### Rensselaer Polytechnic Institute - Department of Mathematical Sciences

**Syllabus**  
**Math 2400**  
**Introduction to Differential Equations** (Syllabus updated on 1/8/2012)  
(Spring 2012) Sections 1 - 4 & 9 – 12


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| 1    | Jan 23 - 27 | 1.3, 2.1 | Terminology. Linear DE  
HW: 1.3 # 1, 5, 8, 11, 25; 2.1 # 2c, 4c, 10c, 13, 16, 20, 32, 33 |
| 2    | 1/30- Feb 3 | 2.2, 2.4 | Separation of Variables. Conditions for solutions  
HW: 2.2 # 2, 3, 6, 9, 13, 30a-e, 31, 37; 2.4 # 1, 3, 13, 14, 17b, 25, 29, 32 |
| 3    | Feb 6 - 10 | 3.1 – 3.5 | Properties of 2nd order linear DE. Real, complex & repeated roots  
HW: 3.1 # 1, 5, 6, 9, 10, 16; 3.2 # 2, 3, 5, 25, 31, 36; 3.3 # 2.12, 16, 18, 20  
3.4 # 1, 12, 14 |
| 4    | Feb 13-17  | 3.4      | Reduction of order. HW: 3.4 # 25, 27, 28, 30  
Exam # 1 (Thursday Feb 23 for sections 1-4 & 9-12) |
| 5    | Feb 20 - 24 | 3.5      | Method of Undetermined Coefficients  
HW: 3.5 # 3, 4, 6, 9, 10, 17, 18, 20a |
| 6    | 2/27 - Mar 3 | 3.6, 5.4 | Method of Variations of Parameters. Euler Equation  
HW: 3.6 # 1, 3, 4, 5, 8, 13, 17, 18, 23; 5.4 # 1, 4, 5, 14, 15, 35  
3.7, 3.8 | These sections are recommended for personal reading |
| 7    | Mar 5 – 9  | 6.1 – 6.3 | Laplace Transformation, its properties and applications  
HW: 6.1 #5ac, 27; 6.2 # 3.12, 16, 20, 21, 22; 6.3 # 3.4, 15, 18, 22, 35, 37 |
| 8    | Mar 19 - 23 | 6.4 – 6.6 | Laplace Transformation (continued)  
HW: 6.4 # 1a, 3a, 6a, 11a; 6.5 # a of 1, 5, 7, 25bc; 6.6 # 5, 6, 15, 25ab  
Exam # 2 (Monday, March 26 for sections 1 – 4 and 9 – 12) |
| 9    | Mar 26–30  | 7.3, 7.5 | Linear Systems of DE  
HW: 7.3 # 3, 4, 17, 20; 7.5 # 3a, 4a, 5a, 13, 16 |
| 10   | Apr 2 – 6  | 7.6, 7.8 | Complex and repeated eigenvalues  
HW: 7.6 # 3a, 5a, 7, 10; 7.8 # 2c, 5c, 7a, 10a |
| 11   | Apr 9 – 13 | 10.2 – 10.4 | Fourier Series. HW: 10.2 # 7, 13, 17, 18; 10.3 # 2, 4, 12, 14; 10.4 # 1, 9, 11, 21ab, 22ab, 25ab |
| 12   | Apr 16 - 20 | 10.5 – 10.7 | Heat conduction in a rod. Vibrating String. Laplace equation  
HW: 10.5 #7, 9, 10, 12; 10.6 #2, 12ab; 10.7 #1a, 3a, 7a , 13, 16, 18  
10.8#1ab, 5, 6ab, 7 |
| 13   | Apr 23 - 27 | 10.8, 9.1 | Laplace Equation (continued). Nonlinear systems  
HW 9.1 # 1abc, 4abc, 13 |
| 14   | Apr 30-5/4 | 9.1, 9.2 | Phase Plane Analysis. Stability  
HW: 9.2 # 1, 3, 17, 18, 23a |
| 15   | May 7      | 9.3      | Almost Linear Systems. Lotka-Volterra Equations  
HW: 9.3 # 1, 4, 10abc, 16abc |

**Grading System:** 20% for each of the 3 exams; HW (20%); Quizzes (9%); Maple Projects (7%). Class attendance and participation (4%). The final exam is optional; it can only improve the student’s grade, and may replace the lowest of the 3 exam grades.

