## Module MBB 7920 – Metal Forming Technology and Laser Material Processing

| 1 | Module Number | Study Programme | Semester | Offered in | Duration | Module Type | Workload (h) | ECTS Points |
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| | 7920 | MBB | 6 | ☒WS ☒SS | 1 Semester | Comp. elective | 240 | 8 |

| 2 | Courses | Teaching and Learning Forms | Contact Time (SWS) | Contact Time (h) | Self-Study Time (h) | Language |
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| | a) Metal Forming Technology | Lecture | 4 | 60 | **120** | English |
| | b) Laser Material Processing | Lecture | 2 | 30 | | |
| | c) Lab Metal Forming Technology | Lab | 1 | 15 | | |
| | d) Lab Laser Material Processing | Lab | 1 | 15 | | |

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

**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

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| 4 | **Contents**<br>a) Lecture "Metal Forming Technology" (4 ECTS):<br>• Plasticity<br>• Sheet metal forming: Deep drawing, drawing of complex parts, car body parts, blanking, press hardening, hydroforming<br>• Sheet metal forming dies<br>• Hydraulic and mechanical presses, modern servo presses, automation part transfer<br>• Development of process chains<br>• Applications: FEM simulation, components, case studies, weight reduction<br><br>b) Lecture "Laser Material Processing" (2 ECTS):<br>• Physical basics of lasers and beam propagation: Principle of laser and beam characteristics; beam guidance and – forming, laser material interactions<br>• Laser beam sources: types of lasers, properties of laser sources,<br>• Laser material processes: Cutting, welding, removing, hardening, marking; laser safety aspects<br>• laser based additive manufacturing technologies: powder-bed based technologies (L-PBF-M/P), direct energy deposition (LB-DED-M)<br><br>c) Laboratory Exercises "Metal Forming Technology" (1 ECTS):<br>• Material behaviour experiments: Work hardening, digital strain measurement<br>• Sheet metal forming experiments: Deep drawing, bending, cutting<br>• Machines: Modern servo press technology in comparison to conventional presses<br>• Learning the industrially used FEM simulation programme AutoForm, carrying out own process designs.<br>• Independent development of a process chain: FEM, tool production, production of a component by deep drawing, trimming with laser. At the end of this exercise, each student can take an own component.<br><br>d) Laboratory Exercises "Laser Material Processing" (1 ECTS):<br>• Design of sheet metal parts in 3D-CAD-systems<br>• Programming of machines for sheet metal processing<br>• Manufacturing of sheet metal parts, complete sheet metal process chain incl. laser cutting |
| 5 | **Participation Requirements**<br>Recommended:<br>- Basic knowledge in production technology<br>- 3D-CAD software |
| 6 | **Examination Forms and Prerequisites for Awarding ECTS Points**<br>a) Metal Forming Technology:<br>Written examination 120 min., graded<br>b) Laser Material Processing:<br>Written examination 60 min., graded<br>c) Laboratory Metal Forming Technology:<br>Not graded (it is also possible to grade the lab exercise if students need a grade)<br>The prerequisite for this laboratory exercise is participation in the lecture "Metal Forming Technology".<br>The laboratory exercises take place on individual dates in small groups; dates are agreed in the lecture.<br>d) Laboratory Laser Material Processing:<br>Not graded (it is also possible to grade the lab exercise if students need a grade)<br>The prerequisite for this laboratory exercise is participation in the lecture "Laser Material Processing ".<br>The laboratory exercises take place on individual dates in small groups; dates are agreed in the lecture. |
| 7 | **Further Use of Module**<br>Compulsory elective subject within Bachelor program.<br>Further use of module contents in:<br>• MBB Production Engineering<br>• MBB Automation Technology |
| 8 | **Module Manager and Full-Time Lecturer**<br>Responsible: Prof. Dr.-Ing. Stefan Wagner<br>Lecturer: Prof. Dr.-Ing. Stefan Wagner, Prof. Dr.-Ing. Lukas Löber |

## Module MBB 7920 – Metal Forming Technology and Laser Material Processing

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| 9 | **Literature**<br>• Lecture Materials<br>• Laser Material Processing, eBook ISBN 978-1-84996-062-5<br>• Metal Forming Handbook, ISBN 978-3-642-58857-0<br>• Altan, T.: Sheet Metal Forming, Fundamentals; ISBN 978-1-61503-842-8<br>• Altan, T.: Sheet Metal Forming, and Applications; ISBN 978-1-61503-844-2<br>• TRUMPF Design Guideline for Sheet Metal Design, Fa. TRUMPF Ditzingen |
| 10 | **Last Updated**<br>07.02.2025 |