Studiengang:	**Master of Science in Mechanical Engineering**			FACH HOCHSCHULE LÜBECK University of Applied Sciences
Program:	*Master of Science in Mechanical Engineering*			

1	**Modul:**	**Selected Topics in Engineering Mathematics**			**English**
	Module:	*Ausgewählte Themen der Ingenieurmathematik*			*Englisch*
		Semester *Semester*	**Dauer** *Duration*	**Status** *Status*	**Turnus** *Regular cycle*
		1. Semester	1 Semester	compulsory	anual
	Kreditpunkte *Credits*	**Aufwand** *Workload*	**Kontaktzeit** *Contact-hours*	**Selbststudium** *Student's efforts*	
	5 ECTS	150h	4hrs/week = 60hrs lectures	30hrs Preparation and post processing 60hrs Self-study	

2	**Beschreibung** *Description*
	In comparison to the lectures mathematics I-III presented in the bachelor curriculum, this lecture deals with more advanced topics which will lead to a deeper understanding of mathematics. Despite of this, all results and methods presented in this lecture have a direct relationship to the work of an engineer in industry or research.

3	**Lernziele** *Learning Outcomes*
	After successful completion of this course, the students are able to

- understand mathematical proofs
- to apply advanced mathematical methods to engineering problems.
- to solve individual problems with the aid modern software tools like MATLAB
- to describe and analyze the behavior of dynamical systems mathematically.

4	**Schlüsselqualifikationen** *Key qualifications*				
	Sozialkompetenz	Methodenkompetenz	Selbstkompetenz / Personenkompetenz	Interkulturelle Kompetenz	Medienkompetenz
		X	X		

5	**Lehrveranstaltung/ -methoden** *Course type and methods*
	Lecture

- Seminar-like teaching
- Exercises and examples (case studies)

Exercise

- Drill and practice

6	**Vorbedingungen / Vorkenntnisse** *Prerequisites*

- Mathematics I, II, III (Bachelor Level)

7	**Arbeitsmittel / Literatur** *Required material / Literature*

- Mainly the specific chapters of Mayberg/Vachenauer: Höhere Mathematik 1, 2; Berlin: Springer
- Kreyszig, Erwin: Advanced Engineering Mathematics, Wiley & Sons
- Shima/Nakuyama: Higher Mathematics for Physics and Engineering, Berlin: Springer

Detailinformationen

8	**Inhalte**
	Course topics

Linear Algebra
Bases, change of bases, orthogonal, unitary, symmetric and positive definite matrices, rotations, eigenvalues and eigenvectors, normal form of Schur, principle vectors, Theorem of Cayley-Hamilton, block-diagonal normal form

Linear Differential equations
Matrix exponential function, linear differential equations of order n, solution formula for linear systems, stability

Boundary value and eigenvalue problems
Fundamental matrices, linear boundary value problem for systems of differential equations, linear boundary value problems for differential equations of order n, Green functions, eigenvalue problems

Partial differential equations (PDEs)
Basic definitions and introductory examples, PDEs of order 2, classification, separation of variables, vibrating string, heat transfer, problem of Dirichlet, solution with Green's functions

Calculus of variations
Functionals and Gateaux derivative, Lagrange functions, Euler-Lagrange equations, natural boundary conditions, transversality conditions, direct Methods (methods of Ritz and Galerkin)

Prüfungsform
Assessment
Written examination at the end of the term: 2 hours.

9	**Voraussetzung für die Vergabe von Kreditpunkten**
	Requirements for granting of credits

- Successful passing of exam

10	**Weiterführende Veranstaltungen**
	Related courses

- Mechanics of Solids,
- Selectec Topics of Finite Element Methods
- Simulation and Control,
- Toolbox for Fluid Mechanical Design

11	**Zuordnung**
	Classification

Mathematik & Naturwissenschaft	Ingenieur-wissen-schaften	Ingenieur-anwen-dungen	Entwicklung & Kon-struktion	Werkstoffe	Wirschaft, Management, Sprachen	Anderes
X	X	X				

12	**Modulbeauftragter / Lehrpersonen**
	Responsible person / Lecturers

Prof. Dr. R. Kral / Prof. Dr. J. Bausa, Dr. A. Harder, Prof. Dr. R. Kral