

## Syllabus

### **BAE5028 Future Mobility: from privately owned Vehicles (ICEVs) to de-carbonised autonomous mobility on demand**

Prof. Dr. Guy Fournier  
Summer Semester 2022

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<b>Level</b>	Master	
<b>Credits</b>	3	
<b>Student Contact Hours</b>	2	
<b>Workload</b>	90 hours	
<b>Prerequisites</b>	none	
<b>Time</b>	s. LSF	
<b>Room</b>	s. LSF	
<b>Start Date</b>	s. LSF	
<b>Lecturer(s)</b>	<b>Name</b>	Prof. Dr. Guy Fournier
	<b>Office</b>	T1.3.29
	<b>Virtual Office</b>	<a href="#">Virtual Office Prof. Fournier</a>
	<b>Office Hours</b>	Monday, 13:45-15:15 individual appointments should be arranged per e-mail (see below)
	<b>Phone</b>	07231 28-6546
	<b>Email</b>	<a href="mailto:guy.fournier@hs-pforzheim.de">guy.fournier@hs-pforzheim.de</a> (preferred mode of communication)

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## Summary

This course aims to advance the student's knowledge in future mobility. Mobility is a key element of our societies but is increasingly criticised because of the external costs it generates. The question is how could future mobility be more sustainable in terms of economic, social and environmental impact. Different new technologies and business models will thus be analysed and evaluated.

Main learning goals are to:

- to increase comprehension on how environment and in general external costs in transport like congestion costs, noise, accidents, climate change, air pollution, habitat damage or resource availability influence future mobility,
- to introduce future automotive technologies and mobility concepts and to evaluate them.
- to open student's mind and develop critical thinking skills.

The course is to be assigned to the "Technology" part of the elective courses.

## Outline of the Course

During a semester approximately 14 sessions are available to consider the following main topics:

- Drivers of the new mobility paradigm
- Options for the new individual mobility:
  - o Short-term strategies:
    - Aerodynamics,
    - Improved drive resistance,
    - Improved energy efficiency of car components (e.g. powersteering, air conditioning, alternator),
    - Light weight design,
    - Downsizing.
  - o Biofuel and synthetic fuels
  - o Hybrid vehicles
  - o Electric vehicles
- Electric vehicles:
  - o operating modes
  - o battery
- Automated vehicles:
  - o Operating modes and levels of automation,
  - o automated technologies:
    - Sense (perceive relevant static objects, determine the location of AV, predict the future behaviour of relevant actors) with sensors like GNSS, Radar, Camera, LiDAR, V2X)
    - Plan (create a collision free and lawful driving plan)
    - Act (correctly execute and actuate the driving plan), micro- and macro navigation
  - o Fields of application (truck, shuttle, car, train etc.)
  - o Player/market

- Legislation; Obstacles
- Mobility and services:
  - EV as a part of mobility solutions: Mobility as a service (Maas)
  - EV as a part of storage solutions: V2G, P2G
- Project and simulation reports:
  - EV and new mobility services and value-added services (V2G)
  - Car-sharing project in Baden-Württemberg
  - Robocabs simulation in Berlin and Stuttgart
  - Autonomous EV and public transportation: the “Avenue” project (Horizon 2020)
- Invited Guest: Martin Lischka, Head of Product Strategy & Product Management Pininfarina Automobili on tbd: E-Mobility and hypercars: the example of Pininfarina

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

Program Intended Learning Outcomes	Course Intended Learning Outcomes
After completion of the program the students will be able...	After completion of the course the students will be able...
<b>1 Responsible leadership in organizational contexts</b>	
<b>2 Creative problem solving skills in a complex business environment</b>	
2.1 ...to recognize and define problems as well as assess their importance.	... to gain insights into the problem of the change of the powertrain towards electrification and to assess alternatives.
2.2 ...to analyse complex in-company and inter-company problems and challenges from different perspectives and/or within an international context.	... to apply knowledge of technologies and solutions in electromobility and automated mobility.
2.4 ...to clarify successfully complex problems and solutions to both experts and laymen.	... to overview the challenges and technical approaches of electromobility and automated electromobility.
<b>3 Creative problem solving skills in a complex business environment</b>	
<b>4 Interdisciplinary and integrative work</b>	
4.1 ...to apply their expert knowledge in the engineering and business field and to provide integrated solutions to complex tasks.	... to understand the interaction of possible solutions, new services and economic conditions.

