

## ISyE 6405 Syllabus

Statistical Methods for Manufacturing Design/Improvement, Section A, 3 Credits  
Fall, 2026

### Instructor Information

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### General Course Information

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#### Description

This course covers statistical methods and their applications in design and improvement in manufacturing and service systems. The focus will be given to monitoring, diagnosis, and control of various complex systems. Detailed procedures and interpretations for advanced quality control and data analysis methodologies will be discussed. Emphasis will be given on the integration of engineering domain knowledge with data analysis techniques. Specifically, it focuses on three topics: (1) advanced control charts, (2) multivariate statistics, data dimension reduction and interpretation, (3) time series modeling, forecasting and control. Some special topics, such as the frontiers in quality improvement research, machine learning enabled quality control in manufacturing, and variation modeling and analysis for multistage systems are also presented. The goal for students is to understand the concepts, operations, applications, and roles of these techniques. Methods discussed will find themselves in a broad spectrum of applications, including manufacturing systems, health care delivery, as well as service industry. Real case studies and examples from various applications will be discussed throughout the course.

#### Tentative Course Topics

Module 1: Basics of Change Detection and Statistical Process Control

- Review of basic statistics and statistical process control (SPC)
- Risk-adjusted control charts and its application in health care

Module 2: Multivariate Statistics Change Detection and Analysis

- Multivariate statistics and multivariate change detection ( $T^2$ , multivariate CUSUM and EWMA)
- Principal Component Analysis and Variation Reduction with applications

Module 3: Time Series Modeling, Analysis and Control

- Time series modeling, analysis, and forecasting
- Predictive control and integration of SPC and APC

Module 4: Additional Advanced Research Topics

- Advanced topics of data analytics with applications in smart manufacturing
- Machine learning enabled quality improvements

#### Required Course Materials

NONE (course pack/handout will be posted on Canvas)

#### Grading Policy:

Homework (as assigned), 20%; Exam 1, 25%; Exam 2, 25%; Term Project, 30%

A>90; B>80; C>70; D>60

### Assignments

Homework	(as assigned)	20%
Exam 1	(Oct. 13, 2026, Tuesday)	25%
Exam 2	(Dec 1, 2026, Tuesday)	25%
Term Project	(report due: Dec 4; presentations: Dec 3 & Dec. 8, 2026)	30%

## Description of Graded Components

### 1. Homework

We will have 4-5 homework assignments, consisting of conceptually, theoretically, and computationally oriented problems. All homework submission should be submitted through the canvas system, and no hard copy is accepted. You should not read, review, or reference the homework problems from previous semesters. You are expected to observe the **Georgia Tech Honor Code** in the preparation of their solutions. You may discuss the problem assignments with other students. However, each student must work independently on the assigned problems and the preparation of the submitted solution. The specified due dates must be strictly observed.

You are also expected to observe the **Georgia Tech Honor Code** throughout the course. The related information can be found at

- Honor Code: <http://osi.gatech.edu/content/honor-code>
- Disability Services: <http://disabilityservices.gatech.edu>

### 2. Exam

- Two exams are given in class on the dates listed in this syllabus. Each exam is 1 hour and 15 minutes total. Exam I covers the first half of teaching material, and Exam II covers the 2<sup>nd</sup> half of teaching material (e.g. not accumulative in the 2<sup>nd</sup> exam).
- The exam will be closed book and closed notes. Students are allowed to have one double-sided sheet note for exam I, and two double-sided sheets of equations for exam II. A calculator is needed for each exam.
- No make-up exams will be given unless prior arrangement is made with the instructor (with written documentation BEFORE the exam, e.g., a note from Dean's office).

### 3. Project

Throughout the semester, each student will also work on a project. The topic of the project will be defined on the basis of the students' interests and must be approved by the instructor. In general, the selected topics should extend the class experience by researching further some of the material presented in class. The developed results will be presented in the class and shared with the rest of the class. Finally, group projects are also possible, provided that the research topic undertaken justifies the size of the group.

Detailed information about the group project can be found on Canvas. Here are some important dates:

- Determine Group Members: Friday **September 25, 2026** at 11:59 pm ET
- Abstract: Friday **Oct. 30, 2026** at 11:59 pm ET
- Report due: Friday **Dec 4, 2026** at 11:59 pm ET
- Presentations: **Dec 3 & Dec.8, 2026**

### 4. Regrade requests:

- **Regrade requests** for assignments must be **within 5 working days** of when you received the grade/feedback. Only **written** complaints (Email “**Regrade Form ISYE 6405**” to Instructor and TA) will be accepted.
- **Mode of regrade request:** If there is a regrade request, we will have written exchange first. If necessary, in person discussion will be followed, determined by the grader.
- **Looking to improve your grade:** If you are working hard in this course but feel that your assignment grades do not reflect your work, please come to see the TA and the Instructor first. If you cannot make office hours, or they seem too busy, email the TA to make an appointment for another time. You may be spending a lot of time on the wrong things and redirecting your efforts may really pay off.

## 5. Further notes on Grading/Assignments

- There will be 4-5 homework assignments for modules 1, 2 and 3.
- The term project is a **multi-week endeavor** – please make sure to complete small milestones each week, so you don't fall behind and need to rush at the end.
- There will be no extra assignments to bump up your grade.
- There will be two exams. All exams are in class, and there will be no make-up exams. Only absences approved by the Division of Student Life, or Dean of Students, or official approval from the registrar are valid excuses for missing an exam and you will be given a make-up exam.

**Academic Honor Code:** It is your responsibility to get familiar with the Georgia Tech Honor Code and you are bound by its requirements.

## Course Policies

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### Attendance

Attendance of classes is required unless with prior approval of absence with justified reasons. A sign-up sheet may be used to check the attendance.

### Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor.

Students are expected to act according to the highest ethical standards. Review [Georgia Tech's Honor Code](#) and the student [Code of Conduct](#).

Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

### Core IMPACTS

[Core IMPACTS](#) is the University System of Georgia's General Education curriculum. If you are teaching a course that counts towards Core IMPACTS, you should include a syllabus statement about the Core area and associated [career competencies](#). [This resource](#) developed by the Center for Excellence in Teaching and Learning and Online Education at Georgia State University includes template syllabus statements for each of the Core IMPACTS areas that you may adapt for your course.

**Accommodation for Students with Disabilities**

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

**Student-Faculty Expectations Agreement**

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

**Pre- &/or Co-Requisites**

- Linear Algebra or Matrix Algebra
- Knowledge of hypothesis testing, likelihood function, and linear regression

**Collaboration, Group Work, and Use of Generative AI**

You are allowed to work in groups on all homework and out-of-class assignments, but any work you turn in must be written in your own hand. In-class quizzes and exams are to be your own work. All in-class exams will be closed book and notes, but allowed with equation summary sheets (one-page for exam 1 and two-page for exam 2).

**Extensions, Late Assignments, & Re-Scheduled/Missed Exams**

No late homework will be allowed without prior approval. Make-up exams are given for illness, approved Institute activities or religious observances.