DEPARTMENT OF CIVIL ENGINEERING
COURSE SYLLABUS

Course Details				
Code		**Academic Year**		**Semester**
MAT302		3		Fall
Title	**T**	**A**	**L**	**ECTS**
Numerical Mathematics	3	1	1	6

Language	German					
Level	**Undergraduate**	**X**	**Graduate**		**Postgraduate**	
Department / Program	Civil Engineering					
Forms of Teaching and Learning	Formal					
Course Type	**Compulsory**		**Elective**	**X**		
Objectives	Upon successful completion of this course, a student will have comprehensive knowledge of below subjects; - Introduction to typical numerical questions - Use numerical algorithms and numerical software - Principles and methods for the numerical solution of mathematical problems - Apply the general methods and principles to particular classes of problems - Develop approaches to extracting practically useful solutions with appropriately chosen numerical software					
Content	-Basic error concepts: condition of mathematical problems, data error, discretization error, round-off error. - Numerical solution of linear and nonlinear systems of equations - Numerical differentiation and integration - Polynomial interpolation and approximation - Numerical solution of differential equation					
Prerequisites	None					
Coordinator						
Lecturer(s)						
Assistant(s)						
Work Placement	None					

Recommended or Required Reading	
Books / Lecture Notes	- Quarteroni, A., R. Sacco, and F. Saleri. "Numerische Mathematik Springer-Verlag." (2002).
Other Sources	- Dahmen, Wolfgang, and Arnold Reusken. Numerik für Ingenieure und Naturwissenschaftler. Springer-Verlag, 2006. - Deuflhard, Peter, andFolkmar Bornemann. "Numerische Mathematik. II." (1994). - Hanke-Bourgeois, Martin. Grundlagen der numerischen Mathematik und des wissenschaftlichen Rechnens. Wiesbaden: Vieweg+ Teubner, 2009

Additional Course Material

DEPARTMENT OF CIVIL ENGINEERING
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Documents	-	
Assignments	-	
Exams	-	
Course Composition		
Mathematics und Basic Sciences	50	%
Engineering		%
Engineering Design		%
Social Sciences		%
Educational Sciences		%
Natural Sciences		%
Health Sciences		%
Expert Knowledge	50	%

Assessment

Activity	Count	Percentage (%)
Midterm Exam	1	40
Quiz		
Assignments	1	10
Attendance		
Recitations		
Projects		
Final Exam	1	50
	Total	**100**

ECTS Points and Work Load

Activity	Count	Duration	Work Load (Hours)
Lectures	14	2	28
Self-Study	1	66	66
Assignments	10	4	40
Presentation / Seminar Preparation			
Midterm Exam	1	3	3
Recitations	14	2	28
Laboratory			
Projects			
Final Exam	1	10	10
		Total Work Load	**168**
		ECTS Points (Total Work Load / Hour)	**6**

Learning Outcomes

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1	Discussion about principles and methods for the numerical solution of mathematical problems
2	The ability to investigate mathematical problems using a scientific programming language
3	An awareness of fundamental numerical algorithms which are used to solve mathematical problems
4	The ability to create well formatted scientific programming language functions
5	The ability to communicate the principles and purposes of scientific computer codes.
Weekly Content	
1	Computer Arithmetic
2	Solution of linear systems of equations and condition number
3	Gaussian elimination with partial pivoting
4	Polynomial Interpolation, Approximation of the First Derivative by Interpolation
5	Solving Systems of Equations for Periodic Splines, Hermite Interpolation, Trigonometric Interpolation
6	Condition of the Newton-Cotes Formulas, Integral Representation of the Interpolation Error
7	Quadrature, Tschebyscheff polynomials
8	Composite Trapezoidal Rule with Non-Uniform Grid , Quadrature Rule Based on Interpolation, Adaptive Quadrature
9	Midterm Exam
10	Error of Simpson's Rule and Gaussian Quadrature, Gauss-Hermite Quadrature
11	Fixed-point Iteration in 1D , Gauss Quadrature Over General Interval, Fixed-point Iteration in 2D
12	Computing an Important Function using Newton's Method, Newton's Method for the Eigenvalue Problem,
13	Convergence of Newton's Method, Conjugate Gradient Iteration Error
14	Conjugate Gradient Method: Number of Iterations, Newton and Conjugate Gradient
15	Computer Implementation

Contribution of Learning Outcomes to Program Objectives (1-5)

	P1	P2	P3	P4	P5	P6	P7
1	5	5	4			3	1
2	5	5	4			3	1
3	5	5	4			3	1
4	5	5	4			3	1

Contribution Level	1: Low 2: Low-intermediate 3: Intermediate 4: High 5: Very High
Compiled by:	
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