ENGINEERING PF
SCHOOL OF ENGINEERING
Fakultät für Technik
Hochschule Pforzheim

HS PF

Syllabus

BAE4152 Future Oriented Production Concepts 1

Prof. Dr. Bernhard Kölmel

Summer Semester 2022

Level	Bachelor	
Credits	3	
Student Contact Hours	2	
Workload	90 hours	
Prerequisites	Fundamental Knowledge in MEN1270 Fertigungstechnik, BAE2330 Operations Management and BAE2120 Logistik.	
Time	s. LSF	
Room	s. LSF	
Start Date	s. LSF	
Lecturer(s)	**Name**	Prof. Dr. Bernhard Kölmel
	Office	T2.3.14
	Virtual Office	Virtual Office Prof. Kölmel
	Office Hours	Tuesday, 11:30 – 13:00 (appointment by E-Mail)
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	Email	Bernhard.koelmel@hs-pforzheim.de (preferred mode of communication)

Summary

The course – a combination of lecture, workshops, case studies, and students' presentations - provides an advanced knowledge in Future Oriented Production Concepts.

Future Oriented Production Concepts are developing at a rapid pace. According to a study by PWC, German industry intends to invest €40 billion a year in applications and network components. Companies thereby hope to increase efficiency and cut costs, as well as achieve qualitative advantages, such as greater flexibility and the possibility of catering for customers' individual wishes. The German government has also realized the importance of this trend for Germany's SME sector and launched the Industry 4.0 Future Project. It is intended to enable German industry to be fit for the future of production. After all, the trend is moving toward highly individualized products under the conditions of highly flexibilized production. As part of that, customers and business partners are directly integrated in business and value added processes. Thanks to intelligent monitoring and decision-making processes, companies can control entire value-added networks in real time by means of the Internet of Things (IoT). Smart processes, automated small-scale production, lasting quality assurance or innovative working time concepts – companies are developing new business models on the basis of the Future Oriented Production Concepts. The fourth industrial revolution is realized by the combination of numerous physical and digital technologies such as artificial intelligence, cloud computing, adaptive robotics, augmented reality, additive manufacturing and Internet of Things (IoT). Regardless of the triggering technologies, the main purpose of industrial transformation is to increase the resource efficiency and productivity to increase the competitive power of the companies.

In more detail:

In this context, the lecture intends to provide a comprehensive guidance for applications in the context of Future Oriented Production Concepts. Therefore, the lecture not only introduces implementation aspects, but also proposes conceptual framework with respect to its design principles. In addition, a maturity and readiness model is proposed so that the students can evaluate companies and overcome the problem of spotting the starting point. A technology roadmap is also presented to guide the students of how to set strategies for Future Oriented Production Concepts, select the key technologies, determine the projects, construct the optimized project portfolio under risk and schedule the projects in planning horizon. Then, the lecture proceeds with key technological advances that form the pillars for Future Oriented Production Concepts and explores their potential technical and economic benefits via demonstrations with real-life applications.

Outline of the Course

- Conceptual Framework for Industry 4.0
- Smart and Connected Product Business Models
- Maturity and Readiness Model for Industry 4.0 Strategy
- Technology Roadmap for Industry 4.0
- Internet of Things and Cyber-physicial Production Systems
- Selected use cases (i.e. Additive Manufacturing Technologies and Applications, Augmented Reality)

Course Intended Learning Outcomes and their Contribution to Program Intended Learning Outcomes / Program Goals

	Learning Objective	Contribution
1.1	Students demonstrate key knowledge in Technical Basics.	Transfer theoretical Knowledge of IoT, CPS etc. in real application cases.
1.3	Students demonstrate key knowledge in Business Administration.	Use advanced concepts like Business Model Canvas etc. in order to evaluate
3.	Students are able to apply analytical and critical thinking skills to complex problems.	Transformation and adaptation of new concepts in future oriented production environments.
4.	Students are able to develop business ethics-based strategies and are able to apply them to typical business decision-making problems.	International and global effects on the strategy and the organization of value chains are considered from ethical and social responsibility perspectives.
5.1	Students demonstrate their ability to express complex issues in writing.	Working out of tasks and case studies, and of a term paper
5.2	Students demonstrate their oral communication skills in presentations and lectures.	Working out and presentation of tasks and case studies in front of the class
6.	Students show that they are able to work successfully in a team by performing practical tasks.	Working out of tasks and problems and presentation of the solutions in teams

