Syllabus
Course description

Course title	Planning and Simulation of Production and Logistics Systems
Course code	47543
Scientific sector	ING-IND/17 (Modul 1) + ING-IND/16 (Modul 2)
Degree	Master in Industrial Mechanical Engineering
Semester	2
Year	I
Academic year	2020/21
Credits	10 (5+5)
Modular	Yes

Total lecturing hours	Modul 1 - 32 hrs, Modul 2 - 20 hrs
Total lab hours	Modul 1 – 12 hrs, Modul 2 – 30 hrs
Total exercise hours	
Attendance	Extremely recommended
Prerequisites	none
Course page	http://www.unibz.it/en/sciencetechnology/progs/master/industrial-and-mechanical-engineering/default.html

Specific educational objectives	The course belongs to the class of characterizing courses in the Master in Industrial Mechanical Engineering. It aims at teaching both scientific foundations and practical methods and helps to develop specific professional skills. Module 1 (Design and Planning of Logistics Systems) provides students with an understanding of the theoretical knowledge and the practical skills needed to approach the configuration and management of an integrated supply chain. Module 2 (Simulation in Production and Logistics), provides the basics in simulation methodologies and professional skills in the application simulation software and tools. In addition to theoretical models and methods the use of specific simulation software in the production environment is treated by means of exercises and practical case studies in the computer lab. In the lab hours students will learn to model, simulate and analyze production and logistics problems with simulation software.

Module 1	Design and Planning of Logistics Systems
Lecturer	Prof. Ferretti Ivan
Teaching language	English
Office hours	See on timetable
Teaching assistant (if any)	None
Office hours	/

List of topics covered	The course covers the following topics: 1) Supply chains: the main trends: the long tail; servitization; circular economy & reverse logistics; digital technologies. The main choices: make vs. buy; n° of tiers; degree of parallelization; centralization vs. decentralization; facility location; facility dimensioning; n° choice of technology & automation level. 2) Supply chains configuration: value proposition configuration; distribution networks design; production networks design; supply networks design. 3) Supply chain performances and costs: the level of service, definition and measure. Supply chain costs, definition and measure. Cost vs. service trade-offs. 4) The sales and operations planning process: rationale, scope, objectives, activities, costs, levers, constraints, KPIs 5) Demand planning & forecasting: demand characterization; independent & dependent demand; forecasting; forecasting accuracy; overview of forecasting models; demand planning process; KPIs 6) Inventory & distribution planning: stocks and their functions; safety stock and cycle stock; order decoupling point and demand fulfillment approaches; centralized stock & dependent system; distributed stock & independent system; overview of main models; parameters setting.
Teaching format	Traditional frontal lectures Guided numerical exercises solution Autonomous Industrial cases discussion

Module 2	Simulation in Production and Logistics
Lecturer	For lectures: Dr.-Ing. Dipl.-Wirt.-Ing. Erwin Rauch Room: Smart Mini Factory Rosministrasse 7 39100 Bozen T: +39 0471 017111 F: +39 0471 017009 erwin.rauch@unibz.it For exercises with simulation software: Dr. Rafael A. Rojas Room: Smart Mini Factory Via Rosmini 7 39100 Bozen rafael.rojas@unibz.it
Scientific sector of the lecturer	ING-IND/16
Teaching language	English

Office hours	By appointment
Teaching assistant (if any)	none
Office hours	/
List of topics covered	The course covers the following topics: Lecture: 1. Introduction and Digital Factory Modelling 2. Fundamentals of simulation modelling 3. Principles, methods and procedures for implementing simulation studies 4. Fields of application for simulation 5. Software tools for simulation 6. Building Information Modelling 7. VR and AR for Planning of Production and Logistic Systems 8. Factory simulation and the internet of things in times of industry 4.0 9. Simulation of Human-Machine Interaction with Siemens Tecnomatix Process Simulate Laboratory: 1. Introduction to FlexSim 2. Data analysis and distributions 3. Case study modelling (production plant and logistics/warehouse modelling) 4. Advanced Features and Virtual Reality Practice
Teaching format	Frontal lectures and exercises in computer lab

