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 2022/2023, 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: upon students' request.
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 their 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 their solution in control engineering. Stability problems of the closed loop control systems. Main elements of the control engineering, and their 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	
0.	Registration for the course.
1.	Basics of automatic control theory. Modern control theory. Mathematical models of dynamical systems. Basics in MATLAB programming.
2.	Laplace-transformation used in control theory. State-space representation of dynamical systems. Time domain responses. Frequency domain responses.
3.	Block diagrams, signal flow charts. Basic terms and their analysis.
4.	Open loop system analysis. Solution of control problems using MATLAB.
5.	Closed loop system analysis. Reference signal tracking problems. Disturbance rejection and sensor noise attenuation problems, and their solution in control engineering.
6.	Stability problems of the closed loop control systems.
7.	Main elements of the control engineering, and their dynamical modelling. Solution of control problems of mechatronics using MATLAB.
8.	Dynamic performances used in control engineering.
9.	Control system preliminary design: pole placement technique.
10	LQ-based controller design methods. The LQR problem formulation and its solution.
11.	Solution of control problems of control engineering using MATLAB.
12.	Analogue and digital devices used in control engineering. Solution of control problems of mechatronics using MATLAB.
13.	Test paper (24 May 2023.)
14.	Closing the Course. Signature and practice mark gaining.

All main areas of the course are evaluated by a single test paper held on week No13. The course is to be considered successfully executed if and only if test paper is evaluated with grade higher than 2 ('Pass'). If the test paper is evaluated by grade of 'Fail' (Grade 1), or is remained as an unwritten one, the teacher's signature is denied with simultaneous cancellation of the student from the course.

To improve: If the test paper evaluated by '1' (Unsatisfactory), the student must be provided 2 occasions to improve during consultation time.

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

Grade: The teacher's signature and practice mark (P) are provided if and only if the test paper is evaluated with '2' (Pass) or with higher grade.

References (but not limited to):

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. Dorf, R.C. – Bishop, R.H. *Modern Control Systems*, Prentice-Hall International Inc., 2001.
7. 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.

Regulation:

'Student Requirement System of Óbuda University; Study and Examination Regulations of Óbuda University' is available at:

https://uni-obuda.hu/wp-content/uploads/2020/06/study-and-examination-regulations-of-obuda-university.pdf

Term:

ECTS credit: 1 credit = 30 working hours, including both the scheduled classes and the individual study (homeworks and other activities) of the students.

Thus, during 14 weeks of this course 42 lectures and computer labs will be held, and the remaining 78 working hours of the students shall be invested, as the minimum to succeed and to gain 4 ECTS credits.

Condition:

This is course will serve perfectly and perform well development of all those students being emotionally driven, highly motivated, eager to improve both theoretical and practical skills and knowledge, ready to sacrifice their resources (like time etc.) for their personal development. Moreover students should lead their study by their best abilities and skills expressing their social responsibility getting chance to take part at this promising course.

27 February 2023, Budapest, Hungary.

Prof. Dr. habil. Róbert Szabolcsi
Lecturer