

Studiengang: <b>Master of Science Maschinenbau</b> Program: <i>Master of Science in Mechanical Engineering</i>														
1	Modul: <b>Surface Engineering and Tribology</b> Module: <i>Oberflächentechnik und Tribology</i>		<b>English</b> <i>Englisch</i>											
	<b>Fach-Nr.</b> <i>Course number</i>	<b>Semester</b> <i>Semester</i>	<b>Dauer</b> <i>Duration</i>	<b>Status</b> <i>Status</i>										
			1	elective										
	<b>Kreditpunkte</b> <i>Credits</i>	<b>Aufwand</b> <i>Workload</i>	<b>Kontaktzeit</b> <i>Contact-hours</i>	<b>Selbststudium</b> <i>Student's efforts</i>										
	5 ECTS	150hrs	3hrs/week = 45hrs lecture 1h/week = 15hrs laboratory	30hrs preparation 30hrs lab evaluation 30hrs exam preparation										
2	<b>Beschreibung</b> <i>Description</i> <p>In many applications, the performance of a mechanical component is rather controlled by the surface properties than by the bulk (volume) material properties. Catalysis, corrosion, adhesion or non-adhesion, friction and wear, optical effects, biological processes (implants) are examples for such applications. Precise control of the surface properties is necessary to get optimal system performance and longevity. This lecture will discuss several surface related applications; different surface engineering approaches to problems will be discussed and compared. According test and analysis methods will be introduced and applied.</p> <p>Tribology is the science of friction, wear and lubrication. Friction and wear appear in every situation where a fluid or a rigid body slides against a surface. Control of friction and wear is essential for proper system function, high energy efficiency, and a long component life. This lecture introduces into the basic concepts of tribology and tribological testing. Special emphasis is put on the analysis of practical tribological problems and a systematic approach to their solution.</p>													
3	<b>Lernziele</b> <i>Learning Outcomes</i> <ul style="list-style-type: none"> <li>• The student will have a theoretical understanding of the physical and chemical surface properties of materials,</li> <li>• the student will be able to analyse the requirements for several practical applications and to select suitable surface treatments or coatings,</li> <li>• the student will be enabled to perform a system analysis of tribo-systems,</li> <li>• the student will be able to describe different friction modes, wear mechanisms and to optimise the tribological system performance.</li> </ul>													
4	<b>Schlüsselqualifikationen</b> <i>Key qualifications</i> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td style="width: 20%;">Sozialkompetenz</td> <td style="width: 20%;">Methodenkompetenz</td> <td style="width: 20%;">Selbstkompetenz / Personenkompetenz</td> <td style="width: 20%;">Interkulturelle Kompetenz</td> <td style="width: 20%;">Medienkompetenz</td> </tr> <tr> <td></td> <td style="text-align: center;">X</td> <td style="text-align: center;">X</td> <td></td> <td></td> </tr> </table>				Sozialkompetenz	Methodenkompetenz	Selbstkompetenz / Personenkompetenz	Interkulturelle Kompetenz	Medienkompetenz		X	X		
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5	<b>Lehrveranstaltung/ -methoden</b> <i>Course type and methods</i> <p><b>Lecture</b></p> <ul style="list-style-type: none"> <li>• Seminar-like teaching</li> <li>• Exercises and examples (case studies)</li> </ul> <p><b>Laboratory exercise</b></p>													
6	<b>Vorbedingungen / Vorkenntnisse</b> <i>Prerequisites</i> Material science lecture from the bachelor programme, material science from the master programme Recommended: Knowledge in heat treatment of metals													
7	<b>Arbeitsmittel / Literatur</b> <i>Required material / Literature</i> <ul style="list-style-type: none"> <li>• Descriptions of laboratory exercises</li> <li>• Script Theoretical Surface Science</li> <li>• Theo Mang, Kirsten Bobzin and Thorsten Bartels, Industrial Tribology</li> <li>• Michel Cartier, Handbook of Surface Treatments and Coatings</li> <li>• A current list will be distributed at the beginning of the lecture.</li> </ul>													

Detailinformationen																				
8	<b>Inhalte</b> <i>Course topics</i> <b>Introduction</b> <ul style="list-style-type: none"> <li>➤ typical materials and their surface properties</li> <li>➤ surface structure and structure of coatings</li> <li>➤ overview of several coating techniques and surface treatments</li> <li>➤ polymer surfaces and polymer coatings</li> </ul> <b>Testing and analysis in surface engineering</b> <ul style="list-style-type: none"> <li>➤ optical effects, adhesion or non adhesion, longevity, tribology</li> <li>➤ roughness, hardness, contact angle (surface energy), light microscopy, SEM, EDX</li> </ul> <b>Tribology</b> <ul style="list-style-type: none"> <li>➤ tribological-system</li> <li>➤ sliding modes</li> <li>➤ micro-mechanisms of friction and wear</li> <li>➤ lubrication and lubricants</li> <li>➤ friction and wear testing, characteristic values</li> <li>➤ system analysis of tribo-systems</li> </ul> <b>Surfaces in several industrial applications</b> <ul style="list-style-type: none"> <li>➤ medicin, food, transport, chemistry</li> <li>➤ standards and approval</li> <li>➤ damages, problems and solutions</li> </ul> <b>Laboratory</b> <ul style="list-style-type: none"> <li>➤ pre-treatment and coating of materials</li> <li>➤ characterisation of treatment result</li> <li>➤ material test with a tribometer</li> </ul>																			
9	<b>Prüfungsform</b> <i>Assessment</i> Written examination at the end of the term: 2 hours.																			
10	<b>Voraussetzung für die Vergabe von Kreditpunkten</b> <i>Requirements for granting of credits</i> <ul style="list-style-type: none"> <li>• successful passing of exam</li> <li>• successful reporting of lab experiments</li> </ul>																			
11	<b>Weiterführende Veranstaltungen</b> <i>Related courses</i> <ul style="list-style-type: none"> <li>• Master – Project and Master - Thesis</li> </ul>																			
12	<b>Zuordnung</b> <i>Classification</i> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 12.5%;">Mathematik &amp; Naturwissenschaft</th> <th style="width: 12.5%;">Ingenieurwissenschaften</th> <th style="width: 12.5%;">Ingenieur-anwendungen</th> <th style="width: 12.5%;">Entwicklung &amp; Konstruktion</th> <th style="width: 12.5%;">Werkstoffe &amp; Fertigung</th> <th style="width: 12.5%;">Wirtschaft, Management, Sprachen</th> <th style="width: 12.5%;">Anderes</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>X</td> <td>X</td> <td></td> <td>X</td> <td></td> <td></td> </tr> </tbody> </table>						Mathematik & Naturwissenschaft	Ingenieurwissenschaften	Ingenieur-anwendungen	Entwicklung & Konstruktion	Werkstoffe & Fertigung	Wirtschaft, Management, Sprachen	Anderes	X	X	X		X		
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13	<b>Modulbeauftragter / Lehrpersonen</b> <i>Responsible person / Lecturers</i> Prof. Dr. Bender / Prof. Dr. Bender, Prof. Dr. Jacobs																			