Advanced Mathematics for the Physical Sciences, Spring 2019
MST-306

Dr. John Gemmer: gemmerj@wfu.edu
Office: 360 Manchester Hall **Phone:** (336) 758-5386
Course Website: http://users.wfu.edu/gemmerj/math306.html
Office Hours: Monday 1-3, Tuesday 2-3, Wednesday 3-5
Class Meeting Times: TR 12:30-1:45
Class Location: Manchester Hall 124

Textbook: Boas, Mary L. *Mathematical methods in the physical sciences*. Wiley, 2006.

Prerequisites: Multivariable calculus (MST 113), linear algebra (MST 121) and ordinary differential equations (MST 251) or MST 205.

Course Description: Advanced topics in Fourier analysis, special functions, integral transforms, partial differential equations and complex variables.

Course Rationale: This course serves to introduce the student to many of the modern mathematical techniques they will need for advanced coursework in the physical sciences. A particular emphasis will be placed on solutions techniques for linear equations. While this is a mathematics course, concepts and skills will be emphasized over rigorous structure. An additional emphasis of this course will be in implementation of the ideas discussed in lecture in Mathematica. When time permits, applications will be discussed.

Course Delivery: The course material will be delivered through a combination of lectures, demonstrations in Mathematica, and in class group assignments. Evaluation of the students understanding of the material will be assessed through written homework assignments, in-class exams, quizzes, Mathematica assignments and participation in group assignments.

Course Policies:

✦ **Grading:** Your grade will be based on:
- Weekly written homework: 15%
- Mathematica assignments: 10%
- Classwork: 5%
- Quizzes: 10%
- Two in-class exams: 30% (15% each)
- Final Exam: 30%

You are guaranteed the following grades if your final percentage lies within the following ranges:

90-92.9: A-	**93-100: A**	
80-82.9: B-	**83-86.9: B**	**87-89.9: B+**
70-72.9: C-	**73-76.9: C**	**77-79.9: C+**
60-62.9: D-	**63-66.9: D**	**67-69.9: D+**

- **Written homework:** Written homework will be assigned most weeks on Tuesday and will be due Thursday the following week. The assigned homework problems will be posted on the course website. Late homework will not be accepted under any circumstances. However, I will drop the lowest homework score from your grade. Written homework must consist of solutions that show all steps, be your own work and be written clearly using complete sentences as appropriate (see homework policy).

- **Mathematica assignments:** Mathematica assignments will be assigned most weeks on Tuesday and will be due the following Tuesday at the beginning of class. The assignment will be posted on the course website in the form of a Mathematica notebook and will be submitted by the student on Sakai. The specific formatting for each assignment is described in detail in the first Mathematica assignment.

- **Quizzes:** On most Thursdays there will be a short 5-10 minute in-class quiz. These quizzes will consist of a very short problem that will test your knowledge of the prior lectures. These quizzes are to help both the students and the instructor understand concepts that students may be struggling with. All quizzes will be announced in class. There will be no "pop" quizzes. There are no retakes for missed quizzes, however I will drop the lowest quiz score from your final grade.

- **Group work:** Throughout the course there will be several unannounced "class works". These consist of structured group assignments that will be completed during class time. These assignments will generally be exploratory allowing students to learn a new concept through a "hands on" approach".

- **In-Class Exams:** There will be two in-class exams and a comprehensive final in the course.

Tentative Course Schedule:

1. 1/15: Fourier series Part 1, **Sections 7.1-7.5**
2. 1/17: Fourier series Part 2, **Sections 7.6-7.9**
3. 1/22: Fourier series Part 3, **Sections 7.10-7.11**
4. 1/24: Fourier transform, **Section 7.12**
5. 1/29: Laplace transform, **Sections 8.8-8.9**
6. 1/31: Convolution theorem, **Section 8.10**
7. 2/05: Dirac delta function, **Section 8.11**
8. 2/07: Green functions, **Section 8.12**
9. 2/12: **Exam #1**

10. 2/14: Gamma function, **Sections 11.1-11.5**
11. 2/19: Beta and error functions, **Sections 11.6-11.9**
12. 2/21: Asymptotic series, **Sections 11.10-11.11**
13. 2/26: Elliptic functions, **Section 11.12**
14. 2/28: Legendre polynomials Part 1, **Sections 12.1-12.5**
15. 3/05: Legendre polynomials Part 2, **Sections 12.6-12.9**
16. 3/07: Bessel functions Part 1, **Sections 12.12-12.15**
17. 3/19: Bessel functions Part 2, **Sections 12.16-12.19**
18. 3/21: Hermite functions, **Section 12.22**
19. 3/26: **Exam #2**

20. 3/28: Laplace's equation, **Section 13.2**
21. 4/02: Heat and Schrodinger's equation, **Section 13.3**
22. 4/04: Wave equation, **Section 13.4**
23. 4/09: Integral transform solutions, **Section 13.9**
24. 4/11: Analytic functions, **Sections 14.1-14.2**
25. 4/16: Contour integrals, **Section 14.3**
26. 4/18: Laurent series, **Section 14.4**
27. 4/23: Residues, **Section 14.5-14.6**
28. 4/25: Evaluation of definite integrals Part 1, **Section 14.7**
29. 4/30: Evaluation of definite integrals Part 2, **Section 14.7**

Important Dates:

1. February 12: Exam 1.
2. February 19: Last day to drop.
3. March 9-17: Spring break.
4. March 26: Exam 2.
5. May 9: Final Exam at 9:00

The Honor Code: At Wake Forest, we expect you to behave as honorable citizens of the class, the university, and the world as a whole. When you complete an assignment with your name on it, you are representing that everything you are turning in is your own work. That means that you do not copy from other students, textbooks, or websites. If at any time I become aware of cheating or plagiarism in this course, I will submit the information to the honor council.