Vehicle System Fundamentals

1	**Module Number** 3904	**Study Programme** ASM	**Semester** 1	**Offered in** ☒WS ☐SS	**Duration** 1 Semester	**Module Type** compulsory	**Workload (h)** 180	**ECTS Points** 6
2	**Courses**		**Teaching and Learning Forms**		**Contact Time**		**Self-Study Time**	**Language**
					(SWS)	**(h)**	**(h)**	
	a) Motor Vehicles		Lecture		3	45	90	Englisch
	b) Introduction to Vehicle Propulsion		Lecture		2	30		
	c) Lab Motor Vehicles		Lab		1	15		

3 **Learning Outcomes and Competences**

Once the module has been successfully completed, the students can...

Knowledge and Understanding

- ... explain the basic terms in vehicle technology and internal combustion engine technology as well as in components of electric and hybrid vehicles
- ….describe the different powertrain topologies like conventional, hybrid and battery- as well as fuel cell electric
- ... describe the different vehicle drivetrain configurations like front wheel, rear wheel and 4-wheel-drive
- … explain basic component parts of the chassis and the drive train
- … understand and calculate rolling resistance, aerodynamic drag, climbing and acceleration resistance and their impact on energy consumption
- … gain a first knowledge of transversal vehicle system simulation including torques, powers and energy flows

Use, Application and Generation of Knowledge

Use and Transfer

- … choose the best engine and driveline combination for different types of vehicles.
- ... create testing reports and present test results.
- ... analyze the state of the art wheel suspension systems
- ... understand the physical behaviour of forces between road and tyre for vehicle dynamics simulation
- … familiarize themselves with new ideas and topics in the field of automotive powertrains and suspensions
- … compare different powertrain topologies and their performance and efficiency

Scientific Innovation

- … find new technologies to lower energy consumption .
- ... optimize powertrains for high driving performance
- ... set up new driving test procedures and experience energy flows and driving performance with the help of simulation
- … calibrate tyre models to measurements
- ... independently develop approaches for new suspension and driveline concepts and assess their suitability.

Communication und Cooperation

- ... communicate actively within a research or development team and obtain information.
- ... interpret the results of vehicle testing and draw admissible conclusions.
- ... communicate with powertrain and chassis designers about new solutions

Scientific Self-Conception/ Professionalism

- … derive recommendations for decisions from an environmental and safety perspective on the basis of the analyses and evaluations made.
- ... justify the solution theoretically and methodically

4 **Contents**

	a) Lecture: Motor Vehicles The course gives a basic knowledge in vehicle technology and their components The power train is mainly focused The aim is to learn the ability to calculate driving resistance and to design the power train with respect to driving performance and fuel consumption b) Introduction to Vehicle Propulsion Internal Combustion Engine (Ice) and Engine Control Fundamentals, including trends of the Ice. Alternative Powertrains: Ice-Hybrid, Battery-Electric Vehicle, Fuel-Cell Electric Vehicle and their specific components (Battery, Fuel-Cell, Electric Motor) Longitudinal vehicle Simulation (Simulink), consumption and performance (torque, power, energy flows) c) Lab: Motor Vehicles Determination of full-load torque and power pattern by using the car test bench Detection of fuel consumption map Determination of a tyre map by using the tyre test bench EUREPA. Analysis of vehicle road tests
5	**Participation Requirements** compulsory: no recommended: Fundamentals of Engineering Mechanics
6	**Examination Forms and Prerequisites for Awarding ECTS Points** Written Examination 120 Minutes
7	**Further Use of Module** Propulsion Systems Team Project
8	**Module Manager and Full-Time Lecturer** Prof. Dr. Holtschulze
9	**Literature** Heywood, J.B. Internal Combustion Engine Fundamentals McGraw-Hill BOSCH Automotive Handbook Distribution SAE
10	**Last Updated** 18.10.2022