YAŞAR UNIVERSITY
FACULTY OF ENGINEERING
ELECTRICAL-ELECTRONICS ENGINEERING
DEPARTMENT
COURSE SYLLABUS

Course Title	Course Code	Semester	Course Hour / Week		Local Credit	ECTS
DIFFERENTIAL EQUATIONS AND DYNAMIC SYSTEMS	MATH 263	Fall	Theory 3	Practice 0	4	7

Course Type	Compulsory
Language of Instruction	English
Level of Course	Bachelor's Degree
Mode of Delivery	Face to Face
Prerequisites Course(s) (compulsory)	(MATH 131)
Special Pre-Conditions of the Course(recommended)	N/A

Course Cordinator

Name Surname
Prof. Dr. M. Erol Sezer

Course Instructor(s)

Name Surname
Assist Prof.Dr. Ahmet Yantır

Course Assistant(s)/Tutor(s)

Name Surname

Aim(s) of Course

To introduce mathematical modeling of dynamical systems by differential equations, basic solution techniques for linear and simple nonlinear differential equations, and simulation of dynamical systems using Matlab and Simulink.

Course Content

Mathematical modeling of dynamical systems with differential equations. Analysis of first order systems modeled with linear, separable exact differential equations. Second order linear systems; oscillations and damping; response to various inputs. Laplace transform. Systems of linear differential equations. Nonlinear systems; equilibrium and stability.

Learning Outcomes of the Course

Upon successful completion of this course, the enrolled students will be gaining the following knowledge, skills and competences:

C01	To understand the concept of mathematical model of a dynamical system.
C02	To relate mathematical models of systems of different physical nature.
C03	To explain linearity and its advantages.
C04	To be able to solve simple differential equations analytically.
C05	To be able apply Laplace transform to solving linear differential equations
C06	To understand concepts of equilibrium and stability.
C07	To be able to construct Simulink models of dynamical systems and to interpret simulation results.

COURSE OUTLINE/SCHEDULE (Weekly)			
Week	**Topic**	**Preliminary Preparation**	**Methodology and Implementation(Theory, practice, assignment etc.)**
1	Introduction to dynamical system modeling by differential equations. Dynamics of a falling body.		
2	First order linear differential equations. Homogeneous and non-homogeneous equations. Initial-value problems. Exponential growth and decay, heating and cooling problems.	(LAB) Introduction to SIMULINK	
3	Separable equations. Population models.	(LAB) Simulation of a falling body.	
4	Numerical integration techniques. Euler and Runge-Kutta methods.	(LAB) Modeling and simulation of an RC circuit and liquid level in a tank.	
5	Second order linear differential equations. Homogeneous case.	(LAB) Simulation of exponential and logistic growth models.	
6	Second order differential equations. Nonhomogeneous case.	(LAB) Programming in MATLAB.	
7	Second order linear electrical and mechanical systems. Oscillations.	(LAB) Implementation of numerical solution techniques inMATLAB.	
8	The Laplace transform.		
9	Solution of first and second order linear DE by Laplace transform. Step response.	(LAB) Simulation of RLC circuits and mass-spring-damper systems. Damping and resonance.	
10	N-th order linear differential equations. Solution by Laplace transform.	(LAB) Transfer functions. Linear system representations.	
11	Systems of linear differential equations. Matrix function exp (At).	(LAB) Phase-plane trajectories of second order systems.	
12	Solution of systems of LDE by Laplace transform.	(LAB) Simulation of a prey-predator system.	
13	Non-linear systems. Equilibrium and stability.	(LAB) Modeling and simulation of competing species.	
14	Linearization	(LAB) Lab exam	

Resources
Required Course Material(s)/Reading(s)/Text Book(s)
"Simulink Getting Started Guide", The Mathworks Inc., 2014,H. Petter Halvorsen, "Introduction to Simulink", Telemark University College, Norway (2011),K. Ogata, "System Dynamics", 2nd ed., Prentice-Hall, (1992), ISBN: 0-13-855941-1,M. E. Sezer, "Linear Algebra with Differential Equations", Bilkent University,J. R. Chasnov, Introduction to Differential Equations, Lecture Notes, The Hong Kong Univ.

ASSESSMENT		
Semester Activities/ Studies	**Number**	**WEIGHT in %**
Mid-Term	1	20
Attendance	0	0
Quiz	4	10
Homework	0	0
Project	0	0
Field Studies(Technical Visits)	0	0
Presentation/Seminar	0	0
Practice(Lab., Virtual Court,Stu. Studies etc.)	10	40
Other (Intership etc.)	0	0
Course Teaching Hours(14 weeks)Total course hours	0	0
Further self-study	0	0
Contribution of final Examination and Final Project	1	30
TOTAL	**16**	**100**

CONTRIBUTION OF LEARNING OUTCOMES TO PROGRAMME OUTCOMES						
Faculty		**DEPARTMENT**				
FACULTY OF ENGINEERING		**ELECTRICAL-ELECTRONICS ENGINEERING**				
No	**Programme Outcomes**	**Level of Contribut 1-lowest 5- highest**				
		1	**2**	**3**	**4**	**5**
P01	Adequate knowledge in mathematics, science and engineering subjects pertaining to the electrical-electronics engineering; ability to use theoretical and applied information in these areas to model and solve complex engineering problems. 				✓	
P02	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose. 					✓
P03	Ability to design a complex system, process, device _or product under realistic constraints and conditions, in such a way as to meet the desired results; ability to apply modern design methods for this purpose. 					
P04	Ability to devise, select, and use modern techniques and tools needed for analyzing and solving complex problems encountered in engineering practice; ability to employ information technologies effectively. 				✓	
P05	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating complex engineering problems _or electrical-electronics engineering research topics. 			✓		
P06	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually. 					

P07	Ability to communicate effectively in Turkish, both orally and in writing; knowledge of a minimum of one foreign language at least at a level of European Language Portfolio B1 General Level; ability to write report and understand written reports effectively, to prepare design and product reports, to conduct effective presentations, and to give and receive clear and understandable instructions. 					
P08	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself. 			✓		
P09	Acting in accordance with ethical principles, consciousness of professional and ethical responsibility; knowledge of the standards used in engineering practice. 					
P10	Knowledge about business life practices such as project management, risk management, and change management; awareness of entrepreneurship and innovation; knowledge of sustainable development. 					
P11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions. 					

ECTS /STUDENT WORKLOAD

ACTIVITIES	NUMBER	HOUR	Total WorkLoad
Mid-Term	1	10	10
Attendance	0	0	0
Quiz	4	1	4
Homework	0	0	0
Project	0	0	0
Field Studies(Technical Visits)	0	0	0
Presentation/Seminar	0	0	0
Practice(Lab., Virtual Court,Stu. Studies etc.)	14	2	28
Other (Intership etc.)	0	0	0
Course Teaching Hours(14 weeks)Total course hours	14	3	42
Further self-study	14	6	84
Contribution of final Examination and Final Project	1	10	10
Total WorkLoad			**178**
Total Workload/ 25			**7,12**
ECTS			**7**

STUDENT WITH DISABILITIES OR SPECIAL NEEDS

Students with disabilities or special needs are encouraged to contact the instructor and the Unit for Student with Disabilities (http://eob.yasar.edu.tr/) for academic adaptations.

ASSESSMENT and EVALUATION METHODS

Final grades and assessment criteria are determined according to the Yaşar University Associate Degree, Bachelor Degree and Graduate Degree Education and Examination Regulation.

PREPARED BY	Prof. Dr. M. Erol Sezer
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