MINISTRY OF EDUCATION AND SCIENCE
REPUBLIC OF KAZAKHSTAN

SATBAYEV UNIVERSITY

APPROVED
Head of Department

B. Suleimenov
"_____" _____ 2019

Syllabus

AUT1093 «Process Management Fundamentals»
(Name of subject)

For specialties 5B070600, 5B074600

3 credits

Semesters: Spring, 2018-2019 years

Almaty, 2019

F KazNRTU 703-08. Syllabus

Satpayev University
Institute Information Telecommunication Technologies
Department "Automation and Control"

1. About teacher :

Lecturer
Assistant-professor, PhD
Zhanar Omirbekova
15 office hours, 703 room
Email zhanomir@gmail.com

2. Learning objective : Describe the importance of process control in terms of variability, efficiency, and safety

Skills Modern control engineering practice includes the use of control design strategies for improving manufacturing processes, the efficiency of energy use, and advanced automobile control (including rapid transit, among others).

3. Course Description :
Control in process industries refers to the regulation of all aspects of the process. Precise control of level, temperature, pressure and flow is important in many process applications. This module introduces you to control in process industries, explains why control is important, and identifies different ways in which precise control is ensured

4. Prerequisites:

- ✓ Mathematics
- ✓ Matlab, AutoCAD

5. Postrequisites:
Subjects according specialties

6. References:

Basic	Additional
[1] Romagnoli, Jose A. Introduction to Process Control. s.l. : CRC press, 2006	[4] Process Control: Designing Processes and Control Systems for Dynamic Performance. by Thomas Marlin
[2] Luyben, William L., Tyreus, Bjorn D., and Luyben, Michael L. "Chapter 8: Eastman Process" in Plantwide Process Control, McGraw-Hill, New York, pp. 251-272.	[5] -Bequette, B. Wayne. Process Dynamics Modeling, Analysis, and Simulation, New Jersey: Prentice Hall. -Bhattacharyya, Shankar P., Datta & Silva, PID Controllers for Time-Delay Systems, 2005
[3] Angeli, David & Sontag, Eduardo D. (2003). Monotone Control Systems.	[6] https://spectrum.ieee.org/ http://www.pacontrol.com/

7. Calendar - thematic plan:

Weeks	Lecturers	Labs	Links	Tasks	Deadline
1	Importance of Process Control, Learning Objectives	Diagram of Surge Tank System; Governing Equations of Surge Tank Model	[1] Basic lecture [5] labs	LW	Before the start of the next class
2	Process Control, Reduce Variability, Increase Efficiency	Control Engineering Practice, Common Types of Flow Meters	[1] Basic lecture, [5], [6] labs	LW	
3	Control Theory Basics, The Control Loop, Three Tasks	Boolean models: truth tables and state transition diagrams.	[1], [2] Basic lecture	LW	
4	Process Control Terms, Process Variable, Setpoint	Modeling Case Studies	[3] Basic lecture	LW	
5	Measured Variables, Process Variables, and Manipulated Variables	Basic Design for Heated Surge Tanks	[1], [2] Basic lecture [6] labs	LW	
6	Control Algorithm Manual and Automatic Control	ODE Modeling of a Distillation Column	[1] Basic lecture [5] labs	LW	
7	Closed and Open Control Loops, Components of Control Loops and ISA Symbology	ODE & Excel model of a heat exchanger	[1] Basic lecture, [5], [6] labs	LW	

8		**Midterm**		**Quiz**	
9	Control Loop Equipment and Technology, Primary Elements/Sensors, Transducers and Converters	Mathematics for Control Systems	[1] Basic lecture [5] labs	LW	
10	Multi-Variable / Advanced Control Loops, Multivariable Loops, Feedforward Control, Feedforward plus Feedback	Constructing Block Diagrams: Visualizing control measurements	[1] Basic lecture, [5], [6] labs	LW	
11	Cascade Control, Batch Control, Ratio Control , Selective Control, Fuzzy Control	PID tuning via classical methods	[1], [2] Basic lecture	LW	
12	Control systems: Measurement Devices	PID tuning via optimization	[3] Basic lecture	LW	
13	Piping and Instrumentation Diagrams	A Description of Amplitude Ratio, Phase Shift and Frequency Response	[1], [2] Basic lecture [6] labs	LW	
14	P&ID standard structures, location of features	Modeling PID Controllers With Euler in Excel	[1] Basic lecture [5] labs	LW	
15	PID Control	**Final**		**Quiz**	

