

BESCHREIBUNG LEHRVERANSTALTUNG – AKADEMISCHES JAHR 2024/2025

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| Titel der Lehrveranstaltung | Fabrik- und Anlagenplanung |
| Code der Lehrveranstaltung | 42180, 42184 |
| Wissenschaftlich-disziplinärer Bereich der Lehrveranstaltung | ING-IND/17 |
| Studiengang | Bachelor in Industrie- und Maschineningenieurwesen |
| Semester | 2 |
| Studienjahr | III |
| Kreditpunkte | 8 |
| Modular | Nein |

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| Gesamtanzahl der Vorlesungsstunden | 50 |
| Gesamtzahl der Laboratoriumsstunden | 24 |
| Anwesenheit | Nein |
| Voraussetzungen | Die Teilnehmer dieses Kurses sollten bereits die Prüfung Produktionssysteme und Industrielogistik bestanden haben. |
| Link zur Lehrveranstaltung | https://www.unibz.it/de/faculties/engineering/bachelor-industrial-mechanical-engineering/course-offering/ |

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| Spezifische Bildungsziele | <p>Die Vorlesung Fabrik- und Anlagenplanung ist Bestandteil der sogenannten „charakterisierenden“ Lernfächer des L-9 Bachelor-Studienganges in Industrie- und Maschineningenieurwesen.</p> <p>Der Kurs folgt die Struktur der Errichtung einer Fabrik inklusive der benötigten Produktionsanlagen. Zu Beginn werden die Studierenden in die Methoden der Fabrikplanung eingeführt. Anschließend werden gängige Methoden der Standortplanung einer Fabrik erläutert. Im dritten Teil werden Methoden zur systematischen Layout- und Flächenplanung einer Fabrik erklärt. Der vierte Teil der Vorlesung behandelt die Grundlagen der Investitionsentscheidungen in einem industriellen Umfeld. Im fünften Teil des Kurses werden wesentliche Methoden für die Instandhaltung von Industrieanlagen erläutert.</p> <p>Im Laufe der Übungsstunden werden die theoretischen Grundlagen in einer praktischen Projektarbeit angewandt. Hierbei wird die innovative Software visTABLE® für die digitale Fabrikplanung verwendet. Die Projektarbeit wird in Gruppen von 2-3 Studenten ausgearbeitet und am Ende des Kurses den Teilnehmern präsentiert.</p> |
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| Dozent | Prof. Dr.-Ing. Patrick Dallasega |
| Kontakt | Office L5.01 E-mail: patrick.dallasega@unibz.it Tel.: +39 0471 017114 |
| Wissenschaftlich-disziplinärer Bereich des Dozenten | ING-IND/17 |
| Unterrichtssprache | Deutsch |

