Course Description Form	
Course Code and Name	ME 308 Control Systems
Course Semester	6
Catalog Content	Modeling of physical systems and obtaining dynamic equations. Transfer functions and block diagrams. Basic concepts of automatic control. Control actions. Time response. Stability and Routh-Hurwitz criterion. Analysis and design of control systems by root locus method. Analysis and design of control systems by frequency response method.
Textbook	Ogata, K., “Modern Control Engineering”, 5th Edition, Prentice-Hall, 2010.
Supplementary Textbooks	Franklin, G. F., Powell, J. D., Emami-Naeini, A., “Feedback Control of Dynamic Systems”, 6th Edition, Prentice-Hall, 2010. Nise, N. S., “Control Systems Engineering”, 6th Edition, Addison-Wesley, Menlo Park, CA, 2010. Kuo, B. C., Golnaraghi, F., “Automatic Control Systems”, 8th Edition, Prentice-Hall, Englewood Cliffs, 2002. Dorf, R. C. and Bishop, R. H., “Modern Control Systems”, 12th Edition, Pearson Prentice-Hall, 2010. Phillips, C. L., and Parr, J., “Feedback Control Systems”, 5th Edition, Prentice-Hall, 2010. Raven, F. H., “Automatic Control Engineering”, 5th Edition, McGraw-Hill, 1995.
Credit	6
Prerequisites of the Course (Attendance Requirements)	
Type of the Course	Compulsory
Instruction Language	English
Course Objectives	This course aims to model dynamic systems and analyze and design dynamic systems by using control systems.
Course Learning Outcomes	1. Students will be able to obtain the mathematical model and the block diagram and transfer function of a control system (by using the dynamics of physical system, measuring device and controller) and how to analyze the functional quality of control system. 2. Students will be able to determine the control parameters for low-order systems under the time response requirements of accuracy, relative stability, and speed of response. 3. Students will be able to determine the control parameters for low-order systems under the time response requirements of accuracy, relative stability, and speed of response. 4. Students will be able to analyze and design of a control system by means of the root locus and frequency response methods.
Instruction Methods	Face to face.
Weekly Schedule	Week 1: Introduction to control systems and definitions. Open-loop and closed-loop systems. Transfer functions. Week 2: Mathematical modeling of mechanical, electrical, fluid and thermal systems. Week 3: Mathematical modeling of mechanical, electrical, fluid and thermal systems. Week 4: Transfer functions of multiple input and multiple output systems. Transfer functions of cascaded systems. Block diagrams. Drawing detailed block diagrams from basic equations. Obtaining transfer functions from block diagrams: Analytical method, block diagram algebra, Mason’s rule.

Week 5: Structure of feedback control systems. Desired characteristics of control systems. Sensitivity of control systems to parameter variations.
Week 6: Controller and control actions. Proportional (P), integral (I), derivative (D) control actions. P, I, P+D, P+I and P+I+D control.
Week 7: Two-position control and its applications. Servo and regulator characteristics of control systems. Examples on applications of different control types. Examples on applications of different control actions. Ziegler-Nichols PID control parameter settings.
Week 8: Midterm 1: Review of transient responses of 1st and 2nd order systems. Transient response specifications and their use in analysis and design of 2nd order systems. Transient responses of higher order systems.
Week 9: Stability of control systems. Stability and system poles. Routh-Hurwitz stability criterion. Special cases of Routh-Hurwitz stability criterion. Selection of parameter values for stability. Relative stability and stability margin.
Week 10: Steady state response. Classification of control systems by type. Steady state error and error constants. Root locus method. Rules of drawing root locus diagrams. Examples of root locus diagrams method.
Week 11: Frequency response method. Graphical representations of frequency response. Bode diagrams. Polar plots. Log magnitude versus phase plots.
Week 12: Nyquist stability criterion. Relative stability criterion.
Week 13: Control system design by root locus method. Lead compensation. Lag compensation. Lag-lead compensation. Parallel compensation.
Week 14: Control system design by frequency response method. Lead compensation. Lag compensation. Lag-lead compensation.
Week 15: Final Exam

Teaching and Learning Methods

(These are examples. Please fill which activities you use in the course)

Weekly theoretical course hours: 4
Weekly applied course hours: 0
Reading Activities:3
Internet browsing, library work:2
Preparation of Midterm and Midterm Exam:2
Final Exam and Preparation for Final Exam:2

Assessment Criteria

	Numbers	Total Weighting (%)
Midterm Exams	1	40
Assignment		
Application		
Projects		
Practice		
Quiz	4	20
Percent of In-term Studies (%)		60
Percentage of Final Exam to Total Score (%)		40
Attendance		

Workload

Activity	Total Number of Weeks	Duration (weekly hour)	Total Period Work Load
Weekly Theoretical Course Hours	14	4	56
Weekly Tutorial Hours			
Reading Tasks	14	3	42
Studies	14	2	28

Material Design and Implementation			
Report Preparing			
Preparing a Presentation			
Presentations			
Midterm Exam and Preparation for Midterm Exam	9	2	18
Final Exam and Preparation for Final Exam	5	2	10
Other (should be emphasized)			
Total Workload			154
Total Workload / 25			6.16
Course Credit (ECTS)			6

Contribution Level Between Course Learning Outcomes and Program Outcomes

No	Program Outcomes	1	2	3	4	5
1	Adequate knowledge of subjects specific to mathematics, natural sciences and related engineering disciplines; ability to use theoretical and applied knowledge related to these areas in complex engineering problems.					X
2	Ability to identify,define,formulate and solve complex engineering problems; ability to select and apply appropriate analysis and modeling methods to this end.					X
3	Ability to design a complex system, process, device or product under realistic constraints and conditions to meet specific requirements; ability to apply modern design methods for this purpose.					
4	Ability to develop, select and use modern techniques and tools required for the analysis and solution of complex problems encountered in engineering practice; ability to use information technologies effectively.					
5	Ability to design and conduct experiments, collect data,analyze and interpret results to investigate complex engineering problems or discipline-specific research topics.					
6	Ability to work effectively in disciplinary and multi-disciplinary teams; ability to work individually.			X		
7	Ability to communicate effectively in Turkish, both orally and in writing; knowledge of at least one foreign language; the ability to write effective reports and understand written reports, to prepare design and production reports, to deliver effective presentations, to give and receive clear and understandable instructions.					
8	Awareness of the necessity of lifelong learning; the ability to access information, to follow developments in science and technology, and to renew oneself constantly.					
9	Acting in accordance with ethical principles, professional and ethical responsibility; information about standards used in engineering applications.					
10	Information about business life practices such as project management, risk					

		management and change management; awareness of entrepreneurship, innovation; information about sustainable development.					
	11	Knowledge about the universal and social effects of engineering applications on health, environment and safety and the problems of the age reflected in the engineering field; awareness of the legal consequences of engineering solutions.					
The Course's Lecturer(s) and Contact Informations	1. Prof. Dr. Mehmet EROĞLU, meroglu@gazi.edu.tr 2. Prof. Dr. Metin U SALAMCI, msalamci@gazi.edu.tr 3. Assoc. Prof. Dr. Sinan KILIÇASLAN, skilicaslan@gazi.edu.tr						