Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

Syllabus
Course description

Course title	Planning and Simulation of Production and Logistics Systems
Course code	47515
Scientific sector	ING-IND/17 (Module 1) + ING-IND/16 (Module 2)
Degree	**Master in Industrial Mechanical Engineering**
Semester	2
Year	*I*
Academic year	2018/19
Credits	10 (5+5)
Modular	*Yes*

Total lecturing hours	Module 1 - 32 hrs, Module 2 - 20 hrs
Total lab hours	Module 1 – 12 hrs, Module 2 – 30 hrs
Total exercise hours	
Attendance	Extremely recommended
Prerequisites	none
Course page	https://www.unibz.it/en/faculties/sciencetechnology/master-industrial-mechanical-engineering/

Specific educational objectives	*The course belongs to the class of characterizing courses for the curricula "Logistics and Production" of 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 (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	Planning of Logistics Systems
Lecturer	External lecturer – to be defined

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. 7) Industry 4.0. and the digital supply chain: WMS and warehouse automation. Supply Chain information systems. Geo-localization & transportation automation. Identification, and tracking & tracing systems.
Teaching format	*The topics are presented by the professor by means of Power Point presentations or the blackboard.* *Practical parts and lab activities/exercises are planned in form of guided numerical exercises and discussion of industrial cases.* *A selection of the material presented in class as well as online resources and useful material will be available in the course reserve collection database.* *Further deepening material will be supplied or recommended by the teacher.*

Module 2	Simulation in Production and Logistics
Lecturer	For lectures: Dr.-Ing. Dipl.-Wirt.-Ing. Erwin Rauch Raum: SER BZ K3.01

	Universitätsplatz 5 39100 Bozen T: +39 0471 017111 F: +39 0471 017009 erwin.rauch@unibz.it For exercises in the computer lab: Dr. Rafael Rojas Smart Mini Factory Lab Rosministrasse 7 39100 Bozen
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 5. Development of dynamic simulation models using Flexsim 6. Building Information Modelling 7. Virtual and Augmented Reality for Planning of Production and Logistic Systems 8. Factory simulation and the internet of things in times of industry 4.0 Laboratory: 1. Introduction to FlexSim 2. Data analysis and distributions 3. Case study modelling (production plant and logistics/warehouse modelling) 4. Advanced features and VR-practice
Teaching format	*The topics are presented by the professor by means of Power Point presentations or the blackboard.* *Practical parts and lab activities/exercises are planned in form of modelling and simulation of logistics and production systems and VR-AR demonstrations in the Smart Mini Factory learning factory laboratory.* *A selection of the material presented in class as well as online resources and useful material will be available in the course reserve collection database.*

	Further deepening material will be supplied or recommended by the teacher.

Learning outcomes	1- 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, in the realm of modern servitized, circular and digitized industry. 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. 2 - 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 learns 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. 3 - 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. 4 - 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. 5 - 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	*Formative assessment* *In class and laboratory exercises and activities (2,3,4,5)* *Summative assessment* *The assessment of the course is:* • *Written exam.* *Written exam with exercises and questions to test the ability to use and transfer the acquired knowledge as well as to make judgement and use a proper technical language (1,2,3,4).* *Group work (module 1) or lab assignments (module 2) and subsequent presentation of results with case studies on the course topics and on the lab-exercises activities (1-5).*
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 following criteria are relevant for the assessment: 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. Module 2 - the following criteria are relevant for the assessment: 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.

Required readings	*Lecture notes and documents for exercise will be available on the reserve collections* *There is no single textbook that covers the entire course. The course material is collected from various sources that will be announced during the course.* *A selection of the material presented in class and useful material will be available in the course reserve collection database*	
Supplementary readings	Books and articles will be suggested by the teacher during the course	