Subject code	ECTS credits
MAT 3008	6

Course title in Lithuanian

MATEMATINĖS FIZIKOS LYGTYS

Course title in English

MATHEMATICAL PHYSICS EQUATIONS

Short course annotation in Lithuanian (up to 500 characters)

Pagrindinės sąvokos ir apibrėžimai. Pirmosios eilės diferencialinės lygtys dalinėmis išvestinėmis. Diferencialinių lygčių dalinėmis išvestinėmis klasifikacija. Pagrindinės matematinės fizikos lygtys ir uždaviniai. Svyravimų lygties Koši ir mišrusis uždavinys. Furje metodas. Šturmo ir Liuvilio uždavinys. Šilumos laidumo lygties Koši ir mišrusis uždavinys. Maksimumo principas. Sprendinių egzistavimas, vienatis. Sprendimo metodai. Pagrindiniai Laplaso lygties paprasčiausių sričių kraštiniai uždaviniai.

Short course annotation in English (up to 500 characters)

The content includes: main concepts; first order partial differential equations; classification of partial differential equations; main types of equations and problems of mathematical physics; the wave equation, initial and initial-boundary value problems; the heat conduction equation, initial and initial-boundary value problems; the existence and uniqueness of a solution; solving methods; boundary value problems for the Laplace equation in simple regions.

Prerequisites for entering the course

Mathematical Analysis. Algebra. Geometry. Ordinary Differential Equations

Course aim

This course aims to develop understanding in partial differential equations

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.	Knoweledge and understanding of main types of partial differential equations and problems	Student is able to recognize main partial differential equations	Lectures, practical works, individual work, consulting	Mid-term exam, Assessment of practical works
2.	Perform the ability to solve simple first order equations using the method of characteristics	Student is able to analyze the first order equations	Lectures, practical works, individual work, consulting	Mid-term exam, Assessment of practical works
3.	Perform the ability to classify the second order PDEs	Student is able to analyze the second order PDEs	Lectures, practical works, individual work, consulting	Mid-term exam, Assessment of practical works
4,	Perform the ability to find solutions of the string equation	Student is able to analyze string equation	Lectures, practical works, individual work, consulting	Mid-term exam, Assessment of practical works
5.	Knowledge and understanding how to find solutions using series for one-dimensional heat conduction equation and wave equation	Student is able to apply Fourier method	Lectures, practical works, individual work, consulting	Mid-term exam, Assessment of practical works

6.	Knowledge and understanding of eigenvalues and eigenfunctions in simple cases	Student is able to analyze Sturm-Liouville Problem	Lectures, practical works, individual work, consulting	Mid-term 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**	**5**	**6**
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	+	+	+	+		+
Having good foundations of mathematics, logically and critically recognize and describe relations between quantities of real life and mathematical concepts		+		+	+	
Operating with formal mathematical symbols and terms, determine mathematical connections between various mathematical quantities; conceive mathematical propositions and logical proofs, construct and prove new statements	+		+		+	
Critically analyze and evaluate obtained results, take responsibility from the mathematical point of view			+		+	

Content

No	Content (topics)
1.	Main concepts and definitions.
2.	First order partial differential equations.
3.	Classification of partial differential equations.
4.	Main partial differential equations.
5.	Cauchy and initial-boundary problem of wave equation.
6.	Fourier method. Sturm-Liouville problem.
7.	Harmonic functions. Maximum principle.
8.	Existence and uniqueness of solutions.
9.	Boundary value problems of Laplace equation for simple domains.

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 assessment sums the assessments of written final examination (50%), written mid-term examination (25%) and assessment of practical works (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.	1974	Paulauskas V. Matematinės fizikos lygtys.	Vilnius, Mintis	12	1	
2.	1996	Ambrazevičius A. Matematinės fizikos lygtys.	Vilnius, Aldorija	20	3	

3.	2008	Pinchover Y., Rubinstein J. An Introduction to Partial Differential Equations.	Cambridge		2	
Supplementary materials						
1.	2004	Arnold V.I. Lectures on Partial Differential Equations.	Springer, Phasis			

Course programme designed by

Prof. habil. dr. Vytautas Kleiza