

Applied Automatization I

Code: MK3AAUT1R06RX17-EN

ECTS Credit Points: 6

Evaluation: Exam, measurement report

Year, Semester: 2nd year, 2nd semester

Its prerequisite(s): Electronics I

Further courses are built on it: Yes/No

Number of teaching hours/week (lecture + practice): 2+4

Topics:

Control engineering of funds and core control technology, feedback (closed-loop) control knowledge acquisition. Theoretical Foundations Control Technology. Control (open-loop) and application control functions. Programmable Logic Controllers. Timers, counters, sequential controls. Tags of the control loop. Examination of the tags of the control loop steady state. linear transition state regulations. a description of the transitional state of the linear members. Examination of the closed-loop control. Stability and quality features. Selection and setting regulators. Control and feedback systems practical exercises using the PLC programming.

Literature:

Compulsory:

- Ed. Robert H. Bishop: The Mechatronics Handbook, Section IV: Systems and Controls, CRC Press; 2nd edition 2007, ISBN: 978-0849392573
- Uday A.Bakshi, S.C.Goyal: Feedback Control Systems, Technical Publications Pune, 2nd edition 2008, ISBN: 978-8189411077

Recommended:

- Uday.A.Bakshi,Varsha.U.Bakshi: Control System Engineering, Technical Publications Pune, 1th edition 2008, ISBN: 978-8184314632

Schedule

1st week Registration week

2nd week:

Lecture: The theoretical bases of control technology. Basic concepts, symbols and allocation. Comparison of control and feedback control. Subdivision of control and feedback control.

Practice: Realization of logic functions "AND, OR, NAND, NOR, XOR, XNOR" with relays.

4th week:

Lecture: Control systems. Boolean algebra, basic operations (And, Or, Not). Basic identity of Boolean algebra.

Practice: Digital circuits realization of Flip-Flop circuits, RS-JK storage, MUX-DEMUX.

3rd week:

Lecture: Feedback control. Signs and characteristics of a control loop. Loop tags (a sensor, a signal generator, subtraction, signal processing, an amplifier, an actuator).

Practice: Realization of logic functions "AND, OR, NAND, NOR, XOR, XNOR" with digital circuits.

5th week:

Lecture: De Morgan's theorems. Two-variable logic functions (Nor, Inhibition, Antivalency, Equivalency, Implication).

Practice: Digital circuits realization of flip-flop circuits, RS-JK storage, MUX-DEMUX.

6th week:

Lecture: Functions to simplify algebraic and graphical way. Operation and programming of freely programmable logic controllers (PLCs).

Practice: Operation of programmable logic controllers. Basic programming tasks with PLC.

7th week:

Lecture: Linear Control Systems. Test methods (time domain, frequency domain, and transfer functions method).

Practice: Operation of programmable logic controllers. Basic programming tasks with PLC. Measuring internal timers and counters.

8th week: 1st drawing week, Self-control test**9th week:**

Lecture: Linear control steady-state operation. Linear terms (P, I, D) and transmission coefficient. Linear coupling of tags (serial, parallel, feedback).

Practice: Application of different programming languages for programmable logic controllers Medium programming tasks with PLC.

11th week:

Lecture: Analysis of proportional (type 0) control. Examination of integral (type 1) control. Gaining and measuring a concept loop.

Practice: Determine and analysis the transfer function of one-two variable proportional tag.

Analyze the transition function of two storage proportional tags with MULTISIM software.

13th week:

Lecture: Transition, transfer function and differential equations of a proportional and integral tag. Transition, transfer function and differential equations of a derivate and dead time tag.

Practice: Proportional Differential (PD) tags transfer function analysis of the function using MULTISIM software.

10th week:

Lecture: A proportional tag, negative feedback through a proportional tag. Examination of feedback.

Practice: Medium level programming exercises with PLC.

12th week:

Lecture: Linear feedback control transition state. Typical testing functions. Linear tags differential equations. Transfer function preparation about transmission function.

Practice: Conditions and analysis of a variable storage differentiator tag and its transfer function.

Proportional Integral (PI) tags transfer function analysis of the function using MULTISIM software.

14th week:

Lecture: Continuous (P, PI, PD, PID) controllers. Non-electrical quantities electrical measuring. Control loops stability criterion with Routh-Hurwitz and high-quality specifics.

Practice: The Proportional-Integral-Derivative

(PID) tag recording its transfer function and

function analyzing. Optimization of measurement of different types of controllers.

15th week: 2nd drawing week, End-term test**Requirements****A, for a signature:**

Attendance at lectures is recommended, but not compulsory. Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during

the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can't make up a practice class with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. Missed practice classes must be made up for at a later date, being discussed with the tutor. Active participation is evaluated by the teacher in every class. If a student's behaviour or conduct doesn't meet the requirements of active participation, the teacher may evaluate his/her participation as absence because of the lack of active participation in class. Students have to submit all the twelve reports as scheduled minimum at a sufficient level. During the semester there is one test: the end-term test in the 15th week. Students have to sit for this test.

B, for a grade:

At the end of the course an oral exam must be taken. Based on the average of the grades of the reports and the test results, the mid-semester grade is calculated as an average of them: - the average grade of the twelve reports (30 %) - the grade of the tests (20 %) - the oral exam (50 %) The minimum requirement for end-term test is 60%. Based on the score of the test separately, the grade for the test is given according to the following table: Score Grade 0-59 fail (1) 60-69 pass (2) 70-79 satisfactory (3) 80-89 good (4) 90-100 excellent (5)