The basis of Mathematical Modeling

bachelors

Russian variant (2016-2017)

N.	Study unit	Contact hours				Individual stud. work	Total hours	ECTS	
		Lecture	Seminar	Tutorial and lab	Other				
4th Year – 7th Semester									
1	Modeling and simulation of complex dynamical systems	36		36		36	144	4.0	

4th Year - 8th Semester									
5	Modeling and simulation of complex dynamical systems	36		36		36	144	4.0	

Suggested Variant

N.	Study unit	Contact hours				Individual stud. work	Total hours	ECTS	
		Lecture	Seminar	Tutorial and lab	Other				
4th Year – 7th Semester									
1	The basis of Mathematical Modeling	36		36		36	144	4.0	

Lectures and Labs 1

№	Lectures	Laboratory works
1	Mathematical modeling Classification of models	1. Differential and difference equations
2	Mathematical modeling Computer experiments	
3	Dynamical systems	2. Singular (fixed) points
4	One-dimensional dynamical systems	

Lectures and Labs 2

№	Lectures	Laboratory works
5	Two-dimensional dynamical systems	3. Linear continuous and discrete dynamical systems
6	Event-Driven Dynamical systems	
7	UML State Machines	
8	Stability	4. Event-Driven Dynamical systems
9	Properties of Classical Dynamical systems	
10	Properties of Event-Driven Dynamical systems	

Lectures and Labs 3

№	Lectures	Laboratory works
11	Bifurcation	5.Linearization
12	Theory of oscillations	
13	Markovian processes	
14	Numerical experiments. Visualization of behavior	6. Bifurcation One-and–two dimensional dynamical systems
15	Software for modeling and simulation dynamical systems _1	
16	Software for modeling and simulation dynamical systems _1	
17	Test	Credit
18	Credit	

Textbook
Table of Contents

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Chapter 3. Stability.

- Stability of dynamical systems. Lyapunov' theorems about stability .
- Linearization and stability. Lyapunov' Functions and stability
- Chapter 4. Hybrid systems.
- Hybrid time. Hybrid automata. Zenon effect, sliding mode.

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Chapter 5. Theory of oscillation

- limit cycle. Poincaré cross-section

Chapter 6. Bifurcation

- Continuous and discrete systems
- Bifurcation diagrams
- Strange attractors.

Chapter 7. Markov chains

- Continuous and discrete chains
- Kolmogorov equations.

Chapter 8. Computing experiment.