

# Ordinary Differential Equations-A(H) (MA230) Syllabus

Spring 2025, SUSTech

**Instructor:** SU Linlin (苏琳琳)

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**Office Hours:** Tue 2:00pm-4:00pm or by appointment

**Teaching Assistant:** CHEN Zuoyu (陈祚侯)

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## Class Schedule:

**Lecture:** Tue(odd weeks) & Thu(every week) 10:20am-12:10pm 三教 305

**Tutorial class:** Fri(every week) 4:20pm-6:10pm 三教 205

**QQ Class Group: 820832601**

## Textbook:

Elementary Differential Equations and Boundary Value Problems, 11th edition, William E. Boyce, Richard C. DiPrima and Douglas C. Meade, Wiley, 2017.

## References:

1. Differential Equations with Boundary Value Problems, second edition, John Polking, Albert Boggess and David Arnold, Pearson, 2005.
2. 常微分方程教程, 第二版, 丁同仁, 李承治, 高等教育出版社, 2004 年.

## Course Policies:

- The **semester grade** will be given according to performance in quizzes (30%) + midterm (30%) +final exam (40%).
- Calculators and cell phones will not be allowed in quizzes, mid-term test, and final exam.
- **Homework** will be assigned for each section covered in class but will not be collected.
- The **quizzes** will be given **every week in tutorial classes**, each lasting about 20 minutes. **NO make-up quizzes**. **Two lowest quiz scores will be dropped**.
- There will be **one in class midterm**, lasting two hours. **The tentative midterm date is Thursday of Week 8, April 10th**.
- There will be **NO make-up midterm**. However, if you have a written excuse from your doctor or school official, and if you notify me within 3 days of the date of the test that you are forced to miss, your final exam will weigh 70%.

## Course Contents and Schedule: LH=lecture hour=50 minutes

### 1. Introduction (2 LHs)

- 1.1. Some Basic Mathematical Models; Direction Fields
- 1.2. Solutions of Some Differential Equations
- 1.3. Classification of Differential Equations

### 2. First Order Differential Equations (12 LHs)

- 2.1. Linear Equations; Method of Integrating Factors

- 2.2. Separable Equations in Variables
- 2.3. Modeling with First Order Equations
- 2.4. Differences between Linear and Nonlinear Equations
- 2.5. Autonomous Equations and Population Dynamics
- 2.6. Exact Equations and Integrating Factors
- 2.7. Elementary Transformation Method
- 2.8. The Existence and Uniqueness Theorem
- 2.9. Proof of the Existence and Uniqueness Theorem
- 2.10. Peano's Existence Theorem
- 2.11. Extensions of Solutions
- 2.12. Comparison Theorems
- 3. Second Order Linear Equations (8 LHs)
  - 3.1. Homogeneous Equations with Constant Coefficients
  - 3.2. Solutions of Linear Homogeneous Equations; the Wronskian
  - 3.3. Complex Roots of the Characteristic Equation
  - 3.4. Repeated Roots; Reduction of Order
  - 3.5. Nonhomogeneous Equations; Method of Undetermined Coefficients
  - 3.6. Variation of Parameters
  - 3.7. Mechanical and Electrical Vibrations
  - 3.8 Sturm Oscillation Theorem
- 4. High Order Linear Equations (2 LHs)
  - 4.1. General Theory of  $n$ th Order Linear Equations
  - 4.2. Homogeneous Equations with Constant Coefficients
  - 4.3. The Method of Undetermined Coefficients
  - 4.4. The Method of Variation of Parameters
- 5. Systems of First Order Linear Equations (8 LHs)
  - 5.1. Introduction
  - 5.2. Review of Matrices
  - 5.3. Basic Theory of Systems of First Order Linear Equations
  - 5.4. Continuous Dependence of Solutions on Initial Conditions and Parameters
  - 5.5. Homogeneous Linear Systems with Constant Coefficients
  - 5.6. Complex Eigenvalues
  - 5.7. Fundamental Matrices
  - 5.8. Repeated Eigenvalues
  - 5.9. Nonhomogeneous Linear Systems
- 6. Nonlinear Differential Equations and Stability (8 LHs)
  - 6.1. The Phase Plane: Linear Systems
  - 6.2. Autonomous Systems and Stability
  - 6.3. Locally Linear Systems
  - 6.4. Liapunov's Second Method
  - 6.5 Periodic Solutions and Limit Cycles
  - 6.6 Poincare-Bendixson Theorem
- 7. Sturm-Liouville Theory (4 LHs)
  - 7.1. Eigenvalues and Eigenfunctions
  - 7.2. Existence and Properties of Eigenvalues
  - 7.3. An Application to the Heat Equation