## Teaching and Learning Approach

The course consists of 6 sessions (see time table) and awards 3 credits for a successful completion of the course. It is therefore expected that student’s workload will amount at least 90 hours to prepare themselves for the sessions, attend and revise the lectures.

The teaching and learning concept is characterised by a three-phase approach, whereby the understanding of interrelationships is clearly in the foreground in comparison to the mere provision of information. In phase I and thus the essential part of the course is taught by the lecturers in the form of a lecture of the relevant knowledge. Here, the students are introduced to the relevant knowledge through e.g. questions and discussions and are actively involved.

In Phase II, these knowledge modules are deepened and transferred to practical applications, usually immediately afterwards, through exercises or case studies to be worked on by the students themselves. The results are presented by the students and then discussed. This means that in the course the basic knowledge is not only conveyed

but is also applied and deepened through application examples and exercises.

In phase III the students deepen the acquired knowledge once again independently based on the literature. Continuous collaboration and reworking of the material is therefore an indispensable prerequisite for learning success. At the same time the effort for the exam preparation is minimized and the time and effort for the whole exam preparation is semester. Active participation in teaching is an elementary component of the teaching and learning concept. The teacher is always available as a discussion partner and provides support and advice. The communication takes place in personal counselling or via e-mail.

### Literature and Course Materials

To be provided in class

### Assessment

PLH/PLL/PLK/PLP/PLR : A written exam (60 min) or housework will be provided.

Students are expected to be present at all classes. Absences have to be excused in advance and agreed upon by the lecturer. Unexcused absence during more than two classes leads to failure of the entire course.

The grading is as follows:

- 1.0 Very good, a performance significantly above the average
- 2.0 Good, an above average performance
- 3.0 Satisfactory, an average performance
- 4.0 Adequate, a below average performance with noticeable shortcomings
- 5.0 Fail, an unacceptable performance

### Schedule

Session	Date	
1	14.03.2022 13:45 - 15:15	Drivers of the new mobility paradigm
2	14.03.2022 15:30 - 17:00	Options for the new individual mobility
3	21.03.2022 13:45 - 15:15	Options for the new individual mobility
4	21.03.2022 15:30 - 17:00	Electric vehicles: operating modes, battery
5	28.03.2022 13:45 - 15:15	Electric vehicles: operating modes, battery
6	28.03.2022 15:30 - 17:00	Automated vehicles: levels of automation, sense (perceive relevant static objects, determine the location of AV, predict the future behaviour of relevant actors)

7	4.04.2022 13:45 - 15:15	Automated vehicles: Plan (create a collision free and lawful driving plan); Act (correctly execute and actuate the driving plan)
8	04.04.2022 15:30 - 17:00	EV and new mobility services and value-added services: V2G, P2G
9	11.04.2022 9:45 – 11:15	Sustainable mobility for people and goods at Quantron AG (tbc)
10	11.04.2022 13:45 - 15:15	Sustainable mobility for people and goods at Quantron AG (tbc)
11	11.04.2022 15:30 - 17:00	Sustainable mobility for people and goods at Quantron (tbc)
12	25.04.2022 9:45 – 11:15	Project and simulation reports: EV and new mobility services and value-added services (V2G)
13	25.04.2022 13:45 - 15:15	Project and simulation reports: Car-sharing project in Baden-Württemberg
14	25.04.2022 15:30 - 17:00	Project and simulation reports: Autonomous EV and public transportation: the “Avenue” project (Horizon 2020)
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## Code of Conduct for Students

[Link to the Code of Conduct for online Teaching](#)

## Teaching Philosophy

Your education is important to me. Therefore, I would like to support you. Please feel free to contact me via email if you have any questions or problems regarding the course. I will respond as soon as possible and if necessary make an appointment with you.

I want to do my part to ensure that you achieve a successful learning progress and gain an understanding of sustainable mobility. I would like to create an interesting and varied lecture for you, which will pave the way for the world of work. Your comments which serve the learning progress of all are welcome. My goal is that you are successful in the lecture, but the majority of the work you must perform yourself.

## Additional Information

**Language:** English