General information	Title and code of subject, number of credits	ETR390 Control System 6 credits
	Department	Physics and Electronics
	Program	Bachelor
	Academic semester	2022 Spring
	Lecturer	MSc, Alim Huseynov
	E-mail:	Alim.Huseynov@gmail.com
	Phone number:	+99455 425 3599
	Lecture room/Schedule	
	Consultations	
Course language	English	
Type of the subject	Major	

Textbooks and additional materials

Textbooks:

1. Practical process control, Cecil L.Smith, 2009
2. Modern Control Technology: Components & Systems, Kilian
3. Introduction to Mechatronics and Measurement Systems, David G. Alciatore & Michael B. Histand, 2011
4. Control Systems Engineering, 7th edition, Nise, 2014
5. Mechatronics-Electronic control systems in mechanical and electrical engineering, Sixth Edition , William Bolton, 2014

Course outline

This course of control system describes fundamental components of industrial control systems, difference between manual and automatic control systems, basics of modeling and transfer function representation, basic properties of feedback, classical controller design in time and frequency domain: lead, lag, lead-lag compensation, rate feedback, PID controller, input elements like different sensors and output elements like actuators and motors.

The role of control systems in green engineering will continue to expand as the global issues facing us require ever increasing levels of automation and precision. This course allows drawing and analyzing the block diagram of open loop and closed loop control system, to recognize elements control system such as instrumentation devices, Programmable Logic Controllers and end devices such as actuator.

Course objectives

In the course of control system students will be able to examine the basic concepts of control system. At the end of course the students understand what the controller, types of controllers and how work the controller and where they are used. They will study that lies on the base of control system, will be able, to analyze the input and output signals of control system by using feedback.

Learning outcomes

What students should know by the end of the course:

To define Control systems and its elements like controllers and actuators, To understand working principles of PID controllers, To define analog controllers eg: temperature controllers, to describe differences between open loop and closed loop systems, to explain how on off controller works, to define transfer functions of control system, to have an overview for instrumentation devices, signal conditioning techniques and modern control strategies.

Teaching methods	Lecture		x
	Group discussions at seminars		x

Assessment	Components	Date/ Deadline	Percent (%)
	Active participation Discussion	At each lesson	10
	Quizzes	During the semester, 3 quiz	20
	Midterm exam		30
	Final exam		40
	Final		100

Rules (Educational policy and behavior)

Lesson organization

General information on the subject will be provided for the students during lectures.

Student's knowledge on the previous topics will be evaluated and new topic will be explained by mins of visual aids during seminars. Student's knowledge level will be tested oraly and in written forms before midterm and final exams.

		Attendance Participation of students at all classis is important. Students should inform dean's office about missing lessons for particular reasons (illness, family issues and etc.). Students, missing more than 25% of lessons, are not allowed to take the exam. **Lates** Those students who are late for lessons for more than 15 minutes are not allowed to participate at the lesson. Despite this, the student is allowed to take part in the second part of the lesson. **Quizzes** Those students who have informed the teacher and the dean's office about missing the quiz in advance for particular reasons, are allowed to take the quiz next week. **Exams** All the issues related to the participation and admission to the exam are regulated by the faculty dean. Topics of midterm and final exams are provided for the students before the exams. The questions of midterm exam are not repeated in the final exam. **Violation of the rules of the exams** Disrupting the quiz and taking copy during midterm and final exams is forbidden. Quiz papers of the student who do not follow these rules are canceled and the students are expelled from the quiz by getting 0 (zero). **The rule for completing the course** In accordance with the University rules the overall success rate to complete the course should be 60% or above. The students who failed the exam would be to take this subject next semester or next year. Rules of conduct for Students Disruption of the lesson and not following ethical norms during the lesson, as well as conduction of the discussions by the students without permission and using mobile phones is forbidden.

Week	Dates	Subject topics	Textbook/ Assignments
1.	12-02-22	Lecture №1. Introduction to control system: types of control system. Closed loop and open loop control system Seminar 2. Solve exercises	[2] p.1-24 [4] p. 1-32 Materials provided by Lecturer
2.	19-02-22	Lecture №2 Feedback control, External disturbance inputs, Plant variations, Dynamic response, Steady-state accuracy, Non-linearity. Seminar 2. Solve exercises	[2] p. 453-510 [4] p. 1-32 Materials provided by Lecturer
3.	26-02-22	Lecture №3 Control loop stability. Seminar 3. Quiz 1	[1] p. 69-110 [2] p. 453-510 Materials provided by Lecturer
4.	05-03-22	Lecture №4. Proportional Mode control Seminar 4. Solve exercises	[1] p. 138-172 [2] p. 453-510 Materials provided by Lecturer
5.	12-03-22	Lecture №5. Integral Mode Control Seminar 5. Solve exercises	[1] p. 174-210 [2] p. 453-510 Materials provided by Lecturer
6.	19-03-22	Lecture №6. PID Control Seminar 6. Quiz 2	[1] p. 212-241 [2] p. 453-510 Materials provided by Lecturer
7.	26-03-22	Lecture №7. PID Controller Tuning Seminar 7. Solve exercises	[1] p. 243-283 Materials provided by Lecturer
8.	02-04-22	Lecture №8. Tranfer function of control system components, Mathematical modeling of control system Seminar 8. Solve exercises	[4] p.33-380 Materials provided by Lecturer
9.	09-04-22	Mid term exam	
10.	16-04-22	Lecture №10. Types of signals analog and digital, Signal conditioning techniques. Seminar 9-10. Solve exercises	[2] p.59-114 [5] p.69 - 111
11.	23-04-22	Lecture №11. ADC and DAC techniques. Types and implementation. Seminar 11. Solve exercises	[3] p. 346 – 363 [5] p. 95-112

12.	30-04-22	Lecture №12. PLC, DCS and SCADA. Programming concepts, industrial standards and applications. Seminar 12. Quiz 3	[2] p. 511-563 [5] p. 349 - 376
13.	07-05-20	Lecture №13. Position, Pressure and Level sensing techniques and sensors. Seminar 13. Solve exercises	[2] p.221-265 [3] p.375 - 406 [5] p.29-56
14.	14-05-20	Lecture №14. Flow and Temperature sensing techniques and sensors. Seminar 14. Solve exercises	[2] p. 265-278 [3] p. 408-414 [5] p. 54-61
15.	21-05-20	Lecture №15. End elements: valves and motors. Seminar 15. Solve exercises	[3] p. 431-477 [5] p. 165-239
		Final Exam	