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**Note:** The homework problems to be handed in and graded will be posted on RPI Mathematical Sciences website. These problems are a subset of those in this syllabus.
Learning outcomes for Math 2400 (Mohamed Boudjelkha)

Students who successfully complete the course at the end of the semester will be able to demonstrate the following:

- Solve linear differential equations of order one. Solve nonlinear first order differential equations by the method of separation of variables.
- Solve second order linear differential equations of constant coefficients
- Apply the methods of undetermined coefficients and variation of parameters to solve linear differential equations.
- Be able to solve Euler Equation.
- Be able to explain and use the Laplace transformation method to solve differential equations of constant coefficients.
- Solve first order linear systems of differential equations of constant coefficients.
- Be able to explain and apply Fourier series
- Be able to apply Fourier series in solving problems of heat conduction with various boundary conditions.
- Be able to apply Fourier series to solve problems related to a vibrating string attached at both ends, as well as to boundary value problems related to the Laplace equation.
- Be able to classify the critical points for the linear system in the plane and determine the type of stability of these points.
- Be able to recognize almost linear systems and determine the points of stability of the pendulum equation, and the Volterra – Lotka equation.

Academic integrity

Student – teacher relationships are built on trust. For example, students must trust that teachers have made appropriate decisions about the structure and content of the courses they teach, and teachers must trust that the assignments that students turn in are their own. Acts, which violate this trust, undermine the educational process. The Rensselaer Handbook of Students Rights and Responsibilities define various forms of Academic Dishonesty and you should make yourself familiar with these. In this class, all assignments that are turned in for a grade must represent the student’s own work. If you have any question concerning this policy, please ask for clarification before submitting an assignment.
Homework Assignments for Math 2400 (S)

HW #1, due Friday Feb 3, 2012

Section 1.3 # 1, 8;
   “ 2.1 # 2c, 4c, 10c, 13, 16;
   “ 2.2 # 3, 9, 13.

HW # 2, due Friday Feb 10, 2012

Section 2.2 # 30a-e, 31, 37;
   “ 2.4 # 1, 3, 13, 17b, 25, 29;

HW # 3, due Friday Feb 17, 2012

Section 3.1 # 1, 9, 10;
   “ 3.2 # 2, 5, 31;
   “ 3.3 # 12, 18;
   “ 3.4 # 1, 12.

HW # 4, due Friday Mar 2, 2012

Section 3.4 # 25, 27, 30;
   “ 3.5 # 3, 6, 9, 10, 17, 18, 20a

HW # 5, due Friday Mar 9, 2012

Section 3.6 # 3, 5, 8, 12, 17;
   “ 5.4 # 1, 4, 5, 14, 15.

HW # 6, due Friday Mar 23, 2012

Section 6.2 # 12, 20, 21, 22
   “ 6.3 # 15, 37; 6.4 # 4a, 11a;
   “ 6.5 # 1a; 6.6 # 15, 25a.
HW # 7, due Friday April 6, 2012

Section 7.3 # 4, 18;

   " 7.5 # 3a, 4a, 13;

   " 7.6 # 3a, 5a, 7a;

   " 7.8 # 2c, 10a.

HW # 8, due Friday April 13, 2012

Section 10.2 # 7, 18, 20ab;

   " 10.3 # 2, 4, 13, 14;

   " 10.4 # 9, 21, 22;

HW # 9, due Friday April 20, 2012

Section 10.5 # 7, 9, 10, 12;

   " 10.6 # 2, 12ab;

   " 10.7 # 1a, 3a, 7a, 13
Math 2400 sections 1 - 4 & 9 – 12

Exam # 1

Material: 2.1 , 2.2 , 2.4 , 3.1 , 3.2 , 3.3 , 3.4

Thursday, Feb 23, 2012. For sections 9 – 12 from 9:00 to 9:50; for sections 1 – 4 from 12:00 to 12:50

Location: TBA

Exam # 2

Material: 3.5, 3.6, 5.4, 6.1, 6.2, 6.3

Monday, March 26, 2012. For sections 9 -12 from 9:00 to 9:50; for sections 1 - 4 from 12:00 to 12:50

Location: TBA

Exam # 3

Material: 7.3, 7.5, 7.6, 7.8, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7

Monday, April 23, 2012. For sections 9-12 from 9:00 to 9:50; for sections 1 - 4 from 12 – 12:50

Location: TBA