

**INDUSTRIAL QUALITY CONTROL
IE330, SPRING 2021**

COURSE INFORMATION

Designated Class Times: TuTh 9:30-10:50AM

Credit Hours: 3 hours

Course Websites: <https://compass2g.illinois.edu> (primary course website)
<https://www.gradscope.com/> (submitting assignments, see “Assignment Policies” for more details)

Instructor: Douglas M. King, Ph.D. (dmking@illinois.edu)

Office Hour*: TBD (to be held via Zoom)

* - Office hours may also be available by appointment (please arrange by email, providing at least 24-hours of advance notice)

Textbook: "Introduction to Statistical Quality Control" (7th Edition) by Douglas C. Montgomery [US Version]

Prerequisites: IE300 (required)

Course Type (ISE): Selected Elective (IE Curriculum)

Course Description: This course is intended to be an introduction to and survey of statistical methods for industrial quality control. A student should complete this course with the ability to understand both the statistical foundations of quality control methods and the procedures for successfully applying them in practice.

Learning Outcomes: Following the completion of this course, students should be able to...

- (¹⁻⁷: ABET outcomes)
- ...connect concepts of quality control to previous coursework in probability and statistics ¹
 - ...construct and interpret statistical process control charts ^{1,4}
 - ...quantify process capability based on observed data ^{1,4}
 - ...conduct a designed experiment to quantify influence of controllable parameters on critical outputs ^{1,4}
 - ...apply outcomes from a designed experiment to improve process performance ^{1,4}
 - ...apply appropriate acceptance sampling procedures ^{1,4}

COURSE STRUCTURE AND POLICIES

OVERVIEW: Synchronous vs. Asynchronous

While much of the content for this course will be delivered asynchronously, some course activities must be completed synchronously, and other activities are available (though not required) synchronously. Currently, the following synchronous activities are planned:

- **Required Synchronous Activities:** Midterm Exam, and Final Exam
- **Optional Synchronous Activities:** Informal Discussion Office Hours

Lecture Content: What to expect each week...

- **Weekly Lecture Videos (Asynchronous):** Lecture videos will be recorded asynchronously, and will be posted in the “Lecture Videos” folder on Compass so you can watch them at a time that is convenient for you during the week. The lecture videos for each week should be available by the beginning of the first scheduled class time of the week, but videos may be added during the week if necessary.
- **Informal Discussion Office Hours (Synchronous):** Since the scheduled office hour takes place during designated class time, each week’s scheduled office hour can be treated as an informal discussion period (i.e., no specific material will be planned beforehand) where all students are welcome to attend and ask questions about the course content and other topics related to industrial quality control. If warranted, this office hour may be replaced on some occasions by a more structured Q&A session with pre-planned topics and materials with the goals of (1) discussing any questions you have about course content in a “live” setting, (2) presenting and discussing the solutions to example problems suggested by students, and (3) presenting interesting extensions of course content. Before each such Q&A session, you will be able to suggest topics for discussion, so the structure of the Q&A can be adapted to best reflect student interests. The dates of these synchronous sessions will be announced in advance, and will be held via Zoom.

Course Announcements and Interaction Opportunities: Though we will not be meeting on campus, you have a number of ways to interact with the course staff and with your fellow students, and to ask course policy questions to course staff. Course announcements will also be made throughout the semester to keep you apprised of key milestones, deadlines, and requirements for the course.

- **Compass Announcements:** The Announcements page on Compass will be your primary source for critical course-related announcements (e.g., exam dates, course policy updates, changes in course deadlines). You are responsible for being aware of these announcements; checking at least once each business day is recommended to ensure prompt notification, and to avoid missing any announcements or deadlines.
- **Discussion Board:** A discussion board will be available on Compass. The discussion board will be monitored by course staff; students are encouraged to discuss their questions among each other.
- **Office Hours:** For discussion of course content in a synchronous environment (i.e., outside of the discussion board). The office hour schedule is posted at the beginning of this syllabus; office hours may also be available by appointment.

- **Email:** For student-specific questions (e.g., grade-related), particularly outside of office hours.
- **NOTE – Student-Specific Questions:** During the course, you may have questions specifically related to your personal circumstances or grades. To maintain the confidentiality of this information, please ask these questions via email to course staff, or in an individual appointment with course staff. To preserve the confidentiality of your personal information, course staff will not respond to these questions in publicly-accessible environments (e.g., on the discussion board, during scheduled office hours).

Attendance: While much of the course content can be accessed under a flexible asynchronous schedule, it is expected that you will keep up with the course as it progresses. This includes watching lecture videos in the week that they are assigned, completing homework assignments by their deadlines, taking exams according to their (synchronous) schedule, and so forth. If you anticipate an extended and unavoidable period where you will be unable to access or participate in the course, or unavoidable absences during critical course meetings (e.g., exams), please alert the instructor as soon as possible if you believe that course-related accommodations beyond those provided in this syllabus are necessary and justified. Such cases will be considered on a case-by-case basis and will require additional University documentation (including, but not limited to, an absence letter from the Office of the Dean of Students).