Teaching and Learning Approach

The teaching and learning approach is based on 3 didactical methods:
The theoretical key knowledge and the basic concepts are thought at the lecture. The students gain the methodology and the guidance to know and to implement the introduced concepts and tools. Questions and comments of the students are welcome during the lecture.
After the lecture the students should reflect and sum up the content of the lecture based on course materials provided.
The theoretical knowledge is enlarged and converted into a practical role by workshops and case studies. An active participation in class is an important part of the teaching and learning approach. The students can always communicate with the instructor and get support and advice by talking or mailing.

Literature and Course Materials

- Ustundag, Cevikcan, Industry 4.0: Managing The Digital Transformation, Springer 2018
- Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat, Industrial Internet of Things: Cybermanufacturing Systems, Springer 2017
- Uwe Winkelhake, The Digital Transformation of the Automotive Industry, Catalysts, Roadmap, Practice, Springer 2018
- Otto Brauckmann, Smart Production, Wertschöpfung durch Geschäftsmodelle, Springer 2015

- Class handouts will be available in the LMS.

Assessment

Exam

There is an optional written exam at the end of the semester.

Basically, the following requirements will be graded each separately, and on that basis an average grade per person will be built by the professor:

- Active general participation during lectures, and especially in brainstormings, workshops, and case studies.
- Individual roles prepared and actively performed in group(s) during workshops and case studies, as defined by and agreed with the professor.
- Individual or group voluntary activities/ presentations, as required by or agreed with the professor – as far as reasonably possible.

Maximum 2 lectures (90 minutes each) missed during the course. More absence must be agreed with the professor and be compensated.

Grading, based on exam results:
'Sehr gut' represents exceptional work, far above average.
'Gut' represents good work, above average.
'Befriedigend' represents average work.
'Ausreichend' represents below average work with considerable shortcomings.
‚Mangelhaft' is just exceptional work in the wrong direction or with unacceptable shortcomings.

Schedule

Date	Theme
Lecture 1	Topic Introduction
Lecture 2	Conceptual Framework for Industry 4.0
Lecture 3	Smart and Connected Product Business Models
Lecture 4	Maturity and Readiness Model for Industry 4.0 Strategy
Lecture 5	Technology Roadmap
Lecture 6	Internet of Things and Cyber-Physicial Production Systems
Lecture 7	Case Presentations
Lecture 8	Case Presentations
Lecture 9	Case Presentations
Lecture 10	Case Presentations
Lecture 11	Case Presentations
Lecture 12	Case Presentations

Tentative Schedule (changes tba)

Academic Integrity and Student Responsibility

The lecturer appreciates a substantial exchange between the students, because the fellow students may have valuable contributions to the comprehension of occurring problems or questions.

Following the arguments, collaboration and also an autonomous exercise solving or the discussions on upcoming questions within the lectures are fundamental for a clearer understanding of the subject matter.

Large class sizes and foreign languages imply a risk of a high noise level, which has a strong negative influence on the work climate, knowledge acquisition and collaboration. Predominantly, a high noise level is caused by a few group members. These 'troublemakers' hinder the other ones from being able to concentrate and therefore won't be tolerated and will be ejected from the class.

Code of Conduct for Students

Link to the Code of Conduct for online Teaching

Teaching Philosophy

In the classes we consider the important concepts, models, principles and phases of strategic and operational management and apply them on a real world situation. I will assist you to develop a self-contained strategic thinking, based on the acquired basic skills, and to evaluate the opportunities and the threats of different strategies and management methods. When you don't understand a learning step, you should pose a question during the lesson. I want to support every student who is committed to take the required knowledge and to pass the exams successfully.

Additional Information

Further details to be announced via e-learning (sign in and check regularly!)

Language: English