T.C.

ESKİŞEHİR OSMANGAZİ UNİVERSİTY

FACULTY OF SCIENCES

MATHEMATİCS AND COMPUTER SCIENCES DEPARTMENT

COURSE INFORMATION FORM

Course Name	Course Code
Dynamical Systems	

Semester	Number of Course Hours per Week		Credit	ECTS
	Theory	Practice		
4	3	0	-	5

Course Category (Credit)				
Basic Sciences	Engineering Sciences	Design	General Education	Social
x				

Course Language	Course Level	Course Type
Turkish	Undergraduate	Compulsory

Prerequisite(s) if any	
Objectives of the Course	It aims to introduce the analysis of simple dynamical systems defined in terms of first- or second-order differential equations, emphasizing concepts such as phase flow, fixed points, and stability of fixed points.
Short Course Content	One-dimensional dynamic systems, autonomous systems, phase flow and fixed points; two-dimensional dynamic systems, phase flow, classification of fixed points; Lyapunov function, Poincare-Bendixon theorem, limit cycles.

	Learning Outcomes of the Course	Contributed PO(s)	Teaching Methods *	Measuring Methods **
1	To be able to choose appropriate symbolic, graphical, qualitative and numerical methods to analyze dynamic systems.	1,2	1,2,6	A
2	To analyze and characterize dynamical systems classifying their fixed points, stability, and possibly bifurcations and limit cycles in one or more dimensions.	1,2,13	1,2	A
3	To have knowledge about the features of systems that arise in various applications.	1,3,4,5,6	2,10	A
4	Be able to use software packages to solve complex dynamic systems.	3,4,5,6	6,10,11	A
5				
6				
7				
8				

***Teaching Methods** **1:**Expression, **2:**Discussion, **3:**Experiment, **4:**Simulation, **5:**Question-Answer, **6:**Tutorial, **7:**Observation, **8**:Case Study, **9:**Technical Visit, **10:**Trouble/Problem Solving, **11:**Induvidual Work, **12**:Team/Group Work, **13**:Brain Storm, **14:**Project Design / Management, **15:**Report Preparation and/or Presentation

****Measuring Methods** **A:**Exam, **B:**Quiz, **C:**Oral Exam, **D:**Homework, **E:**Report, **F:**Article Examination, **G:**Presentation, **I:**Experimental Skill, **J:**Project Observation, **K**:Class Attendance; **L**:Jury Exam

Main Textbook	**Strogatz, Steven H. *Nonlinear dynamics and chaos: with applications to physics, biology, chemistry, and engineering*. CRC press, 2018.**
Supporting References	***1) Lawrence Perko, "Differential Equations and Dynamical Systems", third edition, Springer-Verlag 2001, ISBN-10: 0387951164.*** **2) Savi, Marcelo A. "Nonlinear dynamics and chaos." *Dynamics of Smart Systems and Structures: Concepts and Applications* (2016): 93-117.**
Necessary Course Material	

Course Schedule	
1	A Dynamical View of the World
2	In one Dimensional Flow, Fixed Points and Stability
3	Linear Stability Analysis
4	Saddle-Node Bifurcation, Transcritical Bifurcation
5	Laser Threshold, Pitchfork Bifurcation
6	Imperfect Bifurcations and Catastrophes
7	Solving examples
8	Mid-Term Exam
9	Two-Dimensional Flows Linear SystemsDefinitions and Examples
10	Classification of Linear Systems
11	Phase Portraits and Bifurcation Types
12	Fixed Points and Linearization
13	Liapunov Function
14	Limit Cycles
15	Computer simulation of phase portraits
16,17	Final Exam

Calculation of Course Workload			
Activities	**Number**	**Time (Hour)**	**Total Workload (Hour)**
Course Time (number of course hours per week)	14	3	42
Classroom Studying Time (review, reinforcing, prestudy,….)	14	4	56
Homework			
Quiz Exam			
Studying for Quiz Exam			
Oral exam			
Studying for Oral Exam			
Report (Preparation and presentation time included)			
Project (Preparation and presentation time included)			
Presentation (Preparation time included)			
Mid-Term Exam	1	2	2
Studying for Mid-Term Exam	1	20	20
Final Exam	1	2	2
Studying for Final Exam	1	30	30
		Total workload	**150**
		Total workload / 30	**150/30**
		Course ECTS Credit	**5**

Evaluation	
Activity Type	**%**
Mid-term	40
Quiz	
Homework	10
Bir öğe seçin.	
Bir öğe seçin.	
Final Exam	50
Total	100

RELATIONSHIP BETWEEN THE COURSE LEARNING OUTCOMES AND THE PROGRAM OUTCOMES (PO) (5: Very high, 4: High, 3: Middle, 2: Low, 1: Very low)

NO	PROGRAM OUTCOME	Contribution
1	The ability to apply knowledges of Mathematics and Computer Sciences,	4
2	To have sufficient theoretical and practical knowledge of Mathematics at international level,	4
3	The ability of describing, modelling and solving of mathematical problems at Mathematics and related subjects,	5
4	The skill to solve and design a problem process in accordance with a defined target,	5
5	Skills to analyze data, interpret and apply to other datum and using these data on computer,	5
6	The skill to use the modern techniques and computational tools needed for mathematical applications,	4
7	The skill to make team work within the discipline and interdisciplinary,	3
8	The ability to improve oneself by following the developments on other modern, scientific and technological subjects as well as Mathematics and Computer Sciences,	3
9	The skill to communicate orally and in written way, in a clear and concise manner by having individual work skills and ability to independently decide and analytical thinking,	4
10	The skill to have professional and ethical responsibility,	2
11	The skill to have consciousness for quality issues and scientific research,	3
12	The skill to be sensitive to environmental issues related with problems and development of living area and consistent in the social relations,	1
13	Ability to solve problems in the working life faced to find an appropriate algoritms via mathematical modeling and to write computer programs,	4
14	The skill to developed design of software systems at different complex levels,	1
15	The credence of necessity of life-long learning and ability to apply the formation long-life learning.	1

LECTUTER(S)				
Prepared by	Doç. Dr. Sait SAN			
Signature(s)				

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