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| Sprechzeiten | Nach Vereinbarung |
| Wissenschaftlicher Mitarbeiter | Lanzone Marco |
| Sprechzeiten | Nach Vereinbarung |
| Auflistung der behandelten Themen | <ol style="list-style-type: none"> 1. Einführung <ol style="list-style-type: none"> a) Struktur und Inhalt der Vorlesung b) Einführung in die Fabrikplanung c) Definitionen und Grundlagen 2. Standortplanung <ol style="list-style-type: none"> a) Struktur der Logistiksysteme (Supply Networks) b) Wahl von Produktionsstandorten c) Bewertungsmethoden für Standortentscheidungen (Nutzwertanalyse, Break-Even-Analyse) 3. Layout- und Flächenplanung <ol style="list-style-type: none"> a) Planungsschritte der Strukturplanung b) Der Prozess und die Phasen der Layoutplanung c) Übersicht der Layout Typen d) Innovative Algorithmen zur rechnergestützten Layoutplanung (CRAFT, CORELAP, ALDEP) e) Die „Hollier“ Methode 1 und 2 f) Platzbedarf von Maschinen und Personal g) Kurze Einführung in die Planung von Servicelayouts h) Fallstudien und Übungen 4. Investitionsentscheidungen <ol style="list-style-type: none"> a) Abschreibung von Anlagen b) Deckungsbeitragsrechnung c) Payback-Methode d) Kapitalrentabilität (Return on Investment) e) Nettobarwertmethode (Net Present Value) f) Interne Renditemethode (Internal Rate of Return) g) Fallstudien und Übungen 5. Instandhaltung von Anlagen und Maschinen <ol style="list-style-type: none"> a) Einführung in Zuverlässigkeitskonzepte b) Analytische Formulierungen der Ausfallrate und der Zuverlässigkeit c) Erklärung der Verfügbarkeit von Anlagen d) Zuverlässigkeitsorientierte Instandhaltung e) KPIs für Zuverlässigkeit und Wartung (MTBF und MTTR) f) Die Fehlerbaumanalyse (Fault Tree Analysis) g) Zuverlässigkeits-Blockdiagramme (Systeme in Serie, Parallele Systeme, k-out-of-n parallele Komponenten) h) Das Bayes Theorem zur Berechnung von komplexen Systemen i) Der Fehlertoleranzansatz j) Moderne Instandhaltung: der TPM-Ansatz k) Analyse von Verlusten und Beschreibung des OEE im Kontext der Wartung l) Hinweise zur EU-Maschinenrichtlinie m) Fallstudien und Übungen |
| Unterrichtsform | Vorlesungen, Übungen (Projektarbeit welche mit der |

innovativen Softwarelösung visTABLE® ausgearbeitet wird),
 Expertenvorträge, Exkursionen zu lokalen Industriebetrieben
 (oder Online-Seminare).