** In the calendar - thematic calendar subject to change, taking into account holidays*

8. <u>Tasks and brief guidelines for their implementation:</u>

- ✓ Independent student work:

Section 1. Control systems: Measurement Devices

1.1 Control Systems: Industrial Applications

1.2 Temperature control: Thermocouple

1.3 Pressure Control: Pressure Switch

1.4 Composition Control: Ratio Control

1.5 Level Control: Level Switches

1.6 Flow Control: Flow Meters – An electronic textbook is a student-contributed open-source text covering the materials used at Michigan in our senior level controls course Chemical Process Dynamics and Controls (Book I) 179-182 pp

Section 2. Temperature Sensors

2.1 Temperature Sensors

2.2.1 Thermometers

2.2.2 Resistance Temperature Detectors

2.2.3 Thermocouples

2.2.4 Pyrometers

2.3 Temperature Regulators

2.3.1 Regulator Structure

2.3.2 Regulator Operation

2.3.3 Types of Temperature Regulators

2.4 Resistance Temperature Detector Example

2.5 Temperature Sensor Example

2.6 Sage's Corner – An electronic textbook is a student-contributed open-source text covering the materials used at Michigan in our senior level controls course Chemical Process Dynamics and Controls (Book I) 183-200 pp

✓ Collaboration with a teacher:

1.1 Two Examples of the Use of Feedback [6] additional

1.2 Control Engineering Practice -[6] additional

1.3 Examples of Modern Control Systems - [6] additional

1.4 Automatic Assembly and Robots - [6] additional

1.5 The Future Evolution of Control Systems - [6] additional

1.6 Engineering Design –[6] additional

1.7 Mechatronic Systems - [6] additional

1.8 Control System Design - [6] additional

1.9 Design Example: Turntable Speed Control

1.10 Design Example: Insulin Delivery Control System

1.11 Sequential Design Example: Disk Drive Read System

Laboratory work:

Represent the development and programming of solutions to specific problems. Tasks will be presented on the website in the portal. The execution of tasks is done accordingly and involves the use of the MATLAB and SCADA programming environment. Timeliness of completion and delivery of works will be taken into account.

Boundary control:

Boundary control consists of two stages:
The first solution to the problem manually
The second solution to the problem in the Matlab environment.

✓ **Exam: Writing**

Work evaluation criteria:

Evaluation by letter	Digital equivalent	Criterion
A	**95 – 100**	**The criterion for the evaluation of laboratory work: the completeness of the solution of tasks, accuracy and accuracy, compliance with the standard of the QMS, The fulfillment of an individual task qualitatively and in time according to the schedule.** **The criterion for evaluating the individual tasks: a correctly formulated formulation of the problem, independence, completeness of the solution of the problem, (manual) and programmatic solution of the problem.** **Exam assessment criteria: correctness, accuracy, completeness of answers.**
A -	**90 – 94**	
B +	**85 – 89**	
B	**80 – 84**	
B -	**75 – 79**	
C +	**70 – 74**	
C	**65 – 69**	
C -	**60 – 64**	
D +	**55 – 59**	
D	**50 – 54**	
F	**0 – 49**	

** It is possible to get bonus points for completing additional tasks.*

9. Late Submission Policy:
At the end of the semester, you will receive a general final grade, which is a general indicator of your work throughout the semester. The final grade will be set according to the rating scale adopted in the NJSC "KazNRTU

10. Attendance policy:
At the end of the semester, you will receive a general final grade, which is a general indicator of your work throughout the semester. The final grade will be set according to the rating scale adopted in the KAZNRTU.

11. Policies for academic conduct and ethics:
Be tolerant, respect someone else's opinion. Objections formulate in the correct form. Plagiarism and other forms of dishonest work are unacceptable. Invalid cheating and cheating during exams, passing the exam for another student. A student convicted of falsifying any course information will receive a final "F" grade.
The teachers of this course support the anti-corruption policy of the university. Zero tolerance policy