MATH 3705*B Winter 2020 Course Outline

Last updated: January 6, 2020.

Mathematical Methods I

Instructor: Dr. Elena Devdariani
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Office hours: by appointment. Please email the instructor to schedule one.

Textbook: Mathematical Methods and Boundary Value Problems, Fifth Edition, by S. Melkonian. The textbook is available at the Campus Bookstore. The fourth edition may be used. Any earlier edition is very different for the last two.

Lectures: begin on January 6; Monday and Wednesday 8:05 - 9:55 am, in 101 AT (Azrieli Theatre).

Tutorials: begin on the week of January 13. A Teaching Assistant (TA) will be present, to answer questions and to administer the tests. The class is subdivided into the tutorial groups alphabetically, according to the last names. It is absolutely necessary that the students attend the tutorial groups they assigned to, as the number of test papers is limited to the number of students in each group. The subdivision, the classrooms and the TAs for this course are:
Section B1: [A - Fe], room 316 SA, Margarit Alkhzouz, ritaalkhzouz@cmail.carleton.ca
Section B2: [Fi - Le], room 317 SA, Diego Politis, diegopolitis@cmail.carleton.ca
Section B3: [Li - Sa], room 516 SA, Revanth Sridhar , revanthsridhar@cmail.carleton.ca
Section B4: [Sc - Z], room SA 403, Siyu Zhou, SiyuZhou5@cmail.carleton.ca

Evaluation:

(1) Term Mark 45% (4 tests, 3 best count)

(2) Final Examination 55%.

Term mark : There will be four tests in the regular tutorial hours on **January 27, February 10, March 9 and 23**. Students are expected to take all four tests; the best three will be counted. There will be **ABSOLUTELY NO** make-up tests as we do not have the resources to provide such services. This is the reason why the students are allowed to miss one test without penalty. **The instructor will not answer any emails from the students asking about the possibilities of make-up tests**. In case when a student misses **more than one test** due to illness (supported by a doctor note) jury duty or extreme personal misfortune, the term mark may be pro-rated. It is each student's responsibility to collect the marked tests from the TA. The test papers are normally distributed in the tutorial session following the date of the test.

Final Examination: This is a 3-hour exam scheduled by the University. The exam is taking place during the period of April 13 to 25 (including weekends). It is each student's responsibility to be available at the time of the examination. In particular, no travel plans should be made until the examination schedule is published. It is each students responsibility to find out the correct date and time of the exam and the room where it takes place. To pass this course, a student must obtain at least 50% of total and at least 30% of the final exam mark. Students who missed the examination may be eligible for a deferred exam, provided that they present a doctor note or another supporting document to the Registrars Office. It is the Registrars Office (not the course Instructor!) which makes the decision of granting a deferred examination. After the deferred exam is written, all questions should be directed to the School of Mathematics and Statistics and not to the Instructor.

Calculators: Non-programmable calculators are allowed for tests and the exam.

Academic Accommodation: You may need special arrangements to meet your academic obligations during the term because of disability, pregnancy or religious obligations. You can

visit the Equity Services web site to view the policies and to obtain more detailed information on academic accommodation at http://carleton.ca/equity/accommodation

Academic Accommodations for Students with Disabilities: The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (if applicable).

List of topics:

1 The Laplace Transform, Lectures $1 - 5$

1.1 Introduction
1.2 Further Properties and Initial-Value Problems
1.3 Convolutions and Generalized Functions

2 Series Solutions of Ordinary Differential Equations, Lectures $6 - 10$

2.1 Basic Concepts
2.2 Solutions About Ordinary Points
2.3 Solutions About Regular Singular Points
2.3.1 Cauchy-Euler Equations
2.3.2 The General Equation $y" + p(x)y' + q(x)y = 0$
2.3.3 Bessel's Equation

3 Fourier Series, Lectures $11 - 12$

3.1 Periodic Functions
3.2 Functions Defined on Finite Intervals

4 Partial Differential Equations, Lectures $13 - 17$

4.1 The Heat Equation
4.1.1 The Bar with Zero Boundary Conditions
4.1.2 The Bar with Nonzero Boundary Conditions
4.1.3 The Bar with Insulated Ends

4.2 The Wave Equation
4.3 Laplace's Equation
4.3.1 Solutions Within Rectangular Regions, Polynomial Solutions
4.3.2 Regions with Circular Boundaries, Solutions Inside a Circle, Solutions Outside a Circle, Solutions Within an Annulus

5 Sturm-Liouville Problems, Lectures $18 - 21$

5.1 Regular and Periodic Problems
5.1.1 General Theory
5.2 Singular Problems
5.2.1 Bessel's Equation
5.2.2 The Vibrating Membrane

6 The Fourier Transform, Lectures $22 - 24$

6.1 Fundamental Properties
6.2 Applications
6.2.1 Partial Differential Equations, The Heat Equation on $(-\infty, \infty)$

Exercises

Section 1.1: 1-7
Section 1.2: 1-23
Section 1.3: 1-11
Section 2.1: 1-3
Section 2.2: 1-11
Section 2.3: 1-15
Section 3.1: 1-8
Section 3.2: 1-17
Section 4.1: 1-9
Section 4.2: 1-5
Section 4.3: 1-11
Section 5.1: 1-13
Section 5.2: 1-14
Section 6.1: 1-22
Section 6.2: 1-4