# MA 302 Course Syllabus

## MA 302 – Numerical Applications of Differential Equations

**Section 1**

**FALL 2017**

**1 Credit Hour**

### Course Description

Numerical methods for approximating solutions for differential equations, with an emphasis on Runge-Kutta-Fehlberg methods with stepsize control. Applications to population, economic, orbital and mechanical models.

### Learning Outcomes

This course uses [Matlab](http://www.mathworks.com/), Matlab's [ODE suite](http://www4.ncsu.edu/eos/users/w/white/www/white/ma302/ode45.pdf), and is taught at a level suitable for students who have passed two semesters of calculus. There are five parts, and each has three lectures. The first lecture introduces a new topic, and the following two lectures will stress applications and variation of the model's parameters.

### Course Structure

The classes will meet at a computer lab. Students will use the laptops throughout the semester, and will have Matlab assignments at every class. The first part of each class will be lecturing and question/answer sessions, and the second part is always Matlab assignments.

### Course Policies

Absolutely no food or drinks in the computer lab.

### Instructors

**Stadnyk, Grace** - *Instructor*
**Email:** gstadny@ncsu.edu

### Course Meetings

#### Lecture

**Days:** T
**Time:** 10:40am - 11:30am
**Campus:** Main
**Location:** 110 Cox Hall
*This meeting is required.*

### Course Materials

#### Textbooks

None.

#### Expenses

None.

#### Materials

**Course material posted on Moodle** - 0
*This material is required.*

### Requisites and Restrictions

#### Prerequisites

MA 241

#### Co-requisites

None.

#### Restrictions

None.

### General Education Program (GEP) Information

#### GEP Category

This course does not fulfill a General Education Program category.

#### GEP Co-requisites

This course does not fulfill a General Education Program co-requisite.

### Transportation

This course will not require students to provide their own transportation. Non-scheduled class time for field trips or out-of-class activities is NOT required for this class.

### Safety & Risk Assumptions

None.

### Grading

#### Grade Components

| **Component** | **Weight** | **Details** |
| --- | --- | --- |
| **Quiz 1**  | **25%** |  |
| **Quiz 2**  | **25%** |  |
| **Quiz 3**  | **25%** |  |
| **Quiz 4**  | **25%** |  |

#### Letter Grades

**This Course uses Standard NCSU Letter Grading:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 97 | ≤ | **A+** | ≤ | 100 |
| 93 | ≤ | **A** | < | 97 |
| 90 | ≤ | **A-** | < | 93 |
| 87 | ≤ | **B+** | < | 90 |
| 83 | ≤ | **B** | < | 87 |
| 80 | ≤ | **B-** | < | 83 |
| 77 | ≤ | **C+** | < | 80 |
| 73 | ≤ | **C** | < | 77 |
| 70 | ≤ | **C-** | < | 73 |
| 67 | ≤ | **D+** | < | 70 |
| 63 | ≤ | **D** | < | 67 |
| 60 | ≤ | **D-** | < | 63 |
| 0 | ≤ | **F** | < | 60 |

#### Requirements for Credit-Only (S/U) Grading

In order to receive a grade of S, students are required to take all exams and quizzes, complete all assignments, and earn a grade of C- or better. Conversion from letter grading to credit only (S/U) grading is subject to university deadlines. Refer to the Registration and Records calendar for deadlines related to grading. For more details refer to <http://policies.ncsu.edu/regulation/reg-02-20-15>.

#### Requirements for Auditors (AU)

Information about and requirements for auditing a course can be found at <http://policies.ncsu.edu/regulation/reg-02-20-04>.

#### Policies on Incomplete Grades

If an extended deadline is not authorized by the instructor or department, an unfinished incomplete grade will automatically change to an F after either (a) the end of the next regular semester in which the student is enrolled (not including summer sessions), or (b) the end of 12 months if the student is not enrolled, whichever is shorter. Incompletes that change to F will count as an attempted course on transcripts. The burden of fulfilling an incomplete grade is the responsibility of the student. The university policy on incomplete grades is located at <http://policies.ncsu.edu/regulation/reg-02-50-3>.

#### Late Assignments

Homework each class is the completion of the multiple choice questions, and finishing up the Matlab implementation. The homework is not collected but the quizzes consist of the same multiple choice questions. No solution handed out for the multiple choice questions, but we start each class by answering questions about the previous multiple choice questions.

