Texas A&M University-Corpus Christi
Department of Mathematics and Statistics

MATH 3315-001
Differential Equations
Fall Semester 2011

I. Course Information
Meeting Time & Place: T 1:00-2:50PM CS 115
R 1:00-2:50PM CI 112
Professor: Dr. D. Palaniappan (Dr. Pal)
Office Phone: (361) 825-2221
Office: CI 367
Office Hours: TR 9:30-10:30AM, M 10:00-12:00NOON
and by appointment
E-mail Address: devanayagam.palaniappan@tamucc.edu
Class Hours: Lecture and Lab together count as a three-hour course
Homepage: To be Announced

II. Course Description
Standard types of ordinary differential equations are studied in this course. First, second, and higher order equations are examined. Students will be entertained with Laplace transforms, power series method and the basic theory of existence/ uniqueness. Applications to geometry, biological sciences, and physical sciences are included. This course is enhanced by the computational and graphical capabilities of MATLAB or other software.

III. Prerequisites for the Course
MATH 2414 (Calculus II) or Instructor’s Consent. May be taken concurrently with MATH 3470 (Calculus III)

IV. Text and Other Supplies Required

V. Students Learning Outcomes and Course Competencies
Students Learning Outcomes
Students will be able to
1. Identify and classify differential equations (DE).
2. Solve first-order ordinary differential equations (ODE).
3. Solve first-order ODE in applications.
4. Solve higher-order ODE, including applications.
5. Find power series solutions to ODE.
7. Approximate a solution to ODE using numerical methods.
Course Competencies
1. The learner will be able to identify and classify differential equations (DE).
   A. Classify a differential equation (DE) by type, order, and linearity.
   B. Show that a given function is a solution to an ordinary differential equation.
   C. Determine the existence of a unique solution to an ODE.
   D. Construct ODE’s as mathematical models.
2. The learner will be able to solve first-order ordinary differential equations (ODE).
   A. Solve an ODE by separation of variables with or without an initial condition.
   B. Determine if an ODE is exact and solve it if it is exact.
   C. Find the general solution of a linear ODE with and without initial conditions.
   D. Solve a homogeneous and Bernoulli ODE using a substitution.
3. The learner will be able to solve first-order ODE in applications.
   A. Construct a linear ODE as a mathematical model.
   B. Construct a non-linear ODE as a mathematical model.
   C. Construct a system of linear ODE’s as a mathematical model.
4. The learner will be able to solve higher-order ODE.
   A. Solve a nth-order initial-value problem (IVP).
   B. Solve a nth-order boundary-value problem (BVP).
   C. Determine whether given functions are linearly independent or dependent.
   D. Verify that given functions forms a fundamental set of solutions.
   E. Solve ODE’s using undetermined coefficients.
   F. Solve ODE’s by variation of parameters.
   G. Solve a system of ODE’s by systematic elimination or determinants.
   H. Solve non-linear equations using a substitution.
   I. Construct ODE’s as mathematical models to initial-value problems.
5. The learner will be able to find power series solutions to ODE.
   A. Find the interval of convergence of a power series.
   B. Solve ODE’s using power series.
6. The learner will be able to solve ODE using the Laplace transform.
   A. Find the Laplace transform of a given function.
   B. Find the inverse Laplace transforms.
   C. Solve ODE’s using Laplace transforms.
7. The learner will be able to approximate a solution to ODE using numerical methods.
   A. Create direction fields for ODE’s.
   B. Approximate a solution to a ODE using Euler’s and the improved Euler’s method.
   C. Approximate a solution to an ODE using Runge-Kutta methods.
8. The learner will strengthen his or her general academic skills (critical thinking, writing, verbal explanation, working collaboratively, assuming responsibility, and use of technology).
9. The learner will develop a broad base of differential equations knowledge: Concepts, Basic skills, mathematical senses (quantitative, geometric, symbolic), and thinking process (problem solving, predicting, and generalizing).

VI. Method of Instruction
A variety of instructional methods may be used depending on content area. These include but are not limited to: lecture, multimedia, cooperative/collaborative learning, labs and
demonstrations, projects and presentations, performances, and learning experiences outside the classroom. Methodology will be selected to best meet student needs.

