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

Subject title and code: **System Engineering BMXRTE3BNF** **Credits:** *4*

Full-time study 2026/2027 *ac.* 1 *semester*
year

The course is available at: mechatronical engineering

Supervised by: Prof. Dr. Pokorádi László	**Instructors:** Kornél Földes

Prerequisite (neptun code): Mathematics II. BTXMME2BNF

Weekly number of lessons

Lecture: 2	Group seminar:	Lab: 1	Consultation:

Way of assessment: Exam (Written)

Online consultation *(in case it's required):* *... (BBB link)*

Edu. goal: *Development of engineering and problem-solving thinking, presentation of the tools of mathematical modeling required for engineering work, acquisition of basic modeling and systems analysis methods.*

Schedule

Education week	Topics
1.	Lecture: Introduction to Systems Engineering and mathematical fundamentals Lab: Introduction to the MATLAB numerical computing environment (odd week)
2.	Lecture: Physical quantities and SI base units Lab: Introduction to the MATLAB numerical computing environment (even week)
3.	Lecture: SI derived quantities and fundamental physical laws Lab: Using data structures, complex numbers, vectors, and graphical representation of functions (odd week)
4.	Lecture: Signals and their classification Lab: Using data structures, complex numbers, vectors, and graphical representation of functions (even week)
5.	Lecture: Dimensions and dimensional analysis Lab: Solving systems of equations using matrices (odd week)
6.	Lecture: Identification, modeling, and representation of systems Lab: Solving systems of equations using matrices (even week)
7.	Lecture: System analysis and typical test functions Lab: Solving differential equations in the MATLAB numerical environment; modeling (odd week)
8.	Lecture: Equations describing oscillating and vibrating systems Lab: Solving differential equations in the MATLAB numerical environment; modeling (even week)
9.	Lecture: Block diagrams and graphs Lab: Derivation of the mathematical model of a DC motor (odd week)
10.	Lecture: Block diagram algebra Lab: Derivation of the mathematical model of a DC motor (even week)
11.	Lecture: Block diagram algebra II. Lab: : Block diagram algebra of an oscillating system and an electrical resonant circuit (odd week)
12.	Lecture: General forms of system equations Lab: Block diagram algebra of an oscillating system and an electrical resonant circuit (even week)
13.	Lecture: Analogy Lab: Project Presentation
14.	Lecture: Frequency response and its graphical representation Lab: Project Presentation

Mid-semester requirements

Test		Assignment to be submitted		Szöveg beírásához kattintson vagy koppintson ide.	
amount	dates	amount	deadlines	amount	dates
		1	Week 13		

According to the HKR attendance of group seminars and lab exercises are mandatory.

Other requirements for participation in sessions not covered by the regulations and restrictions on substitutions:

Test		Assignment to be submitted		Szöveg beírásához kattintson vagy koppintson ide.	
maximum points available	minimum score required to pass /test	maximum points available	minimum score required to pass / assignment	maximum points available	minimum score required to pass /lab
…points	…points	100 points	50 points	…points	…points

Total number of points achievable in semester: 100 points				
Grading thresholds	**satisfactory** 50 % and above	**average** 60 % and above	**good** 75 % and above	**excellent** 90 % and above

Other evaluation criteria:
Attendance at laboratory sessions is mandatory. Throughout the semester, students are required to prepare a laboratory work log for each session and upload it to Moodle by the specified deadline. Attendance at a laboratory session will only be recognized upon submission of the corresponding laboratory work log.
Failure to upload the work log will result in the respective laboratory session being recorded as an absence. A missing laboratory work log may be made up on one occasion only during the semester. In the case of an excused absence, the student must contact the laboratory instructor without delay to arrange an appropriate time for making up the missed session.

The final grade for the course will be determined based on the project presented by the student in Week 13.

During the semester, students are required to develop a MATLAB-based project using the knowledge and methods acquired during the laboratory sessions. Each student should select a system of their choice, develop its mathematical model, and implement the model in MATLAB.

The project should demonstrate the student's ability to apply the system modeling and analysis methods covered during the semester. The MATLAB implementation should be used to investigate and illustrate the behavior of the selected system, including appropriate calculations, simulations, and graphical representations of the results.

The completed project must be presented and defended during the laboratory sessions in Weeks 13–14. Each student will have maximum 10 minutes to present their project. During the presentation, students should briefly introduce the selected system, explain the mathematical model and the MATLAB implementation, present and interpret the obtained results, and demonstrate their understanding of the applied methods.

Receive a signature denied entry:	• fail to attend any required assessment without providing a valid justification, • fail to submit the project assignment, • exceed the maximum number of absences permitted by the Study and Examination Regulations.
Required references:	Moodle materials

Recommended references:	1. Pokorádi László – Szabolcsi Róbert: Mathematical Models Applied to Investigate Aircraft Systems. Budapest: Mûegyetemi Kiadó, 1999. 146 p. Monographical Booklets in Applied and Computer Mathematics; 12. ISBN:ISSN 1417 278 X. 2. ALBERT-LÁSZLÓ BARABÁSI: Network Science, https://barabasi.com/book/network-science 3. Applied Dimensional Analysis and Modeling, Kindle Edition 4. System Book, http://sysbook.sztaki.hu/bevezeto_en.php
Quality assurance methods of the subject:	

Things, that are not included, can be found within the regulations of Óbuda University.