ADVANCED DIFFERENTIAL EQUATIONS

1	Course Title:	ADVANCED DIFFERENTIAL EQUATIONS
2	Course Code:	INS4021
3	Type of Course:	Optional
4	Level of Course:	First Cycle
5	Year of Study:	4
6	Semester:	7
7	ECTS Credits Allocated:	5.00
8	Theoretical (hour/week):	3.00
9	Practice (hour/week):	1.00
10	Laboratory (hour/week):	0
11	Prerequisites:	
12	Language:	Turkish
13	Mode of Delivery:	Face to face
14	Course Coordinator:	Prof. Dr. M.ÖZGÜR YAYLI
15	Course Lecturers:	Prof. Dr. M. Özgür YAYLI
16	Contact information of the Course Coordinator:	bdeliktas@uludag.edu.tr 224 2900744 Uludağ Univ. Müh.Mim Fak. İnşaat Müh. Böl. Görükle, Bursa
17	Website:	http://insaat.uludag.edu.tr
18	Objective of the Course:	• To be able to solve the linear and nonlinear differential equation system • Understanding the stability of the equation system • Learning basic and important theorems for dynamical systems • Learning Bifurcation theory
19	Contribution of the Course to Professional Development:	fixed points, stability, Lyapunov functions. Stability analysis, potential function, bifurcation in one dimensional autonomous systems, Linear autonomous systems and Lyapunov functions for them, stability and Lyapunov functions Nonlinear autonomous systems, local analysis at fixed points, nonlinear centers, conserved systems, reversible systems • Index theory, Limit cycles, Dulac criterion, orbital stability definition. • Poincare-Bendixsion Theorem, Linard systems. Hopf bifurcation
20	Learning Outcomes:	
	1	fixed points, stability, Lyapunov functions.
	2	Stability analysis, potential function, bifurcation in one dimensional autonomous systems,
	3	Linear autonomous systems and Lyapunov functions for them, stability and Lyapunov functions
	4	Nonlinear autonomous systems, local analysis at fixed points, nonlinear centers, conserved systems, reversible systems
	5	• Index theory, Limit cycles, Dulac criterion, orbital stability definition.
	6	• Poincare-Bendixsion Theorem, Linard systems.
	7	• Hopf bifurcation
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21	Course Content:
	Course Content:

Week	Theoretical	Practice
1	Autonomous dynamical systems, existence and uniqueness, fixed points and stability.	
2	Lyapunov functions. Stability analysis in one dimensional autonomous systems, potential function,	
3	bifurcations in one-dimensional autonomous systems,	
4	bifurcations	
5	Stability in linear autonomous systems	
6	Stability and Lyapunov functions, two-dimensional linear autonomous systems	
7	Nonlinear autonomous systems, local analysis of fixed points, nonlinear centers	
8	Conservative systems, reversible systems	
9	Index theory	
10	Limit cycles, Dulac criterion	
11	Orbital stability definition, Poincare-Bendixson Theorem	
12	Poincare-Bendixsion Theorem, Linard	

Activites	Number	Duration (hour)	Total Work Load (hour)
Theoretical	14	2.00	28.00
Practicals/Labs	14	2.00	28.00
Self study and preperation	8	5.00	40.00
Homeworks	2	7.00	14.00
Projects	1	10.00	10.00
Field Studies	0	0.00	0.00
Midterm exams	1	15.00	15.00
Others	0	0.00	0.00
Final Exams	1	15.00	15.00
Total Work Load			150.00
Total work load/ 30 hr			5.00
ECTS Credit of the Course			5.00

TERM LEARNING ACTIVITIES	**NUMBER**	**WEIGHT**
Quiz	0	0.00
Home work-project	0	0.00
Final Exam	1	60.00
Total	2	100.00
Contribution of Term (Year) Learning Activities to Success Grade		40.00
Contribution of Final Exam to Success Grade		60.00
Total		100.00
Measurement and Evaluation Techniques Used in the Course		Understanding the principles of applied mathematics used in the course

24	**ECTS / WORK LOAD TABLE**

• Perko L. (2001). Differential Equations and Dynamical Systems, Üçüncü Sürüm, Springer.
• Wiggins S. (2003). Introduction to Applied Nonlinear Dynamical Systems and Chaos, Addison-Wesley Using MAPLE, Ikinci Sürüm, Birkhauser.
• Miller, R. K. ve Michel, A. N (1982). Ordinary Differential
• Cronin, J. (2008). Ordinary Differential Equations - Introduction and Qualitative Theory, Üçüncü Sürüm, CRC

25	CONTRIBUTION OF LEARNING OUTCOMES TO PROGRAMME QUALIFICATIONS															
	PQ1	**PQ2**	**PQ3**	**PQ4**	**PQ5**	**PQ6**	**PQ7**	**PQ8**	**PQ9**	**PQ10**	**PQ11**	**PQ12**	**PQ13**	**PQ14**	**PQ15**	**PQ16**
ÖK1	5	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0
ÖK2	5	5	3	0	5	5	0	0	0	0	0	0	0	0	0	0
ÖK3	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ÖK4	5	5	0	0	5	0	0	0	0	0	0	0	0	0	0	0
ÖK5	0	0	0	0	4	0	5	0	0	0	0	0	0	0	0	0
ÖK6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ÖK7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LO: Learning Objectives PQ: Program Qualifications																
Contribution Level:	**1 very low**		**2 low**		**3 Medium**		**4 High**			**5 Very High**						