### Attendance Policy

For complete attendance and excused absence policies, please see <http://policies.ncsu.edu/regulation/reg-02-20-03>

#### Attendance Policy

Attendance will be taken at every class. Students are expected to arrive on time, and to stay until they finish all work assigned at class. Each student have to show individually his/her completed work to the instructor, who then marks the attendance sheet for the student. Failing to do so will be considered as an absence from class.

#### Absences Policy

Those students who have at most 2 absences (for any reason) at the end of the semester, will have their worst test grade dropped.

#### Makeup Work Policy

Missed quizzes are not allowed unless an official written (medical, legal) excuse is presented before the test or in emergency cases at most one week after the test. In these special cases the students are allowed to reschedule the quiz.

#### Additional Excuses Policy

None.

### Academic Integrity

#### Academic Integrity

Students are required to comply with the university policy on academic integrity found in the Code of Student Conduct found at <http://policies.ncsu.edu/policy/pol-11-35-01>

Students are expected to follow university guidelines available at
<http://www.ncsu.edu/policies/student_services/student_discipline/POL11.35.1.php>

#### Academic Honesty

See <http://policies.ncsu.edu/policy/pol-11-35-01> for a detailed explanation of academic honesty.

None.

#### Honor Pledge

Your signature on any test or assignment indicates "I have neither given nor received unauthorized aid on this test or assignment."

### Electronically-Hosted Course Components

Students may be required to disclose personally identifiable information to other students in the course, via electronic tools like email or web-postings, where relevant to the course. Examples include online discussions of class topics, and posting of student coursework. All students are expected to respect the privacy of each other by not sharing or using such information outside the course.

**Electronically-hosted Components:** http://moodle.wolfware.ncsu.edu/

### Accommodations for Disabilities

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, student must register with the Disability Services Office (<http://www.ncsu.edu/dso>), 919-515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation at [http://policies.ncsu.edu/regulation/reg-02-20-01.](http://policies.ncsu.edu/regulation/reg-02-20-01)

### Non-Discrimination Policy

NC State University provides equality of opportunity in education and employment for all students and employees. Accordingly, NC State affirms its commitment to maintain a work environment for all employees and an academic environment for all students that is free from all forms of discrimination. Discrimination based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation is a violation of state and federal law and/or NC State University policy and will not be tolerated. Harassment of any person (either in the form of quid pro quo or creation of a hostile environment) based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation also is a violation of state and federal law and/or NC State University policy and will not be tolerated. Retaliation against any person who complains about discrimination is also prohibited. NC State's policies and regulations covering discrimination, harassment, and retaliation may be accessed at <http://policies.ncsu.edu/policy/pol-04-25-05> or [http://www.ncsu.edu/equal\_op/.](http://www.ncsu.edu/equal_op/) Any person who feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact the Office for Equal Opportunity (OEO) at 919-515-3148.

## Course Schedule

**NOTE:** The course schedule is subject to change.

### Lecture T 9:35am - 10:25am — Part 1

Lesson 1 - Introduction

Lesson 2 - 1. Matlab (plot, function, loop, m-file)

Lesson 3 - 2. Falling mass, Euler and improved Euler methods, y(t) = 70 +130e-kt

Lesson 4 - 3. Cooling with variable ambient temperature, variable time steps

### Lecture T 9:35am - 10:25am — Part 2

Lesson 5 – Quiz 1 and Lesson 4. Population, Taylor and Runge-Kutta methods

Lesson 6 - 5. Population with harvesting, ODE45

Lesson 7 - 6. Spread of information, ODE45

### Lecture T 9:35am - 10:25am — Part 3

Lesson 8 – Quiz 2 and Lesson 7. Predator-prey(s), ODE45

Lesson 9 - 8. SIR Epidemic model, ODE45

Lesson 10 - 9. Diffusion of Heat (discrete rod), ODE45

### Lecture T 9:35am - 10:25am — Part 4

Lesson 11 – Quiz 3 and Lesson 10. Mass-spring and resonance, ODE45

Lesson 12 - 11. Vibrating string  (discrete string), ODE45

Lesson 13 - 12. LRC circuit and tuning, ODE45

Lesson 14 - 13. Rapid cooling, Euler-trapezoid, ODE23s

### Quiz 4 at Final Exam Time slot 10am – 11am