Differential Equations MATH-3315-001  
Department of Mathematics and Statistics  
Fall 2016

A. COURSE INFORMATION

<table>
<thead>
<tr>
<th>Course number/section:</th>
<th>MATH-3315-001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class meeting time:</td>
<td>TR 08:00-09:15 AM</td>
</tr>
<tr>
<td></td>
<td>IH 268</td>
</tr>
<tr>
<td>Course Website:</td>
<td><a href="mailto:bb9@tamucc.edu">bb9@tamucc.edu</a></td>
</tr>
</tbody>
</table>

B. INSTRUCTOR INFORMATION

| Instructor:           | Dr. Mufid Abudiab |
| Office location:      | CI 306           |
| Office hours:         | TR 12:00 - 02:00 pm or F 11:00 am-12:00 pm |
| Telephone:            | (361) 825-6019   |
| e-mail:               | mufid.abudiab@tamucc.edu |
| Appointments:         | email me to make an appointment to meet outside office hours |

C. COURSE DESCRIPTION

Catalog Course Description
4 sem. hrs. (3:2)
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.

Extended Course Description
The course is enhanced by the computational and graphical capabilities of MATLAB or other software. This course utilizes differentiation and integration tools to solve ordinary differential equations arising in engineering, biological and physical sciences.

D. PREREQUISITES FOR THE COURSE

Prerequisites
MATH 2414 (Calculus II). May be taken concurrently with MATH 3470 (Calculus III). Students must know all derivative and integration techniques very well.

Corequisites
None
E. REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES

Required Textbook(s)

Optional Textbook(s) or Other References
Will be provided as needed

Supplies
None

F. STUDENT LEARNING OUTCOMES AND ASSESSMENT

Assessment is a process used by instructors to help improve learning. Assessment is essential for effective learning because it provides feedback to both students and instructors. A critical step in this process is making clear the course’s student learning outcomes that describe what students are expected to learn to be successful in the course. The student learning outcomes for this course are listed below. By collecting data and sharing it with students on how well they are accomplishing these learning outcomes students can more efficiently and effectively focus their learning efforts. This information can also help instructors identify challenging areas for students and adjust their teaching approach to facilitate learning.

By the end of this course,

1. The student 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 ODEs 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.
4. The learner will be able to solve higher-order ODE.
   (a) Solve a nth-order initial-value problem (IVP).
   (b) Solve an 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 ODEs using undetermined coefficients.
   (f) Solve ODEs by variation of parameters.
   (g) Solve a system of ODEs by systematic elimination or determinants.
   (h) Solve non-linear equations using a substitution.
   (i) Construct ODEs 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 ODEs 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 ODEs using Laplace transforms.

7. The learner will be able to approximate a solution to ODE using numerical methods
   (a) Create direction fields for ODEs.
   (b) Approximate a solution to a ODE using Eulers and the improved Eulers 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)

G. INSTRUCTIONAL METHODS AND ACTIVITIES

A variety of instructional methods may be used depending on content area. These in-
clude but are not limited to: lecture, multimedia, cooperative/collaborative learning,
labs and demonstrations, projects and presentations, performances, and learning expe-
riences outside the classroom. Methodology will be selected to best meet student needs.
H. MAJOR COURSE REQUIREMENTS AND GRADING

Students learning outcomes will be measured in the 5 following progressive stages:

1. Before a lesson is discussed in class, students will read about that lesson in the text or will watch a corresponding lecture from a OpenCourseWare over WWW. **Students will take a reading quiz over that lesson on Blackboard before coming to class or pencil and paper in class. This is a very important part of students’ learning and will greatly enhance student learning during class time.**

2. After a lesson is discussed in class, students will work through a corresponding homework and quiz assignments online via WebAssign (which will be accessed through Blackboard). Clicking the WebAssign button on the top left of our Blackboard page should take you directly into WebAssign. You will either need the access code that comes with the book or will need to buy an access code online. There is an initial grace period where you can use the system without an access code. Online homework and online quizzes provide students with immediate feedback, but it is not personalized. Students have the responsibility to seek out personalized help from the instructor when their understanding of a particular homework solution or mathematical concept is not satisfactory. Help is also available from CASA on campus, but obtaining help from the instructor is more highly recommended.