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| <p>Erwartete Lernergebnisse</p> | <p><u>Wissen und Verstehen</u></p> <ol style="list-style-type: none"> 1. Der Student kennt die Grundlagen der modernen Layout- und Flächenplanung, Investitionsentscheidungen für Anlagen sowie der industriellen Instandhaltung. 2. Der Student kennt die gängigen Methoden und Modelle zur Layout- und Flächenplanung, Investitionsentscheidungen für Anlagen sowie zur industriellen Instandhaltung. <p><u>Anwenden von Wissen und Verstehen</u></p> <ol style="list-style-type: none"> 3. Der Student erhält die Möglichkeit theoretische Inhalte durch Übungen, Fallstudien und Projektarbeit praktisch anzuwenden und damit zu verstehen. Mittels Rechenübungen werden Theorie-Inhalte anhand praktischer Beispiele veranschaulicht. 4. Die Studenten erarbeiten eigenständig eine Fabrikplanung anhand eines praktischen Fallbeispiels. 5. Präsentationstechniken werden mittels Power-Point, Tafel und Flipchart geschult. 6. Im Laufe verschiedener Betriebsbesichtigungen und anhand von Expertenvorträgen haben die Studenten die Möglichkeit einen Einblick in die Praxis zu erhalten. <p><u>Urteilen</u></p> <ol style="list-style-type: none"> 7. Der Student kann in Abhängigkeit der Situation im Unternehmen über den Einsatz geeigneter Methoden und Modelle zur Layoutplanung, Investitionsentscheidung und Instandhaltung urteilen. 8. Der Student ist zudem im Stande wichtige Leistungskennzahlen der Auftragsfertigung, Layoutplanung, Investitionsrechnung und Instandhaltungsplanung zu interpretieren. <p><u>Kommunikation</u></p> <ol style="list-style-type: none"> 9. Der Student kann fachliche Diskussionen zum Thema Fabrikplanung führen und ist imstande fachliche Inhalte auf analogen (Flipchart) und digitalen (Power Point) Medien strukturiert aufzubereiten, zu präsentieren und zu argumentieren. <p><u>Lernstrategien</u></p> <ol style="list-style-type: none"> 10. Der Student erlernt den Stoff sowohl durch Frontalunterricht (Theorieteil) sowie durch Übungen im Hörsaal und im Labor (praktische Übungen) 11. Zudem ist der Student in der Lage das erworbene Wissen durch autodidaktisches Selbststudium und Konsultation von wissenschaftlichen und technischen Texten zu erweitern. |
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| Art der Prüfung | <p>Formative Bewertung (nicht Teil der Note)</p> <table border="1"> <thead> <tr> <th>Form</th> <th>Dauer</th> <th>Nr. Lernergebnisse</th> </tr> </thead> <tbody> <tr> <td>Übungen im Hörsaal</td> <td>Im Anschluss an jede Einheit</td> <td>2,3,5,10</td> </tr> <tr> <td>Wiederholungen vor jeder Einheit</td> <td>5-10 Min. vor jeder Einheit</td> <td>1,2,8,9,10</td> </tr> <tr> <td>Gruppenarbeit</td> <td>Im Laufe der Vorlesung (Übungsstunden)</td> <td>1,2,3,4,5,8,9,10</td> </tr> </tbody> </table> <p>Summative Bewertung (Zusammensetzung der Note)</p> <table border="1"> <thead> <tr> <th>Form</th> <th>%</th> <th>Dauer</th> <th>Nr. Lernergebnisse</th> </tr> </thead> <tbody> <tr> <td>Schriftliche Prüfung (Fragen zu Theorie und Seminare, Übungen)</td> <td>50</td> <td>2,5 h</td> <td>1,2,3,6,7,8,11</td> </tr> <tr> <td>Ausarbeitung und Präsentation einer praktischen Fallstudie</td> <td>50</td> <td>15 Min. pro Gruppe (10 Min. Präs. 5 Min. Fragen)</td> <td>2,3,4,5,7,8,9,10,11</td> </tr> </tbody> </table> | Form | Dauer | Nr. Lernergebnisse | Übungen im Hörsaal | Im Anschluss an jede Einheit | 2,3,5,10 | Wiederholungen vor jeder Einheit | 5-10 Min. vor jeder Einheit | 1,2,8,9,10 | Gruppenarbeit | Im Laufe der Vorlesung (Übungsstunden) | 1,2,3,4,5,8,9,10 | Form | % | Dauer | Nr. Lernergebnisse | Schriftliche Prüfung (Fragen zu Theorie und Seminare, Übungen) | 50 | 2,5 h | 1,2,3,6,7,8,11 | Ausarbeitung und Präsentation einer praktischen Fallstudie | 50 | 15 Min. pro Gruppe (10 Min. Präs. 5 Min. Fragen) | 2,3,4,5,7,8,9,10,11 |
|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|---------------------|--------------------|--------------------|------------------------------|----------|----------------------------------|-----------------------------|------------|---------------|----------------------------------------|------------------|------|---|-------|--------------------|----------------------------------------------------------------|----|-------|----------------|------------------------------------------------------------|----|--------------------------------------------------|---------------------|
| Form | Dauer | Nr. Lernergebnisse | | | | | | | | | | | | | | | | | | | | | | | |
| Übungen im Hörsaal | Im Anschluss an jede Einheit | 2,3,5,10 | | | | | | | | | | | | | | | | | | | | | | | |
| Wiederholungen vor jeder Einheit | 5-10 Min. vor jeder Einheit | 1,2,8,9,10 | | | | | | | | | | | | | | | | | | | | | | | |
| Gruppenarbeit | Im Laufe der Vorlesung (Übungsstunden) | 1,2,3,4,5,8,9,10 | | | | | | | | | | | | | | | | | | | | | | | |
| Form | % | Dauer | Nr. Lernergebnisse | | | | | | | | | | | | | | | | | | | | | | |
| Schriftliche Prüfung (Fragen zu Theorie und Seminare, Übungen) | 50 | 2,5 h | 1,2,3,6,7,8,11 | | | | | | | | | | | | | | | | | | | | | | |
| Ausarbeitung und Präsentation einer praktischen Fallstudie | 50 | 15 Min. pro Gruppe (10 Min. Präs. 5 Min. Fragen) | 2,3,4,5,7,8,9,10,11 | | | | | | | | | | | | | | | | | | | | | | |
| Prüfungssprache | Deutsch | | | | | | | | | | | | | | | | | | | | | | | | |
| Bewertungstypologie | Monocratic | | | | | | | | | | | | | | | | | | | | | | | | |
| Bewertungskriterien und Kriterien für die Notenermittlung | <p>Bewertung durch eine einzige finale Abschlussnote.</p> <p>Die Abschlussnote ermittelt sich zu 50% aus den Ergebnissen der schriftlichen Abschlussprüfung (Theorie und Rechenaufgaben) und zu 50% aus den Ergebnissen der Projektarbeit im Rahmen des Übungsbetriebs.</p> <p>Kriterien für die Bewertung der schriftlichen Prüfung: Vollständigkeit und Richtigkeit der Antworten.</p> <p>Kriterien für die Bewertung der Projektarbeit: Inhaltliche Richtigkeit und Vollständigkeit sowie Qualität, Richtigkeit der Präsentation als auch zur Beantwortung von fachspezifischen Fragen.</p> | | | | | | | | | | | | | | | | | | | | | | | | |
| Pflichtliteratur | Vorlesungsskriptum und Unterlagen zum Übungsteil werden auf den Reserve Collections und MS-Teams zur Verfügung gestellt. | | | | | | | | | | | | | | | | | | | | | | | | |
| Weiterführende Literatur | <ol style="list-style-type: none"> 1. Pawellek, G. <i>Ganzheitliche Fabrikplanung: Grundlagen, Vorgehensweise, EDV-Unterstützung</i>. Springer-Verlag, 2014. (Verfügbar in der Bibliothek der Freien Universität Bozen) 2. Grundig, C. G. <i>Fabrikplanung: Planungssystematik-Methoden-Anwendungen</i>. Carl Hanser Verlag GmbH Co KG. 2012. (Verfügbar in der Bibliothek der Freien Universität Bozen) 3. Helbing, K. W. <i>Handbuch Fabrikprojektierung</i>. Springer-Verlag 2010. | | | | | | | | | | | | | | | | | | | | | | | | |

