Control theory and system dynamics

1. Subject name	Control theory and system dynamics				
2. Subject name in Hungarian	Irányításelmélet és rendszerdinamika				
3. Code	BMEKOKAM701	4. Evaluation type	exam grade	5. Credits	4
6. Weekly contact hours	2 (28) Lecture	0 (0) Practice	2 (28) Lab		
7. Curriculum	Autonomous Vehicle Control Engineering MSc (A)	8. Role	Mandatory (mc) at Autonomous Vehicle Control Engineering MSc (A)		
9. Working hours for fulfilling the requirements of the subject					120
Contact hours	56	Preparation for seminars	10	Homework	0
Reading written materials	27	Midterm preparation	12	Exam preparation	15
10. Department	Department of Control for Transportation and Vehicle Systems				
11. Responsible lecturer	Dr. Bokor József				
12. Lecturers	Dr. Gáspár Péter, Dr. Németh Balázs				
13. Prerequisites					

14. Description of lectures

The course aims the study of the analytical and control design methods of electromechanical systems. First, the modeling paradigms and state space representations are outlined. After this, system analysis is presented, such as controllability, observability and stability, Through the control design problem, the course examines the different qualitative properties, and the consideration techniques of system uncertainties and disturbances. From the classical methods, the pole allocation and the quadratic linear control is presented. The course focuses on the interpretation of the observer design and the separation principle.
Course thematic:

- System modeling based on physical principles
- Analysis in time and frequency domain
- State space of dynamic systems
- Quantitative properties and stability analysis of closed loop systems
- Properties of state space representations
- Controllability and observability of state space representations
- Compensator design
- Full state feedback with pole allocation
- Controller design with linear quadratic method
- Separation principle and observer design

15. Description of practices

16. Description of labortory practices

In the laboratory practice the computerized implementation and evaluation of the known control theory models and algorithms is performed.

17. Learning outcomes

A. Knowledge

- knows the basic dynamic system modeling paradigms, their mathematical background
- knows the time and frequency domain description of linear time-variant systems
- knows the principles of feedback control, and the quantitative and qualitative criteria
- knows the state space of theory
- is familiar with various simple feedback control methods
- knows the basics of modern control theory, the principle of quadratic regulation
- knows the methods of observer design

B. Skills

- is able to independently design a specific system model
- be able to apply the control design methods independently
- is able to use the most popular softwares on the field

C. Attitudes

- is interested in a mathematical solution to control problems
- acquires system-level thinking

D. Autonomy and Responsibility

- can independently provide quality and quantity parameters for a system's performance, enabling them to make decisions about system redesign
- can independently describe a particular system, use the appropriate mathematical formalisms
- is able to make decisions on the appropriate methods of solving the control task

18. Requirements, way to determine a grade (obtain a signature)

One midterm exam, which is successfull if 50% of its points are reached. The mark of the course depends on the result of the midterm exam (50%) and on the result of the successful written final exam (50%). The final exam is successfull, if 50% of its points are reached.

19. Opportunity for repeat/retake and delayed completion

The midterm exam can be retried once

20. Learning materials

Lecture Notes

Effective date	10 October 2019	**This Subject Datasheet is valid for**	2024/2025 semester II