Math2214: Introduction to differential equations

Michal Outrata, CRN 87176, Fall 2023

E-mail: `michaloutrata@vt.edu`   Web: **course** & **personal**

Class Hours: MW 2:30 – 3:45pm   Office Hours: TBD

Class Room: McBryde 209   Office: D&DS building, office 411

Basic Info

- Course content: The important areas covered are *first order differential equations*, *second order differential equations*, *linear systems of ordinary differential equations*, *modeling* and *numerical methods* and they are covered in Chapters 1–4 and 6 of the course book.

- Course book: *Elementary Differential Equations with Boundary Value Problems*, Kohler and Johnson, 2$^{\text{nd}}$ Edition, 2006

- Prerequisities: Math 2114 or 1114 **and** Math 1226 or 1206

Course Structure

Lecture

We will meet twice a week, hopefully with a healthy mixture of explanation of concepts, hands on and with enough time where you can work on your own and get help if you get stuck.

Assignments & assessments

- **Final exam** (**FE**) – **Tuesday December** 12$^{\text{th}}$**, 11:05 am – 12:05 pm – 1:05 pm**. The goal is to asses your overall level of knowledge and understanding of the key course concepts. Consists of 1 hour CTE part, which ius identical for everyone class in the semester and is multiple choice (see previous years) and 1 hour that is sepcific for each class and is designed by me.

- **Midterm exams** (**ME**) – The goal is to asses your level of knowledge and understanding of the key concepts after finishing an important section of the course. It will be mostly open questions and will take place during one of our classes, hence roughly 75 minutes to finish the test (tentatively, it should take place during weeks 5, 9 and 13). These tests should be

a bit more thorough/in-depth than the final exam as they specialize on only a particular section.

- **Homework – written** (**HW_w**) – The goal is to let you practice the methods and consider in more depth the concepts you have seen during each week of the semester. Revisiting both of these on your own time and pace is (imho) **the** most important step in learning and understanding new material in general and should a) give you confidence for the next lecture because you refreshed the important terms and b) good check point to return to when studying for either of the exams. There should be 12 homework assignments during the semester. To accommodate for illnesses etc., I will consider only your best 10 scores. The homework assignments will be posted ahead of time and collected on the next Monday's lecture (4.5 – 5 days to work on these). The homework assignments will contain also further exercises for you to practice that will not be graded – these will be at the end, clearly marked as not graded.

- **Homework – online** (**HW_o**) – An easier and faster version of the above accesible here. The first time you log in, your username is the same as your VT username but your temporary password is the last five digits of your Hokie Passport number. You can set a permanent password after logging in by clicking on "User Settings". We run this as a pilot program for the first time this semester, meaning it's a new platform for me as well. Hence, there will be bugs and glitches, so please have patience with me and if you think about something that can be improved, let me know! Importantly, it is not integrated with Canvas yet and therefore you will not get reminders (the way you would from Canvas) and the scores have to be manually uploaded to Canvas by me (and it might take some time, especially at the beginning of the semester).

- **Emporium quizzes** (**EQ**, optional) – The goal is to encourage you to practice multiple-choice questions of the kind that will possibly appear in the first part of the final exam in May.

- **Pathway quizzes & Canvas quizzes** (**PCQ**) – The goal is identical to the emporium quizzes above. There will be 5 quizzes over the semester – 3 pathways quizzes for Chapters 1 and 2, Chapter 3, Chapters 4 and 6 (weeks 6, 11 and 16) *and* a 2-part canvas quiz for the canvas project (week 16) – with the tentative weeks given in the syllabus.

- **Canvas project** (**CP**) – The goal is to familiarize yourself with a particular application of the tools and skills we have learned in Chapter 6 (and throughout the previous chapters as well), including using numerical methods in either MATLAB (or other appropriate numerical software, e.g., python, jupyter, julia, octave or others) or in Microsoft Excel (if preferred by the student). The canvas project will be detailed after we finish Chapter 2. The project can be and should be consulted with me so – ideally, this is not an exam-like process but rather a learn-as-we-go process. The submission deadline is during the last week of the semester (week 16).

- **Self-study projects** (**SSP**, optional) – The goal is to give you incentives to peek a little bit further than what you've seen in the course – in any direction you find interesting. The options include (but are not limited to) writing or using computer solvers for the problems you have seen in lecture and/or properly (i.e., using math) analyzing these **or** relating what we

have learned to other courses you have completed in mathematics **or** self-studying some additional materials that expand on what we have seen during the lecture and demonstrating you've understood it properly **or** self-studying some related fields/topics and presenting (in some form) you've grasped their basic concepts **or** working out rigorous mathematical proofs and definitions for some of the topics we have gone over during the lecture. Everyone is encouraged to come and see me for further consultations if they would be interested in working on their own project during the semester. The output of the project will usually include some summary of the new material you learned (written in your own words) together with some required outputs, e.g., solutions to exercises, graphs/plots/figures of the experiments or proper mathematical definitions and proofs. The project can be and should be consulted with me so – ideally, this is not an exam-like process but rather a learn-as-we-go process. The timeline of each project can differ and the submission deadline is set (tentatively) the same as the final exam date (TBA).

