

DEPARTMENT OF CIVIL ENGINEERING  
COURSE SYLLABUS

Course Details				
<b>Code</b>	<b>Academic Year</b>			<b>Semester</b>
MAT201	2			1
<b>Title</b>	<b>T</b>	<b>A</b>	<b>L</b>	<b>ECTS</b>
Differential Equations	2	2	1	6
<b>Language</b>	German			
<b>Level</b>	<b>Undergraduate</b>		<b>Graduate</b>	<b>Postgraduate</b>
<b>Department / Program</b>	Civil Engineering			
<b>Forms of Teaching and Learning</b>	Formal			
<b>Course Type</b>	<b>Compulsory</b>		<b>Elective</b>	
<b>Objectives</b>	The students, have an understanding of the essential mathematical concepts of differential equations, have the methodological foundations for the mathematical foundation of the natural and engineering sciences, have a sound knowledge of the scientific and mathematical contents, principles and methods, master basic terms and techniques and apply them to various (e.g. physical) problems.			
<b>Content</b>	1st order differential equations, 2nd order linear differential equations, especially with constant coefficients, Separation solutions, Integrating factor, Indefinite coefficients and variation of the constants, Sinusoidal and exponential disturbance functions, Nonlinear autonomous systems, critical points and phase diagrams, Existence and uniqueness, stability, Modeling, Numerical and graphic solution methods, Systems of linear differential equations; Eigenvalues, eigenvectors, fundamental matrices, Laplace transformation, solution of the linear differential equations with Laplace transformation, Delta function, convolution (folding).			
<b>Prerequisites</b>				
<b>Coordinator</b>				
<b>Lecturer(s)</b>				
<b>Assistant(s)</b>				
<b>Work Placement</b>				
Recommended or Required Reading				
<b>Books / Lecture Notes</b>	<ul style="list-style-type: none"> <li>•Şanal Ziya, Mathematik für Ingenieure • Papula Lothar, Mathematik für Ingenieure und Naturwissenschaftler, Band 2</li> <li>•Gilbert Strang, Differential Equations and Linear Algebra</li> <li>•George Simmons, Differential Equations with Applications and Historical Notes</li> </ul>			
<b>Other Sources</b>	<ul style="list-style-type: none"> <li>•P. Furlan, Das GelbeRechenbuch 3</li> <li>•Skriptum „Integraltransformationen und partielleDifferentialgleichungenfürIngenieure“, Prof. Dr. Dirk Ferus</li> </ul>			
Additional Course Material				
<b>Documents</b>				

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Assignments			
Exams			
<b>Course Composition</b>			
Mathematics und Basic Sciences		%	
Engineering		%	
Engineering Design		%	
Social Sciences		%	
Educational Sciences		%	
Natural Sciences		%	
Health Sciences		%	
Expert Knowledge		%	
<b>Assessment</b>			
<b>Activity</b>	<b>Count</b>	<b>Percentage (%)</b>	
Midterm Exam	1	40	
Quiz			
Assignments			
Attendance			
Recitations			
Projects			
Final Exam	1	60	
	<b>Total</b>	<b>100</b>	
<b>ECTS Points and Work Load</b>			
<b>Activity</b>	<b>Count</b>	<b>Duration</b>	<b>Work Load (Hours)</b>
Lectures	14	5	70
Self-Study	14	3	42
Assignments			
Presentation / Seminar Preparation			
Midterm Exam	1	2	10
Recitations			
Laboratory			
Projects			
Final Exam	1	2	15
		<b>Total Work Load</b>	<b>137</b>
		<b>ECTS Points (Total Work Load / Hour)</b>	<b>6 ECTS</b>
<b>Learning Outcomes</b>			

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1	Model a simple, physical system in the form of a 1st degree DE
2	Test the plausibility of a DE solution (analyzing extreme cases, graphic analysis, reality check, unit control ...).
3	Visualize solutions of a DE with the help of directional fields and calculate approximately using the Euler method.
4	Find and classify critical points of an autonomous DG and use them to describe the qualitative behavior of the solutions.
5	Know the basic types of DEs and use them to model exponential growth / decay, spring-mass systems, LRC circles, etc.
6	Solve DEs with different disturbance functions (zero, constant, exponential, sinusoidal, step function, impulse, super positions of these).
7	Understand and smoothly use the following properties of linear systems: solution, stability, transient, steady-state, phase response, phase response, amplitude phase shape, weight and transfer functions, pole diagram, resonance, fundamental matrix.
8	Use the following techniques to solve DEs: characteristic equation, exponential response formula, Laplace transformation, convection integrals, Fourier series, complex arithmetic, parameter variation, elimination and anti-elimination, matrix eigenvalue method.
9	Know the basic concepts of linearity, superposition, existence and uniqueness of solutions and use them when solving DGn.
10	
11	
12	

**Weekly Content**

1	Introduction
2	1st order differential equations
3	Linear 2nd order differential equations, especially with constant coefficients
4	Separation solutions
5	Integrating factor
6	Indefinite coefficients and constant variation
7	Sinusoidal and exponential disturbance functions
8	Nonlinear autonomous systems, critical points and phase diagrams
9	Existence and uniqueness, stability
10	Modeling
11	Numerical and graphic solution methods
12	Systems of linear differential equations;
13	Eigenvalues, eigenvectors, fundamental matrices
14	Laplace transformation, solution of the linear differential equations with Laplace transformation
15	

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Contribution of Learning Out comes to Program Objectives (1-5)							
	P1	P2	P3	P4	P5	P6	P7
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
<b>Contribution Level</b>	1: Low 2: Low-intermediate 3: Intermediate 4: High 5: Very High						
<b>Compiled by:</b>							
<b>Date of Compilation:</b>							