TECHNISCHE HOCHSCHULE LÜBECK

Module: Composite Materials

Level	Master	**Short Name**	CMat
Responsible Lecturers	Prof. Dr.-Ing. Olaf Jacobs		
Department, Facility	Mechanical Engineering and Business Administration		
Course of Studies	Mechanical Engineering, Master		
Compulsory/elective	Elective	**ECTS Credit Points**	5
Semester of Studies	2	**Semester Hours per Week**	4
Length (semesters)	1	**Workload (hours)**	150
Frequency	WiSe	**Presence Hours**	60
Teaching Language	English	**Self-Study Hours**	90
The following section is filled only if there is **exactly one** module-concluding exam.			
Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			
The previous section is filled only if there is **exactly one** module-concluding exam.			
Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✘ Making subject diversity visible (female researchers, cultures etc.)		
Applicability	MSc thesis		
Remarks			

TECHNISCHE HOCHSCHULE LÜBECK

Module Course: Composite Materials (Lecture)

(of Module: Composite Materials)

Course Type	Lecture	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	5
Participation Limit		**Semester Hours per Week**	4
Group Size		**Workload (hours)**	150
Teaching Language	English	**Presence Hours**	60
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	90
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type	Written Exam	**Exam Language**	English
Exam Length (minutes)	120	**Exam Grading System**	One-third Grades

Learning Outcomes	• The student will be able to choose for practical applications the most suitable fibre type among the available fibres, to select the most suitable matrix material and the most suitable preform and processing method. • The student will be able to derive the laminate properties (micromechanics and laminate therory) data and to tailor laminate properties to external loads. • The student will be able to calculate internal thermal stresses of plies and laminates.
Participation Prerequisites	

The previous section is filled only if there is a course-specific exam.

Contents	**Introduction** • Technical and economic significance of composite materials, • overview: classification of composite materials **Fibres and matrices** • CF, GF, AF, other synthetic and natural fibres: structures and properties, selection rules • Thermoplastics, thermosets, elastomeres: properties and processing, selection rules • Tayloring of interfaces: adhesion, coupling agents **Processing of polymer composites** • Textile processing of fibres, semi-finished products, manufacturing of composite components. • Effects of processing method on mechanical properties • Processing of short fibre reinforced polymers and resulting microstructures (anisotropy)

	Micromechanics • Fibre/matrix interaction, rules of mixture, internal stresses, • Properties of UD laminae and of textile preforms **Calculation of laminate properties** • Network theory, calculation of optimal fibre orientations, symmetry considerations • Laminate theory: calculation of elastic constants and strength of laminates, laminates under stress (stress distribution, interaction of laminae), hygrothermal stresses and their effects on laminate properties **Failure mechanisms in fiborous laminates** • Failure modes under static loads: fibre matrix debonding, matrix cracking, fibre fracture, delamination • Damage development under cyclic stresses • Failure criteria and calculation of laminate failure **Designing with composite materials** • Tailoring of material properties to loadings • Joining of composites • Design to manufacture rules **Practice** • Visit at a company
Literature	• O. Jacobs, Composite Materials, Manuscript, FH Lübeck • D. Hull, An introduction to composite materials, Cambridge Univ. Press • R.F. Gibson, Principles of Composite Materials Mechanics, McGraw Hill • A. Kelly, C. Zweben (eds.), Comprehensive Composirte Materials, Vol. 1-6, Elsevier, Amsterdam et al.
Remarks	