Grading

Each of the above assignments and assessments will be graded on the scale 0–100%. The contribution of this percentage toward the final grade is given below.

FE	ME	HW_w	HW_o	EQ	PCQ	CP	SSP
32%	33%	20%	5%	0%	5%	5%	see below

The final score from this class will be on the scale 0–100% and the grades will be (tentatively) given as follows (the final judgment is at my discretion but will follow the scale except in outstanding circumstances).

A-	B-	C-	D-
90%	80%	70%	60%

For FE, ME, HW_w, HW_o and PCQ the final score is the average of all the scores within that group over the semester. For example, if you get from your three midterms 10%, 20% and 30% respectively, your midterm score is $(0.1 + 0.2 + 0.3)/3 = 0.2 = 20\%$ and thus you will obtain $0.33 \times 0.2 = 6.6\%$ from your midterms toward your final grade (analogously for others). The canvas project (CP) is graded based on the level of the document submitted and contributes analogously to the others, e.g., if you complete the canvas project and get 70%, the contribution from CP towards your final grade will be $0.7 \times 0.05 = 3.5\%$.

Regarding the self-study project (SSP), only one project will be graded (but we can work on multiple if you like) and it will replace your worst midterm score (if it would overall help your grade, that is), e.g., if you get from your three midterms 10%, 20% and 30% respectively and finish a self-study project with 90%, then your ME grade contribution will become $\frac{0.9+0.2+0.3}{3} \times 0.33 = 15.4\%$ instead of $\frac{0.1+0.2+0.3}{3} \times 0.33 = 6.6\%$. The goal is to reward your extra interest in the subject of differential equations and the grading of these projects will reflect that, i.e., I want to see that you genuinely tried to learn something new on your own and to what degree you've succeeded. The goal *is not* to give you an easy fix for neglecting your preparations during the semester. The grading could differ depending on the project and in general may be "converging", i.e., if I will think that the project is lacking in some areas, I give you corresponding feedback, you improve on these areas and so on until, eventually, we converge to a project solution we are both happy

with (which also generally means near full marks for the students). This obviously works only if the project is started soon enough during the semester.

Course Policies

Grading appeals

Specific grading disputes (points totaled incorrectly, asking for higher score, etc.) should be brought up within 1 week of return of the assignment. Coming to me within this period does not guarantee a change, only the consideration. Appeals outside of this timeframe might not be considered.

Attendance

Each lecture you are required to verify your attendance in the class by putting your initials on the "attendance sheet" available in the classroom. Your attendance is not counted in any way towards your grade. Important announcements regarding tests, grades, scheduling and others might be made during class and it is the student's responsibility to be informed of these.

Classroom behavior

From *Section V – Class Attendance and Classroom Conduct* of the Student Life Policy: "The professor has the authority to determine acceptable classroom conduct for his or her students as long as those decisions do not infringe on the students' rights. Disruptive classroom conduct may be considered disorderly conduct; i.e., behavior that disturbs the peace, disrupts or interferes with the orderly functioning of the university, or interferes with the performance of the duties of university personnel. When considered in violation of this policy, you will be asked to leave the classroom."

Accommodations for Disabilities

If you need adaptations or accommodations because of a documented disability, if you have emergency medical information to share with me, or if you need special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible but no later than in the first two weeks of the course.

Honor Policy

All assignments and tests submitted will be considered graded work and must be completed individually. No consultation is permitted on tests and quizzes. Homework may be discussed with other students as well as with the instructor. However, in writing up an assignment to be handed in, each student works alone and certifies that what is written accurately represents the student's own understanding of the material expressed in the student's own words. The Undergraduate Honor Code pledge that each member of the university community agrees to abide by the following: "As a Hokie, I will conduct myself with honor and integrity at all times. I will not lie, cheat, or steal, nor will I accept the actions of those who do."

The Virginia Tech honor code pledge for assignments states: "I have neither given nor received unauthorized assistance on this assignment." The pledge is to be written out on all graded assignments at the university and signed by the student. The honor pledge represents both an expression of the student's support of the honor code and an unambiguous acknowledgment

that the student has, on the assignment in question, abided by the obligation that the Honor Code entails. In the absence of a written honor pledge, the Honor Code still applies to an assignment. Students enrolled in this course are responsible for abiding by the Honor Code. A student who has doubts about how the Honor Code applies to any assignment is responsible for obtaining specific guidance from the course instructor before submitting the assignment for evaluation. Ignorance of the rules does not exclude any member of the University community from the requirements and expectations of the Honor Code.