San José State University
Department of Mechanical Engineering
ME 283 Manufacturing Process Control, Section 01, Fall 2022

Course and Contact Information

Class Days and Time:	Tuesdays and Thursdays 4:30 PM to 5:45 PM
Classroom:	ENG 401
Registration Codes:	47680, 3 units
Prerequisites:	BSME or instructor consent
Instructor:	Sang-Joon (John) Lee
Email:	sang-joon.lee@sjsu.edu
Telephone:	408-924-7167
Office Location:	Online only (link posted in Canvas)
Office Hours:	Mondays and Wednesdays 10:30 AM to 11:30 AM and by appointment

Course Format

All regular class meetings are in-person, but the class will also require use of the Canvas learning management system (LMS), accessed via https://sjsu.instructure.com/. Successful completion of course requirements necessitates accessing the course website frequently. Technical support for Canvas is available at http://www.sjsu.edu/ecampus/. Important communications regarding this class may be sent via Canvas or to student email addresses listed in MySJSU, and thus each student is expected to maintain up-to-date contact information in both systems.

Course Description: https://catalog.sjsu.edu/preview_course_nopop.php?catoid=13&coid=118473

Develops general concepts for control of manufacturing processes. The concepts of and tools for process modeling, process optimization and process control. Emphasizes the integrated approach combining statistical process control (SPC) and automatic process control.

Course Learning Outcomes

Upon successful completion of this course, students will be able to:

1. Explain the significance and benefits for controlling variability as a fundamental goal in manufacturing process control.
2. Identify specific controllable parameters, measurable variables, and disturbance sources for specific manufacturing processes.
3. Apply tools from design-of-experiments, in particular factorial design, analysis-of-variance, regression models, and response surfaces.
4. Apply tools from statistical process control, in particular control charts for process monitoring.
5. Apply knowledge of manufacturing processes to tools of automatic process control, including transfer functions, feedback loops, and discrete process control.
6. Select and justify a strategy as well as a set of tools for reducing variability in a given manufacturing process..

Required Textbooks

Introduction to Statistical Quality Control, 8th edition, by D. C. Montgomery. Published by John Wiley & Sons, 2020: https://www.wiley.com/en-us/Introduction+to+Statistical+Quality+Control%2C+8th+Edition-p-9781119399308.

Software Requirements

The software most highly recommended for this course is Google Colab https://colab.research.google.com/, using Python. No prior Python experience is assumed. An alternative Python environment such as Jupyter Notebook https://jupyter.org/ is also effective. It is also possible to complete many assignments using MATLAB https://www.mathworks.com/, Minitab https://www.minitab.com/, JMP https://www.jmp.com/, or even spreadsheets (Google Sheets or Microsoft Excel). Simulink https://www.mathworks.com/products/simulink.html (via campus license) will also be used to a limited extent.

Library Resources

The engineering librarian as listed at https://library.sjsu.edu/staff-directory/subject-librarians can provide faculty and students with research instruction and resources, as needed, in person and online through the library website http://library.sjsu.edu/. Research guides http://libguides.sjsu.edu/ are accessible for departments and subject areas, including a guide specific to mechanical engineering at http://libguides.sjsu.edu/me.

Course Requirements and Assignments

University policies relevant to syllabi are posted at https://www.sjsu.edu/curriculum/courses/syllabus-info.php. As stated, "Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally 3 hours per unit per week with 1 of the hours used for lecture) for instruction or preparation/studying or course related activities including but not limited to internships, labs, clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus."

- Participation Tasks: Throughout the semester there will be several participation tasks to promote active engagement. Specific examples may include assigned discussion posts, surveys, progress updates, and peer review. These will be tallied for credit with strict deadlines and there are no make-up options.
- Checkpoint Quizzes: Short online quizzes will be used to checkpoint baseline knowledge and concepts that are relatively common for engineering statistics, statistical process control, and design-of-experiments. These quizzes permit use of any available source (books, notes, online resources), but must be done strictly individually. Collaboration on any of these quizzes is cheating and will be reported as academic dishonesty.
- Homework (HW): Routine homework will be assigned at least five days before each respective deadline. Collaboration among classmates on strategies and cross-checking intermediate values is welcome. However, all homework must still be freshly prepared and submitted individually. Raw copying of software code, solutions or copy/paste use of figures is cheating and will be reported as academic dishonesty. Homework will be graded not only on correctness but also on clarity and professionalism of written and visual communication.
- Projects: There are two projects in the course. Both are open-ended and team-based. Specific requirements and expectations are detailed in separate documentation for each project.

