University of Nicosia, Cyprus

Course Code MATH-330	**Course Title** Ordinary Differential Equations	**ECTS Credits** 6
Department Computer Science	**Semester** Fall, Spring	**Prerequisites** MATH-191
Type of Course Required	**Field** Mathematics	**Language of Instruction** English
Level of Course 1st Cycle	**Year of Study** 3rd	**Lecturer(s)** Dr Nectarios Papanicolaou
Mode of Delivery Face-to-face	**Work Placement** N/A	**Co-requisites** None

Objectives of the Course:

The main objectives of the course are to:

- Provide students with all the necessary techniques for solving first order ordinary differential equations.
- Familiarize students with the concepts of linear independence, fundamental solutions, general solutions and Initial Value Problems.
- Develop and demonstrate solution methods for linear higher order equations.
- Introduce students to applications and modelling using Ordinary Differential Equations.
- Provide students with the fundamentals of the power series method
- Introduce students to the Laplace Transform and its applications

Learning Outcomes:

After completing the course students are expected to be able to:

1. Apply a number of techniques for solving 1st order equations
2. Construct models and analyze simple problems using 1st order equations
3. Compute the solutions of higher order linear equations with constant coefficients
4. Apply the power series method for solving 2nd order linear equations with variable coefficients
5. Implement the Laplace Integral Transform and use its properties to solve linear initial value problems

Course Contents:

1. First Order Differential Equations-Initial Value Problems
   - Linear Equations
   - Separable Equations

- Integrating Factors
- Exact Equations
- Applications: Mixing and Compound Interest

2. Second Order Equations
   - Equations with Constant Coefficients,
   - Non-Homogeneous Equations,
   - Linear Independence and the Wronskian,
   - Applications: Springs and Electric Circuits
3. Higher Order Equations with Constant Coefficients
   - Higher Order Initial-Value Problems
   - The Wronskian for Higher Order Equations
   - The method of Undetermined Coefficients
4. Power Series Solutions of Second Order Equations with Variable Coefficients
   - Regular points
   - Regular and irregular singular points
   - Series solutions near a regular point
5. Euler Equations
6. The Laplace Transform Method for Solving Initial Value Problems
   - Definition of the Laplace Transform
   - Laplace Transforms of basic functions
   - Solving Initial Value Problems(IVPs) with Laplace transforms
   - IVPs with step functions and discontinuous forcing functions
   - IVPs with impulse functions and the Dirac delta function
7. Systems of Ordinary Differential Equations

Learning Activities and Teaching Methods:

Lectures, Handouts and Assignments

Assessment Methods:

2 Mid-Term Exams; Final Exam; Class Participation.

Required Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
Boyce and DiPrima	Elementary Differential Equations and Boundary Value Problems	Wiley	2005	0-471-43338-1

Recommended Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
E. A. Coddington	An Introduction to Ordinary Differential Equations	Dover	1989	0-486-65942-9