MATH-3315, DIFFERENTIAL EQUATIONS
DEPARTMENT OF MATHEMATICS & STATISTICS
SPRING 2019

A. COURSE INFORMATION

Course Number/Section: MATH 3315.002 & 003
Class Meeting Time & Location:
Section 002—TTH 8:00-9:15AM, IH-157
Section 003—MWF 1:00-1:50PM, OCNR -258
Course Website: bb9.tamucc.edu

B. INSTRUCTOR INFORMATION

Instructor: Dr. B. Veena S. N. Rao
Office Location: CI-213A
Office Hours: T 9:30 AM-12:00 PM, TH 11:30 PM - 2:00 PM
Telephone: 361-825-3613
e-mail: bv.rao@tamucc.edu
Appointments: Contact me by e-mail to set up an appointment

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)
A First Course in Differential Equations with Modeling Applications by Dennis G. Zill,

Optional Textbook(s) or Other References
Will be provided as needed.
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, students should be able to:

- Identify and classify differential equations (DE).
- Solve first-order ordinary differential equations (ODE).
- Solve first-order ODE in applications.
- Solve higher-order ODE, including applications.
- Find power series solutions to ODE.
- Solve ODE using the Laplace transform.
- Approximate a solution to ODE using numerical methods.
- Solve system of first order ODEs.

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 ODE’s as mathematical models.

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.

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.

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.

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.

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.

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.

The learner will strengthen his or her general academic skills (critical thinking, writing, verbal explanation, working collaboratively, assuming responsibility, and use of technology).

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

The expected learning outcomes for the course will be assessed by homework assignments, two mid terms, and a comprehensive final exam.

**Homework/Quiz:** Homework will be assigned weekly. Students will be informed by the instructor via Blackboard (https://bb9.tamucc.edu) about the homework, which should be completed before the given deadline (generally not more than a week). Late homework will NOT be accepted. Should you have to miss the class, it is solely your responsibility to have your work turned in before that class time (on the due date) in order for it to be graded. Do not wait until the weekend to start your homework. Work on the problems daily. Your work should be legible and neat. If the work is not presentable, you will NOT receive credit for it. Please staple the sheets of your assignment together in the upper left corner and do not use papers torn out of spiral bound notebooks. Write clear readable solutions, they will be of great value as a review. You need to show both your answer and the work leading to it. NO credit for merely having the right answer. A short quiz will be given on the last class day of every week.

**Final grade:** Homework, Quizzes and tests are counted towards the final grade with weights as follows:

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>% of FINAL GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>10%</td>
</tr>
<tr>
<td>Quiz</td>
<td>20%</td>
</tr>
<tr>
<td>2 Midterms</td>
<td>40%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>30%</td>
</tr>
</tbody>
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Based on the above, grades will be assigned according to the following scale:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Average</th>
</tr>
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<tbody>
<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>
</tr>
<tr>
<td>F</td>
<td>0-59</td>
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</tbody>
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I. COURSE CONTENT/SCHEDULE

Important Dates:

- **Mid Term I for Section002 (TTH class):** Thursday, February 21.
- **Mid Term I for Section003 (MWF class):** Friday, February 22.
Mid Term II for Section002 (TTH class): Thursday, April 11.
Mid Term II for Section003 (MWF class): Friday, April 12.
March 11 – 15, Spring Break
May 3, 6 – 9, Final Exams

Course Outline:

- Week 1: Intro. to Differential Equations (DE): Classification, Solutions, Existence, and Models
- Week 2: First Order DE: Separation of variables and Exact equations
- Week 3: First Order DE: General solutions and Substitutions
- Week 4: Modeling with First Order DE: Linear, Non-linear and Systems
- Week 5: Higher Order DE: Initial and Boundary-value equations
- Week 6: Review and Midterm exam-I
- Week 7: Higher Order DE: Linear Independence and Fundamental Set
- Week 8: Higher Order DE: Undetermined Coefficients and Variation of Parameters
- Week 9: Spring Break
- Week 10: Modeling with Higher Order DE
- Week 11: Series solutions of linear DE
- Week 12: Laplace Transform
- Week 13: Review and Midterm exam-II
- Week 14: Systems of differential equations
- Week 15: Numerical Methods of ODE
- Week 16: Review for Final Exam

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
This course moves very fast. If you fall behind, even by one section, you may not be able to catch up, since each section generally depends very heavily on the ones before. You must attend every class. If you miss a class, it is your responsibility to find out what you missed (announcements, assignments, notes, ...).

Attendance:
Attendance is mandatory!

Late Work and Multiple Submissions:
Homework is not accepted after the deadline. There are no make ups for the in-class
examinations, except for reasons of illness, stated in writing by the medical doctor, or observance of a religious holiday. Usually, no other reasons are accepted (events, plane tickets, weddings, etc. . .). If you have to miss an exam, it is your responsibility to contact me no later than the day of the exam. Failure to contact me on or before the exam day results in a grade of 0 points for the exam. This also applies to the final exam. For missed final exams due to an acceptable excuse, the university rules about “I” (Incomplete) grades apply and the make-up is at the instructors convenience early in the next long semester. Only extreme emergencies or official university business are acceptable reasons to miss exams and documentation will be required. Car trouble, routine doctors appointments, family reunions or graduations of siblings etc. are not valid reasons to miss exams. If your reason to miss the exam is not a valid one, your exam score is 0 points. Be sure to check before missing an exam whether your reason is acceptable.

Extra Credit: There is no extra credit in this class.

Calculator: Use of calculators and formula sheets in all the exams is not permitted. Electronic devices which can store formulas, including cell phones, should be turned off and stored during the exams.

Cell Phone Use: Cell phones and such must be turned off or kept in silent mode before class. If disturbance happens multiple times because of the same student, the student will be asked to leave the classroom.

Laptop Use: You may use a laptop to take notes during lecture. Distracting other students by surfing the web is not an acceptable behavior.

Food in Class: No food in class (except during the final).

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

Grading: On mid terms and final, partial credit for correct steps will be awarded even if the final answer is wrong. Full credit will be given only if the final answer and all intermediate steps are correct. A correct final answer per se does not guarantee any credit.

Participation: Participation is not part of the grade, but you learn more by interacting, than by watching passively.

Incompletes A grade of I (Incomplete) will only be given in exceptional circumstances, such as a death in the family or personal injury that might prevent someone from taking the final test. In this case, it is the responsibility of the student to notify me as soon as possible, preferably by e-mail, and to complete the required Incomplete Form available from the University Registrar. If this is not done, a score of 0% will be assigned for any incomplete tests and a final grade will be computed using the criteria described above.

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 instructor’s 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/](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 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 and also by e-mail to the class.