VII. Evaluation and Grade Assignment
The assessment methods may include but are not limited to, the following:

<table>
<thead>
<tr>
<th>Method</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Quizzes and Homework</td>
<td>20%</td>
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<tr>
<td>Lab and Project(s)</td>
<td>10%</td>
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<tr>
<td>Class Tests</td>
<td>45%</td>
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<tr>
<td>Final Exam</td>
<td>25%</td>
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GRADES: A = 90.00 - 100%, B = 80.00 - 89.99%, C = 70.00 - 79.99%, D = 60.00 - 69.99%, F = below 60%

Homework will be assigned in class along with the due date. No credit for late homework. Quizzes will be given in class. At the end of the semester the lowest homework/quiz grade gets dropped.

VIII. Course Outline

<table>
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<tr>
<th>Week of</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Aug 22</td>
<td>Introduction to the Course and Online Set Up</td>
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<tr>
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<td>Intro. to Differential Equations (DE): Classification, Solutions, Existence, and Models</td>
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<tr>
<td>Sep 5</td>
<td>First Order DE: Separation of variables and Exact equations</td>
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<td>First Order DE: General solutions and Substitutions</td>
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<td>Sep 12</td>
<td>Modeling with First Order DE: Linear, Non-linear and Systems.</td>
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<td>Sep 19</td>
<td>Test #1</td>
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<td>Oct 3</td>
<td>Higher Order DE: Initial and Boundary-value equations</td>
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<td>Higher Order DE: Linear Independence and Fundamental Set</td>
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<td>Sep 17</td>
<td>Higher Order DE: Undetermined Coefficients and Variation of Parameters</td>
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<td>Sep 24</td>
<td>Test #2</td>
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<td>Oct 31</td>
<td>Modeling with Higher Order DE</td>
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<td>Nov 7</td>
<td>Series Solution of Linear DE</td>
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<td>Laplace Transform</td>
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<td>Nov 21</td>
<td>Numerical Methods of ODE</td>
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<td>Dec 28</td>
<td>Test #3</td>
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<tr>
<td>Dec 5</td>
<td>Review</td>
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<td></td>
<td>FINAL EXAM: Tuesday, Dec. 13, 11:00-1:30PM</td>
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IX. Class Policies and Remarks

- This syllabus is subject to change at the discretion of the instructor. Material included is meant to provide an outline of the course and rules that the instructor will adhere to in evaluating the student’s progress. However, this syllabus in not intended to be a legal contract. Questions regarding the syllabus are welcome any time.
- Attendance is required except in sickness and emergency situations.
- I do expect that you come to each class ready to learn and to participate. You are expected to devote for each hour of class 2-3 hours outside the class.
- Homework will be assigned every meeting to promote adequate student learning.
- The lab component of this class will take the form of computer projects that contain additional and extended problem material designed to engage students in the exploration and application of subject matter using computational technology.
- Make up work is not possible except in sickness and emergency situations.
• If at any point in the semester you are considering to drop the class, talk to me before you do it. I am here to help you in your learning experience and to help you succeed in your college career.

• Please Turn Your Cellular Phones, Pagers, and other Electronic Devices off before you enter class. THANKS!

• Reviews sessions will be used to master material covered in class, catch up on lab activities, and planned topics for class.

• **Academic Integrity**: You are assumed to be familiar with, and to abide by, all TAMUCC policies and procedures, particularly the Code of Academic Integrity and the Student Code of Conduct. Students found to be in violation of any of these policies will be appropriately sanctioned.

**X GRADE APPEALS PROCESS**

As stated in University Rule 13.02.99.C2, Student Grade Appeals, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Rule 13.02.99.C2, Student Grade Appeals, and University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules Web site at [http://www.tamucc.edu/provost/university_rules/index.html](http://www.tamucc.edu/provost/university_rules/index.html). For assistance and/or guidance in the grade appeal process, students may contact the Office of Student Affairs.

**XI DISABILITY STATEMENT**

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Disabilities Service Office at (361) 825-5816 or visit the office in Driftwood 101. The Disabilities Service Office will determine appropriate accommodations and outline them in a notification letter. You will then be asked to give this letter to your instructors. Without an accommodation plan, no student can be treated differently from the others.