Electromechanical Systems Dynamics

Students*:*   Automation (AT) Bachelors
Year: Third
Semester: Sixth
Lecturer, Instructors:

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Course Description

The course of Electromechanical Systems Dynamics is designed for bachelor students of engineering specialties. The course is devoted to the modelling of the electromechanical systems dynamics' components using formal mathematical equations and/or implemented using computational languages and simulation programs. Electromechanical systems are considered physical structures characterized by the interaction of electromagnetic fields with inertial bodies. Electromechanical Systems are regarded from Kirchhoff's theory define discrete electromechanical systems and Lagrange's equations point of view.

Learning objectives

After the course, the students will be understanding:

- the fundamental principles for solving dynamic problems in electromechanical systems.
- the fundamental principles dynamics of rigid bodies
- the principles for mathematical calculation applied in actual engineering problems and applications
- the dynamic of electrical systems
- the dynamic of mechanical systems
- basic in control dynamic systems
- sensors for dynamic systems
- apply dynamic response analysis of mechanical or electrical oscillators to perform basic system identification.

Materials

Main materials:
1. Lecture presentations
2. Lab guides

Additional materials will be presented in class.

Course policies

- The course may use various learning technologies to facilitate learning in traditional on-campus face-to-face education, such as virtual labs with subject software for the course (Vlabs), flipped classes (FC), hybrid or blended learning with computer-based communication (CBC), asynchronous learning (AS), and self-work (SW).

- Students can ask questions via email, or a Ding Talk group dedicated to the course. Instructors answer questions on weekdays two-three times a week between 5 and 7 p.m. Moscow time.

- Participants are expected to attend all classes. It is required to attend at least 70% of classes. Omissions without a valid reason may affect the final grade.

- Please **inform the student office** if you will be late or unable to come to a class two or more times. If you miss more than 30% of classes without informing the student office, you will not be allowed to the final test.

- **The teacher is not authorized to dismiss students from classes**, give permission for internships, deal with the student's medical documents, etc. All such operations must be carried out by the student through the student office. And then the student office informs the teacher about the passes.

- **Students should not copy the work of other students and cheat. The teacher IS OBLIGED to inform the student office about attempts to cheat. Please, be responsible!**

- Participants who successfully complete the attendance and the imperative class work will be allowed to the final test. The success in the final test will determine the result mark for the course.

- Individual DingTalk calls or grouping webinars will be used for debt closing.

The course will run in 2025. The 44-hour course includes 16 hours of lectures, 28 hours of practice including 2 hours for a final test.

Grade System
Below is the breakdown of grades for the course.

Attendance — 10%. Tests — 30% (6 tests). Labs — 40% (4 labs). Final test — 20%

The description of the result mark and grade is presented below:

Result score (%)	Result grade	Explanation
91 – 100	5A	Excellent
84 – 90	4B	Very good
75 – 83	4C	Good
68 – 74	3D	Satisfactory
60 – 67	3E	Satisfactory
0 – 59	FX	Unsatisfactory

Course schedule

№	Topic	Class Type	Hours	Date	Time	Group	Teacher	Comments
1	Introduction to system dynamics	Lecture	2	Tuesday 04.03.2025	10:00 – 11:35	AT3	Alexander Mamatov	#106
2	Introduction to modelling	Lab	2	Tuesday 04.03.2025	13:30 – 15:05	AT3.1	Alexander Mamatov	#203
				Tuesday 04.03.2025	15:15 – 16:50	AT3.2	Alexander Mamatov	#203
3	Mathematic modelling of dynamic systems	Lecture	2	Thursday 06.03.2025	10:00 – 11:35	AT3	Alexander Mamatov	#106
4	Simulation components of dynamic systems	Lab	2	Thursday 06.03.2025	13:30 – 15:05	AT3.1	Alexander Mamatov	#203
				Thursday 06.03.2025	15:15 – 16:50	AT3.2	Alexander Mamatov	#203
5	Simulation components of dynamic systems + **consultation** + **test**	Lab	2	Friday 07.03.2025	13:30 – 15:05	AT3	Alexander Mamatov	#301 + #303
6	Mathematic modelling of mechanical systems dynamic	Lecture	2	Monday 10.03.2025	13:30 – 15:05	AT3	Alexander Mamatov	#108
7	Simulation components of dynamic systems	Lab	2	Tuesday 11.03.2025	13:30 – 15:05	AT3.1	Alexander Mamatov	#303
				Tuesday 11.03.2025	15:15 – 16:50	AT3.2	Alexander Mamatov	#303
8	Mechanical systems dynamic identification + **consultation** + **test**	Lab	2	Wednesday 12.03.2025	10:00 – 11:35	AT3	Alexander Mamatov	#301 + #303
9	Typical dynamic blocks	Lecture	2	Mondayday 17.03.2025	13:30 – 15:05	AT3	Galina Demidova	#106
10	Introduction to state-space modelling + **consultation** + **test**	Lab	2	Mondayday 17.03.2025	15:15 – 16:50	AT3	Galina Demidova	#305 + #307
11	Modelling dynamic bloc20	Lab	2	Tuesday 18.03.2025	13:30 – 15:05	AT3	Galina Demidova Sergey Lovlin	#305 + #307
12	Multidimensional dynamics+ **consultation** + **test**	Lab	2	Tuesday 18.03.2025	15:15 – 16:50	AT3	Galina Demidova	#305 + #307
13	Mechanical systems dynamic with nonlinearities	Lecture	2	Wednesday 19.03.2025	13:30 – 15:05	AT3	Galina Demidova	#108
14	Kinematic nonlinearities modelling in mechanical dynamics	Lab	2	Wednesday 19.03.2025	15:15 – 16:50	AT3	Galina Demidova Sergey Lovlin	#305 + #307
15	Sensors for dynamic systems	Lecture	2	Thursday 20.03.2025	13:30 – 15:05	AT3	Sergey Lovlin	#108
16	Mathematic modelling of electrical systems dynamic	Lecture	2	Monday 24.03.2025	13:30 – 15:05	AT3	Sergey Lovlin	#305 + #307
17	Kinematic nonlinearities modelling in mechanical dynamics	Lab	2	Monday 24.03.2025	15:15 – 16:50	AT3	Galina Demidova Sergey Lovlin	#305 + #307
18	Electrical system dynamic identification + **consultation** + **test**	Lab	2	Monday 24.03.2025	18:30 – 20:05	AT3	Galina Demidova	#305 + #307

№	Topic	Class Type	Hours	Date	Time	Group	Teacher	Comments
19	Analysis and control of linear systems	Lecture	2	Tuesday 25.03.2025	13:30 – 15:05	AT3	Galina Demidova	#106
20	Basic control action in dynamic systems	Lab	2	Tuesday 25.03.2025	15:15 – 16:50	AT3	Galina Demidova Sergey Lovlin	#305 + #307
21	Solutions, technics to control the dynamic systems + **consultation** + **test**	Lab	2	Tuesday 25.03.2025	18:30 – 20:05	AT3	Galina Demidova	#305 + #307
22	Consultation	Lab	2	Wednesday 26.03.2025	13:30 – 15:05	AT3	Galina Demidova Sergey Lovlin	#305 + #307
Final written **test**		Test	2	Wednesday 26.03.2025	15:15 – 16:50	AT3	Galina Demidova Sergey Lovlin	#305 + #307