3. Two in-class exams will be given during the semester (with a third comprehensive final exam at the end of the semester). Students will not be allowed to use calculators, phones, notes, or any other type of help during the exams. This means students are expected to have an understanding of where various formulas come from and are expected to be able to produce and use those formulas without outside help. **By the end of the semester, students should be ready to apply what they have learned to more exciting problems encountered in the students’ chosen field of work.**

4. A comprehensive final exam will be given at the end of the semester and will be similar in style to the two semester exams. Studying for the final exam helps solidify students’ understanding of key concepts developed in the class. Studying for the exam serves as the finishing step in preparing the student for future work with the powerful mathematical tools developed throughout the semester. **Students who consistently study well throughout the semester should find studying for the final to be a pleasant experience.**

5. **Project:** Each student will select a topic to describe a physical problem from engineering or other disciplines. The problem should be such that its mathematical model uses some concepts of this course. Project paper (report) should include the following:

(a) Statement of the problem
(b) Its Mathematical Model
(c) Analytical/numerical solution of the model
(d) results and analysis

Grades will be calculated based on the following

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>% of FINAL GRADE</th>
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<tbody>
<tr>
<td>Class Participation</td>
<td>10%</td>
</tr>
<tr>
<td>WebAssign Homework</td>
<td>10%</td>
</tr>
<tr>
<td>WebAssign Quizzes</td>
<td>10%</td>
</tr>
<tr>
<td>Exam 1</td>
<td>20%</td>
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<tr>
<td>Exam 2</td>
<td>20%</td>
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<tr>
<td>Final Exam</td>
<td>30%</td>
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Grading Scale will be as follows

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<tr>
<th>LETTER GRADE</th>
<th>RANGE</th>
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<tr>
<td>A</td>
<td>90-100%</td>
</tr>
<tr>
<td>B</td>
<td>80-89%</td>
</tr>
<tr>
<td>C</td>
<td>70-79%</td>
</tr>
<tr>
<td>D</td>
<td>60-69%</td>
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<tr>
<td>F</td>
<td>below 60%</td>
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I. COURSE CONTENT/SCHEDULE

<table>
<thead>
<tr>
<th>WEEK</th>
<th>TOPIC</th>
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<tbody>
<tr>
<td>August 29th</td>
<td>Intro. to Differential Equations(DE); Classification, Solutions, Existence, and Models</td>
</tr>
<tr>
<td>Sept. 5th</td>
<td>First Order DE: Separation of variables and Exact equations</td>
</tr>
<tr>
<td>Sept. 12th</td>
<td>First Order DE: General solutions and Substitutions</td>
</tr>
<tr>
<td>Week</td>
<td>TOPIC</td>
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<tr>
<td>Sept. 19th</td>
<td>Modeling with First Order DE: Linear, Non-linear and Systems</td>
</tr>
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<td>Sept. 26th</td>
<td>Higher Order DE: Initial and Boundary-value equations</td>
</tr>
<tr>
<td>Oct. 3rd</td>
<td>Higher Order DE: Linear Independence and Fundamental Set</td>
</tr>
<tr>
<td>Oct. 10th</td>
<td>Higher Order DE: Undetermined Coefficients and Variation of Parameters</td>
</tr>
<tr>
<td>Oct. 17th</td>
<td>Modeling with Higher Order DE</td>
</tr>
<tr>
<td>Oct. 24th</td>
<td>Review and Test 1</td>
</tr>
<tr>
<td>Oct. 31st</td>
<td>Series solutions of linear DE and Laplace Transform</td>
</tr>
<tr>
<td>Nov. 7th</td>
<td>Laplace Transform</td>
</tr>
<tr>
<td>Nov. 14th</td>
<td>Systems of differential equations</td>
</tr>
<tr>
<td>Nov. 21st</td>
<td>Systems of differential equations</td>
</tr>
<tr>
<td>Nov. 28th</td>
<td>Review and Test 2</td>
</tr>
<tr>
<td>Dec. 5th</td>
<td>General Review</td>
</tr>
<tr>
<td>Thursday, December 8th</td>
<td>8-10:30AM, Final Exam</td>
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Note: Changes in this course schedule may be necessary and will be announced to the class by the instructor. The assignments and exams shown are directly related to the Student Learning Outcomes described in Section F.

