MATH 380 (Ordinary Differential Equations) · Fall 2016

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Office Hours: Mondays and Wednesdays, 9:00–10:00 a.m., 11:00 a.m.–12:00 p.m., and by appointment.

Course Number and Sections: Section 01, CRN 60194, meets TR 8:00–9:15 in Bowman 203.
Canvas Page: Please find our page on MCLA's Canvas system. If you are not automatically granted access to this page, please contact the instructor.
Required Text: *Ordinary Differential Equations: An Elementary Textbook for Students of Mathematics, Engineering, and the Sciences*, by Morris Tenenbaum and Harry Pollard. Dover Books edition, 2016 (copyright 1963). ISBN 978–0–486–64940–5. Available in the MCLA bookstore and at online booksellers. Please obtain your textbook through legal means.

Goal

Examines first- and second-order differential equations with particular emphasis on n^{th} order equations with constant coefficients, differential operators, systems of equations, series solutions, and Laplace transforms.

Classes

The required course textbook has the word "Elementary" in the name, but is likely to be very different from the textbooks you are accustomed to working with. The student preface to the text contains the following paragraph:

> "We do not wish to imply, however, that you will be able to read this text as if it were a novel. If you wish to derive any benefit from it, you must study each page slowly and carefully. You must have pencil and plenty of paper beside you so that you yourself can reproduce each step and equation in an argument. When we say, 'verify a statement,' 'make a substitution,' 'add two equations,' 'multiply two factors,' *etc.*, you yourself must actually perform these operations. If you carry out the explicit and detailed instructions we have given you, we can almost guarantee that you will, with relative ease, reach the conclusion."

In class, you will be asked to form groups, and these groups will change several times over the course of the semester. Together within these groups, we will read carefully through the text on Thursdays and, as the authors suggest, will reproduce the steps in the authors' reasoning. This is designed to be a workshop where you learn how to read through particularly dense material like that encountered in many textbooks the age of ours (1963). Until just after Thanksgiving break (when the roles of Tuesdays and Thursdays will switch for the last two weeks), Tuesdays will be more traditional lecture days, designed to firm up some of the notions that we (hopefully) exposed in our group work the preceding Thursdays and that you studied at home in the elapsed time.

Attendance Policy

Students are expected to attend all of their classes and to be aware of course requirements. Whenever possible, students should notify their instructors prior to an absence from class. Students who expect to be absent from classes for three days or longer should contact the Center for Student Success and Engagement for help notifying their instructors. The complete college attendance policy may be located at: http://www.mcla.edu/Academics/registrar/academicpolicies/index

Electronic Device Policy

While it is not forbidden to use electronic devices such as mobile phones, laptops, and tablets in the classroom, it is assumed that if a student is using such a device, it is for legitimate academic purposes (*e.g.*, taking notes, displaying electronic textbooks, using calculator functionality). The instructor reserves the right to request that students display their screens to prove that they are not violating this assumption.

Notebook

A major part of this class is about learning how to learn from particularly dense sources. This can usually not be done without creating a journal or a notebook, which you are required to do, and which will contribute 40% of your course grade. As mentioned in the "Classes" section, we will actively work through the text and write in our notebooks during class time on Thursdays, but I expect that you will also do some of this work on your own between each Thursday and the subsequent Tuesday. The material we will cover each "week" (which, for us, until after Thanksgiving break, will really go from Wednesday to Wednesday) is listed in the Schedule at the bottom of this syllabus, and I expect that you will add some notes to your notebook that show you've read and studied each section before I collect your notebook on Tuesdays. When I return your notebooks to you on Thursdays, I'll have graded your week's entries on an increasing scale from 0 to 10 based on the quality, clarity, completeness, neatness, and comprehensiveness of your entries. You can use these notebooks to communicate any comments or questions about the material (in addition, of course, to visiting my office hours and contacting me via e-mail for more urgent matters of confusion). I will not collect your notebook in the penultimate week, but will collect it on the last day of class and you can make an appointment to retrieve it at your convenience starting the first day of finals week.

Demos

Another 40% of your course grade will be based on 26 demonstrations, or "demos", of your mastery of the major course topics. These demonstrations will consist of one basic question each, and you will need to schedule an appointment with me outside of class time to complete them. (If we can all find a common convenient time each week, I can schedule a classroom for a certain optional "demo time", if that would help you with scheduling; we'll discuss this on the first day of class.) At least twelve hours before your requested appointment to complete a demo, you'll have to tell me which demo(s) (numbered 1–26) you want to complete, so that I can have it ready for you when you come. You can have as many tries as you want for each demo, and they are graded pass/fail. The only deadline is that you complete them all before December 16 (the Friday of final exams week), however, I strongly suggest that you try to keep pace with the general schedule, and *not* leave all of them until exams week.