Learning outcomes	Knowledge and understanding Module 1: The students knows the main theoretical foundations of modern supply chain configuration & management, specifically regarding how to configure, plan and control a supply chain. Module 2: The student knows the basics of simulation modelling, the current methods and tools for simulation and computer integrated solving of complex logistics and production problems. Applying knowledge and understanding The student applies and practices theoretical contents through exercises, case studies and project work. Theory contents are practiced through exercises using practical examples. In Module 1 the students learn how to apply their theoretical understanding to real cases through guided numerical exercises and autonomous case studies discussion. In Module 2 the students develop independently a simulation model for given case studies out from the production and logistics environment such as material flow analysis, capacity analysis or 3D visualization as well

as bottleneck analysis in the computer lab. Presentation techniques are trained using equipment such as flipcharts and power point presentations.

Making judgements
Module 1: In the case studies, students work in small groups and put to practice their judgment on which hypotheses to apply, how to analyze data, which methods or models to use, and how to apply them.
Module 2: Depending on the problem, the student can judge the use of appropriate methods, models and systems for simulation and problem solving. He is also able to judge and interpret simulation results and to define measures for optimization.

Communication skills
Ability to structure, prepare and present scientific and technical documentation describing project activities and to discuss them with decision-makers. The student can make professional discussions on simulation techniques and tools and is able to structure, present and argue professional content through analog (flipchart) and digital (PowerPoint, simulation software) media. The students are encouraged to present, discuss and support their results through power point presentations.

Learning skills
Module 1: Students will learn the theoretical part from traditional frontal lectures; they will develop quantitative skills by practicing numerical exercises with the teacher's guidance; they will develop problem-solving abilities by autonomously discussing real case studies.
Module 2: The student learns both by frontal teaching (theory part) as well as by exercises in the classroom and in the computer lab (practical exercises). The student is able to enlarge his knowledge through self-study and consultation of scientific and technical texts. Ability to autonomously extend the knowledge acquired during the study course by reading and understanding scientific and technical documentation.

Assessment	Module 1: Knowledge and understanding: written/oral exam Applying knowledge and understanding: group work Making judgements: group work Communication skills: group work Learning skills: group work, written/oral exam Module 2: Knowledge and understanding: written exam Applying knowledge and understanding: assignments in lab exercises

	Making judgements: assignments in lab exercises Communication skills: presentation of results of lab exercises Learning skills: lab exercises, written/oral exam Written exam means exam with review questions and exercises. Assignments in lab exercises means: case study work and subsequent presentation of the results.
Assessment language	English

Evaluation criteria and criteria for awarding marks	Final single grade by arithmetic average of the grade in Module 1 and Module 2.
	
	Module 1: The evaluation of students learning will follow a curricular method. It will be done through a combination of these factors:
	  – group work results (40%)
	  – final written / oral examination (60%)
	
	Module 2: The grade is calculated 50% from the results of the written exam and 50% from the results of the project work performed in the computer lab with simulation software.
	Criteria for the evaluation of the written examination: completeness and correctness of the answers.
	Criteria for the evaluation of the project work / case study: accuracy and completeness as well as creativity in structuring of the proposed solution, the quality of the results and quality of presentation.
	
	In case a written exam cannot be held due to "force majeure" such as COVID-19 restrictions, the course responsible reserve the right to hold an oral exam with digital communication platforms instead of the written exam.

Required readings	Lecture notes and documents for exercise will be available on the reserve collections
Supplementary readings	**Applied simulation: modeling and analysis using FlexSim** M. Beaversotck, A. Greenwood, W. Nordgren 2017 ISBN : 978-0-9832319-7-4 Available in the unibz library for students of this course Bozen-Bolzano University Library 14-Reference Collection ST 341 F34 B386