SYLLABUS

MTH 211 – Introduction to Ordinary Differential Equations, Section C – Fall 2018

Instructor: Dr. Sofya Chepushtanova

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Class Meetings: MTWF 9:00-9:50am, room SLC 405.

Office Hours: MWF 11:00-11:50am, R 8:00-9:50am or by appointment, room SLC 410.

Course Description and Objectives: First-order and linear higher order differential equations; matrices, determinants, and systems of differential equations; numerical and power series methods of solution; the Laplace transform.
Students successfully completing this course should be able to:

- Solve various types of first order equations, including separable, linear, exact, and Bernoulli equations, and be able to compute integrating factors and use them to solve differential equations and initial value problems.
- Solve second order linear equations, including the solution of inhomogeneous equations with the methods of undetermined coefficients and variation of parameters, and apply them in various settings, including vibrating springs and circuit problems.
- Use infinite series to solve nonlinear equations at ordinary points.
- Compute Laplace transforms and inverse Laplace transforms and use them to solve problems involving step functions and impulse functions.
- Solve systems of differential equations and apply them to problems like the mixing of solutions and coupled oscillators.
- Use matrix methods to solve systems of differential equations and higher-order equations.
- Solve differential equations numerically, using Euler's method, the modified Euler's method, and Runge-Kutta methods.
- Understand the theory of differential equations and differential operators, including existence and uniqueness results.

Prerequisites: MTH 112 or its equivalence *with a grade 2.0 or better*.

Required Textbooks:

- *Ordinary Differential Equations: From Calculus to Dynamical Systems*, Virginia Noonburg, MAA Textbook Series, ISBN: 978-1-93951-204-8.
- *Schaum's Outlines: Differential Equations 4th Ed.*, Richard Bronson and Gabriel Costa, McGraw Hill, ISBN: 978-0-07-182485-9.
- *Schaum's Outlines: Matrix Operations 2nd Ed.*, Richard Bronson, McGraw Hill, ISBN: 978-0-07-175604-4.

Attendance: You are expected to attend all classes. You are responsible for everything that goes on in class (even if you are not there). Roll will be taken at each class. I will adhere to the Wilkes University Policy regarding class attendance policies (see the Wilkes Student Handbook). In particular, after 5 consecutive instructional hours of unexcused absences from a class, students may be readmitted to the class only by action of the Office of Student Affairs and the department chairperson concerned. *Remember that poor attendance is a major contributor to poor performance!*

Calculators and Software: You may want a calculator to help with homework, but *NO calculators will be allowed (or needed) on exams.* Computer access is needed for *WeBWorK*, *Mathematica*, email communication with me, and accessing these web pages. For all official communications and any discussion of grades I will use your Wilkes University email account. Check it regularly. You will also need a mathcs account to use the computers in SLC 409.

Exams, Homework, and Computer Projects: There will be 4 (four) in-class exams, the best three of which will each count for 1/6 of your grade (or 1/2 altogether). Note that **no makeups will be given for exams, if you miss an exam, it will be the one you drop.** If classes are canceled or put on a compressed schedule due to the weather on an exam day, the exam will be given at the next regular class.
There will be a final exam, given during finals week, which will count for 1/3 of your grade.
There will be *WeBWorK* homework assignments during the semester following the schedule shown on our web page that will count for 1/12 of your grade.
There will be 6 (six) Mathematica projects during the semester and the average of the best 5 (five) of these will count for 1/12 of your grade. Note that **homework and projects will not be accepted late**.
You need to keep up with the homework – completing the homework will help you understand the issues that come up in class. If you have any questions, you should see me outside of class during my office hours to get help. A list of assignments and projects can be found on our web page. It will be updated as the semester progresses.

Grading: Your grade in this course is calculated from the following components:

ITEM	**Max. Pts.**
WeBWorK grades	50
Average of 5 best *Mathematica* projects	50
3 best exams (100pts each)	300
Final Exam	200
TOTAL	600

and your final grade will be assigned from the total percentage you earn as follows:

Raw Score	0 to 359	360 to 389	390 to 419	420 to 449	450 to 479	480 to 509	510 to 539	540 to 600
Grade	0	1.0	1.5	2.0	2.5	3.0	3.5	4.0

However, there is an additional restriction for a failing grade on the final exam: if a student does not score at least 50% on the final (i.e., at least 100 out of 200 possible points), the highest grade they are eligible for is a 1.5.

Expectations: In addition to good attendance, you should plan to study 2-3 hours outside of class for each hour in class. So, for our 4-hour class, this means you should spend 8-12 hours per week *studying outside of class.* You are expected to *read the textbook for comprehension.* It gives a detailed account of the material of the course. *It is your responsibility to learn the material.* The instructor's job is primarily to provide a framework, to guide you in doing your learning of the concepts and methods that comprise the course. If you are experiencing difficulty, go to your instructor's office hours for extra help. Form a study group of classmates who are also committed to mastering multivariate calculus.
Please note that all students have the same opportunity in this class, so I cannot provide you (or a subset of the students) with extra credit assignments. Work hard and earn the grade you want!

Drop Policy: If you wish to drop from the course, I will give my permission during the first ten weeks of the semester. Thereafter you will need the permission of the Dean. Be aware that poor performance in the course will not be a sufficient reason for the Dean's permission to be granted.