Project

There will also be a single, long-term, individual project worth 20% of the course grade, and you are encouraged to choose your own topic (details about the project goals, expectations, and rubric will be given separately from this syllabus). You will need to submit three reports on your work throughout the course of the semester, due on the following dates:

First report due:	Thursday, 13 October 2016
Second report due:	Thursday, 10 November 2016
Final report due:	Thursday, 08 December 2016

Grading Scheme

Notebook	40%
Demos	40%
Project	20%

Final Grades

You will be assigned a letter grade corresponding to your final course average as follows:

$98\% \leq$	**A+**	
$91\% \leq$	**A**	$< 98\%$
$89\% \leq$	**A-**	$< 91\%$
$87\% \leq$	**B+**	$< 89\%$
$80\% \leq$	**B**	$< 87\%$
$78\% \leq$	**B-**	$< 80\%$
$76\% \leq$	**C+**	$< 78\%$
$69\% \leq$	**C**	$< 76\%$
$67\% \leq$	**C-**	$< 69\%$
$60\% \leq$	**D**	$< 67\%$
	F	< 60

Students with Disabilities

Any student who believes he or she may need an accommodation based on the impact of a documented disability may be eligible for accommodations that provide equal access to educational programs at MCLA. Students are advised to contact that Disability Resource Office at (413) 662–5318 or stop by CSSE, Eldridge Hall to schedule an appointment. In compliance with the Americans with Disabilities Act (ADA), the Disability Resource Office will work with students to coordinate reasonable accommodations. Students who wish to request accommodations should do so within the first four weeks of the semester. Once accommodations have been determined, the student will provide a copy of his/her accommodation plan to each individual instructor. Students must fulfill all course requirements in order to receive passing grades in their classes, with or without reasonable accommodations. Please note that accommodations cannot be granted retroactively.

Center for Student Success and Engagement

The Center for Student Success and Engagement (CSSE) offers an integrated array of services and resources to assist your transition to college. We believe every student has the ability to excel academically and be successful, goals supported by a range of peer-advisory programs. If you need academic support, tutoring, or supplemental advising, please stop by their office at the top level of Eldridge Hall.

Counseling Services

MCLA's Counseling Services offers a range of services including individual and couples counseling, crisis intervention, outreach workshops and educational programming, psychiatric treatment, alcohol and other drug education, consultation to faculty, staff, parents, and students, and off-campus referrals. Group counseling is available as needs arise. Counseling services are confidential and free to all enrolled MCLA students, and it's perfectly normal to ask for help. Counseling Services is located in the MountainOne Student Wellness Center, second Floor, and is open Monday–Friday from 8:30 a.m. to 4:45 p.m. Students are seen at Counseling Services by appointment only. To schedule an appointment, please call or drop by the office. Please do not use e-mail to make an appointment.

Academic Integrity

A college is a community of students and faculty interested in the search for knowledge and understanding. This requires a commitment to honesty and integrity. Honesty on the part of every college student is integral to higher education at Massachusetts College of Liberal Arts. Acts of dishonesty are not merely a breach of academic honesty but conflict with the work and purpose of the entire College Community. Violations of academic honesty include but are not limited to:

- Submitting the work of others as one's own
- Unauthorized communication during or about an examination
- Use of information (notes, electronic communication, etc.) that is not permitted during exams, tests, quizzes
- Obtaining or disseminating unauthorized prior knowledge of examination questions
- Substitution of another person in an examination
- Altering College academic records
- Knowingly submitting false statements, data or results
- Submission of identical or similar work in more than one course without the approval of the current instructor
- Collaborating on material after being directed not to collaborate
- Forging a signature or false representation of a College official or faculty member or soliciting an official signature under false pretense
- Other behavior or activities in completing the requirements of a course that are explicitly prohibited by an instructor
- Plagiarism (as defined below)

Plagiarism: The academic departments of the College have varying requirements for reporting the use of sources, but certain fundamental principles for the acknowledgment of sources apply to all fields and levels of work. The use of source materials of any kind and the preparation of essays or laboratory reports must be fully and properly acknowledged. In papers or laboratory reports, students are expected to acknowledge any expression or idea that is not their own. Students submitting papers are implying that the form and content of the essays or reports, in whole and in part, represent their own work, except where clear and specific acknowledgement is made to other sources. Even if there is no conscious intention to deceive, the failure to make appropriate acknowledgment may constitute plagiarism. Any quotation—even of a phrase—must be placed in quotation marks and the precise source stated in a note or in the text; any material that is paraphrased or summarized and any ideas that are borrowed must be specifically acknowledged. A thorough reordering or rearrangement of an author's text does not release the student from these responsibilities. All sources that have been consulted in the preparation of the essay or report should be listed in the bibliography. Upon an occurrence of alleged academic dishonesty instructors may exercise their discretion in imposing a sanction.