Access to Electronic Materials: Access to electronic recordings used in this course is offered only for students enrolled in the course via the posted platforms, and only for the duration of the course. Recording or storing recordings of any course materials, including lectures, discussions, or other activities is forbidden. Sharing recorded material or posting it online is also forbidden. Any violation of these policies will be forwarded to the Office of Student Conflict Resolution for disciplinary action.

GRADING AND POLICIES

Grades will be based on the following:	Exams (two – midterm and final)	75%	(45% and 30%, see “Exam Policies”)
	Homework assignments	20%	
	Quizzes	5%	

Exam Policies (Midterm and Final):

- **Schedule:** Exam dates will be announced on Compass. The midterm exam will be scheduled to take place during designated class time, and the final exam will be scheduled according to University guidelines. **Exams will need to be taken synchronously according to the designated schedule.** Please plan ahead to be available during the exams.
- **Internet Reliability:** Exams will be taken through Compass, and will require an Internet connection. To the greatest extent possible, please make arrangements to have access to a reliable Internet connection during exams. If you lose your Internet connection during an exam, we will do our best to allow you to resume your exam, but your exam clock will continue to run while you are logged out, and we cannot guarantee that you will be able to resume your exam.
- **Absences and Other Issues:** To ensure that student performance is assessed uniformly, make-up exams are only offered in rare circumstances. Students who have an unavoidable, University-approved, and documented reason to be absent during the midterm exam will have their final exam score replace it when determining course grades. Make-up final examinations are only offered if required by University policy, or a student has made arrangements with their college to receive an “I” (Incomplete) grade in the course. Other missed examinations will receive a grade of zero. Please notify the instructor as early as possible if you believe you will need to take a make-up final exam; make-up exam arrangements will be made on a case-by-case basis. To accommodate extraordinary and unavoidable circumstances that may arise and negatively impact exam performance (e.g., illness, personal emergency, Internet connectivity issues), students who take both exams will have their better exam score weighted more heavily when determining their final course grade; the better exam score will count for 45% of their course grade and the lower exam score will count for 30% of their course grade.
- **Allowed materials:** The exams are open-book and open-notes. Calculators are allowed. Accessing other electronic resources (e.g., websites and other Internet resources) is not permitted during exams, other than referencing electronic documents posted by course staff to the Compass site and accessing your own personal electronic notes. Contacting or otherwise consulting with other people during an exam is not permitted.
- **Regrades:** If you believe that an error has been made while grading your exam, please alert the instructor via email within one week after the exam scores are posted. This email must include detailed rationale for why you believe additional credit is justified. This rationale should be as specific as possible, and refer to specific errors that were made in the grading. Requests with insufficient rationale may be disregarded. No regrade requests will be accepted after the one-week deadline has passed.

Quiz/Participation Policies: Quizzes will be held to assess student engagement in the course and understanding of course topics.

- **Schedule:** Quiz dates may or may not be announced in advance. Unless specifically announced ahead of time, quizzes will be posted only on regularly-scheduled class days, by the beginning of the designated lecture time; quizzes will be available for a minimum of 24 hours after they are posted, and you will need to start the quiz during that span.
- **Platform:** Quizzes will be held on Compass, and will be posted in the “Quizzes” folder when they are available. Quizzes may also be held via other platforms; you will be informed in advance if any other platforms will be used.
- **Quiz duration:** Most quizzes will be timed, and the duration of each timed quiz will be shown before you begin the quiz; the duration of each timed quiz will typically be 10-20 minutes.
- **Absences: Make-up quizzes are not offered.** Any student who misses a quiz will receive a grade of zero. To accommodate unavoidable absences that may occur during the semester, each student’s lowest quiz score will be dropped.

- **Allowed materials:** The quizzes are open-book and open-notes. Calculators are allowed. Calculators are allowed. Accessing other electronic resources (e.g., websites and other Internet resources) is not permitted during quizzes, other than referencing electronic documents posted by course staff to the Compass site and accessing your own personal electronic notes. Contacting or otherwise consulting with other people during a quiz is not permitted.

