Name of module:	**Powertrain Management**
Keywords:	Power-train, Transmission, Hybrid, Drive Control, Engine Control
Modulenumber:	**ASM 224**
Target group(s):	2. Semester ASM
ECTS-Credits:	8
Language of instruction:	english
Module owner:	Prof. Werner Klement

Extent of work (hours)

Workload	Contact hours	Self study	Exam preparation
240	120	90	30

Prerequisites:	• undergraduate course in mechanics (especially planar kinematics and kinetics of rigid bodies) • fundamentals of automotive engineering including principles of chassis design • linear algebra including fundamental matrix calculus and eigenvalues
Total target:	• To understand the design of state of the art transmissions like planetary gear sets, double clutch and continuously variable transmissions. • Analyze power train systems regarding speeds, torques and efficiency. • To be able to control combustion engines, hybrid power trains and power shift transmissions.
Module content:	• Electro hydraulic transmission control systems. • Mathematical models for pressure control valves and shift process. • Shift schedules for optimal fuel economy and best drive ability. • Electronic control units for transmission control including interfaces and power stages. • Diving strategy using car to car and car to infrastructure communications. • Demands for transmissions, Planet gears (Torque and Speed diagrams) • Type of transmission for vehicles CVT, Automatic, Hybrid systems

Reference material:	BOSCH: Automotive Handbook, Distrubution SAE Klement, W.: Fahrzeuggetriebe Hanser Verlag 2005 Lechner, G. ; Naunheimer, H.:Automotive Transmissions Springer Verlag 1999
Offered:	Summer term only

Submodules and assessment

Title of submodule	**Engine Control Systems**
Type of instruction / form of learning:	• Lecture, simulation exercises
ECTS-Credits:	2
Hours per week:	2
Aims, learning outcomes:	• Basic knowledge of the Otto combustion engine and the needed components to control the engine • History and new trends of gasoline engines • ECU functions for torque structure, load detection, injection time calculation and ignition timing including the control functions “idle speed control” and “Lambda control” • Matlab / Simulink simulation model of the Otto engine and the engine control unit • Perform simulations with parameter variation with the help of the model • Outlook for future power train concepts like hybrid vehicles
Type of assessment:	final written examination 60 min

Title of submodule	**Transmission Control**
Type of instruction / form of learning:	Lecture
ECTS-Credits:	3
Hours per week:	3
Aims, learning outcomes:	• To understand the overall structure of transmission control systems. • To know the components of automatic transmissions like disc clutches and brakes, gear sets , control valves, electronic control units, interfaces. • To find mathematical models for different types of pressure control valves like slider valve, flat seat or PWM valve. To be able to compare the different types of control valves. • To be able to derive mathematical models for hydraulic networks used in transmission control systems. • To understand the basic valve timing used in power shift transmission technology. • To be familiar with the basic principles of driving strategy.
Type of assessment:	final written examination part I: 60 min together with transmission systems

Title of submodule	**Transmission Systems**
Type of instruction / form of learning:	Lecture
ECTS-Credits:	3
Hours per week:	3
Aims, learning outcomes:	• Calculation of vehicle performance data, Demands for vehicle transmissions Range of transmissions • Planetary gear sets, Speed sheet, Torque calculation • Continuously variable torque converters Mechanical variable torque converters Hydrodynamic torque converters • Automatic transmissions Shifting components • Power split transmission • Hybrid transmission, parallel systems, serial systems
• **Type of assessment:**	final written examination part II: 60 min together with transmission control