MAT 3270B ORDINARY DIFFERENTIAL EQUATIONS 2004/2005
1st term

Section B: Lecturer: Dr. Juncheng Wei, LSB216, Tel. 26097967
TA: Yang Jun and Yeung Sik Ming, LSB 233, Tel. 26097956

and

Section A: Lecturer: Prof. Zhouping Xin, LSB 211, Tel. 26097965
TA: Wang Jin

Objectives
(1) To acquaint with standard techniques in solving linear or nonlinear ordinary differential equations;
(2) To understand the basic theory of linear ODES and the stability theory of nonlinear ODES
(3) To solve basic boundary value problems

Text Book
(Please buy this book at the University Bookstore on campus.)
It is Ok if you have a 6th edition.

References

Syllabus and Teaching Scheme

Part 1 Introduction and First Order Differential Equations (2.5 weeks)
(a) Mathematical models leading to ODEs: fall subject; compound interest.
Solutions of ODE
(b) Explicitly solvable equations: linear, separable, exact, homogeneous equations. Techniques in solving nonlinear equations.
(c) Nonlinear blow up; nonlinear uniqueness; fundamental existence and uniqueness for Initial Value Problems - a sketch of proof.
We will cover: 1.1-1.3, 2.1-2.8

Quiz 1

Part 2 Linear Theory (2.5 weeks)
(a) Linear second order equations with constant coefficients
(b) General structure for the solution space for linear equations; variations of parameters.
(c) Free and forced vibrations; resonance.
(d) Higher order linear equations: general theory, homogeneous equations. 
We will cover: Chapters 3, 4

**Midterm Examination**

**Part 3 System of ODEs (1.5 weeks)**

- First order systems; the exponential of a matrix; Fundamental solutions; solving systems using linear algebra.
- We will cover: Chapter 7

**Quiz 2**

**Part 4 Stability (2.5 weeks)**

(a) Phase portraits for $2 \times 2$ linear autonomous systems; concept of stability and asymptotic stability.
(b) The method of linearisation
(c) Liapunov’s function
(d) Applications to population models
(e) Liapunov’s second method, periodic solutions, limit cycles and chaos
- We will cover: 9.1-9.8

**Quiz 3**

**Part 5 Boundary Value Problems (2.5 weeks)**

(a) Linear Homogeneous Boundary Value Problems.
(b) Sturm-Liouville two-point boundary value problems and eigenvalue problems.
(d) Properties of the eigenvalues and eigenfunctions.
(e) Nonhomogeneous BVPs
- We will cover: 11.1-11.4

**Quiz 4**

**Final Examination**

**Assignments**

Each week I will give homework assignment. (I will post them on my web page: www.math.cuhk.edu.hk/ we... You do not need to turn in the assignment (I STRONGLY suggest you do ALL of them). Your TA will answer questions from the homework. Every 2.5 weeks there will be a quiz.
Midterm: Nov. 2nd. One final examination is scheduled.

**Assessment Scheme**

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>Final Examination</td>
<td>50%</td>
</tr>
<tr>
<td>Midterm Examination</td>
<td>30 %</td>
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<tr>
<td>4 Quizzes</td>
<td>20 %</td>
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<tr>
<td>Total</td>
<td>100 %</td>
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Office Hours
Monday-Thursday: 9:00am to 12:00pm

Language
I will use English in class. You can speak to me in Cantonese or English or Putonghua.

Final Remark
Any question? Please send me an email or drop by my office LSB 216.