ISYE 4112 Syllabus

Workflow Design: Manufacturing & Service Systems, Section A, 3 Credits

Spring 2027

Instructor Information

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General Course Information

Description

Manufacturing and distribution of goods and services are critical to the economy and to societal well-being. These activities are enabled by networks of facilities that perform value-added activities. In this course, we study the design and operation of such facilities, for example manufacturing, service, and warehouse facilities. We characterize these as discrete flow systems. Topics of interest include material and information flow, cycle time, throughput, utilization, bottlenecks, capacity, queueing, variability, buffers, push vs. pull systems, planning and scheduling, lot-sizing, warehouse operations, material handling, and order picking.

Course Learning Outcomes

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

1) Describe the factors and performance measures related to workflows in manufacturing and service systems;
2) Apply mathematical models to coordinate the deployment and allocation of resources such as labor, inventory, space, equipment, and capital towards the satisfaction of the demand and any additionally posed constraints;
3) Decompose systems into smaller units of analysis and use these and their interactions to determine overall system performance;
4) Characterize variability and how it affects system performance;
5) Distinguish between exact solutions and approximations, articulate assumptions behind approximations, and provide qualitative descriptions of approximation errors;

6) Apply flow modeling to warehouses and distribution centers to assess performance;
7) Use analytics, optimization, database, and productivity software tools in solving practical operational problems;
8) Utilize course concepts and methods to formulate and solve real problems in manufacturing and service systems such as those found in senior design projects and in your future career.

Required Course Materials

Textbook: The course uses a free Ebook available on Canvas.

- *Workflow in Production and Service Systems by Bodner, Li, Williams & Zhou*

Reference materials: The following sources may be useful as references. Earlier editions of the first two books are fine.

- *Factory Physics, 3rd Edition, by Hopp & Spearman*
- *Production and Operations Analysis, 8th Edition, by Nahmias & Olsen*
- *Warehouse Science: https://www.warehouse-science.com/*

Course Website: The course website on Canvas will be used extensively throughout the semester for distributions of various materials that will include the syllabus, course schedule, lecture slides, assignments, and announcements. This site will be continually updated, so make sure you check it frequently.

Sharing course information with anyone not currently enrolled in this class is strictly prohibited.

Grading Policy

Each student will have an opportunity to earn a total of 400 points towards their final course grade (if grade components are added, deleted, or modified, the points will be adjusted accordingly). The final course grade will be computed based on the following components:

- Midterms (2, each worth 100 points), 50%
- Final Exam (100 points), 25%
- Review Exercises (3, each worth 15 points), 11.25%
- Course Project (35 points), 8.75%
- Participation Quizzes (10, each worth 2 points), 5%

Grade/minimum points required: A/360; B/320; C/280; D/240

Description of Graded Components

- *Midterms (200 points) and the Final Exam (100 points)*

Exams are individual efforts. There will be three exams: two midterms and a final exam, each worth 100 points. The exams are not designed to be cumulative, but it should be clear that the materials covered later in the semester rely on materials covered earlier in the semester. The two midterms are in-class tests during the semester. The final exam is 2.5 hours long and it is conducted during the institute's final exam period. There will be no makeup for any exams, except for institute approved absences.

All exams are closed-books, closed-notes, paper-based exams. One standard-size (A4) handwritten crib sheet (single-sided) is allowed at each exam. Printouts from electronic devices are not considered handwritten.

Students are responsible for bringing a calculator to all exams. Calculators must be computation-only devices with no internet capability. Cell phones may not be used as calculators. Calculators with power functions and storage registers are strongly recommended.

- *Review Exercises (45 points)*

The primary purpose of the review exercises (REs) is to strengthen students' understanding of course concepts and skills and to help them prepare for exams. The exercises are designed to familiarize students with the types of questions and level of difficulty they may encounter on exams, making the exams more predictable and manageable.

There will be three REs, each worth 15 points and covering material from approximately six class sessions. REs are individual assignments. Each RE submission must include three components, each worth five points. The three components are designed to guide students through independent problem-solving, AI-assisted review and revision, and self-grading and reflection.

