

New course proposal

Process optimization and scheduling

Teacher

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Gruppo Scientifico Disciplinare: 09/ICHI-01 – Sistemi, metodi e tecnologie dell'Ingegneria Chimica e di Processo

Tentative starting date

Academic year 2025-2026

Objectives, methods, target skills and knowledge

The aim of the course is providing to the students the basic techniques for formulating and solving an optimization problem related to process engineering. The main topics of the course may be related with optimal process engineering design, optimal usage of the resources in manufacturing industries, selection of an optimal production process, planning and scheduling multistage process operations, scheduling multi-product batch processes in an optimal fashion, optimization of dynamic systems, investment portfolio planning and optimization of process profitability in terms of capital cost.

The students will learn:

- how to formulate an optimization problem, identify the decision variables and define the objective functions and constraints;
- how to solve an optimization problem through: algorithms of direct search and with derivatives; linear and quadratic programming; global optimization; dynamic programming;
- how to solve scheduling problems for: batch and continuous processes; sequence-dependent changeovers; storage limitations; multi-product plants; campaigns planning; maintenance interventions; multi-product plants; supply-chain optimization.

Motivating examples will comprise: refinery scheduling; pharmaceutical production planning; chemical supply chain optimization; batch process scheduling in food industry; energy systems optimization.

At the end of the course, the student will be able to formulate and solve a problem of process optimization and scheduling.

Planned learning activities, teaching methods, and learning strategies

- Classroom and on-line lecturing;
- Computational laboratory with Minitab and Solo;
- Slides and videos of the lectures available in Moodle;

- Case studies;
- Working in group;
- Auto correcting quizzes or tests for periodic feedback;
- Active quizzes for concept verification tests;
- Class discussions;
- Flipped lecturing.

Sustainable development goals

- Quality education;
- Industry, innovation and infrastructure;
- Responsible consumption and production.

Examination methods

Final written exam.

Textbooks

- Grossmann “Advanced optimization for process systems engineering” Cambridge University press
- Maraveilas “Chemical Production Scheduling: mixed-integers programming and methods” Cambridge university Press
- Edgar, Himmelblau, Lasdon “Optimization of chemical processes” McGraw-Hill
- Biegler “Nonlinear programming” SIAM
- Rardin “Optimization in operation research” Pearson 2017

Software and applications

Matlab.