MATH 391K (23535) **Methods of Differential Equations**

Fall, 2017 Tuesday, Thursday 8:00 – 9:15 am NAC 0/201

Book: *Elementary Differential Equations and Boundary Value Problems* , 10th Edition, by William E. Boyce and Richard C. DiPrima
[The 9th Edition is fine, but make sure that "Boundary Value Problems" is in the title.]

Chapter 2, first order equations: 2.2, 2.1, 2.6, 2.3, 2.9.
Chapter 3,4 higher order equations: 3.2, 3.1, 3.3, 3.4,
3.5, 3.6, 3.8, 3.9, 4.1, 4.2, 4.3.
Chapter 5 series solutions: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6.
Chapter 6 Laplace transforms: 6.1, 6.2
Chapter 10 partial differential equations: 10.1, 10.2, 10.3, 10.4, 10.5

Grading: There will be three in class tests [after 3.4, 5.6 and 10.5, approximately] and a final exam. The final counts 40 % of the grade. You should be warned that there are no makeups. Instead the remaining work will simply be counted more heavily.

Please attend regularly and be on time.

Office Hours: Thursday 10:00-11:50am
Other times by appointment.

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COURSE LEARNING OUTCOMES

After taking this course, the student should be able to:	Contributes to Departmental Learning Outcome(s):
1. Solve a variety of first order differential equations selecting from a variety of techniques covered in the syllabus..	a. b, e2, g.
2. Likewise, solve a variety of second order differential equations, selecting from several techniques covered in the syllabus.	a, b, e2, g.
3. Be able to analyze certain physical problems (tank flow, compound interest, mechanical and electrical vibration), set up their determining differential equations , solve them using the techniques in 1. and 2. above, and use these solutions to answer questions about the physical system.	a, b, c, g.
4. Give series solutions (and approximations) for second order linear differential equations, both at ordinary points and at regular singular points.	a, b, g.
5. Have a fundamental understanding of Fourier series and be able to give Fourier expansions of a given function.	a, b, e1, e2, g.
6. Understand and be able to apply all the mathematical aspects that contribute to the solution of heat conduction of a rod problem with constant temperature boundary conditions (the method of separation of variables, the use of Fourier series, as well as the specific solution).	a, b, c, g.
7. Understand and be able to use various theoretical ideas and results that underlie the mathematics in this course covered in the syllabus (including various existence/uniqueness results, ideas of linear independence and the Wronskian, and convergence properties of Fourier series).	e1, e2, g.

COURSE ASSESSMENT TOOLS

1. The average of class examinations: 60% of grade
2. Comprehensive written final exam: 40% of grade.

DEPARTMENTAL LEARNING OUTCOMES

The mathematics department, in its varied courses, aims to teach students to

a. perform numeric and symbolic computations
b. construct and apply symbolic and graphical representations of functions
c. model real-life problems mathematically
d use technology appropriately to analyze mathematical problems
e. state (e1) and apply (e2) mathematical definitions and theorems
f. prove fundamental theorems
g. construct and present (generally in writing, but, occasionally, orally) a rigorous mathematical argument.

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Homework Assignments - 10th Edition [9th Edition]:

Chapter 2:

2.2 Separable Equations: p. 48/ 3-17odd [pp. 47-48/ 3-17odd].
2.2 Homogeneous Equations: pp. 50-51/ 31-37odd [p. 50/ 31-37odd].
2.1 Linear Equations: p. 40/ 7-10, 11-15odd
[p. 39/ 7-10, 11-15odd].
2.6 Exact Equations: p. 101/ 1, 3, 4, 7-13odd, 17, 18
[pp. 99-100/ 1, 3, 4, 7-13odd, 17, 18 differential notation].
2.3 Modeling: pp. 60-63/ 1-4, 7-10, 16
[pp. 59-62/ 1-4, 7-10, 16].
Reduction of Order Problems pp. 135-136/ 36, 37, 41, 42, 43, 45, 48, 49
[pp. 134-135/ 36, 37, 41, 42, 43, 45, 48, 49].
2.9 Miscellaneous: pp. 133-134/ 1-14, 28, 29
[pp. 132-133/ 1-14, 28, 29].

Chapters 3,4:

3.1 Homogeneous Constant Coeffs p. 144/ 1-11odd, 16.
3.2 Fundamental Solutions; Wronskian pp. 155-157/ 1, 3, 5, 14, 16, 38, 39
[pp. 155-156/ 1, 3, 5, 14, 16, 38, 39].
3.3 Complex Roots p. 164/ 1-11odd, 17, 19
[p. 163/ 1-11odd, 17, 19].
3.4 Repeated Roots; Reduction of Order pp. 172-174/ 1-11odd; 23, 25, 28
[pp. 171-173/ 1-11odd; 23, 25, 28].
3.5 Undetermined Coefficients
p. 184/ 5-11odd, 12, 15, 17, and 21-25 (Y(t) alone)
[p. 183/ 3-9odd, 10, 13, 15, and 19-23 (Y(t) alone)].
3.6 Variation of Parameters p. 190/ 3, 5, 7, 9, 10, 13, 14
[p. 189/ 3, 5, 7, 9, 10, 13, 14].
3.7, 3.8 Spring Problems pp. 203-204/ 5, 6, 7, 9 p. 217/ 5, 6, 9
[p. 202/ 5, 6, 7, 9 p. 215/ 5, 6, 9].
4.2 Higher Order Linear p. 234/ 11-23odd [p. 232/ 11-23odd].
4.3 Higher Order Undeter. Coeffs p. 239/ 13-18 (Y(t) alone)
[p. 237/ 13-18 (Y(t) alone)].

Chapter 5

5.2 Ordinary Point part 1 pp. 263-264/1, 2, 5-17 odd
[pp. 259-260/1, 2, 5-17 odd].
5.3 Ordinary Point part 2 pp. 263-264 /8, 14 p. 269/ 1, 2, 3
[pp. 259-260 /8, 14 p. 265/ 1, 2, 3].
5.4 Euler Equations p. 280/ 3-15 odd [p. 276/ 3-15 odd].
5.5 Regular Singular Point p. 286/ 1-9 odd [p. 282/ 1-9 odd].

Chapter 6

6.1, 6.2 Laplace Transforms pp.324-325/ 13-17 odd, 21, 22
[pp.320-321/ 13-17 odd, 21, 22].

Chapter 10

10.2 Fourier Series p. 605/ 13-18 [p. 593/ 13-18].
10.4 Even and Odd Functions p. 620/ 15-19 [p. 608/ 15-19]
10.5 Heat Equation pp. 630-631/ 1-12 [pp. 618-619/ 1-12].