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| | <ol style="list-style-type: none"> 4. Günther, H.-O., Tempelmeier, H.: <i>Produktion und Logistik. 9. Aufl.</i>, Springer Verlag, Berlin 2012 (Verfügbar in der Bibliothek der Freien Universität Bozen) 5. Aggteleky, B. <i>Fabrikplanung: Werksentwicklung und Betriebsrationalisierung. 3. Ausführungsplanung und Projektmanagement. Planungstechnik in der Realisationsphase.</i> Hanser. 1990. (Verfügbar in der Bibliothek der Freien Universität Bozen) 6. De Carlo, F.: <i>Impianti industriali: conoscere e progettare i sistemi produttivi.</i> Sixth edition, Lulu.com 2016. (Verfügbar in der Bibliothek der Freien Universität Bozen) 7. Hopp, W.J., Spearman, M.L. and Sarker B.R.: <i>Factory physics: foundations of manufacturing management.</i> Irwin/McGraw-Hill Burr Ridge, IL, 2001. 8. Wiendahl, H.P., Reichardt, J. and Nyhuis, P.: <i>Handbook Factory Planning and Design.</i> Springer 2015. |
| Verwendete Software | Für die Ausarbeitung der Projektarbeit wird die innovative Softwarelösung visTABLE® verwendet (Unibz Lizenz verfügbar). |