Academic Honesty: By handing in your assignments, projects, and exams you certify that this is **your own work**. If there is evidence that work you hand in is not your own, the first time you will receive a zero on the exam and the second time you will receive a grade of 0.0 in the course. Appropriate deans will also be notified. **Put simply: do not cheat. I have no patience for academic dishonesty.**

Cell Phones should be switched to silent mode (or turned off), and put out of sight during class time. **NOTE: THE USE OF CELL PHONES DURING EXAMS IS EXPRESSLY FORBIDDEN AND WILL RESULT IN A GRADE OF 0.**

Email Etiquette: Please refer to the following tutorial on how to communicate with your instructor via email: `https://www.math.uh.edu/~tomforde/Email-Etiquette.html`. View an email to a professor as a professional interaction. How you choose to interact conveys your level of seriousness and professionalism.

Next page: recommended homework problems on matrix operations and differential equations

Good luck this semester!

RECOMMENDED HOMEWORK PROBLEMS:

1) Matrix Operations

Topic	**Problems in Noonburg**	**Problems in Schaum's**
Review of Complex Numbers	website	website
Solving Systems of Linear Equations	website	pp. 22, 23: ♯ 15 – 32
Matrix Operations	§4.2 pp. 152, 153: ♯ 1 – 7	p. 10: ♯ 19 – 35
Square Matrices	none	pp. 32, 33: ♯ 13 – 35
Determinants & Matrix Inverse	§4.2 pp. 152, 153: ♯ 8 – 13	p. 51: ♯ 19 – 35
Eigenvalues & Eigenvectors	§4.3 p. 159: ♯ 1 – 6	pp. 69, 70: ♯ 18 – 50
Functions of Matrices	§4.5.1 p. 178: ♯ 1 – 6	pp. 80, 81: ♯ 19 – 37

2) Differential Equations

Chapter in Noonburg	**Topic**	**Problems in Noonburg**	**Problems in Schaum's**
1	Modeling with ODEs	§1.3 pp. 16,17	pp. 12–13: ♯ 17–22
1	Basic Terminology	§1.1 pp. 5,6: ♯ 1–21	pp. 6–8: ♯ 14–23
1	Families of Solutions & Initial Value Problems (IVP)	§1.2 p. 10: ♯ 1–11	pp. 6–8: ♯ 24–54
2	Separable First-Order Eqns.	§2.1 pp. 26–28: ♯ 1–21, 23, 25	pp. 29,30: ♯ 23–50
2	First-Order Linear Eqns.	§2.3 pp. 44,45: ♯ 1–16	pp. 48, 49: ♯ 20–36, 50–52, 55
2	Qualitative Methods: Slope Fields	§2.2 pp. 34,35: ♯ 1–12	pp. 171 - 175: ♯ 17 – 32
2	Existence & Uniqueness of Solutions	§2.4 p. 49: ♯ 1–6	none
2	Exact First-Order Eqns	§2.5 p. 57: ♯ 1–14	pp. 40, 41: ♯ 24–50
2	Bernoulli Eqns.	§2.5 p. 57: ♯ 15–20, 22	pp. 48, 49: ♯ 37–42, 53
2	Numerical Methods	handout	handout
2	Autonomous First-Order Eqns.	§2.7 p.75: ♯ 1–10	none
3	Homogeneous Linear Eqns.	§3.1 p. 85: ♯ 1–18	p. 81: ♯ 33 – 62
3	Homogeneous Linear Eqns with Constant Coeff.	§3.2 p. 92: ♯ 1–15	p. 88: ♯ 17 – 45 p. 93: ♯ 16 – 50
3	Spring-Mass Equations	§3.3 pp. 99,100: ♯ 1–12	mixed in with above
3	Non-Homogeneous Linear Eqns. a) Undetermined Coeff. b) Variation of Parameters	§3.4 pp. 111, 112: ♯ 1–27 mixed in with above	pp. 101, 102: ♯ 15 – 52 p. 109: ♯ 9 – 30
3	Forced Spring-Mass Systems	§3.5 pp. 122, 123: ♯ 1 – 7	pp. 128 - 130: ♯ 26 – 81
3	Series Solutions	§3.6 pp. 131, 132: ♯ 1 – 11	p. 274: ♯ 26 – 49 p. 289: ♯ 25 – 38
6	The Laplace Transform	§6.1 pp. 221, 222: ♯ 1 – 17	pp. 221 - 223: ♯ 27 – 76
6	The Inverse Laplace Transform	§6.2 pp. 226, 227: ♯ 1 – 18	pp. 231,232: ♯ 20 – 53
6	More Laplace Transforms	§6.3 pp. 234, 235: ♯ 1 – 23	none
6	The Unit Step Function	§6.4 pp. 246, 247: ♯ 1 – 20	pp. 240, 241: ♯ 20 – 60
6	Convolution and the Dirac Delta	§6.5 p. 256: ♯ 1 – 9	mixed in with above
4	Intro. to Linear Systems	§4.1 p. 145: ♯ 1 – 12	pp. 155, 156: ♯ 10 – 20
4	Analytic Solutions to Linear Systems	§4.4 pp. 171, 172: ♯ 1 – 20	none
4	Solutions via the Matrix Exponential	§4.5 p. 178: ♯ 1 – 13	p. 261: ♯ 9 – 29
5	The Phase Plane	§5.1 pp. 182, 182: ♯ 1 – 5	none
5	Linear Autonomous Systems	§5.2 pp. 191, 192: ♯ 1 – 20	none
5	Nonlinear Autonomous Systems	§5.3 pp. 201 - 203: ♯ 1 – 8	none