Ostfalia
Hochschule für angewandte Wissenschaften

Curriculum Mechanical Engineering in English Language

The following lectures are based on two years of fundamental Mechanical Engineering or Industrial Engineering studies.

Single Lecture	Class hour	ECTS	Period	Lecturer
M03.2 Fluid Mechanics (Strömungslehre)	3	3	SS	Klinge
PA2.1 Surface Engineering and Technology (Technische Oberflächen)	2	3	WS	Ahmed
PA1.1 Vehicle Dynamics (Fahrzeugdynamik)	2	3	WS	Dorsch
PA1.2 Mobile Car Drive Systems (Fahrzeugantriebe)	2	3	WS	Heikel
PM2.1 Microcontroller (Mikrocontroller)	3	4	WS	Roskam
PM3.1 Sensor Engineering and Measured Data Processing (Sensortechnik und Messdatenverarbeitung)	3	4	WS	Balan
PM3.2 Circuit Technology (Schaltungstechnik)	3	4	WS	Hartwig
PP2.1 Handling and Assembly Technology (Handhabungs- und Montagetechnik)	2	2	WS	Brüggemann
PP3.3 Machine and Factory Planning (Anlagen- und Fabrikplanung)	2	3	WS	Borbe
WP2.1 Process Chain of Sheet Metal Working (Prozesskette Blechverarbeitung)	3	4	WS	Rambke
WP3.1/PDP3.1 Internet of Production	3	3	WS	Triltsch
PM 1.2 Communication and Computation for CPS	3	4	WS	Strube
WP2.1 Additive Manufacturing Process (Additive Fertigungsverfahren)	4	5	WS	Menzel
Sum	38	45		13

Project Work	Class hour	ECTS	Period	Lecturer
Project	1	2	WS/SS	All
Student Project I	-	12	WS/SS	All
Student Project II	-	12	WS/SS	All
Colloquium (topic of Student Project I or II)	1	1	WS/SS	All
Workshop Social Competence	1	1	Special	Klinge/Roskam
Bachelor Thesis	-	12	WS/SS	All
Bachelor Colloquium	-	2	WS/SS	All

Period: WS: Winter Semester: Monday, September third week to January 31st, SS: Summer Semester: March 1st to July second week, Exams are given in Englisch and German language.

Wolfenbüttel, 16.06.2022, R. Roskam

Module Description

Fluid Mechanics	
Learning objective	The students attending this course will understand fundamentals of fluid mechanics. They are able to apply this knowledge to simple tasks and to explain them. By preparing and presenting experiments of fluid mechanics, each student will have a close look to major effects of fluid mechanics and the possibility to improve his knowledge by experimenting with them on its own.
Content	Types of fluid motions, boundary layer, viscosity, mechanism of flow separation, conservation of momentum, lift and drag forces of bended plates (airfoils), supersonic flows, pressure losses of tubes and installations. Fundamental principles of computational fluid mechanics (CFD), general overview to theoretical background and application of cross correlation based optical flow and structure measurement techniques.

Surface Engineering and Technology	
Learning objective	To provide an introduction to the basic principles and techniques of surface engineering and technology. Students are made aware of a wide variety of surface-related issues and the means to engineer a surface to achieve desired properties. The in-class segment of the course is accompanied by a laboratory segment.
Content	Properties of technical surfaces. Corrosion and surface wear. Surface pre-coating as well as post-coating treatments. Galvanic (including electroless) coatings. Physical and chemical vapour deposition. Conversion coatings. Metal Enameling. Organic coatings. Thermal spraying techniques. Surface characterization and analysis.

Vehicle Dynamics	
Learning objective	The students apply their knowledge of basic dynamics to analyse and design vehicles. They know the influence of parameters on vehicle features and can thus design the conceptual vehicle layout. They know target numbers of important features to be reached by their design concepts.
Content	Longitudinal dynamics with tyre slip and rolling radius, driving resistances, behaviour of clutch and gearbox; Traction force diagram with computation of top speed, acceleration, slope and fuel consumption; Dynamic load distribution when braking and accelerating, distribution of braking forces and braking distance; Vertical dynamics with corner model for spring and damper layout due to natural frequencies, rolling behaviour using a four-wheeled model; Handling with single-track (two-wheeled) model, over- and understeer.

