# ENS 208
# Introduction to Industrial Engineering

## Course Syllabus – Spring 2023-2024

**Instructor**

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Office Hours:         Tuesdays 11:00-12:30

**Teaching Assistants**

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Saeedeh Ahmadi Basir (saeedeh@sabanciuniv.edu), **Online** Office Hours: Tuesdays 14:40 to 15:30 (Zoom Link)

**Learning Assistants**

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**Course Schedule & Sections**

**Section A:**

    Lectures:

        M 2:40 PM - 4:30 PM (FASS 1076-1078), W 10:40 AM - 11:30 AM (FASS 1076-1078)

    Recitations:

        F 2:40 PM - 3:30 PM (FASS 1076-1078)

**Section B:**

    Lectures:

        M 9:40 AM - 11:30 AM (FASS 1076-1078), W 2:40 PM - 3:30 PM (FASS 1076-1078)

    Recitations:

        F 3:40 PM - 4:30 PM (FASS 1076-1078)

**Objectives & Learning Outcomes**

The objective of the course is to take you on a journey on set problems and case studies that modern Industrial Engineers are involved within real life. Upon completing this course, you will be able to

- o implement algorithms for business problems that can be depicted as analytical/mathematical problems,
- o develop mathematical models in the form of linear programming problem formulations and solve these problems with (commercial) solvers,
- o comprehend how variation and randomness in life/observations can be depicted with functions,
- o establish the link between industrial engineering and required professional skills,
- o identify IE problems that you can attack, formulate, and solve,
- o familiarize yourself with the industrial engineering profession.

## Recommend or Required Reading

There is no specific textbook for ENS 208. We will have lecture notes, reading materials, book chapters, case ("real life") documents, and coding tutorials. All course materials will be available on SUCourse.

## Grading

| | |
|---|---|
| In-class Exercises | 15% |
| Midterm Exam 1 | 25% |
| Midterm Exam 2 | 25% |
| Final Exam | 35% |
| Total | 100% |

- o **The instructor might adjust this grading scheme if necessary (please see the Disclaimer).**

## Attendance

- o It is required that the students **attend the classes with a computer** (via which an algorithm can be texted and run properly, and the outputs can be uploaded to a designated site). **Students without a functional computer shall not be admitted to the sessions.**
- o **You are expected to attend the sections to which you are registered to.**
- o We want students to explain their thoughts and recommendations clearly and engage in constructive discussions with others.
- o Each student's class participation (i.e., comments, questions, answers, discussions with other students, etc.) will be graded.
- o Rules for attendance: **classroom practice contributes to 15% of the final grade.**
- o Please e-mail the TAs if you will miss (or have missed) a class session with a valid reason. The TAs will keep track of the in-class participation records.

## Exams

- o Two Midterm Exams and one Final Exam.

## To receive a passing letter grade:

- o You are required to take a minimum of "**25**" from the **Final Exam** (this is a necessary condition, not a sufficient condition).

## Make-up Exam Policy

- o You have to have a valid reason for not taking an exam. If proof such as a medical report is not brought to us before or within the first three days of the exams, you will NOT be given a make-up exam and will be assumed to score **ZERO** in the missed exam.
- o A **comprehensive make-up exam** will be offered after the final exam to those who have missed a midterm or the final exam.
- o If you miss multiple exams, the remaining grades will be "**ZERO**" regardless of your excuse.

## Computational Part

- o We use Python (https://www.python.org/), the programming language in the freshman year course IF 100 Computational Approaches to Problem-Solving.
- o We utilize "*anaconda,*" which is known as the "most popular" and easy-to-use Python data science *platform*. It may be downloaded from the following URL: https://www.anaconda.com/download. **NOTE:** There should be no Turkish alphabet-specific characters in the directory path name where you are trying to install Anaconda.
- o It is highly recommended that each student recollect their fundamentals about Python before the first lecture.

**Academic Integrity and Conduct:**

Each student in this course is expected to abide by the Sabanci University Academic Integrity Statement (available at http://www.sabanciuniv.edu/en/academic-integrity-statement) and to behave properly against the instructors and the teaching assistants. The violations of the integrity principles and any disrespect toward course assistants will not be tolerated.

**Course (Tentative) Outline:**

| Week | Topic | Week | Topic |
|------|-------|------|-------|
| 1 | Syllabus Review and Course Introduction Shortest Path Problem | 8 | Linear Programming<br>- Multi-Plant Production Model<br>   o Optimal Allocation of Raw Material<br>   o Demand Satisfaction |
| 2 | Traveling Salesman Problem<br>- Nearest Neighborhood Algorithm | 9 | Linear Programming<br>- Type of Decision Variables<br>- Multi-Period Production Planning |
| 3 | Traveling Salesman Problem<br>- Savings Heuristic | 10 | Linear Programming<br>- Lot Sizing Problem |
| 4 | Traveling Salesman Problem<br>- 2-Opt Heuristic<br>Vehicle Routing Problem | 11 | Review<br>**Midterm Exam 2 (Sunday 12 May, 15:00)** |
| 5 | Vehicle Routing Problem<br>- Heuristics (RFCS, CFRS) | 12 | Randomness and Distributions - Review<br>Newsvendor problem |
| 6 | Review<br>**Midterm Exam 1 (Saturday 30 March, 12:00)** | 13 | Newsvendor problem<br>- Optimal Order Quantity<br>Time series |
| 7 | Linear Programming<br>- Production Planning<br>- Graphical Solution Method | 14 | Time Series<br>- De-trending (Regression)<br>- De-seasonalizing |

**Disclaimer:**

The instructors reserve the right to alter the grading policy, change examination dates, and modify the syllabus and course content when necessary. Modifications will be announced in class and via SUCourse. Students are responsible for keeping up with the announced changes.