Course Unit Descriptor

Study Programme: Computer Science – Master
Course Unit Title: Differential Equations
Course Unit Code: CS754
Name of Lecturer(s): Dušanka Perišić
Type and Level of Studies: Master Academic Degree
Course Status (compulsory/elective): Elective
Semester (winter/summer): Winter
Language of instruction: Serbian (primary), English (secondary)
Mode of course unit delivery (face-to-face/distance learning): Face-to-face
Number of ECTS Allocated: 6
Prerequisites: None
Course Aims: The aim of the course is to help students gain expertise in understanding, constructing, solving, and interpreting ordinary differential equations (ODE's), with ephasise on understanding the interplay between analitic, graphic, and numeric representations of differential equations and the contextual situations that particular equations are intended to model.
Learning Outcomes: Students should gain personal mastery over the following skills: 1. Model a simple system to obtain a first order ODE. 2. Visualize solutions using direction fields and isoclines, and approximate them using Euler's method. 3.Solve a first order linear ODE by the method of integrating factors or variation of parameter. 4.Solve a constant coefficient second order linear initial value problem with driving term exponential times polynomial. If the input signal is sinusoidal, compute amplitude gain and phase shift.. 5.Utilize Delta functions to model abrupt phenomena, compute the unit impulse response, and express the system response to a general signal by means of the convolution integral. 6.Solve constant coefficient linear initial value problems using the Laplace transform together with tables of standard values. 7.Solve first order linear systems. Relate first order systems with higher-order ODEs. 8.Determine the qualitative behavior of an autonomous nonlinear two-dimensional system by means of an analysis of behavior near critical points.
Syllabus: *Theory* Topics include: • Solution of First-order ODE's by Analytical, Graphical and Numerical Methods; • Linear ODE's, Especially Second Order with Constant Coefficients; • Sinusoidal and Exponential Signals: Oscillations, Damping, Resonance; • Laplace Transform Methods; • Matrix and First-order Linear Systems: Eigenvalues and Eigenvectors; • Non-linear Autonomous Systems: Critical Point Analysis and Phase Plane Diagrams; • Difference equations vs. differential equations;

- Elements of modeling real phenomena.

Practice

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Required Reading:

1. Edwards, C., and D. Penney. Elementary Differential Equations with Boundary Value Problems. 6th ed. Upper Saddle River, NJ: Prentice Hall, 2003. ISBN: 9780136006138.
2. MITOPENCORSEWARE https://ocw.mit.edu/courses/mathematics/18-03-differential-equations-spring-2010/#

Weekly Contact Hours: 4	**Lectures:** 2	**Practical work:** 2

Teaching Methods:

Lecture sessions and exercise sessions using computers.This course employs a series of Java™ applets, which are avaiable at the MIT web site https://ocw.mit.edu/courses/mathematics/18-03-differential-equations-spring-2010/index.htm# They are used in lecture to ilustrate main concepts, and each homework assigment contains a problem based around one or another of them.

Knowledge Assessment (maximum of 100 points):

Pre-exam obligations	points	**Final exam**	points
Homework assignments	30	Oral exam	40
Written exam	30		

The methods of knowledge assessment may differ; the table presents only some of the options: written exam, oral exam, project presentation, seminars, etc.