DEPARTMENT OF CIVIL ENGINEERING
COURSE SYLLABUS

Course Details						
Code				**Academic Year**		**Semester**
MAT201				2		Fall
Title				**T**	**A**	**L**	**ECTS**
Differential Equations				2	1	1	6

Language	German				
Level	**Undergraduate**	✓	**Graduate**		**Postgraduate**	
Department / Program	Civil Engineering				
Forms of Teaching and Learning	Formal				
Course Type	**Compulsory**	✓	**Elective**		
Objectives	The students should • understand the essential mathematical concepts of differential equations • have the methodical foundations for the mathematical foundation of natural and engineering sciences, • have a sound knowledge of scientific and mathematical content, principles and methods, • Master basic concepts and techniques and apply them to various (physical) problems. Knowledge & Understanding: 70% Analysis & Methodology: 30%				
Content	• Differential equations 1st order • Linear differential equations of 2nd order, in particular 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 graphical 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.				
Prerequisites	--				
Coordinator	--				
Lecturer(s)	Asist Prof.Dr. Mehmet Gökhan Gökçen				
Assistant(s)	Res. Assist. Sefer Arda Serbes, Res. Assist. Uğur Yıldırım				
Work Placement	--				
Recommended or Required Reading					
Books / Lecture Notes	https://drive.google.com/drive/folders/0B0yLQsBqSm-9R3h5SmFhb3pHMEk				

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Other Sources	• P. Furlan, Das Gelbe Rechenbuch 3 • Skriptum „Integraltransformationen und partielle Differentialgleichungen für Ingenieure", Prof. Dr. Dirk Ferus • Khan Academy (Deutsch, Englisch, Türkisch)

Additional Course Material

Documents	https://drive.google.com/drive/folders/0B0yLQsBqSm-9R3h5SmFhb3pHMEk
Assignments	https://drive.google.com/drive/folders/0B0yLQsBqSm-9R3h5SmFhb3pHMEk
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		
Assignments	1	10
Attendance		
Recitations	1	10
Projects		
Final Exam	1	50
Total		**100**

ECTS Points and Work Load

Activity	Count	Duration	Work Load (Hours)
Lectures	28	1	28
Self-Study	86	1	86
Assignments	1	8	8
Presentation / Seminar Preparation			
Midterm Exam	1	2	2
Recitations	28	1	28
Laboratory	14	1	14
Projects	1	2	2

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Final Exam		1	2	2
		Total Work Load		**168**
		ECTS Points (Total Work Load / Hour)		**5,6**

Learning Outcomes	
1	Model a simple, physical system in the form of a first-degree DE.
2	To test the plausibility of a solution of a DE (analyzing extreme cases, graphic analysis, reality check, control of units ...).
3	Visualize solutions of a DE using directional fields and approximate them using the Eulerian method.
4	Find and classify critical points of an autonomous DE, and describe with them the qualitative behavior of the solutions.
5	Know basic types of DEs and use them to model exponential growth / decay, spring-mass systems, LRC circles, etc.
6	Solve DEs with different interfering functions (zero, constant, exponential, sinusoidal, step function, impulse, superpositions of these).
7	Understand and use the following properties of linear systems: Solution, Stability, Transient, Steady State, Phase Response, Amplitude 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, convolution integral, 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 to solve DEs.

Weekly Content	
1	Intro
2	1. order DE
3	2. Order, const. coeff. LDE
4	Separation of variables
5	Integrating factor
6	undetermined coeff and variation of constants Unbestimmte Koeffizienten und Variation der Konstanten
7	Sine and exponantial forcing functions
8	Midterm Exam
9	Nonlinear Autonomous Systems, Critical Points and Phase Diagrams
10	Existence and uniqueness, stability
11	Modeling
12	Numerical and graphical solutions
13	System of LDEs
14	Eigenvalues, eigenvectors, fundamental matrices
15	Laplace transformation, solution of the linear differential equations with Laplace transformation
16	Final Exam

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Contribution of Learning Out comes to Program Objectives (1-5)							
	P1	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**
1	5	5	5	5	5	5	
2	5						
3	5						
4	5						
5	5						
6	5						
7	5						
8	5						
9	5						

Contribution Level	1: Low 2: Low-intermediate 3: Intermediate 4: High 5: Very High
https://obs.tau.edu.tr/oibs/bologna/progLearnOutcomes.aspx?lang=en&curSunit=208	
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