

IE 553 Facility Design and Analysis Spring 2023-24

Instructor : Bülent Çatay (FENS 1058)

Office Hour : W 15:00–16:00

Lectures : T 13:40–16:30 (FENS L061)

Objectives:

Facilities planning and design is the process of locating and laying out of new industrial and service facilities and revising or expanding old facilities, while respecting constraints on resources. In this course we will address both the layout and the location of facilities. As part of the layout we will consider the arrangement of departments within a manufacturing or service facility, focusing on mathematical programming modeling. We will also consider the theory, application methods, and techniques that are needed to successfully model, analyze, and present a proposed location for single and multiple facilities. We will develop and employ both exact and approximate methods to solve problems arising in facilities planning, and implement computerized applications. The course is designed for graduate students who have a solid background in mathematical programming. Proficiency in a programming language (C, C++, C#, Java, Python as such) and CPLEX/GUROBI is required, familiarity with (meta)heuristics is strongly recommended.

Learning Outcomes:

- Identify and state advanced concepts in facilities design.
- State mathematical models and advanced algorithms for facility layout and location problems.
- Develop her/his own heuristic and meta-heuristic algorithms to efficiently solve layout and location problems.
- Utilize optimization tools and layout software.
- Formulate facilities design problems and solve facilities design-related decision problems using operations research methods.
- Investigate modelling and algorithmic solution approaches to difficult facilities design problems.
- Read, analyze, and present technical papers.
- Work independently in solving challenging facility layout and location problems.

Textbook:

Facilities Design, 5th edition. S. Heragu. CRC Press, 2022. [TS177 .H47 2022] (eBook available online at the Information Center)

Additional References:

Manufacturing Facilities: Location, Planning, and Design. D.R. Sule. PWS Pub. Co., Boston, 1994. [TS177 .S85 1994]

Facility Layout and Location: An Analytical Approach. R.L. Francis, et al. Prentice-Hall, Inc., Englewood Cliffs, N.J., 1992. [TS178 .F73 1992]

Tentative Course Outline:

- Introduction and Review (Ch. 1, 4)
- Models for the Layout Problem (Ch. 7)
- Basic Algorithms for the Layout Problem (Ch. 5)
- Advanced Algorithms for the Layout Problem (Ch. 8)
- Group Technology (Ch. 6)
- Basic Models for the Location Problem (Ch. 11)
- Advanced Location and Routing Models (Ch. 12)

Grading Policy:

40% Exam + 10% Presentations + 20% Project + 10% Term Paper + 20% Homework

Exam: A single comprehensive exam will be given in class, closed book/notes. A make-up exam will be offered after the final exams period to those who missed the exam and have a medical report provided/approved by the Health Center.

Project: A term project will be conducted individually throughout the semester. The project involves the development and implementation of a methodological/algorithmic approach to solve one of the problems discussed in the course or selected from the relevant literature. The topic will be assigned by the instructor. The implementation will be through a programming language (C/C++/C#/Java/Python) and optimization solver (CPLEX, GUROBI). The outcome of the project will be a short paper, which will be presented in class.

Presentations: Each student will make two presentations throughout the semester. The topic will be determined by the instructor and the content will include technical papers from the relevant literature, subject to the approval of the instructor.

Assignments: The purpose of the assignments is to encourage you to study in an organized method and to let you gain some insight into the strength and limitations of the techniques discussed in the lectures. The assignments are expected to be turned in on the due date.

Disclaimer:

The instructor reserves the right, when necessary, to alter the grading policy, change exam dates, and modify the syllabus and course content. Modifications will be announced in class and at the SU Course website. Students are responsible for the announced changes.

Academic Integrity:

Students in this course are expected to honor the academic integrity principles according to the SU rules and procedures. Non-compliance to [academic integrity](#) principles through plagiarism, using or accomplishing another person's work, and/or submitting previously used work will be penalized severely.