DEPARTMENT OF ENERGY SCIENCE AND TECHOLOGIES
COURSE SYLLABUS

Course Details				
Code	**Academic Year**			**Semester**
MAT201	2			3
Title	**T**	**A**	**L**	**ECTS**
Differential Equations	2	2	1	6

Language	German					
Level	**Undergraduate**	**X**	**Graduate**		**Postgraduate**	
Department / Program	Energy Science and Technologies					
Forms of Teaching and Learning	Face to face					
Course Type	**Compulsory**	**X**	**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. Neşe Aral					
Assistant(s)						
Work Placement	No					

Recommended or Required Reading	
Books / Lecture Notes	• P. Furlan, Das Gelbe Rechenbuch 3 • Skriptum „Integraltransformationen und partielle Differentialgleichungen für Ingenieure“, Prof. Dr. Dirk Ferus

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	• Khan Academy (Deutsch, Englisch, Türkisch)	
Other Sources		
Additional Course Material		
Documents		
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		
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	60	1	60
Assignments	1	8	8
Presentation / Seminar Preparation			
Midterm Exam	1	2	2
Recitations	28	1	28
Laboratory	14	1	14
Projects			

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Final Exam	1	2	2
		Total Work Load	**142**
		ECTS Points (Total Work Load / Hours)	**5**

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

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15	Laplace transformation, solution of the linear differential equations with Laplace transformation
16	Final Exam

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

	P1	P2	P3	P4	P5	P6	P7
1	3		4				
2	3		4				
3	3		4				
4	3		4				
5	3		4				
6	3		4				
7	3		4				
8	3		4				
9	3		4				

Contribution Level	1: Low 2: Low-intermediate 3: Intermediate 4: High 5: Very High
Compiled by:	Asist Prof.Dr. Neşe Aral
Date of Compilation:	