Subject code	ECTS credits
MAT3018	6

Course title in Lithuanian

MATEMATINIAI MODELIAI BIOMEDICINOJE

Course title in English

MATHEMATICAL MODELS IN BIOMEDICINE

Short course annotation in Lithuanian (up to 500 characters)

Matematiniai modeliai biomedicinoje yra taikomosios matematikos dalis, kuri yra skirta įvairių sričių problemoms spręsti, naudojant virtualius eksperimentinius metodus. Kursas susideda iš matematinių modelių kūrimo ir jų pirminės analizės, skaitinių algoritmų kūrimo ir analizės, tam tikro pobūdžio stebėjimų ir eksperimentų rezultatų apdorojimo bei naujos informacijos, apie sumodeliuotus procesus, sistemas ar reiškinius, gavimo ir analizės. Per pastaruosius du ar tris dešimtmečius, ryšium su nauja praktika, matematinis modeliavimas yra viena iš plačiai plėtojamų taikomosios matematikos šakų.

Short course annotation in English (up to 500 characters)

Mathematical Models in Biomedicine – the part of applied mathematics, which is dedicated to solution of the different areas problems using virtual methods of the experiment. It is based on creation of mathematical models and their initial analysis, development and analysis of numerical algorithm, treatment of the kind of observations and experimental results, acquisition and analysis of new information about the modeled processes, systems and phenomena. Over the past two to three decades, in connection with the new practice, mathematical modeling is intensively developed branch of applied mathematics.

Prerequisites for entering the course

Mathematical Analysis, Algebra, Differential Equations, Numerical Methods and Optimization.

Course aim

Course aim is to introduce students with the mathematical models in biomedicine.

Links between course outcomes, criteria of learning achievement evaluation, study methods and methods of learning achievement assessment

No	Course outcomes	Criteria of learning achievement evaluation	Study methods	Methods of learning achievement assessment
1	Knowledge and understanding of main concepts of mathematical modelling.	Student demonstrates the ability to illustrate main concepts with examples.	Lectures, practical works, individual work, consulting	Mid-term exam, assessment of practical works
2	Provide knowledge to choose appropriate method for solution of practical task.	Student demonstrates the ability to analyze problem and to choose appropriate method for solution.	Lectures, practical works, individual work, consulting	Mid-term exam, assessment of practical works, Final exam
3	Knowledge and understanding of mathematical models of equations with nonlocal conditions.	Student demonstrates the ability to analyze differential problems with nonlocal conditions.	Lectures, practical works, individual work, consulting	Final exam, assessment of practical works
4	Knowledge on numerical solution methods suitable for the realization of mathematical models	Student demonstrates the ability to choose and apply numerical solution methods for various differential problems.	Lectures, practical works, individual work, consulting	Final exam, assessment of practical works

Links between study programme outcomes and course outcomes

Study programme outcomes	Running number of course outcome			
	1	**2**	**3**	**4**
Comprehend and be able to apply classical analytical and numerical methods as well as the main algorithms for solving differential equations	+	+	+	+
Summarize and evaluate critically scientific and professional literature, as well as use various tools for collecting of information for the study process and for solving fixed practical/theoretical problems	+	+		
Identify the problem, collect and analyze real/theoretical data using various mathematical methods, tools and IT technologies		+	+	+
Think logically and analytically, evaluate alternative ways of task solving and implement optimal solutions	+	+	+	+
Work individually and/or in groups by developing and adopting appropriate mathematical models and tools for use in case analysis		+	+	+
Demonstrate awareness of economic, legal, social, ethical and environmental context in mathematical projects	+	+		

Content

No	Content (topics)
1.	The basic concepts and methods of mathematical modeling. The simplest forms of mathematical models.
2.	The main stages of mathematical modeling, numerical (virtual) experiment. Classification of mathematical models.
3.	The exact mathematical models and its analysis (processes of diffusion, chemical and enzymatic kinetics equations, transfer processes, population dynamics, models of diabetes).
4.	Mathematical models with nonlocal conditions.
5.	Numerical solution methods of differential equations and systems of linear equations, which are suitable for the realization of mathematical models.

Distribution of workload for students (contact and independent work hours)

Lectures	**45 hours**
Practical work	**30 hours**
Individual students work	**85 hours**
Total:	**160 hours**

Structure of cumulative score and value of its constituent parts

Final written exam (50%), mid-term written exam (25%), assessment of practical work (25%).

Recommended reference materials

No	Publication year	Authors of publication and title	Publishing house	Number of copies in		
				University library	*Self study rooms*	*Other libraries*
Basic materials						
1	2003	R. Čiegis. Diferencialinių lygčių skaitiniai sprendimo metodai (Numerical methods for differential equations)	Vilnius, Technika	1	3	

2	2004	A. Ambrazevičius, M.Meilūnas, Matematinis modeliavimas (Mathematical modeling)	Vilniaus universitetas	0	2	
3	2007	M.Sapagovas. Diferencialinių lygčių kraštiniai uždaviniai su nelokaliosiomis sąlygomis (Boundary value problems of differential equations with nonlocal conditions)	Vilnius, MII	15	5	
Supplementary materials						
1	1993	E. Kreyszig. Advanced engineering mathematics	John Whiley& Sons			
2	1997	A.A. Samarskii, A.P. Mikhailov. Matematicheskoe modelirovanie (Mathematical modeling)	Moskva, Nauka			
3	2007	A.D. Myshkis Elementy teorii matematicheskikh modelei (Elements of mathematical modeling theory)	Moskva, KomKniga			

Course programme designed by

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