COURSE DESCRIPTION – ACADEMIC YEAR 2024/2025

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| Course title | Factory and plant planning |
| Course code | 42180, 42184 |
| Scientific sector | ING-IND/17 |
| Degree | Bachelor in Industrial and Mechanical Engineering |
| Semester | 2 |
| Year | III |
| Credits | 8 |
| Modular | No |

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| Total lecturing hours | 50 |
| Total lab hours | 24 |
| Attendance | No |
| Prerequisites | Students attending this course should have already passed the exam of Production Systems and Industrial Logistics. |
| Course page | https://www.unibz.it/de/faculties/engineering/bachelor-industrial-mechanical-engineering/course-offering/ |

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| Specific educational objectives | <p>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.</p> <p>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</p> |
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| | <p>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.</p> |
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| Lecturer | Prof. Dr.-Ing. Patrick Dallasega |
| Contact | Office L5.01 E-mail: patrick.dallasega@unibz.it Tel.: +39 0471 017114 |
| Scientific sector of the lecturer | ING-IND/17 |
| Teaching language | German |
| Office hours | By agreement |
| Teaching assistant (if any) | Lanzone Marco |
| Office hours | By agreement |
| List of topics covered | <ol style="list-style-type: none"> 1. Introduction <ol style="list-style-type: none"> a) Structure and content of the lecture b) Introduction to factory planning c) Definitions and fundamentals 2. Site planning <ol style="list-style-type: none"> 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 <ol style="list-style-type: none"> 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 <ol style="list-style-type: none"> 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 <ol style="list-style-type: none"> 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 |

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| | <p>MTTR)</p> <ul style="list-style-type: none"> 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 |
| <p>Teaching format</p> | <p>Lectures, exercises (teamwork which is carried out with the innovative software solution visTABLE®), expert lectures, excursions to local industrial companies (or online seminars).</p> |
| <p>Learning outcomes (ILOs)</p> | <p><u>Knowledge and understanding</u></p> <ol style="list-style-type: none"> 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. <p><u>Applying knowledge and understanding</u></p> <ol style="list-style-type: none"> 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. <p><u>Making judgements</u></p> <ol style="list-style-type: none"> 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. <p><u>Communication skills</u></p> <ol style="list-style-type: none"> 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 |