J. COURSE POLICIES

Attendance/Tardiness
Punctual class attendance is highly recommended.

Late Work and Make-up Exams

In general, late work will not be accepted. Some reading quiz grades and Webassign homework/quiz grades will be dropped. These drops are meant to cover all possible good excuses for late work, such as illness, technical problems, and family emergencies. Long term illness and official university business are probably the only exceptions to this rule.

Make-up exams will not be given. If a student misses one exam, the student’s score on the final exam will serve as the score for the missed exam. If a student misses a second exam, they will receive a zero on that exam. For students who take every exam, the final exam score will replace the student’s lowest semester exam score (unless the final score is lower than all three semester exam scores).

Extra Credit
There is no extra credit given in this course. Just study diligently throughout the semester.
Cell Phone Use
Please turn off cell phones before class starts. I will ask any student with their phone out to turn it off and put it up. If this happens multiple times with the same student, I will ask the student to leave class.

Laptop Use
Please do not open laptops during class. This can distract others from learning, and part of my job is to provide a class atmosphere that aids student learning.

Food in Class
Please do not eat during class. This can distract others from learning, and part of my job is to provide a class atmosphere that aids student learning.

Missed Exam
See “Late Work and Make-up Exams” above.

Participation
Strong, consistent class participation is expected from all students.

K. COLLEGE AND UNIVERSITY POLICIES

- Academic Integrity (University)
  University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) In this class, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in a failing grade.

- Classroom/Professional Behavior
  Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructors ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.
• **Statement of Civility** Texas A&M University-Corpus Christi has a diverse student population that represents the population of the state. Our goal is to provide you with a high quality educational experience that is free from repression. You are responsible for following the rules of the University, city, state and federal government. We expect that you will behave in a manner that is dignified, respectful and courteous to all people, regardless of sex, ethnic/racial origin, religious background, sexual orientation or disability. Behaviors that infringe on the rights of another individual will not be tolerated.

• **Deadline for Dropping a Course with a Grade of W (University)** The grade of W will be assigned to any student officially dropping a course. Please consult with the instructor before you decide to drop to be sure it is the best thing to do. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Should dropping the course be the best course of action, visit the Office of the University Registrar for the Course Drop Form that must submitted. No student is eligible to receive a W without completing the official drop process by this deadline. Please consult the Academic Calendar at

http://www.tamucc.edu/academics/calendar/

for the last day to drop a course.

• **Grade Appeals (College of Science and Engineering)** As stated in University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures, 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 Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at

http://www.tamucc.edu/provost/university_rules/index.html

and the College of Science and Engineering Grade Appeals webpage at

http://sci.tamucc.edu/students/GradeAppeal.html

For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school, the Office of the College of Science and Engineering Dean, or the Office of the Provost.

• **Disability Services**

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 call (361) 825-5816 or visit Disability Services in Corpus Christi Hall 116.

If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.

http://disabilityservices.tamucc.edu/

- **Statement of Academic Continuity**
In the event of an unforeseen adverse event, such as a major hurricane and classes could not be held on the campus of Texas A&M University Corpus Christi; this course would continue through the use of Blackboard and/or email. In addition, the syllabus and class activities may be modified to allow continuation of the course. Ideally, University facilities (i.e., emails, web sites, and Blackboard) will be operational within two days of the closing of the physical campus. However, students need to make certain that the course instructor has a primary and a secondary means of contacting each student.

**L. OTHER INFORMATION**

- **Academic Advising**
The College of Science & Engineering requires that students meet with an Academic Advisor as soon as they are ready to declare a major. The Academic Advisor will set up a degree plan, which must be signed by the student, a faculty mentor, and the department chair. Meetings are by appointment only; advisors do not take walk-ins. Please call or stop by the Advising Center to check availability and schedule an appointment. The Colleges Academic Advising Center is located in Center for Instruction 350 or can be reached at (361) 825-3928.

**GENERAL DISCLAIMER**
I reserve the right to modify the information, schedule, assignments, deadlines, and course policies in this syllabus if and when necessary. I will announce such changes in a timely manner during regularly scheduled lecture periods.