

Degree	Type	Year
4318306 Logistics and Supply Chain Management	OT	2

Contact

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Teachers

(External) Prof. Dr. Gaby Neumann

(External) Prof. Dr. Rene Krenz-Baath

(External) Prof. Dr. Thomas Masurat

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Teaching groups languages

You can view this information at the [end](#) of this document.

Prerequisites

The student has to have successfully passed the following subjects:

- Decision making (44760)
- Material handling and transportation technologies (44762)
- Information Technology (44761)

Objectives and Contextualisation

This module has two course units: Cyber-physical Production Systems (Prof. Dr. Rene Krenz-Baath) and Management system specification in production and logistics (Prof. Dr. Thomas Masurat, Prof. Dr. Gaby Neumann, Stefan Viehmann).

CU1: Cyber-physical Production Systems (5 ECTS)

After the course the student will:

- understand specific requirements of cyber-physical production systems and their complexity

- be able to apply procedure, methods, tools for specifying, selecting, implementing, testing and analysing entities of cyber-physical production systems
- be able to evaluate different digital alternatives and select the entities to be implemented
- be able to acknowledge the risk of using autonomous technical entities (i.e. mobile robots) as well as the importance of rules in social and technical level
- be able to program and adapt procedures to collect and communicate data from process environment using simple open source software-tools
- elaborate solid arguments to convince and motivate decision makers

CU2: Management system specification in production and logistics (5 ECTS)

After the course the student will:

- understand specific requirements of management systems in production and logistics and their complexity
- understand specification needs and market situation of management systems in production and logistics in general and with regard to Manufacturing Execution Systems (MES), Warehouse Management Systems (WMS), Shopfloor Management Systems (SFMS), Management Information Systems (MIS) and Customer Information Systems (CIS) in particular
- be able to apply procedure, methods, tools for specifying, selecting, implementing, testing and analysing specific management systems
- be able to evaluate alternative solutions and select the management system to be implemented (including tendering procedure)
- be able to evaluate the impact of latest technological advancements, like e.g. Industry 4.0, digitalization and Artificial Intelligence, on the future appearance, need, and functionality of management systems in production and logistics
- be able to use creativity techniques to derive new ideas for visionary concepts for the adaptation of the systems or formulating new requirements to these systems based on new development in the ongoing digitalization tendencies in industry
- elaborate solid arguments to convince and motivate decision makers

Learning Outcomes

1. CA21 (Competence) Use procedures, methods and tools to specify, select, implement, test and analyse cyber-physical production systems by identifying and assessing the risk of using autonomous technology (i.e., mobile robots) and the importance of social and technical standards.
2. CA22 (Competence) Devise and/or adapt procedures for gathering and communicating data from the process environment using simple, open-source software tools.
3. CA23 (Competence) Develop new ideas and visionary concepts in order to adapt management systems, or come up with new requirements for these systems based on new developments and current digitalisation trends in the industry.
4. KA26 (Knowledge) Identify the requirement specifications and market availability of production and logistics management systems in general in terms of production planning and control systems (PPC), manufacturing execution systems (MES), warehouse management systems (WMS) and shop floor management systems (SFMS).
5. SA32 (Skill) Select and apply appropriate methodologies and strategies to specify and implement the requirements of a logistics-related management and control system and of cyber-physical production systems whilst taking their complexity into account.
6. SA33 (Skill) Apply procedures, methods and tools to specify, select, implement, test and analyse the entities of cyber-physical production systems and PPC and WMS systems.
7. SA34 (Skill) Assess the impact of the latest technological developments, such as Industry 4.0 and digitalisation, on the future emergence, requirements and features of production and logistics management systems.
8. SA35 (Skill) Evaluate different alternatives and select a logistics management and control solution to implement (including the tendering procedure).

Content

CU1: Cyber-physical Production Systems (5 ECTS)

- Concept formation/ definitions
- Control architecture of automated systems
- Technical entities and closed loop controls for cyber-physical production systems
- Methods and tools of a cyber-physical production system
- Information flow horizontally and vertically: methods and examples
- Node-Red applications for information communication
- Human/Machine/Factory interaction
- Multi-agent, multi-vendor systems
- Human-robot collaboration/Middleware/Real-time systems
- Information computation and communication along the value chain
- Artificial intelligence: basics

CU2: Management system specification in production and logistics (5 ECTS)

- Management systems in production and logistics - introduction and overview
- Specification and selection of management systems in production and logistics
- The role of Artificial Intelligence in management systems today and tomorrow
- Artificial Intelligence tools to support market search and market analysis
- Creativity techniques, creative future-oriented thinking, development of visions on the future of production and logistics management

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
CU1. Laboratory work	15	0.6	CA21, CA22, SA33
CU1. Theory lectures	45	1.8	CA21, CA22, SA33, SA35
CU2. Laboratory work	7.5	0.3	CA23, KA26, SA32
CU2. Theory lectures	12.5	0.5	CA23, KA26, SA32, SA34, SA35
Type: Supervised			
CU1. Case study	40	1.6	CA21, CA22, SA33, SA35
CU1. Practical training	20	0.8	CA21, CA22, SA33
CU2. Case study	30	1.2	CA23, SA32, SA34, SA35
CU2. Practical training	10	0.4	CA23, SA32, SA34
Type: Autonomous			
CU1. Self-learning	32.5	1.3	SA33, SA35
CU2. Self-learning	32.5	1.3	KA26, SA32, SA34

