YEDİTEPE UNIVERSITY
FACULTY OF ENGINEERING

COURSE DESCRIPTION FORM
2019/2020-1

COURSE INFORMATON				
Course Code	**ISE 352**	**Course Title**	**LINEAR SYSTEMS AND CONTROL**	
Semester	*Credits*	*ECTS*	*C +P + L Hour*	Prerequisites
6	3	5	2+2+0	MATH 241

Language of Instruction	**Course Level**	**Course Type**
English	Undergraduate	Core

Course Coordinator	Assist. Prof. Uğur Yıldıran
Instructors	Assist. Prof. Uğur Yıldıran
Assistants	Alperen Pehlivan
Goals	The aim of this course is to teach students the fundamental concepts about modeling and analysis of dynamic system described by linear differential equations.
Content	Definition and classification of dynamic systems. Modeling, state space representation and simulation diagrams. Laplace transform, transfer functions and block diagrams. Transient response analysis. Stability analysis. Feedback systems and root-locus analysis.
Contribution of the Course to the Professional Education	Modeling and analysis of dynamic systems is one of the fundamental working areas of systems engineers. In this course, students learn fundamentals of modeling and analysis of dynamic systems from an engineering perspective by means of mathematical techniques.

Course Learning Outcomes	**Detailed Program Outcomes**	**Teaching Methods**	**Assessment Methods**
Derives mathematical models of dynamic systems as linear ordinary differential equations and puts them into state space form.	1a, 1b, 2a, 2b, 6c	1, 3, 5	A,E
Draws simulation diagram from a given state space representation and uses it to find numerical solution of corresponding differential equations by means of simulation software.	1a, 1b, 2a, 2b, 4b, 6c	1, 3,4, 5	A,E

Uses Laplace-transform to solve differential equations analytically and to derive transfer functions.	1a, 1b, 2a, 2b, 6c	1, 3, 5	A,E
Finds the transfer function from a given block diagram.	1a, 1b, 2a, 2b, 6c	1, 3, 5	A,E
Performs transient response analysis of first, second or higher order systems. Uses associated metrics to evaluate performance.	1a, 1b, 6c	1, 3, 5, 7	A,D,E
Performs stability analysis of linear time invariant systems using Routh-Hurwitz criterion.	1a, 1b, 2b, 6c	1, 3, 5	A,E
Describes how a feedback system works and performs its parametric analysis using root-locus technique.	1a, 1b, 2b, 6c	1, 3, 5	A,E
Conducts experiment(s) on modeling and analysis of dynamical systems and prepares a report in English	5b,7b,7c	7	D

Teaching Methods:	1: Lecture by instructor, 2: Lecture by instructor with class discussion, 3: Problem solving by instructor, 4: Use of simulations, 5: Problem solving assignment, 6: Reading assignment, 7: Laboratory work, 8: Term research paper, 9: Presentation by guest speaker, 10: Sample Project Review, 11: Interdisciplinary group working
Assessment Methods:	A: Written exam, B: Multiple-choice exam C: Take-home quiz, D: Experiment report, E: Homework, F: Project, G: Presentation by student

COURSE CONTENT

Week	Topics	Study Materials
1	Introduction to dynamic systems	Lecture notes, TB: CH1
2-3	Mathematical modeling of dynamic systems	Lecture notes, TB: CH2
4-5	State-space modeling and solving differential equations using simulation diagrams	Lecture notes, TB: CH7
6-7	Solving differential equations using Laplace-transform	Lecture notes, TB: CH3
8	Block diagrams	Lecture notes, TB: CH3
9-10	Transient response analysis	Lecture notes, TB: CH3
11	Stability analysis	Lecture notes, TB: CH3

12	Feedback and closed-loop response	Lecture notes, TB: CH4
13-14	Root-locus analysis	Lecture notes, TB: CH5

RECOMMENDED SOURCES	
Textbook	Franklin, G., Powell, D., Emami-Naeini, A., "Feedback Control of Dynamic Systems", seventh Ed., Pearson, 2015
Additional Resources	• Lecture notes • Ogata, K., "Modern Control Engineering", Third Ed., Prentice-Hall, 1997

MATERIAL SHARING	
Documents	Summary notes on modeling and root-locus, transformation tables, lab booklet
Assignments	Lab, homework and quizzes
Exams	2 midterms and a final exam

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Midterm exams	2	67
Homework	9	3
Quiz	3	13
Lab	1	17
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Field Course

COURSE'S CONTRIBUTION TO PROGRAM OUTCOMES

No	Program Learning Outcomes	check √
1a	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline,	√
1b	Ability to use theoretical and applied knowledge in these areas in complex engineering problems.	√
2a	Ability to identify, formulate, and solve complex engineering problems,	√
2b	Ability to select and apply proper analysis and modeling methods for this purpose.	√
3a	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result,	
3b	Ability to apply modern design methods for this purpose.	
4a	Ability to devise, select and use modern techniques and tools needed for analyzing and solving complex problems encountered in engineering practice.	
4b	Ability to employ information technologies effectively.	√
5a	Ability to design experiments for investigating complex engineering problems or discipline specific research questions,	
5b	Ability to conduct experiments, gather data, analyze and interpret results for investigating complex engineering problems or discipline specific research questions.	√
6a	Ability to work efficiently in intra-disciplinary teams,	
6b	Ability to work efficiently in multi-disciplinary teams,	
6c	Ability to work individually.	√
7a	Ability to communicate effectively in Turkish, both orally and in writing,	
7b	Knowledge of a minimum of one foreign language,	√
7c	Ability to write effective reports and comprehend written reports, prepare design and production reports,	√
7d	Ability to make effective presentations,	
7e	Ability to give and receive clear and intelligible instructions.	
8a	Recognition of the need for lifelong learning, ability to access information, ability to follow developments in science and technology,	
8b	Ability to continue to educate him/herself.	
9a	Consciousness to behave according to ethical principles and professional and ethical responsibility.	
9b	Knowledge on standards used in engineering practice.	
10a	Knowledge about business life practices such as project management, risk management, change management.	
10b	Awareness in entrepreneurship and innovation.	

10c	Knowledge about sustainable development.	
11a	Knowledge about the global and social effects of engineering practices on health, environment, and safety,	
11b	Knowledge about contemporary issues of the century reflected into the field of engineering.	
11c	Awareness of the legal consequences of engineering solutions.	

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x course+13xPS+1xLab hour)	14	4	56
Hours for off-the-classroom study (midterm exams)	2	7	14
Hours for off-the-classroom study (quiz)	3	1	3
Hours for off-the-classroom study (final)	1	14	14
Hours for off-the-classroom study (lab)	1	4	4
Midterm exams	2	2	4
Quizzes	3	1	3
Homework	9	4	36
Final	1	2	2
Total Work Load			136
Total Work Load / 25 (h)			5.44
ECTS Credit of the Course			5

Prepared by: Uğur Yıldıran	Preparation date: 03.10.2019