are set forth in writing in order to give students general notice of prohibited conduct. They should be read broadly and are not designed to define academic misconduct in exhaustive terms. If a student is in doubt regarding any matter relating to the standards of academic integrity in a given course or on a given assignment, that student must consult with the faculty member responsible for the course before presenting the work.

8.1 Aiding and Abetting
Aiding and abetting others to cheat or plagiarize is as detrimental to the scholarly community as engaging in the acts themselves. Aiding and abetting others to cheat or plagiarize includes, but is not limited to, the following:
(a) Giving unauthorized assistance to another or others during a test or evaluation;
(b) Posing as another student in order to meet a course or graduation requirement;
(c) Providing specific information about a recently given test, examination, or assignment to a student who thereby gains an unfair advantage in an academic evaluation;
(d) Providing aid to another person, knowing such aid is expressly prohibited by the faculty member, in the research, preparation, creation, writing, performing, or publication of work to be submitted for academic evaluation;
(e) Permitting one's academic work to be represented as the work of another; or
(f) Sharing or distributing academic materials, including class notes, in violation of the UNC Policy Manual 500.2 – Patent and Copyright Policies or NCSU REG01.25.02 – Copyright Infringement – Policy Statement.

8.2 Cheating
Cheating is the giving, taking, or presenting of information or material by a student that unethically or fraudulently aids oneself or another person on any work which is to be considered in the determination of a grade or the completion of academic requirements or the enhancement of that student's record or academic career. Cheating includes, but is not limited to, the following actions:
(a) Copying from someone else’s assignment, examination, or other academic exercise;
(b) Possessing, buying, selling, removing, receiving, or using, at any time or in any manner not prescribed by the faculty member, any information related to an instrument of academic evaluation;
(c) Using materials, equipment, or assistance in connection with an assignment, examination, or other academic exercise which have not been authorized by the faculty member, including but not limited to, notes, calculator, or other technology;
(d) Obtaining or attempting to obtain, in a dishonest manner, any material relating to a student's academic work;
(e) Working with another or others in completing an assignment, examination, or other academic exercise when the faculty member has required independent and unaided action;
(f) Attempting to influence or change an academic evaluation, grade, or record by unfair means;
(g) Permitting another individual to substitute for one's self in an academic evaluation;
(h) Marking or submitting an examination or evaluation material in a manner designed to deceive the grading system;
(i) Failing to comply with a specific condition of academic integrity, which has been clearly announced in a particular course;
(j) Submitting, without prior permission of the faculty member, any work by a student, which has at any time been submitted in identical or similar form, by that student in fulfillment of any other academic requirement at any institution;
(k) Submitting of material in whole or part for academic evaluation that has been prepared by another individual(s);
(l) Submitting data which have been altered or contrived in such a way as to be deliberately misleading; or
(m) Providing false information to the University in any manner to achieve an unfair advantage, enhance one’s record, or complete a requirement.

8.3 Destruction or Removal of Academic Materials
The destruction or removal of academic materials denies access to, and prevents the ability to develop the full potential of, scholarly resources. Prohibited acts under this section include, but are not limited to, the following:
(a) Removing or attempting to remove, destroy, steal, or make inaccessible library or other academic material without authorization; or
(b) Willfully damaging the academic work or efforts of another.

8.4 Plagiarism
Plagiarism is the use or close imitation of the language and thoughts of another and the representation of the other’s work as their own. The act of submitting work for evaluation or to meet a requirement is regarded as assurance that the work is the result of the student's own thought and study, produced without assistance, and stated in that student's own words, except as quotation marks, references, or footnotes acknowledge the use of other sources. Any ideas or materials taken from another source for either written or oral use must be fully and correctly acknowledged. Submission of work used previously must first be approved by the faculty member. Plagiarism includes, but is not limited, to the following actions:
(a) Representing the work of others as his or her own; or
(b) Submitting written materials without proper attribution or acknowledgment of the source.

I have read, understand, and agree to abide by the Code of Student Conduct.

Name (Printed)  Signature  Date