Differential Equations Math 3315-001
Department of Mathematics and Statistics
Fall 2017

A. COURSE INFORMATION

Course number/section: Math 3315-001
Class meeting time: TR 8:00-9:15 AM
Class location: IH 158
Course Website: bb9.tamucc.edu

B. INSTRUCTOR INFORMATION

Instructor: Dr. Aubrey Rhoden
Office location: CI 213B
Office hours: 1-3 pm W 10:00-12:00 pm TR
Telephone: 316-825-3445
e-mail: aubrey.rhoden@tamucc.edu
Appointments: Appointments outside of office hours are available by request

C. COURSE DESCRIPTION

Catalog 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.

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
none

Supplies
Paper and pen or pencil

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 courses 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.

Student Learning Outcomes:

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.
8. Solve system of first-order ODE.

Course Competencies:

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.
   (c) Construct a system of linear ODEs 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 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 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.
H. MAJOR COURSE REQUIREMENTS AND GRADING

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.

**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 the concepts of this course. Project paper (report) should include the following:

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

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I. COURSE CONTENT/SCHEDULE

Tentative Schedule:

Sep. 5 Week 1
Sep. 11 Week 2
Sep. 18 Week 3
Sep. 25 Week 4
Oct. 2 Week 5
Oct. 9 Week 6
Oct. 16 Week 7
Oct. 23 Week 8
Oct. 30 Week 9
Nov. 6 Week 10
Nov. 13 Week 11
Nov. 20 Week 12
Nov. 27 Week 13
Dec. 4 Week 14
Dec. 11 Week 15

Intro. to Differential Equations (DE): Classification, Solutions, Existence, and Models
First Order DE: Separation of variables and Exact equations
First Order DE: General solutions and Substitutions
Modeling with First Order DE: Linear, Non-linear and Systems
Higher Order DE: Initial and Boundary-value equations
Test #1
Higher Order DE: Linear Independence and Fundamental Set
Higher Order DE: Undetermined Coefficients and Variation of Parameters
Modeling with Higher Order DE
Test #2
Series solutions of linear DE
Laplace Transform
Systems of differential equations
Test #3, Numerical Methods of ODE
Review
Final Exam: Thurs. Dec 14, 8:00-10:30 am

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
Attendance for this course is required.

Late Work and Make-up Exams
Late work is not accepted unless previously approved. In the event of an excused absence for an exam, it is the student’s responsibility to arrange for a time to make up the exam as soon as possible.

Extra Credit
Extra credit will be given on some assignments for completing advanced problems, but there will be no extra credit assignments given to students on an individual basis to improve a grade.

Cell Phone Use
Cell phone use is not allowed during class.

Laptop Use
Laptop or tablet use is not allowed during class.
Food in Class
Food is not allowed in the classroom.

Missed Exam
All absences from class or exams will be considered unexcused unless they are documented in advance as excusable with the instructor or as soon as possible in the case of emergencies. No credit will be awarded for work missed resulting from unexcused absences.

Participation
Participation in class discussion is important, and students that actively participate generally gain a better understanding of the material.

K. COLLEGE AND UNIVERSITY POLICIES

• Academic Honesty:
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, forgery, or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.)
For the complete statement, see
http://catalog.tamucc.edu/content.php?catoid=10&navoid=313%23Academic_Integrity#Academic_Honesty

• 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)**
  I hope that you never find it necessary to drop this or any other class. However, events can sometimes occur that make dropping a course necessary or wise. Please consult with your academic advisor, the Financial Aid Office, and me, before you decide to drop this course. Should dropping the course be the best course of action, you must initiate the process to drop the course by going to the Student Services Center and filling out a course drop form. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Please consult the Academic Calendar (http://www.tamucc.edu/academics/calendar/) for the last day to drop a course.

- **Grade Appeals 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](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](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

- **Notice to Veterans**
  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.

- **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 College's 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.