Component 1: Independent Work. Provide your own answers to all questions without assistance from AI-based tools.

Component 2: AI-Assisted Review and Revision. Consult generative AI (GenAI) tools to review your answers, identify potential mistakes, and improve your understanding. Present any revised answers resulting from these consultations, along with the name of the GenAI tool and a list of the prompts you used. You are not required to use GenAI for every question, or at all. If you choose not to use GenAI for some or all questions, state that in this component.

Component 3: Self-Grading and Reflection. Compare both your original and revised answers, if applicable, with the instructor's solutions and determine whether you have answered each question correctly. For any incorrect answers, identify the root causes of the mistakes and provide corrected answers. If all your answers are consistent with the instructor's solutions, state that in this component. In addition, reflect on the role of GenAI, if used, in helping you reach the correct answers, including its contributions and limitations.

Grading: Points are awarded for completing the required activities in each component, rather than for the correctness of the answers. However, points may be deducted for inconsistencies, misrepresentation of work, or academic dishonesty, including inaccurate reporting of GenAI use.

Submission Policy: Submissions are via File Uploads on Canvas. Links to documents hosted on third-party platforms are not acceptable submissions. Late submissions will be accepted until 11:00 p.m. on the last day of instruction (April 26, 2027). Each late submission will incur a one-point deduction per day after the due date, up to a maximum deduction of ten points.

- *Course Project (35 points)*

Students will form teams of up to four members to complete a project involving important "inside-the-facility" process design tasks for a hypothetical firm operating a manufacturing facility and a factory distribution center (FDC). The project has three grading components, as described below.

Component 1 (8 points): In-class development and submission of proposed solution approaches for Tasks 1–4. Teams should complete this component without GenAI assistance.

Component 2 (9 points): In-class development and submission of proposed solution approaches for Tasks 5 and 6. Teams should complete this component without GenAI assistance.

Component 3 (18 points): Online submission of the complete project report. Present your final solution approaches and numerical answers for all six tasks. You are encouraged to consult GenAI tools to verify your solution approaches and answers, but you do not have to. If you use GenAI, include the name of the GenAI tool and a list of the prompts used in your project report.

Grading: Each component will be graded based on the accuracy of the required solution approaches and numerical answers, as applicable. Components 1 and 2 will be graded and returned to students in the class following their submission. Students are expected to use the feedback received on Components 1 and 2 to improve their solutions in the final project report.

Submission Policy: Components 1 and 2 are in-class teamwork requiring paper-based submissions. Component 3 must be submitted via File Uploads on Canvas.

- *Participation Quizzes (20 points)*

Ten participation quizzes, each worth two points, will be given in class on random dates, and they are due at the end of those classes. Their purpose is to encourage active learning and enhance problem solving skills. These quizzes are graded based on participation, not accuracy. Late submissions will not be accepted, except for institute approved absences.

Course Policies

Attendance and/or Participation

This is an in-person course. It has been shown that for most students, in-person attendance provides the best learning experience. Students are expected to attend the classes. Feel free to ask questions in class. You will receive the benefit of answers to questions asked by others in class. Keep in mind that participation quizzes are graded class activities. You are responsible for all materials presented in class, plus class discussions thereof.

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.

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-Requisites

ISyE 2028/3030 – Basic Statistical Methods; ISyE 3232 – Stochastic Manufacturing & Service Systems; ISyE 3133 – Engineering Optimization (with concurrency)

Makeup Exams due to Excused Absences

Please inform the instructor of your approved absences and discuss the time of the makeup exams in a timely manner. We only accept notifications from Dean's office or institute Approved Absences with the link to the on-line request form below: https://registrar.gatech.edu/info/institute-approved-absence-form-for-students.

Grade Appeals

Grade appeals should be presented in writing within one week after the grades are released. A grade appeal may result in the entire exam or assignment being regraded.

Student Use of Mobile Devices in the Classroom

Cell phone, tablet and/or computer use is permitted in class only if you are using the device to take notes or participate in a class activity.

Inclement Conditions

Campus closures or opening delays may occur due to inclement conditions. Exam dates and assignment due dates may be modified if, in the instructor's judgment, conditions impair successful student learning and performance.