

<i>Name of the subject:</i> <b>Automatics</b>		<i>NEPTUN-code:</i> KMAAU1AMND	<i>Contact hours/week:</i> 2 lectures + 1 lab. practice	
<i>Credits: 5</i> <i>Requirement:</i> Assignment		<i>Recommended (optional) prerequisite:</i> -		
<i>Lecturer:</i> Árpád Varga	<i>Assignment:</i> teaching assistant	<i>Faculty and institute:</i> Kandó Kálmán Faculty of Electricity Institute of Instrumentation and Automation		
<b>Subject</b>				
<i>Aim of the course:</i> Presenting the basics of automation theory and industrial applications of automatics.				
<b>Lecture topics:</b>			<b>Week</b>	<b>Cont. hours</b>
Introduction: Concept of automation, historical background. Manufacturing and process technologies. General structure of process control systems. Static and dynamic system characteristics.			<b>1.</b>	<b>2</b>
LTI Systems. Using Differential equations as possible transcription method of processes. Transfer functions in time and frequency domain.			<b>2.</b>	<b>2</b>
Basic transfer functions: P, I, D, PT1, PT2, H elements, transfer and step functions. Block diagram manipulation, serial/parallel/feedback connections			<b>3.</b>	<b>2</b>
Structure of closed loop control. Concept of PID compensation. Loop stability conditions.			<b>4.</b>	<b>2</b>
Actuators I: Electric actuators. Relays, AC/DC/stepper motors. Inverters.			<b>5.</b>	<b>2</b>
Actuators II: Hydraulic and pneumatic actuators. Control valves, industrial hydraulic cylinders			<b>6.</b>	<b>2</b>
<b>Theoretical test I.</b>			<b>7.</b>	<b>2</b>
Transmitters I: Position measurement devices: Limit switches, potentiometers, absolute and incremental encoders.			<b>8.</b>	<b>2</b>
Transmitters II: Level measurement in reservoirs. Temperature measurement: thermocouples, thermistors and RTD-s.			<b>9.</b>	<b>2</b>
Transmitters III: Pressure measurement. Flow measurement: volume flow rate and mass flow rate devices.			<b>10.</b>	<b>2</b>
Concept and architecture of industrial Programmable Logical Controllers (PLC-s). PLC programming languages. Structure of PLC programs, interruption handling.			<b>11.</b>	<b>2</b>
Communication protocols used in industrial process control systems. Noise reduction technologies. SCADA systems.			<b>12.</b>	<b>2</b>
<b>Theoretical test II.</b>			<b>13.</b>	<b>2</b>
<b>Retake test, consultation</b>			<b>14.</b>	<b>2</b>
<b>Laboratory topics:</b>			<b>Week</b>	<b>Cont. hours</b>
Introducing open loop digital control devices. Zelio hardware and software presentation.			<b>1.</b>	<b>1</b>
Solving control tasks with Zelio: guided practice.			<b>3.</b>	<b>1</b>
<b>Laboratory test I.: solving control tasks with Zelio independently.</b>			<b>5.</b>	<b>1</b>
Matlab software presentation.			<b>7.</b>	<b>1</b>
Defining transfer functions and function blocks in Matlab and Simulink: guided practice.			<b>9.</b>	<b>1</b>
<b>Laboratory test II.: simple control loop design with Matlab.</b>			<b>11.</b>	<b>1</b>
<b>Laboratory retake test</b>			<b>13.</b>	<b>1</b>

***Requirements for subject accomplishment, marking system.***

The subject consists of a theoretical section and a laboratory practice section. The materials connecting to theoretical part are discussed during the lecture (held every week). The laboratory practice is held every second week.

Visit of the lectures and the laboratories are obligatory!  
Missing more than **6** occasions (30% of the total 14 + 6 lecture + laboratory occasions) cause “*not accomplished*” notice in the Neptune system.

The subject is evaluated by a *midterm mark*.

Midterm mark is calculated based on the average of 4 marks (the mark of the 2 theoretical and the 2 laboratory tests).

For the subject accomplishment *all of the test marks must be larger than “1”!*

More than one test with mark “1” cause “*not accomplished*” notice in the Neptune system!

Limits for test grading (results are given in %):

0%	-	35%	mark “1”
35%	-	50%	mark “2”
50%	-	62,5%	mark “3”
62,5%	-	75%	mark “4”
75%	-	100%	mark “5”

### ***Retake possibilities:***

*One of the failed theoretical tests* and *one of the failed laboratory tests* can be retaken during the semester.

There are one extra retake possibility during the exam period, concerning on *only one test*.

### **Literature:**

László Gecsey –József Neszveda Ph.D.: Design Engineering In Practice

Practical Process Control