Welcome to IE579 Fall 2024 class

Classes: M, Aug. 19, 2024 – F Dec. 6, 2024

Class Website: BrightSpace (abbreviated: Bs)

Instructor: Professor Shimon Y. Nof (nof@purdue.edu) *Office*: GRIS 243

PRISM Center (Production, Robotics, and Integration Software for Manufacturing & Management) https://engineering.purdue.edu/~prism

Office hours: Open door policy - Anytime by email - Online meetings by appointment.

TAs: TBD -- Office hours posted on Bs.

Class related e-mail: We will respond to your emails promptly. To prevent getting it lost in spam mail, please send all class related email to BOTH instructor and TAs;

- Begin the subject line with [IE579]

Lectures: MWF 2:30-3:20 PM WANG 2599 **Web:** purdue.brightspace.com

Course Objectives and Learning Outcomes – After taking this course, students will be able to design and achieve cost-effective, competitive and sustainable production, mfg. and supply systems and factories of the future, by applying analytic models of their operations and flow.

Course Description: To achieve cost-effective and sustainable production, mfg., and supply systems, in the age of cyber-physical systems, AI and robotics, this course focuses on the engineering fundamentals affecting the performance of such systems operations. We learn models and techniques that enable you to design and control them effectively and competitively.

Course Topics:

Supply and inventory control and optimization - EOQ model, dynamic lot-sizing, dynamic lot-sizing in supply chains/networks, news vendor model, base stock model, (R,Q) and (s,S) models; Learning models; Digital twins.

Queuing flow analysis - M/M/1, M/M/s, M/M/s/k, M/G/1, G/M/1, multi-class queues, queuing networks, approximations.

Scheduling, systems collaboration, and supply decision networks - Cyber physical, AI, and robotics in manufacturing, production and supply systems; Disruption handling and control, design for resilience and sustainability.

Pre-requisites: Basic concepts of production, statistics, and optimization.

Textbook: No textbook required. Five optional reference books:

1. Hopp and Spearman, "*Factory Physics*," McGraw-Hill, 2008 or later.
2. Nof, Ceroni, Jeong, and Moghaddam, "*Revolutionizing Collaboration through e-Work, e-Business, and e-Service*," Springer ACES Series, 2015.
3. Reyes Levalle, "*Resilience by Teaming in Supply Chains and Networks*," Springer ACES Series, 2018.
4. Nahmias and Olsen, "*Production & Operations Analytics*," 8th Ed., Waveland Press, 2021, or later.
5. Russell and Taylor, "*Operations and Supply Chain Management*," 11th Ed., Wiley, 2023.

[2, 3 are available as online books in Purdue library.]

Class Notes: Class notes will be posted on Bs usually before the class.

Homework: Approximately 5 assignments will be posted on Bs. **Only Gradescope submissions will be graded. Do NOT submit through Bs.**

Exams: Two exams (in class; open books and notes): W 10/9/24; F 11/22/24; Project in lieu of final exam.

Project: Develop and write a research report as a team, on either one of four options:

Models and algorithms optimizing the design and control of collaborative automation in either: (1) Mfg., OR (2) Production and Supply, applying either:

(A) AMR, autonomous mobile robots/drones; OR (B) DT, digital twins.

Projects must integrate application of models learned in our course and from articles.

Students will work in teams including off- and on-campus students. This project involves a formal technical report and presentation. The minimum project requirement is a conceptual design supported by literature reviews and model analyses. Further details will be defined early in the semester. Develop your project in two phases [due dates will be defined]:

1. *Proposal*: Introduction of the model(s) / Problem to be solved / Articles review and analysis.
2. *Report*: The three previous sections improved / Analytic methodology / Experiments, results and analytic observations / Analyses graphs and evaluation / Conclusions.

- Teams will submit pre-recorded video presentations by all students of their project.
- **Submit project reports on Gradescope; video presentations -- on Bs.**
- The best projects will be presented in class by the project teams, and debated by all of us.

Grading: HW (25%); Exams 2 x (25%); Project (25%). Grading on a relative curve; no +/-.

Honor Pledge

"As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable as individuals and together - we are Purdue." Each student will sign this pledge in our first assignment.

Copyright of class materials

All posted, recorded, or videotaped class materials, presentations, and discussions are the intellectual property of Purdue University and the instructor. As students enrolled in this class you are provided with them during the semester for the sole purpose of your learning. You are legally not allowed to transfer these materials, presentations, and discussions to any outlet, nor share them with anybody not enrolled in our class.

Use of AI tools in our class

We are all encouraged to learn AI tools and use them in this class. But remember: Students and staff are responsible for developing **knowledge, critical skills, ethics and values** to be successful in our careers. This development requires work that AI cannot do for us.

See other University Policies and Services information posted on Bs.

Our course motto:

Models Help us Think Better and Design for a Better Future.