SUBJECT:	Partial differential equations
ECTS CREDITS\КРЕДИТЫ ECTS:	5 ECTS
TEACHERS, UNIVERSITY AND EMAILS:	Roza Ismagul, A.Baitursynov KSU IsmagulR@mail.ru
RESPONSIBLE TEACHER:	Roza Ismagul, A.Baitursynov KSU IsmagulR@mail.ru
LANGUAGE OF INSTRUCTION:	Russian
ACADEMIC COURSE:	2016-17
NAME OF THE MASTER'S DEGREE	Master's in Mathematical Engineering

COURSE AIMS:

Aims:
- Basic training in the field of partial differential equations, applied in mechanics, physics, engineering;
- mastery of analytical and numerical methods for solving boundary value problems
Objectives:
- to learn the basic tenets of the theory of partial differential equations;
- to develop the ability to build a mathematical model of a physical phenomenon;
- to develop the approach to modelling and solving mechanical problems, crafts and physical content

LEARNING OUTCOMES:

As a result of studying the course the student should
know:
- The basic concepts of the theory of differential equations; methods for solving basic differential equations; setting the basic boundary value problems for elliptic, parabolic and hyperbolic equations;
be able to:
- Determine the type of the equation, find solutions to boundary value problems; apply the equations for modelling physical processes; find solutions to the Cauchy problem for equations of hyperbolic and parabolic; derive wave equation; derive heat equation;
apply:
- the methods of derivation of the equations on the basis of the laws of physical phenomena;
- the methods for solving differential equations in partial derivatives of various types

COURSE SYLLABUS:

1. Classification of differential equations in partial derivatives

1.1 Basic concepts and definitions in the theory of linear differential equations.

1.2 Classification of linear second order differential equations and reducing them to the canonical form. The basic equations of mathematical physics.

1.3 The Cauchy problem. Formulation of the Cauchy problem. The correctness of the Cauchy problem. Stability of solutions. The existence and uniqueness of solutions

2. Methods for solving differential equations in partial derivatives

2.1 Fourier method. The general scheme of the method of separation of variables

2.2 Fourier method for equations of string vibration and heat equations.

2.3 Equations of hyperbolic type. The Cauchy problem for the wave equation. Boundary value problems for the wave equation.

2.4 Equations of parabolic type. The solution of the Cauchy problem for the heat equation. Poisson formula.

2.5 Equations of elliptic type. Statement of the main boundary value problems. The equation of Laplace and Poisson. The Green's function.

LITERATURE:

Basic literature:

[1] M. Abramowitz and I. A. Stegun, Handbook of Mathematical Functions with Formulas, Graphs, and Mathematical tables. Vol. 55, National Bureau of Standards Applied Mathematics Series, U.S. Government Printing Office, Washington, DC, 1964. Reprinted by Dover, New York, 1972.
[2] Бицадзе А.В., Калиниченко Д.Ф. Сборник задач по уравнениям математической физики. – М, Наука, 1985.
[3] Смирнов М.М. Дифференциальные уравнения в частных производных второго порядка. – М, Наука, 1964
[4] H. Sagan, Introduction to the Calculus of Variations. Dover, New York, 1992.
[5] W. A. Strauss, Partial Differential equations. An Introduction. Second edition, Wiley-Interscience, 2008. German translation: Partielle Differentialgleichungen. Vieweg, 1995.
[6] Тихонов А.Н., Самарский А.А. Уравнения математической физики. – М., Наука, 1997

Further reading:
[1] Бицадзе А.В. Уравнения математической физики. – М, Наука, 1976.
[2] E. Bombieri, E. De Giorgi and E. Giusti, Minimal cones and the Bern-stein problem. Inv. Math. 7 (1969), 243–268.
[3] Джеффис Г., Свирлс Б. Методы математической физики. – М, Мир, 1970.
[4] C. Evans and R. F. Gariepy, Measure Theory and Fine Properties of Functions, Studies in Advanced Mathematics, CRC Press, Boca Raton, 1992
[5] Кошляков И.С., Глинер Э.Б., Смирнов М.М. Уравнения в частных производных математической физики. – М, Наука, 1970.Etc. и д.р.

TEACHING METHOD:

Lecturing, discussions, practical exercises, case-study, abstracting, e-learning, videoconference learning

METHOD OF ASSESSMENT:

65% assessment of the theoretical knowledge:
- theoretical questions on the course content

35% assessment of practical abilities:
- to solve problems on the course content;
- computer implementation of specialized tasks solutions

STUDENT WORKLOAD:

Classroom work (attending all kinds of classes) = 60 hours
Lectures - 1 hour per week (15 weeks)
Practical / Lab sessions - 3 hours per week (15 weeks)
Independent work of a student = 75 hours
Total hours - 135 hours.

RECOMMENDATIONS:

OTHER COMMENTS: