COURSE UNIT (MODULE) DESCRIPTION

Course unit (module) title	Code
Mathematical Physiology	

Lecturer(s)	Department(s) where the course unit (module) is delivered
Coordinator: prof. Aidas Alaburda **Other(s):**	Faculty for Natural Sciences, Deartment of Neurobiology and Biophysics, Sauletekio Av. 7 Vilnius, LT-10222

Study cycle	Type of the course unit (module)
Full-time studies (2nd stage)	Compulsory

Mode of delivery	Period when the course unit (module) is delivered	Language(s) of instruction
Face-to-face, self-study Lectures, and practice	III semester	English

Requirements for students	
Prerequisites: basics of mathematical analysis	**Additional requirements (if any):**

Course (module) volume in credits	Total student's workload	Contact hours	Self-study hours
5	150	64	86

Purpose of the course unit (module): programme competences to be developed

- Readiness for life-long continuous professional education
- Knowledge acquired and understanding
- Knowledge application
- Decision making

Learning outcomes of the course unit (module)	Teaching and learning methods	Assessment methods
3.1 Be able to critically analyse their own professional practices with a view to improving them	Exercises, self study.	Exam
4.3 Perceive mathematical models describing evolutionary processes of biological systems	Lectures, exercises, self study.	Exam
5.2 Be able to describe evolutionary processes of biological systems in mathematical language	Lectures, exercises, self study.	Exam
6.1 Be able select an appropriate modelling strategy for a given biological domain and problem	Exercises, self study.	Exam

Content: breakdown of the topics	Contact hours	Self-study work: time and assignments

	Lectures	Tutorials	Seminars	Exercises	Laboratory work	Internship/work	**Contact hours**	**Self-study hours**	**Assignments**
1. Introduction	1						**1**		
2. Living systems and differential equations. Population dynamics. Drug administration.	2			2			**4**	**4**	Reading lecture related literature
3. First order differential equations with separable variables	1			2			**3**	**4**	Reading lecture related literature
4. Linear first order differential equations	2			2			**4**	**4**	Reading lecture related literature
5. Different equations with constant coefficients	2			4			**6**	**8**	Reading lecture related literature
6. Systems of differential equations	2			2			**4**	**6**	Reading lecture related literature
7. Boundary conditions	2			2			**4**	**10**	Reading lecture related literature
8. Partial differential equations. Diffusion. Equation of string.	4			6			**10**	**10**	Reading lecture related literature
9. Mathematical description on neurons. Potential distribution in dendrites	4			2			**6**	**5**	Reading lecture related literature
10. Model of blood circulation.	2			2			**4**	**6**	Reading lecture related literature
11. Mathematical description of systems. Neuronal networks.	2			2			**4**	**6**	Reading lecture related literature
12. Systems of control. Biological control systems	4			2			**6**	**10**	Reading lecture related literature
13. Linear, exponential and logistic dynamics of systems.	2			2			**4**	**6**	Reading lecture related literature
14. Kinetics of chemical and biochemical reactions. Stability of equilibrium points.	2			2			**4**	**7**	Reading lecture related literature
Total	**32**			**32**			**64**	**86**	

Assessment strategy	**Weigh t,%**	**Deadline**	**Assessment criteria**
Exam	100	session	Exam consists of two parts: Computer – based test (max. 6) and practical solution of differential equation (max. 4). Computer –based test consists of 50 questions (right answer or answers should be selected) and covers all topics of the course. The grade is proportional to number of correct answers. Practical solution of differential equation – student should practically solve a given differential equation. Evaluation: selection of appropriate method (max. 2) and getting the correct solution (max. 2)

Author	**Year of public ation**	**Title**	**Issue of a periodical or volume of a publication**	**Publishing place and house or web link**
Compulsary reading				
C.H. Taaubes	2008	"Modeling Differential Equations in Biology"		Cambridge University Press

D.S. Jones, M.J. Plank & B.D. Sleeman	2009	"Differential equations and mathematical biology"		Chapman&Hall/CRC
Optional reading				
M. C. K. Khoo	2018	"Physiological Control Systems : Analysis, Simulation, and Estimation", II ediion		Wiley-IEEE Press
C. Koch, I. Segev	1989	"Methods in Neuronal Modeling: From synapses to networks"		MIT Press
J.D Murray	2007	"Mathematical Biology I: An Introduction"		Springer
J.D Murray	2011	"Mathematical Biology II: Spatial Models and Biomedical Applications"		Springer