

# METU

## Graduate School of Natural and Applied Sciences

1. Course Code and Title : **MATH 587 Ordinary Differential Equations I**

2. Catalogue Data

**Initial Value Problem: Existence and Uniqueness of Solutions; Continuation of Solutions; Continuous and Differential Dependence of Solutions. Linear Systems: Linear Homogeneous and Non-homogeneous Systems with Constant and Variable Coefficients; Structure of Solutions of Systems with Constant and Periodic Coefficients; Higher Order Linear Differential Equations; Sturmian Theory. Stability: Lyapunov Stability and Instability. Lyapunov Functions; Second Lyapunov Method; Linearization; Quasilinear Systems. Stability of an Equilibrium and Stable Manifold for Non-autonomous Differential Equations.**

3. Frequency : **Fall Semesters**

4. Faculty Member(s)

**Marat Akhmet, PhD, Mathematics  
A. Okay Çelebi, PhD, Mathematics  
Ağacık Zafer, PhD, Mathematics**

4. Background required

**Students wishing to take this course should be familiar with ordinary differential equations.**

5. Overlapping and Complimenting Courses

**None**

6. Textbook(s)

**R. K. Miller: Ordinary Differential Equations.**

7. References

- 1. J. Cronin: Differential Equations: Introduction and Qualitative Theory.**
- 2. J.K. Hale: Ordinary Differential Equations.**
- 4. C. Corduneanu: Introduction to Differential Equations and Integral Equations.**

## 8. Course Objectives

**By the end of the course the student is expected to have full grasp fundamental concepts in ordinary differential equations and to be ready for taking more specialized courses in the field of ordinary, impulsive, and delay differential equations.**

## 9. Course in relation to Program(s)

**The current course MATH 587 is one of the core course together with MATH 583 in the field of differential equations.**

## 10. Course Outline

1. Week: **Introduction: Initial Value Problems; Existence of Solutions;**
2. Week: **Gronwall Lemma; Uniqueness of Solutions;**
3. Week: **Continuation of Solutions; Continuous and Differential Dependence of Solutions;**
4. Week: **Continuous and Differential Dependence of Solutions;**
5. Week: **Linear systems: Linear homogeneous and nonhomogeneous Systems with Constant and Variable;**
6. Week: **Structure of Solutions of Systems with Constant and Periodic Coefficients;**
7. Week: **Structure of Solutions of Systems with Constant and Periodic Coefficients;**
8. Week: **Higher Order Linear Differential Equations; Sturmian Theory;**
9. Week: **Stability: Lyapunov Stability and Instability;**
10. Week: **Lyapunov Functions; Second Lyapunov Method;**
11. Week: **Lyapunov Functions; Second Lyapunov Method;**
12. Week: **Linearization; Quasilinear systems;**
13. Week: **Stability of an Equilibrium and Stable Manifold for Nonautonomous Differential Equations;**
14. Week: **Stability of an Equilibrium and Stable Manifold for Nonautonomous Differential Equations.**

## 11. Course Conduct

**In addition to formal lectures, it is required that each student do homework assignments in every other week.**

## 12. Grading

**Formal examinations (1 midterm and final). Homework assignments**

## 13. Effective Date: **Fall 2002**

## 14. Prepared by: Ağacık Zafer, PhD, Professor of Mathematics