Assignment Policies:

- **Schedule:** Roughly five homework assignments will be collected throughout the semester. Due dates will be posted on Compass; you will have approximately one week to complete each assignment.
- **Platform/Submission:** Assignments will be submitted via Gradescope. Instructions for how to submit homework assignments will be provided. Please follow these instructions carefully! **Late submissions will not be accepted!** Each student's lowest homework assignment score will be dropped.
- **Access to Gradescope:** Students will be added to the Gradescope roster after the first week of classes; an announcement will be made on Compass once the roster has been added. If you add the course after that time, or find that you do not have access to the course's Gradescope site by the end of the second week of classes, please contact the instructor as soon as possible.
- **Regrades:** After each assignment is returned, there will be a one-week period when regrade requests will be permitted. These requests must be made via Gradescope, and must include detailed rationale for why you believe additional credit is justified. This rationale should be as specific as possible, and refer to specific errors that were made in the grading; for example, if there is evidence that some of your work may have been missed or misinterpreted by the grader, and you did not receive credit for work that you completed. Requests with insufficient rationale may be disregarded. No regrade requests will be accepted after the one-week deadline has passed.
- **Assignment Groups:** You may submit assignments in groups of up to three students, with the following restrictions:
 - (a) Groups must submit a group agreement form before the deadline. Details will be available on Compass.
 - (b) Once a group has been formed, no new members can join that group.
 - (c) Each group must turn in one assignment; all group members will receive the same grade for the assignment.
 - (d) If you are a member of a group, you may decide to leave that group, but you cannot join another group (i.e., you must complete all future assignments on your own). You must notify the group members of your current group before leaving.

Computation Policies (Assignments/Exams/Quizzes): For computational questions on exams and quizzes, please report your final numerical answer; provide at least four significant digits, to ensure that your work can be properly assessed. On homework assignments, please simplify any computations to a final numerical answer; show all of your work to demonstrate your understanding of course content and allow for partial credit to be assessed.

Academic Integrity: It is expected that your exams and quizzes will contain only your own work, and that your assignments will contain only the work of your group. Any student who misrepresents their work in an exam or quiz, or group who misrepresents their work on an assignment, will receive a grade of zero on that exam, quiz, or assignment; other sanctions may also be pursued, as allowed by University policy. Any homework assignment, quiz, or exam on which an academic integrity infraction has occurred cannot be dropped or replaced when computing a student's final course grade.

ADDITIONAL CAMPUS POLICIES

Disability-Related Accommodations: All reasonable accommodations required for students with disabilities will be offered, as ensured by Article 1, Part 1 of the Student Code. Documentation of accommodations from the Division of Disability Resources and Educational Services (DRES) must be provided before accommodations are offered. Please provide this documentation to the instructor by the end of the first week of class to ensure that accommodations can be offered in a timely manner. If documentation is provided after this time, they will be made available as soon as is practical, but may be delayed by several weeks from the time of the request. If you are concerned you have a disability-related condition that is impacting your academic progress, there are academic screening appointments available that can help diagnose a previously undiagnosed disability. You may access these by visiting the DRES website (<https://www.disability.illinois.edu/>) and selecting "Request an Academic Screening" at the bottom of the page.

Religious Observances: Illinois law requires the University to reasonably accommodate its students' religious beliefs, observances, and practices in regard to admissions, class attendance, and the scheduling of examinations and work requirements. You should examine this syllabus at the beginning of the semester for potential conflicts between course deadlines and any of your religious observances. If a conflict exists, you should notify your instructor of the conflict and follow the procedure at <https://odos.illinois.edu/community-of-care/resources/students/religious-observances/> to request appropriate accommodations. This should be done in the first two weeks of classes, or within one week of any course deadlines announced after the second week of class.

Sexual Misconduct Reporting Obligation: The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University's Title IX Office. In turn, an individual with the Title IX Office will provide information about rights and options, including accommodations, support services, the campus disciplinary process, and law enforcement options. A list of the designated University employees who, as counselors, confidential advisors, and medical professionals, do not have this reporting responsibility and can maintain confidentiality, can be found here: wecare.illinois.edu/resources/students/#confidential

Other information about resources and reporting is available here: wecare.illinois.edu

Family Educational Rights and Privacy Act (FERPA): Any student who has suppressed their directory information pursuant to Family Educational Rights and Privacy Act (FERPA) should self-identify to the instructor to ensure protection of the privacy of their attendance in this course. See <https://registrar.illinois.edu/academic-records/ferpa/> for more information on FERPA.

TENTATIVE LIST OF TOPICS

Introduction to quality control

- Introduction and definitions
- Historical perspectives (e.g., Deming, Taguchi)
- Review of critical statistical concepts

Statistical process control

- General structure of process control charts
- Connection to hypothesis testing
- Rational subgrouping and sample size selection
- Control charts for variables (e.g., \bar{x} and R , \bar{x} and S)
- Control charts for attributes (p , np , c , u)
- Process capability (C_p , C_{pk})
- Cumulative sum charts

Design of experiments

- Goals and general structure of designed experiments
- Analysis of Variance (ANOVA)
- Factorial experiments
- Interpretation of outcomes from designed experiments
- Fractional factorial experiments (time permitting)

Acceptance Sampling

NOTE: The policies contained in this syllabus are subject to change. Any such changes will be posted on Compass.