Instructors may also report this sanction to the Registrar or file additional charges against students if they believe that additional sanctions are appropriate. Instructors will notify the Registrar in writing in either or both of the following cases:

- Any acts of academic dishonesty whenever they have imposed a sanction that is beyond the value of the assignment
- The instructor requests that the College take further action.

The Academic Appeals Committee will hear academic grievances from and about students enrolled in the undergraduate program. It will also serve as a hearing board for students charged with academic dishonesty. Further information regarding instructor and student rights and responsibilities and appropriate procedures to be followed in applying this policy may be obtained from the Office of the Dean of Academic Affairs or the Registrar. Additional policies may be found at:

`http://www.mcla.edu/Academics/registrar/academicpolicies/index`

Policies with approval dates and text (focused on curriculum) can be found by clicking on "Approved Courses and Policies" at the left of the Campus Collaboration page, then clicking on "Undergraduate Policies".

Tentative Schedule

Please find below the tentative schedule for the class. As previously mentioned, the "weeks" in this course will (mostly) go from Wednesday to Wednesday; each Thursday, we will begin studying the listed topics in group reading sessions during class. You are expected to continue these reading sessions individually (or also in groups) as homework, and to write in your notebook at least something about each of the textbook sessions mentioned; on Tuesday, you will submit your notebook for grading, and we will have a more "traditional" lecture intended to recapitulate what you've learned in your reading.

The only exception to the "Wednesday–Wednesday" week structure will be after the Thanksgiving break, when the last two weeks will have group work on Tuesday and lecture on Thursday. I will not collect your notebook on the penultimate week, but will collect it on the last day of class. You can pick it up (because over the course of the semester you will either come to cherish it, or will want the opportunity to personally destroy it, depending on your temperament) by appointment during final exams week.

Week	Dates	Deliverables	Topics	Lesson Numbers in Textbook
W1	Sept 8 (R) Sept 13 (T)	 Notebook	Definition of an ODE; Order; Explicit and implicit solutions	3A, 3B, 3C
W2	Sept 15 (R) Sept 20 (T)	 Notebook	Multiplicity of solutions; General solutions of ODEs; Exact DEs	4A, 4C, 9A, 9B, 10A
W3	Sept 22 (R) Sept 27 (T)	 Notebook	Separable DEs; Integrating factors	6C, 10B
W4	Sept 29 (R) Oct 4 (T)	 Notebook	Linear, first-order ODEs	11A, 11B, 11C, 11D
W5	Oct 6 (R) Oct 11 (T)	 Notebook	Miscellaneous methods of solving first-order ODEs	12B
W6	Oct 13 (R) Oct 18 (T)	First project draft Notebook	Linear independence of functions; Linear ODEs of order n; The Wronskian	19A, 19B, 63A, 63B
W7	Oct 20 (R) Oct 25 (T)	 Notebook	Homogeneous, linear ODE of order n with constant coefficients	20A, 20B, 20C, 20D
W8	Oct 27 (R) Nov 1 (T)	 Notebook	Method of undetermined coefficients; Simple electric circuits	21A, 21B, 30A
W9	Nov 3 (R) Nov 8 (T)	 Notebook	Variation of parameters; Simple harmonic motion	22A, 22B, 28A
W10	Nov 10 (R) Nov 15 (T)	Second project draft Notebook	Reduction of order for nonconstant coefficients	23A, 23B
W11	Nov 17 (R) Nov 22 (T)	 Notebook	Solving systems of first-order ODEs, Reducing second-order ODEs to systems of first-order ODEs	31A, 31B, 31C, 35A, 35B
W12	Nov 29 (T) Dec 1 (R)		Power series solutions of linear ODEs	37A, 37B
W13	Dec 6 (T) Dec 8 (R)	 Notebook; Final draft	Laplace transforms	27A, 27B, 27C
Finals	Dec 12 (M) Dec 16 (F)	Can pick up notebook Demo deadline		

Demo Topics

As you will see, these correlate pretty closely with the tentative course schedule. Please refer to these numbers when you request to do demos.

1. Classification of differential equations
2. Implicit and explicit solutions of differential equations
3. Multiplicity of solutions and initial conditions
4. Exact ordinary differential equations
5. Separation of variables
6. Integrating factor
7. First-order linear ordinary differential equations
8. Bernoulli equations
9. Multiplication as a solution technique
10. Substitution as a solution technique
11. Linear independence
12. The Wronskian
13. Second-order linear constant coefficient equations—real roots of characteristic equation
14. Second-order linear constant coefficient equations—some complex roots of characteristic equation
15. Method of undetermined coefficients
16. Differential equations arising from electrical circuits
17. Variation of parameters
18. Simple harmonic motion
19. Reduction of order
20. Euler equations
21. Solving systems of ordinary differential equations
22. Reduction of second-order equations to systems of first-order equations
23. Basics of Taylor polynomials
24. Taylor polynomials for solving differential equations
25. Definition of the Laplace transform
26. Using the Laplace transform to solve differential equations