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| | <p>(power point) media in a structured way.</p> <p><u>Ability to learn</u></p> <p>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).</p> <p>11. The student is also able to expand the acquired knowledge through self-study and consultation of scientific and technical texts.</p> |
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| Assessment | <p>Formative assessment</p> <table border="1"> <thead> <tr> <th>Form</th> <th>Length / duration</th> <th>ILOs assessed</th> </tr> </thead> <tbody> <tr> <td>Exercises in the lecture hall</td> <td>Following each unit</td> <td>2,3,5,10</td> </tr> <tr> <td>Repetitions before each unit</td> <td>5-10 min. before each unit</td> <td>1,2,8,9,10</td> </tr> <tr> <td>Group work</td> <td>During the lecture (exercise hours)</td> <td>1,2,3,4,5,8,9,10</td> </tr> </tbody> </table> <p>Summative assessment</p> <table border="1"> <thead> <tr> <th>Form</th> <th>%</th> <th>Length /duration</th> <th>ILOs assessed</th> </tr> </thead> <tbody> <tr> <td>Written examination (questions on theory and seminars, exercises)</td> <td>50</td> <td>2,5 h</td> <td>1,2,3,6,7,8,11</td> </tr> <tr> <td>Elaboration and presentation of a practical case study</td> <td>50</td> <td>15 min. for each group (10 min. pres. 5 min. Q&A)</td> <td>2,3,4,5,7,8,9,10,11</td> </tr> </tbody> </table> | Form | Length / duration | ILOs assessed | Exercises in the lecture hall | Following each unit | 2,3,5,10 | Repetitions before each unit | 5-10 min. before each unit | 1,2,8,9,10 | Group work | During the lecture (exercise hours) | 1,2,3,4,5,8,9,10 | Form | % | Length /duration | ILOs assessed | Written examination (questions on theory and seminars, exercises) | 50 | 2,5 h | 1,2,3,6,7,8,11 | Elaboration and presentation of a practical case study | 50 | 15 min. for each group (10 min. pres. 5 min. Q&A) | 2,3,4,5,7,8,9,10,11 |
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| | Form | Length / duration | ILOs assessed | | | | | | | | | | | | | | | | | | | | | | |
| Exercises in the lecture hall | Following each unit | 2,3,5,10 | | | | | | | | | | | | | | | | | | | | | | | |
| Repetitions before each unit | 5-10 min. before each unit | 1,2,8,9,10 | | | | | | | | | | | | | | | | | | | | | | | |
| Group work | During the lecture (exercise hours) | 1,2,3,4,5,8,9,10 | | | | | | | | | | | | | | | | | | | | | | | |
| Form | % | Length /duration | ILOs assessed | | | | | | | | | | | | | | | | | | | | | | |
| Written examination (questions on theory and seminars, exercises) | 50 | 2,5 h | 1,2,3,6,7,8,11 | | | | | | | | | | | | | | | | | | | | | | |
| Elaboration and presentation of a practical case study | 50 | 15 min. for each group (10 min. pres. 5 min. Q&A) | 2,3,4,5,7,8,9,10,11 | | | | | | | | | | | | | | | | | | | | | | |
| Assessment language | German | | | | | | | | | | | | | | | | | | | | | | | | |
| Assessment Typology | Monocratic | | | | | | | | | | | | | | | | | | | | | | | | |
| Evaluation criteria and criteria for awarding marks | <p>Final evaluation by a single final grade.</p> <p>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.</p> <p>Criteria for the assessment of the written examination: completeness and correctness of the answers.</p> <p>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.</p> | | | | | | | | | | | | | | | | | | | | | | | | |

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| Required readings | Lecture notes and documents for the exercise part will be |
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| <p>Supplementary readings</p> | <p>provided on the Reserve Collections and MS-Teams.</p> <ol style="list-style-type: none"> 1. Pawellek, G. <i>Ganzheitliche Fabrikplanung: Grundlagen, Vorgehensweise, EDV-Unterstützung</i>. Springer-Verlag, 2014. (Verfügbar in der Bibliothek der Freien Universität Bozen) 2. Grundig, C. G. <i>Fabrikplanung: Planungssystematik-Methoden-Anwendungen</i>. Carl Hanser Verlag GmbH Co KG. 2012. (Verfügbar in der Bibliothek der Freien Universität Bozen) 3. Helbing, K. W. <i>Handbuch Fabrikprojektierung</i>. Springer-Verlag 2010. 4. Günther, H.-O., Tempelmeier, H.: <i>Produktion und Logistik. 9. Aufl.</i>, Springer Verlag, Berlin 2012 (Verfügbar in der Bibliothek der Freien Universität Bozen) 5. Aggteleky, B. <i>Fabrikplanung: Werksentwicklung und Betriebsrationalisierung. 3. Ausführungsplanung und Projektmanagement. Planungstechnik in der Realisationsphase</i>. Hanser. 1990. (Verfügbar in der Bibliothek der Freien Universität Bozen) 6. De Carlo, F.: <i>Impianti industriali: conoscere e progettare i sistemi produttivi</i>. Sixth edition, Lulu.com 2016. (Verfügbar in der Bibliothek der Freien Universität Bozen) 7. Hopp, W.J., Spearman, M.L. and Sarker B.R.: <i>Factory physics: foundations of manufacturing management</i>. Irwin/McGraw-Hill Burr Ridge, IL, 2001. 8. Wiendahl, H.P., Reichardt, J. and Nyhuis, P.: <i>Handbook Factory Planning and Design</i>. Springer 2015. |
| <p>Software used</p> | <p>The innovative software solution visTABLE® is used to develop the project work (Unibz licence available).</p> |