Syllabus

Course Description

Course Title	Factory and plant planning
Course Code	42180
Course Title Additional	
Scientific-Disciplinary Sector	IIND-05/A
Language	German
Degree Course	Bachelor in Industrial and Mechanical Engineering
Other Degree Courses (Loaned)	
Lecturers	Prof. Patrick Dallasega, Patrick.Dallasega@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/33073
Teaching Assistant	
Semester	Second semester
Course Year/s	3
CP	8
Teaching Hours	50
Lab Hours	30
Individual Study Hours	120
Planned Office Hours	24
Contents Summary	- Factory site planning; - Digital factory planning; - Layout and space planning; - Investment decisions; - Plant and equipment maintenance; - Project based learning by using: visTable®, Virtual Reality, BIM.
Course Topics	1. Introduction a) Structure and content of the lecture b) Introduction to factory planning c) Definitions and fundamentals

	2. Site planning a) Structure of logistics systems (supply networks) b) Choice of production sites c) Valuation methods for location decisions (cost-benefit analysis, break-even analysis) 3. Layout and space planning a) Planning steps in structural planning b) The process and phases of layout planning c) Overview of layout types d) Innovative algorithms for computer-aided layout planning (CRAFT, CORELAP, ALDEP) e) The "Hollier" methods 1 and 2 f) Space requirements of machines and workforces g) Short introduction to the planning of service layouts h) Case studies and exercises 4. Investment decisions a) Depreciation of machines/plants b) Calculation of the contribution margin c) Payback method d) Return On Investment (ROI) e) Net Present Value method (NPV) f) Internal Rate of Return method (IRR) g) Case studies and exercises 5. Plant and equipment maintenance a) Introduction to reliability concepts b) Analytical formulation of failure rate and reliability c) Explanation of the availability of machines/plants d) Reliability Centered Maintenance e) The KPIs for reliability and maintenance (MTBF and MTTR) f) The Fault Tree Analysis g) Reliability Block Diagrams (Systems in series, systems in parallel, k-out-of-n parallel components) h) The Bayes theorem for the calculation of complex systems i) The Fault-Tolerance approach j) The Total Productive Maintenance (TPM) approach k) The analysis of losses and the OEE in the maintenance

	context l) Notes on the EU Machinery Directive m) Case studies and exercises.
Keywords	Location planning, layout planning, investment calculations, industrial maintenance
Recommended Prerequisites	Students attending this course should have already passed the exam of Production Systems and Industrial Logistics.
Propaedeutic Courses	
Teaching Format	Lectures, exercises (teamwork which is carried out with the innovative software solution visTABLE®), expert lectures, excursions to local industrial companies (or online seminars).
Mandatory Attendance	No.
Specific Educational Objectives and Learning Outcomes	Specific educational objectives The lecture Factory and plant planning is part of the so-called "characterizing" learning subjects of the L-9 Bachelor's programme in Industrial and Mechanical Engineering. The course follows the process for building a factory including the required production facilities. At the beginning the students are introduced to the methods of factory planning. Next, common methods of factory location planning are explained. In the third part, commonly used methods for layout and area planning of a factory are explained. The fourth part of the lecture deals with the basics of investment decisions in an industrial environment. The fifth part of the course covers essential methods for the maintenance of industrial plants. During the exercise hours, the theoretical basics are applied in a practical teamwork. Here, the innovative software visTABLE® is used for digital factory planning. The teamwork is elaborated in groups of 2-3 students and presented to the participants at the end of the course. Knowledge and understanding 1. The student knows the basics of modern layout planning, investment decisions for plants as well as industrial maintenance. 2. The student knows the common methods and models for layout planning, plant investment decisions as well as for industrial maintenance. Applying knowledge and understanding 3. The student can apply and understand theoretical content