Grading Information

The course grade is calculated from a weighted sum of all graded components as follows:
15% for Participation Tasks
15% for Checkpoint Quizzes
20% for Homework
20% for Statistical Process Control (SPC) Project
30% for Design-of-Experiments (DoE) Project

The overall course grade is calculated from a weighted sum of all graded components. Graded percentage points correspond to letter grade as follows:
93.0-100 A | 90.0-92.9 A- | 87.0-89.9 B+ | 83.0-86.9 B | 80.0-82.9 B- | 77.0-79.9 C+ | 73.0-76.9 C | 70.0-72.9 C- 67.0-69.9 D+ | 63.0-66.9 D | 60.0-62.9 D- | 0-59.9 F

When individual assignments or projects are graded on a letter-grade basis, numerical conversions are as follows:
A+ 100 | A 95 | A- 91.5 | B+ 88.5 | B 85 | B- 81.5 | C+ 78.5 | C 75 | C- 71.5 | D 65

While specific criteria for any given assignment may differ, common expectations for all assignments are (1) completeness, (2) correctness, (3) clarity, and (4) compliance. Grades below D would earn scores between 60 and zero, depending on partial merits along these criteria. The grade of A+ is rare, generally earned for work that is not only excellent along all criteria, but furthermore *best-in-class* and usable as an exemplary model for peers to emulate.

Assignment Submission: All graded assignments must be submitted using the designated assignment tool in the Canvas course shell. Assignments will not be accepted over email.

Team Assignments and Peer Grading: Team assignments will be used for some portions of the course, and some assignments may involve peer grading. Alternative options will be considered for compelling reasons, but arrangements must be pre-approved in writing with ample time before corresponding deadlines (i.e. several days in advance).

Late Policy: Unless otherwise specified for a particular assignment, work that is submitted late will be accepted with reduced credit according to a depreciation rate of 1.5% for each late hour breached. Exams, however, are strictly limited to designated times; late exams are not accepted.

Exceptions: Any grading appeals or petitions must be communicated promptly in writing (or email). Exceptions will normally be evaluated at the very end of the semester in context with an individual's overall semester track record and all other exceptions class-wide. Special consideration for truly unavoidable and extenuating circumstances will depend on timeliness and supporting documentation (e.g., doctor's note, police report).

University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/ .

Free Equipment Loan

Students are required to have an electronic device (laptop, desktop or tablet) with a camera and built-in microphone. SJSU has a free equipment loan program available for students. https://www.sjsu.edu/learnanywhere/equipment/

Recording Policy

Students are prohibited from recording class activities, distributing class recordings, or posting class recordings. Materials created by the instructor for the course (lectures and lecture notes, presentations, etc.) are copyrighted by the instructor. This university policy https://www.sjsu.edu/senate/docs/S12-7.pdf is in place to protect the privacy of students in the course, as well as to maintain academic integrity through reducing the instances of cheating. Students who record, distribute, or post these materials will be referred to the Student Conduct and Ethical Development office. Unauthorized recording may violate university and state law. It is the responsibility of students that require special accommodations or assistive technology due to a disability to notify the instructor.

Course Schedule

This schedule is a tentative plan, subject to change with fair notice via announcement in class or notification via Canvas.

Dates and Planned Topics	**Tentative and approximate deadlines**
8/23 Course introduction 8/25 Variability and distributions	
8/30 Statistical inference 9/1 Statistical inference	
9/6 Significance and power 9/8 Statistical process control (SPC) overview	HW1 statistical inference due 9/5
9/13 Control charts (Shewhart) 9/15 Control charts (individuals and moving averages)	
9/20 Control charts (cumulative sums) 9/22 Control charts (exponential weighting)	HW2 control charts due 9/19
9/27 Uncertainty analysis 9/29 Gauge repeatability and reproducibility (R&R)	HW3 weighted control charts due 9/26
10/4 Design-of-experiments (DoE) overview 10/6 Factorial design and factor effects	
10/11 **SPC Project presentations** 10/13 **SPC Project presentations**	**SPC Project** video due 10/10
10/18 *DoE Project launch* 10/20 Fractional factorials	
10/25 Analysis of variance (ANOVA) 10/27 Post-hoc analysis	HW4 factorial design due 10/24
11/1 Regression modeling 11/3 Response surfaces	
11/8 Robustness 11/10 Automatic process control (APC) overview	HW5 regression and response surfaces due 11/7
11/15 Classical feedback control (review) 11/17 Digital feedback control (introductory)	
11/22 Run-by-run control 11/24 *Thanksgiving holiday (no class)*	**DoE Project** draft video due 11/21
11/29 Discrete process control simulation 12/1 Discrete process control simulation	
12/6 *DoE Project working time*	HW6 feedback adjustment due 12/5 **DoE Project** final video due 12/7

The Final Exam period will be used for presentation and peer evaluation of the DoE Project. The session will be held online on **Thursday, December 8th, from 2:45 PM to 5:00 PM**, according to the university-designated dates and times posted at https://www.sjsu.edu/classes/final-exam-schedule/fall-2022.php.