Fakultät für Ingenieurwesen
Facoltà di Ingegneria
Faculty of Engineering

COURSE DESCRIPTION – ACADEMIC YEAR 2023/2024

Course Title	**Operations Research (OR)**
Course Code	42150
Scientific sector	MAT/09
Degree	Bachelor in Industrial and Mechanical Engineering (L-9)
Semester	2
Year	2
Credits	6
Modular	No

Total Lecturing Hours	40
Total Lab Hours	20
Attendance	Recommended
Prerequisites	The students should be familiar with the basic concepts of linear algebra and calculus.
Course page	-----

Specific Educational Objectives	The course mainly aims to acquaint students with mathematical modelling and analysis of the real-world decisions-making problems, algorithmic tools for finding optimal solutions of the models, as well as the popular OR softwares. At the end of the course, the students are expected to be able to formulate a practical decisions-making problem in the framework of a linear (integer) programming model, suggest appropriate algorithms for solving the model, find an optimal solution of the model by a software, and finally, conduct the post-optimal analysis.

Lecturer	Saman Babaie–Kafaki https://www.unibz.it/en/faculties/engineering/academic-staff/person/48578-saman-babaiekafaki
Contact	Faculty of Engineering, Free University of Bozen-Bolzano, Piazza Università 5, 39100 Bolzano, Italy
Scientific Sector of Lecturer	Mathematics
Teaching language	English
Office Hours	-----
Lecturing Assistant	-----
Contact LA	-----
Office Hours LA	-----
List of Topics	1. Preliminaries of the linear algebra and algorithmic 2. Linear programming: modelling 3. Linear programming: geometric interpretations 4. Linear programming: the simplex algorithm 5. Linear programming: duality and sensitivity analysis 6. Transportation and assignment models 7. Network flow problems 8. Integer programming: modelling 9. Integer programming: algorithms 10. Dynamic programming 11. Heuristic algorithms 12. Goal Programming 13. Nonlinear programming
Teaching Format	Lectures + Exercices + Software Lab

Learning Outcomes	**Knowledge and Understanding:** ▪ Knowledge of the main concepts of the OR ▪ Understanding of the analytical origins of the OR algorithms ▪ Knowledge of the OR applications in science and engineering **Applying Knowledge and Understanding:** ▪ Ability to formulate some real-world problems in the framework of the linear (integer) programming models ▪ Ability to deal with some problems in the practical fields such as transportation, network flows and supply chain management **Making Judgments:** ▪ Ability to evaluate reliability of the linear (integer) programming models ▪ Ability to assess efficiency of the OR algorithms **Communication Skills:** ▪ Ability to interpret different parts of the well-known OR models ▪ Ability to analyse complexity and performance of the OR algorithms ▪ Ability to conduct post-optimal analysis **Learning Skills:** ▪ Ability to design heuristic algorithms for high-dimensional complex OR models ▪ Ability to design (use) software to solve the practical OR models

Assessment	Formative and Summative Assessments
Assessment Language	English
Assessment Typology	-----
Evaluation Criteria and Criteria for Awarding Marks	Written Exam: 60% 'Oral Exam + Software Skills' [or] 'Real-World Project + Report (Oral & Written)': 20% Exercises: 20%

Required Readings	- Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, *Linear Programming and Network Flows*, 4th Edition, Wiley, 2010.
Supplementary Readings	- Hamdy A. Taha, *Operations Research: An Introduction*, 10th Edition, Pearson, 2021. - Dimitris Bertsimas and John N. Tsitsiklis, *Introduction to Linear Optimization*, Athena Scientific, 1977.
Software	TORA + MATLAB