DEPARTMENT OF CIVIL ENGINEERING
COURSE SYLLABUS

Course Details				
Code		**Academic Year**		**Semester**
MAT108		1		Spring
Title	**T**	**A**	**L**	**ECTS**
Calculus 2	3	2	0	6

Language	German					
Level	**Undergraduate**	**X**	**Graduate**		**Postgraduate**	
Department / Program	Civil Engineering					
Forms of Teaching and Learning	Formal					
Course Type	**Compulsory**	**X**	**Elective**			
Objectives	In this course students should - master differential and integral calculus for functions of several variables as a prerequisite for dealing with mathematical models of engineering, - develop an understanding of and the ability to work with functions in multidimensional space, master vector calculations in multi-dimensional space, - have a sound knowledge of the scientific and mathematical concepts, principles and methods of the natural and engineering sciences, - master basic terms and techniques and apply them to various (e.g. physical)problems, - use digital technologies effectively to solve problems. Knowledge & Understanding: 70% Analysis & methodology: 30%					
Content	- Parameter display - Polar coordinates - Vectors, lines and planes in space - Vector functions and movement in space - Functions of several variables - Partial derivatives, directional derivative, gradient - Applications of multivariable differential calculus - Multiple integrals - Multiple integrals in polar coordinates - Applications of integrals with multiple variables - Vector fields, integrals along curves, surface integrals					
Prerequisites	Recommended: Calculus 1					
Coordinator						
Lecturer(s)						
Assistant(s)						
Work Placement	None					

Recommended or Required Reading

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Books / Lecture Notes	- George B. Thomas, Analysis 2, Pearson Deutschland, Hallbergmoos2013. - Papula Lothar, Mathematik für Ingenieure und Naturwissenschaftler, Band 2+3, Wiesbaden2011. - Şanal Ziya, Mathematik für Ingenieure, Vieweg+Teubner, Wiesbaden2009.
Other Sources	- David Jerison, and Arthur Mattuck. MIT OpenCourseWare, *18.02 Multivariable Calculus*. URL: https://ocw.mit.edu/courses/mathematics/18-02-multivariable-calculus-spring-2006/[16-03-2020]

Additional Course Material	
Documents	https://www.geogebra.org/u/canan.yildiz OneNote Notizbuch MAT108
Assignments	-
Exams	-

Course Composition		
Mathematics und Basic Sciences	100	%
Engineering		%
Engineering Design		%
Social Sciences		%
Educational Sciences		%
Natural Sciences		%
Health Sciences		%
Expert Knowledge		%

Assessment

Activity	Count	Percentage (%)
Midterm Exam	1	30
Quiz	1	20
Assignments		
Attendance		
Recitations		
Projects		
Final Exam	1	50
	Total	**100**

ECTS Points and Work Load

Activity	Count	Duration	Work Load (Hours)
Lectures	14	3	42
Self-Study	1	62	62
Assignments	10	3	30
Presentation / Seminar Preparation			
Midterm Exam	1	3	3

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Recitations	14	2	28
Laboratory			
Projects			
Final Exam	1	3	3
		Total Work Load	**168**
		ECTS Points (Total Work Load / 28)	**6**

Learning Outcomes	
1	Parametrization of curves, calculus with parametrized curves
2	Calculate derivatives, tangents, surfaces and arc lengths in the parametric form
3	Vectors, angles between vectors, vector projections in space; Cross product of two vectors in space, determinant, the mixed product (spat product)
4	Vectors and parametrized lines and planes in space, angle between planes
5	Vector valued functions; Curves, derivatives and movement in space, integrals of vector functions
6	Functions of several variables, graphs, contour lines
7	Second and higher order partial derivatives, mixed derivatives, differentiability
8	Chain rule for functions of two and three variables, implicit differentiation
9	Directional derivations, calculation of gradients, gradients and tangents on contour lines
10	Tangential planes, linearization, error estimation, differentials, the total differential
11	Extreme values and saddle points, Hesse matrix, Lagrange multipliers
12	Double integrals over restricted areas, volumes, determination and exchange of the integration limits, double integrals in polar form, masses and center of mass
13	Line integrals, vector fields, gradient fields, work as an integral, flow integrals and circulation
14	Path independence, conservative fields, gradient fields and potential functions; Surface integrals, flow of a vector field through an oriented surface

Weekly Content	
1	Overview, introduction of multivariable functions, parametrization
2	Polar coordinates (points, intervals, point sets, curves, areas), calculation of areas in polar coordinates
3	Lines and planes in space, curves in space, tangents, vector functions, movement along a curve
4	Functions of several variables, partial derivatives, meaning of the partial derivative, slope in one point
5	Generalized chain rule, directional derivative, gradient
6	Tangential planes and differentials
7	Extreme values and saddle points, Lagrange multipliers
8	Double integrals, determination of the integration limits
9	Midterm exams

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10	Double integrals, swapping the integral limits, double integrals with polar coordinates
11	Triple integrals, mass, center of mass
12	Vector fields line integrals
13	Line integrals of vector fields, work along curves, flow integrals and circulation
14	Flow through a flat curve, conservative fields, potential functions
15	Line integrals in conservative fields, determination of potentials, divergence and rotation

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
5	5	5	3			3	1
6	5	5	3			3	1
7	5	5	3			3	1
8	5	5	3			3	1
9	5	5	3			3	1
10	5	5	3			3	1
11	5	5	3			3	1
12	5	5	3			3	1
13	5	5	3			3	1
14	5	5	3			3	1

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