	through exercises, case studies and project work. Theory contents are illustrated by means of practical examples using arithmetic exercises. 4. The students independently work out a factory plan based on a practical case study. 5. Presentation techniques will be trained by MS-Power-Point, blackboard, and flipchart. 6. During excursions to local companies and through expert lectures, the students have the opportunity to gain insight into practice. Making judgements 7. According to a specific situation in practice, the student is able to judge on the use of suitable methods and models for layout planning, investment decisions and maintenance planning. 8. The student is also able to interpret specific Key Performance Indicators (KPIs) for make to order production, layout planning, investment calculation and maintenance planning. Communication skills 9. The student can hold technical discussions about factory planning and is able to prepare, present and argue technical contents on analogue (flipchart) and digital (power point) media in a structured way. Ability to learn 10. The student learns the material by frontal teaching (theory part) as well as by exercises in the lecture hall and in the laboratory (practical exercises). 11. The student is also able to expand the acquired knowledge through self-study and consultation of scientific and technical texts.
Specific Educational Objectives and Learning Outcomes (additional info.)	
Assessment	Formative assessment Form: Exercises in the lecture hall; Duration: Following each unit; ILOs assessed: 2,3,5,10 Form: Repetitions before each unit; Duration: 5-10 min. before each unit; ILOs assessed: 1,2,8,9,10 Form: Group work; Duration: During the lecture (exercise hours); ILOs assessed: 1,2,3,4,5,8,9,10

	Summative assessment Form: Written examination (questions on theory and seminars, exercises); 50%; Duration 2,5 hours; ILOs assessed: 1,2,3,6,7,8,11 Form: Elaboration and presentation of the group work: 50%; Duration: 15 min. for each group (10 min. pres. 5 min. Q&A); ILOs assessed: 2,3,4,5,7,8,9,10,11
Evaluation Criteria	Final evaluation by a single final grade. 50% of the final grade is determined from the results of the written final examination (theory and exercises) and 50% from the results of the project work. Criteria for the assessment of the written examination: completeness and correctness of the answers. Criteria for the evaluation of the project work/case study: Accuracy and completeness of content as well as quality, correctness of presentation and answers to subject-specific questions.
Required Readings	Lecture notes and documents for the exercise part will be provided on MS-Teams.
Supplementary Readings	1. Pawellek, G. *Ganzheitliche Fabrikplanung: Grundlagen, Vorgehensweise, EDV-Unterstützung*. Springer-Verlag, 2014. (Verfügbar in der Bibliothek der Freien Universität Bozen) 2. Grundig, C. G. *Fabrikplanung: Planungssystematik-Methoden-Anwendungen*. Carl Hanser Verlag GmbH Co KG. 2012. (Verfügbar in der Bibliothek der Freien Universität Bozen) 3. Helbing, K. W. *Handbuch Fabrikprojektierung*. Springer-Verlag 2010. 4. Günther, H.-O., Tempelmeier, H.: *Produktion und Logistik. 9. Aufl.*, Springer Verlag, Berlin 2012 (Verfügbar in der Bibliothek der Freien Universität Bozen) 5. Aggteleky, B. *Fabrikplanung: Werksentwicklung und Betriebsrationalisierung. 3. Ausführungsplanung und Projektmanagement. Planungstechnik in der Realisationsphase*. Hanser. 1990. (Verfügbar in der Bibliothek der Freien Universität Bozen) 6. De Carlo, F.: *Impianti industriali: conoscere e progettare i sistemi produttivi*. Sixth edition, Lulu.com 2016. (Verfügbar in der Bibliothek der Freien Universität Bozen)

	7. Hopp, W.J., Spearman, M.L. and Sarker B.R.: *Factory physics: foundations of manufacturing management*. Irwin/McGraw-Hill Burr Ridge, IL, 2001. 8. Wiendahl, H.P., Reichardt, J. and Nyhuis, P.: *Handbook Factory Planning and Design*. Springer 2015.
Further Information	Software used: The innovative software solution visTABLE® is used to develop the project work (Unibz licence available).
Sustainable Development Goals (SDGs)	Good health and well-being, Industry, innovation and infrastructure, Decent work and economic growth