Car Drive Systems	
Learning objective	The students will be able to analyze and evaluate current drive systems in terms of energy and road performance.
Content	Vehicle energy storage systems; energy conversion of the drive system; energy transmission from the engine to the wheel; internal combustion engine; electric drive systems; Cooperation of the engine, the transmission and the energy storage; hybrid drives.

Microcontroller	
Learning	The students can develop control tasks using a microcontroller. This includes

objective	the design of the hardware as well as the programming and testing of the software.
Content	Basics (state information, information presentation and processing), development environment, memory, IO control, structured programming, timer, D/A converter, PWM control, A/D converters, interrupts, time/frequency measurement, project task

Sensor Engineering and Measured Data Processing	
Learning objective	Learning of metrological procedures and selection of suitable sensors for measuring physical quantities. Understanding of the functioning of sensors and their applications. Students are able to select suitable sensors, practical dimension the measurement circuit and amplifier circuit with operational amplifiers, build filter circuits and perform the programming of data acquisition. The static and dynamic properties of sensors are considered. The influence of factors such as: construction of the measuring system, bus system, type of measurement, software and operating system for data acquisition is theoretically and practically studied. Laboratory setups in combination with various types of sensors, and the data acquisition and measurement data processing in LabView complete the theoretical knowledge acquired. Measuring practice.
Content	Operation and applications of sensors such as resistive, capacitive, inductive, optical, Hall, ultrasonic, piezoelectric. Static and dynamic characteristics, advantages and disadvantages of practical applications. Data Processing: bus systems, bandwidth and latency, sampling of a measurement system. Modulation schemes for data transmission. Protocols. The ISO-OSI-reference model. Structure and function of amplifier and filter circuits. Operational amplifier in practice. A/D conversion method including: successive approximation, two ramps method, delta-sigma, as well as D/A conversion process such as: binary-stepped resistances R/2R network. Circuits with operational amplifiers. Experimental investigation of sensors on laboratory setups as well as the programming of data acquisition in LabView. Experimental design of circuits for data acquisition and amplification. Embedded-Systems.

Circuit Technology	
Learning objective	Students understand and are able to analyze the non-linear characteristics of semiconductor devices, basic analog and digital circuits. They can calculate basic analog circuits based on technical data and thresholds. Students have basic knowledge about the control of electromagnetic actuators with switching amplifiers. They know how to use transistors both as linear and switch amplifier. Students are able to calculate and simulate the basic functions of switching power supplies and switching circuits.
Content	Voltage stabilization with a Z-diode. Current stabilization with a junction field effect transistor. Switching amplifier and pulse width modulation (frequency). Stabilized power supplies. Optocoupler. Automotive sensor technology. Combinatorial and sequential digital circuits. Electromagnetic compatibility.

Handling and Assembly Technology	
Learning objective	Teaching basic skills of handling and assembly technology; Application of methods for assembly planning, practical laboratory.
Content	Basics of handling and assembly technology, feeding systems, robotic systems, assembly systems, planning of assembly systems, assembly-friendly product design, case studies for handling and assembly technology, programming exercises and tasks for programming of robots in the laboratory.

Machine and Factory Planning	
Learning objective	
Content	

Process Chain of Sheet Metal Working	
Learning objective	Students are able to explain the development process for sheet metal parts. They can decide on the correct usage of simulation tools (incremental FEA / 1-Step) at the right time. They know the importance of using virtual prototypes as well as physical prototypes close to production. They can interpret process layouts for progressive and transfer tools based on the manufacturing by deep drawing, hydroforming, press hardening and (fine-)blanking. They can explain the influence of different materials and lubricants on sheet metal forming processes.
Content	Material values which are relevant for the forming technology; stamping simulation with incremental and 1-step FEA; basic principles concerning tool layout, tool design, tooling and planned maintenance; Integration of the tooling process into the product development process.

Internet of Production	
Learning objective	At the end of the course, students will be familiar with the current possibilities of networked and digitalized production. In addition to the overview of the topic, individual areas will be deepened.
Content	Networking and control of production plants and systems; Smart assistance systems, data aggregation.

Communication and Computation for CPS	
Learning objective	
Content	

Additive Manufacturing Process	
Learning objective	
Content	