Óbuda University ***Donát Bánki Faculty of Mechanical and Safety Engineering***	Institute of Mechatronics and Vehicle Engineering Department of Mechatronics

Subject name and Neptun-code: Control Engineering (BMXIRE4BNE) **Credit points:** ***4***
Spring Semester of the Academic year of 2019/2020, Full time training.

The course is available at: BSc in Mechatronics.

Supervised by:		Lectured by:	Prof. Dr. habil. Róbert Szabolcsi

Requirements of the course: (Neptun Codes)	

Lessons per week:	Theory: **2**	Practice (in Auditorium): **0**	Computer Lab: **1**	Consultation: **0**

Level of exam (E, P):	**P (Practice mark)**

The Syllabus

Aim: Give an overview about classical and modern control systems, systems' analysis and preliminary design.

Topics: Basics of automatic control theory. Classical and modern control theory. Mathematical models of dynamical systems. Laplace-transformation used in control theory. State-space representation of dynamical systems. Block diagrams, signal flow charts. Basic terms and theirs analysis. Time domain responses. Frequency domain responses. Open loop system analysis. Closed loop system analysis. Reference signal tracking problems. Disturbance rejection and sensor noise attenuation problems, and theirs solution in control engineering. Stability problems of the closed loop control systems. Main elements of the control engineering, and theirs dynamical description. Dynamic performances used in control engineering. Control system preliminary design: pole placement, LQ-based design methods. Solution of control problems of control engineering using MATLAB.

Requirements

Weeks	
1.	Registration for the course.
2.	Basics of automatic control theory. Modern control theory. Mathematical models of dynamical systems. Basics in MATLAB Programming.
3. – 4.	Laplace-transformation used in control theory. State-space representation of dynamical systems. Block diagrams, signal flow charts. Basic terms and theirs analysis. Time domain responses. Frequency domain responses. Open loop system analysis. Solution of control problems using MATLAB.
5.	Test paper No 1.
6.-7.	Closed loop system analysis. Reference signal tracking problems. Disturbance rejection and sensor noise attenuation problems, and theirs solution in control engineering. Stability problems of the closed loop control systems. Main elements of the control engineering, and theirs dynamical description. Solution of control problems of mechatronics using MATLAB.
8.	Test paper No 2.
9.–13.	Dynamic performances used in control engineering. Control system preliminary design: pole placement, LQ-based design methods. Solution of control problems of control engineering using MATLAB. Analogue and digital devices used in control engineering. Solution of control problems of mechatronics using MATLAB.
14.	Test paper No 3.
15.	Closing the Course. Test papers. Signature gaining.

All main areas of the course are evaluated by test papers. The course is to be considered successfully executed if and only if all the 3 test papers are evaluated with grades higher than 2 ('Pass'). If there is any test paper evaluated by grade of 'Fail' (Grade 1) of those all 3 written test papers, the teacher's signature is denied. If there is a single test paper not written one, the student must be cancelled from the course.

To improve: If there is any unsatisfactory evaluated test paper, the student must be provided 2 occasions to improve including the 15^{th} lecture.

Participation: The participation is not obligatory at all lectures with the exemption of the test paper lectures.

Grade: The teacher's signature and practice mark (P) is provided if and only if the average grade of three test papers is higher than 'Pass' (Grade 2). Practice mark is an average of the grades of the three written tests.

References:

1. Burns, R. S. *Advanced Control Engineering*, Butterworth-Heinemann, Oxford-Auckland-Boston-Johannesburg-Melbourne-New Delhi, 2001.
2. Franklin, G. F. – Powell, J. D. – Emami-Naeini, A. *Feedback Control of Dynamic Systems*, Prentice-Hall, Pearson Education International, 2002
3. Stefani, R. T. – Shahian, B. – Savant Jr., C. J. – Hostetter, G. H. *Design of Feedback Control Systems*, Oxford University Press, New York-Oxford, 2002
4. Lantos, B. *Control System Engineering, Part I-II, Modern Control Engineering*, (in Hungarian), Academic Press, ISBN 963-05-7922-7, Budapest, Hungary (2003).
5. Nise, N. S. *Control Systems Engineering,* John Wiley & Sons, Inc., 2004.
6. Dr. Szabolcsi Róbert: A MATLAB programozása, Zrínyi Miklós Nemzetvédelmi Egyetem, 2004.
7. Prof. Dr. Szabolcsi Róbert: *Korszerű szabályozási rendszerek számítógépes tervezése*, egyetemi tankönyv, Zrínyi Miklós Nemzetvédelmi Egyetem, ISBN 978-615-5057-26-7, 415 oldal, 2011.
8. Dorf, R.C. – Bishop, R.H. *Modern Control Systems*, Prentice-Hall International Inc., 2001.
9. Dorf, R.C. – Bishop, R.H. *Modern Control Systems*, Pearson Education Ltd., 12th Edition, 2014.

Quality Assurance: using feedback provided by the students for improving content and methods of teaching of the subject.

This course will perform well if students are emotionally-driven, pro-active, and self-motivated ones whilst eager to gain brand-new knowledges and skills in automatic control systems and in their engineering.

31 January 2020, Budapest, Hungary.

Prof. Dr. habil. Róbert Szabolcsi
Lecturer