CU1: Cyber-physical Production Systems (5 ECTS)

The course is organized by means of traditional lectures combined with seminars and practical work. The learning process will combine the following activities:

- Classroom sessions: include theory lectures and guest lectures. Aims to understand specific requirements of cyber-physical production systems and their complexity; understand specification needs, market situation of typical entities; specify and formalize requirements for a CPPS management and control systems; explain procedure, methods, tools for specifying, selecting, implementing, testing and analysing cyber-physical production systems.
- Lab sessions: include demonstrations, programming exercises, experiments in physical environment, classroom discussions. Aims to understand challenges, elements and solutions for cyber-physical production systems (CPPS).
- Practical assignment: experiments in physical environment, classroom discussions, group work, experimentation reporting. Aims to understand working principle, functionality and applicability of sensor technology to control production flows; understand working principle, resulting processes and constraints in CPPS-control; implement simple control algorithms for social and technical CPPS-system; setup test scenarios, plan and run experiments, report experimentation outcome in a practical setting (seminar work).
- Autonomous work: reading, self-testing, reflecting. Retrieve and analyse information from different sources; reflect learning and problem solving processes in order to derive lessons learned.

CU2: Management system specification in production and logistics (5 ECTS)

The course is organized by means of traditional lectures combined with seminars and practical work. The learning process will combine the following activities:

- Classroom sessions: include theory lectures and guest lectures. Aim to understand specific requirements of logistics and production management and their complexity; understand specification needs and market situation of typical categories of management systems in production and logistics; specify and formalize requirements for a logistics/production management and control system; explain procedure, methods, and tools for specifying, selecting, implementing, testing and analysing management systems in production and logistics.
- Workshop: discussion on how Artificial Intelligence tools can support market search and analysis; practical training on the application of creativity techniques in teams
- Lab sessions: include demonstrations, experiments in physical environment, classroom discussions. Aim to understand challenges, elements and solutions for managing and controlling production and logistics.
- Case study: group work, student presentation. Aims to (i) apply procedures, methods, and tools for specifying requirements for management systems in production and logistics; (ii) identify and apply criteria for selecting management systems; (iii) elaborate solid arguments to convince and motivate decision makers; (iv) run and manage a management system specification project in order to prepare for respective purchasing activities; (v) create a vision on management systems of the future.
- Autonomous work: reading, self-testing, reflecting. Retrieve and analyse information from different sources; reflect learning and problem solving processes in order to derive lessons learned.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous Assessment Activities



Title	Weighting	Hours	ECTS	Learning Outcomes
CU1. Practical assignment and seminar work	25%	0	0	CA21, CA22, SA33, SA35
CU2. Case study presentation and results	50%	2	0.08	CA23, KA26, SA32, SA34, SA35
Final exam (CU1)	25%	3	0.12	CA21, SA33

CU1: Cyber-physical Production Systems (5 ECTS)

The final mark of this course will be calculated from the assessment of following evaluation activities:

- Final exam. Theoretical questions on topics addressed throughout the semester in order to present an understanding of cyber-physical production systems.
- Practical assignments and seminar paper in the topic of CPPS.

CU2: Management system specification in production and logistics (5 ECTS)

The final mark of this course will be calculated from the assessment of following evaluation activities:

- Case study - part A. Student teams run a market analysis on Manufacturing Execution Systems (MES), Warehouse Management Systems (WMS), Shop floor Management Systems (SFMS), Management Information Systems (MIS), or Customer Information Systems (CIS) using AI-based tools like ChatGPT in order to analyse market situation and derive functional specification of the given class of management systems. Results are summarized in a meaningful, illustrative PowerPoint presentation and presented towards potential decision makers, i.e. other students (peer review).
- Case study - part B. Student teams analyse chances and challenges from digitalization, Industry 4.0, Artificial Intelligence etc. on the class of management systems given in order to characterize the impact latest technological developments might have on user/functional requirements for management systems in production and logistics and their identification/specification. Here, looking into future and developing visionary scenarios concerning the given class of management systems is of particular importance. Results are summarized in a meaningful, illustrative PowerPoint presentation for potential decision makers, i.e. other students (peer review), followed by a wide discussion of the ideas.

CU1 and CU2

The student passes the module if practical assignment, case study and the final exam are evaluated "sufficient" (grade 4.0 corresponding to a minimum of 50% of the maximum performance per evaluation activity) at least. The student fails if performance in at least one of the evaluation activities does not reach the 50% threshold or if seminar work and case study report are not submitted within the due date specified by the professor.

In case of fail the student needs to retake just that part of module exam s/he failed. The decision about this is in hands of the examiners. If seminar work or case study is failed, the student (team) will either be provided with a new assignment/case study or asked to re-submit seminar work or case study report according to the corrections/indications provided by the professor.

Students who fail an exam may be permitted the opportunity to retake this examination twice at a maximum. After that his/her right for examination terminates. Retaking an exam is allowed only in case the student previously failed, but not to improve grades achieved so far.

Examination dates are announced in due time, but at least two weeks prior to the respective exam. Submission deadlines for practical assignments, project reports and any presentation activities related to them are announced when giving assignments/project to students. The final exam and a first opportunity for eventually retaking it are scheduled within specified examination periods. Specific examination dates are published on the university's website.

The weights of each evaluation activity are given in the table below.

Bibliography

To be provided during lecturing period

Software

To be provided during lecturing period

Language list

Information on the teaching languages can be checked on the CONTENTS section of the guide.