MBB Nr folgt – Metal Forming Technology and Laser Material Processing

1	**Module Number**	**Study Programme**	**Semester**	**Offered in**	**Duration**	**Module Type**	**Workload (h)**	**ECTS Points**
	MBB Nr folgt	MBB	6	☒WS ☒SS	1 Semester	Comp. elective	150	5

2	**Courses**	**Teaching and Learning Forms**	**Contact Time**		**Self-Study Time**	**Language**
			(SWS)	**(h)**	**(h)**	English
	a) Metal Forming Technology	Lecture	2	30	**75**	
	b) Laser Material Processing	Lecture	1,5	22,5		
	c) Lab Metal Forming Technology	Lab	1	15		
	d) Lab Laser Material Processing	Lab	0,5	7,5		

3 **Learning Outcomes and Competences**

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

Knowledge and Understanding

- Explain the basic processes of metal forming
- Describe sheet metal forming processes mostly used in industry
- Understand the process limits
- Describe the functionality of forming presses
- Understand possibilities of modern production processes with laser as a tool (e.g. additive manufacturing)

Use, Application and Generation of Knowledge

Use and Transfer

- Create reports and presentations in English
- Develop possible process chains for new products
- Calculate sheet metal processes by FEM simulations
- Create new design concepts for parts, using sheet metals or tubes

Scientific Innovation

- Optimize existing process chains by further use of simulation tools
- Independently develop approaches for new forming concepts and assess their suitability
- Develop concepts for the optimization of forming processes
- Automatization of high volume production with sheet metals

Communication and Cooperation

- Interpret the results of FEM process simulation of sheet metal forming
- Use the learned knowledge, skills and competences to evaluate the feasibility of forming processes
- Present the feasibility to manufacture new components
- Working in groups and present new solutions for design tasks

Scientific Self-Conception/ Professionalism

- Justify the feasibility of sheet metal forming process chains and methodically
- Production of the group work sheet metal designs to see how it works

4 **Contents**

a) Plasticity; Sheet metal forming: Deep drawing, drawing of complex parts, car body parts, blanking; Development of process chains using FEM; Hydraulic and mechanical presses, modern servo presses; Applications: Components, case studies, weight reduction

b) Laser beam sources: Principle of laser and beam characteristics, beam guidance and –forming, laser security; Laser material processes: Cutting/welding/removing/hardening/marking, quality systems for laser material processing; Laser- and sheet metal processing systems: Cutting and welding systems, punching and forming of sheet metal, design of sheet and pipe constructions. Introduction of laser based additive manufacturing technologies: powder-bed based technologies (L-PBF-M/P), direct energy deposition (DED) and introduction to new tooling concepts such as conforming cooling channels

c) Sheet metal forming: Experiments deep drawing, bending, blanking, digital strain measurement; Machines: Modern servo press technology; Development of process chains within case studies using the industrial FEM-Software AutoForm

d) Design of sheet metal parts in 3D-CAD-systems, programming of machines for sheet metal processing, manufacturing of sheet metal parts, marking, demonstration of complete sheet metal process chain / alternatively designing of parts for L-PBF-M process and applying consequent software tools (e.g. slicing, support structure generation,…)

5	**Participation Requirements** Recommended: - Basic knowledge in production technology - 3D-CAD software
6	**Examination Forms and Prerequisites for Awarding ECTS Points** a) Metal Forming Technology: Written examination 60 min., graded b) Laser Material Processing: Written examination 45 min., graded c) Lab: Report, not graded d) Lab: Report, not graded
7	**Further Use of Module** Compulsory elective subject within Bachelor program. Further use of module contents in: • MBB Production Engineering • MBB Automation Technology
8	**Module Manager and Full-Time Lecturer** Responsible: Prof. Dr.-Ing. Stefan Wagner Lecturer: Prof. Dr.-Ing. Stefan Wagner, Prof. Dr.-Ing. Lukas Löber
9	**Literature** • Lecture Materials • Metal Forming Handbook, ISBN 978-3-642-58857-0 • Altan, T.: Sheet Metal Forming, Fundamentals; ISBN 978-1-61503-842-8 • Altan, T.: Sheet Metal Forming, and Applications; ISBN 978-1-61503-844-2 • TRUMPF Design Guideline for Sheet Metal Design, Fa. TRUMPF Ditzingen
10	**Last Updated** 30.11.2023