

MATH2351

Introduction to Differential Equations

Course outline - Spring 2023-2024

Instructor

Mo Mu

Contact Details: e-mail: mamu@ust.hk, Office: Room 3445

Office Hour: Friday 11:00am-12:00 noon

Meeting Time and Venue

Monday 13:30 - 14:50, Room2464

Friday 9:30 - 10:50, Room2464

Teaching Assistants

Huang, Chutian/chuangat@connect.ust.hk, tutorial starting from Week2

Pu, Zhigang/zpuac@connect.ust.hk, tutorial starting from Week2

Course Description

Credits: 3 units;

Topic: Differential equations

Exclusions: MATH 2350, MATH 2352

Prerequisites: AL Pure Mathematics/AL Applied Mathematics; or MATH 1014; or MATH 1018; or MATH 1020; or MATH 1024

Assessment Scheme

Homework: 10%; **Midterm Exam:** 30 %; **Final Exam:** 60 %

Final grades are determined based on the University Grading Guidelines, for details, refer to <https://registry.hkust.edu.hk/files/2021-05/GuidelinesOnGrading.pdf>

Exams:

1. **Midterm exam:** Topics to be covered up to Section 3.5 as in the list of topics.

March 22, Week 8, in class, 9:30-10:50, Room 2464

If you *miss the midterm* due to a valid (e.g. hospitalization) and well proven reason (original documents must be submitted for verification), the only alternative is to move the midterm mark to the final.

2. **Final exam:** 120 minutes. All materials taught in the whole semester will be tested, including those already tested in the midterm exam. But focus will be on those topics not covered in the midterm exam. The Laplace Transform Table 6.2.1 on Page 319 will be provided.
3. Closed-book, No calculators are allowed in all exams.

Student Learning Resources

Textbooks:

Boyce and DiPrima, Elementary Differential Equations and Boundary Value Problems, 12th Ed., Global Ed., Wiley

References:

[Math Support Center](#)

Course Topics:

- **Introduction** (Chapter 1)
 - Mathematical models; Direction Fields (1.1)
 - Solution of Some DEs (1.2)
- **First Order Equations** (Chapter 2)
 - Linear equations; Method of Integrating Factors (2.1)
 - Separable equations (2.2)
 - Exact Equations (2.6) -- tentative
- **Second Order Linear Equations** (Chapter 3)
 - Homogeneous Equations with constant coef. (3.1, 3.3, and 3.4)
 - Solutions of linear homogeneous equations, the Wronskian (3.2)
 - Non-homogeneous equations: undetermined coef. (3.5)
- **Series Solutions of Second Order Linear Equations** (Chapter 5)
 - Power series (5.1)
 - Series solutions near an ordinary point (5.2)
 - Euler Equations; Regular Singular Points (5.4)
- **Laplace Transform** (Chapter 6)
 - Laplace transform (6.1)
 - Initial value problems (6.2)
 - Step functions (6.3, 6.4)
 - Impulse functions (6.5)
- **Systems of First Order Linear Equations** (Chapter 7)
 - Introduction (7.1)
 - Basic theory (7.4)
 - Homogeneous linear systems with constant coefficients (7.5, 7.6)

Teaching Approach

Lectures: focus on illustrating the concepts of the course content.

Tutorials: focus on examples and problem solving skills.

Intended Learning Outcomes

Upon successful completion of this course, students should know the following:

1. How to model and solve simple problems using first order odes;
2. How to solve linear, constant coefficient second-order odes;
3. How to use the Laplace transform method;
4. How to construct series solutions;
5. How to solve a system of linear, constant coefficient, first-order odes;
6. How to solve partial differential equations using separation of variables;

In addition, students should

1. Demonstrate skills in reading, interpreting and communicating mathematical content which are integrated into other disciplines or appear in everyday life;
2. Develop the mathematical maturity to undertake higher level studies in mathematically related fields.

Assessing Course ILOs:

Assignments and exams: 1, 2, 3, 4, 5, 6