University of Manitoba
September–December 2024

Course Number and Title: MATH 3132 Engineering Mathematical Analysis 3

Pre-requisites: MATH 2130 and MATH 2132

Class Times and Locations: Monday, Wednesday, Friday, 8:30-9:20, in Wallace 221

Instructor information: D. Trim, Office: St. Paul's 306, Telephone: 255-2740,
Email- Donald.Trim**@umanitoba.ca**

Office hours are: Monday, Wednesday, Friday 10:30-12:30

Tuesday, Thursday 9:45-11:15

I will endeavour to be in my office at these times, but unforeseen circumstances may sometimes prevent me from being there, and I apologize for this. If these hours do not fit your schedule, I am willing to discuss an alternative time for an appointment. If my door is open at any time outside official office hours, feel free to ask me any questions concerning the course. If the door is closed, I am either not in, or prefer not to be disturbed. When you have difficulty with a certain exercise, and you wish to discuss it with me, bring whatever attempts you have made to solve the problem. This makes it much easier for me to diagnose what is troubling you.

Web Page: The web page for the course can be found at home.cc.umanitoba.ca/~dtrim/
Follow the links to this course.

Calendar Description of Course:

Vector integral calculus; series of ordinary differential equations; Fourier series and partial differential equations.

A more Detailed Description of the Course:

Line and surface integrals; Green's, Divergence, and Stokes' theorems. Taylor series and Frobenius series solutions of ordinary differential equations; ordinary and singular points. Representations of functions in the form of Fourier, Fourier sine, and Fourier cosine series. Sturm-Liouville systems and eigenfunction expansions of functions. Derivation of the heat conduction and wave equations. Solutions of homogeneous, and nonhomogeneous wave, heat conduction, Laplace, and Poisson equations using separation of variables.

Goals: The course has five main goals:

1. evaluate line and surface integrals
2. use infinite series to solve linear differential equations
3. represent functions in Fourier series form
4. solve Sturm-Liouville systems and calculate eigenfunction expansions
5. use separation of variable to solve partial differential equations

Instructional Objectives: At the completion of the course, the student is expected to be able to:

1. calculate line integrals using parametric equations of curves, independence of path, Green's and Stokes' theorems
2. calculate surface integrals using double integrals and the divergence theorem
3. find Taylor and Frobenius series solutions of ordinary differential equations and determine their intervals of convergence
4. classify points of linear second-order linear differential equations as ordinary, regular singular, and irregular singular
5. calculate Fourier, Fourier sine, and Fourier cosine series of suitably-behaved functions and predict their convergence properties
6. find eigenvalues and eigenfunctions of Sturm-Liouville systems
7. calculate eigenfunction expansions of suitably-behaved functions
8. set up partial differential equations, initial conditions, and boundary conditions for heat conduction, vibration, and electrostatic problems
9. solve heat conduction, vibration, and electrostatic problems using separation of variables

Textbook and Notes: Calculus for Engineers (fourth edition) by Donald Trim, Prentice-Hall
Notes for the course to be purchased from the Bookstore
Three sections of notes on the web page for the course

Not all sections of the text or notes will be covered. Information about which sections are required material will be given in lectures.

Class Schedule: Below is a list of section numbers to be covered n the course in the order that they will be covered.

14.1,2,3,4,6,7,8,9,10: 17.1,2,3: 18.1,2; 19:1,2: 20.1,2,3: 21.1,2

It is not my practice to suggest which exercises from the text students should attempt. I simply recommend that you do as many exercises that you can in the time that you have available. It goes without saying, however, that the grade that you receive in the course is closely related to the amount of work that you put in, especially in the number of exercises and tutorial problems that you do. Exercises with no asterisk * are considered routine problems. Difficulty with these exercises indicates a definite lack of understanding of associated material and help should be sought. Exercises with a single star are more difficult; they may require more intensive calculations or some creative thinking. Exercises with two asterisks are challenging and should be attempted only when other exercises have been mastered.

Tutorials From 11:30 – 12:45 **o**n Thursdays**,** there are tutorials in 100 St. Paul's. Tutorials are posted on the web page for the course. I will announce before each tutorial which problems are appropriate for the upcoming tutorial.

Evaluation: There are two components contributing to the final grade in the course.

1. Two one-hour tests during tutorial hours on dates to be decided by the class. They will count 50% of the final grade in the course. The better of the tests will count 2/3 of the 50% and the lesser will count 1/3 of the 50%. Material that you will be responsible for on the tests will be announced in class. There are no make-up tests. If you miss one and can provide an acceptable reason for doing so, marks will be redistributed between the other test and the final examination.

2. A three-hour final exam counting 50%. The final exam is scheduled by Student Records and covers the entire course.

Past examinations are for practice only. There is no guarantee that examinations this term will be similar to examinations from previous years.

Notes, books, calculators or other computing devices are not allowed for the tests or the final exam. Appropriate reference material may accompany a test.

Grading: The following can be used as a guide in changing numerical grades to letter grades. It is only a guide, however, as fluctuations in grade lines may occur.

Numerical Grade	Letter Grade
90-100	A+
80-89	A
74-79	B+
68 -73	B
61-67	C+
55-60	C
50-54	D
0-49	F

Voluntary Withdrawal Date: Voluntary withdrawal date is November 19, 2024.

Academic Dishonesty:

The Department of Mathematics, the Faculty of Science and the University of Manitoba regard acts of academic dishonesty in quizzes, tests, examinations or assignments as serious offenses and may assess a variety of penalties depending on the nature of the offense. Acts of academic dishonesty include bringing unauthorized materials into a test or exam, copying from another student, plagiarism and examination personation. Students are advised to read sections of the "General Academic Regulations and Requirements" of the current Undergraduate Calendar that refer to Academic Integrity and Examinations: Personations. Note, in particular that cell phones and pagers are explicitly listed as unauthorized materials and hence may not be present during tests or examinations. Penalties for violation include being assigned a grade of zero on a test or assignment, being assigned a grade of "F" in a course, compulsory withdrawal from a course or program, suspension from a course/program/faculty or even expulsion from the University. For specific details about the nature of penalties that may be assessed upon conviction of an act of academic dishonesty, students are referred to University Policy 1202 (Student Discipline Bylaw) and to the Department of Mathematics policy concerning minimum penalties for acts of academic dishonesty. The Student Discipline Bylaw is printed in its entirety in the Student Guide, and is also available on-line or through the Office of the University Secretary. Minimum penalties assessed by the Department of Mathematics for acts of academic dishonesty are available on the Department of Mathematics web-page. All faculty members (and their teaching assistants) have been instructed to be vigilant and report incidents of academic dishonesty to the Head of the Department.

This is what you can expect of me:

- make every effort to plan the course and each class so that learning will be maximized
- arrive five minutes early and begin class at precisely the appointed time
- conduct classes, and not give lectures. I will explain this under my expectations of you.
- be patient when you struggle with ideas (struggling reveals that learning is taking place)
- be open to suggestions (Suggestions can often lead to improvements in a course.)
- treat you as adult learners, with related respect
- provide you with plenty of office hours for consultations. I encourage you to see me during office hours as soon as you encounter difficulties. Do not delay.

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This is what I expect of you:

- be punctual. The first few moments of a class are the most important. There is often a quick review of the main ideas from the last class and how they lead into the present class. General ideas and the "big picture" are often discussed in the first few moments. You are doing yourself a disservice by missing these discussions (as well as perhaps disturbing me and the rest of the class by being tardy).
- participate in class, which includes both speaking up and listening. Learning begins in class but most of it takes place when you study. Learning will begin here only if you contribute to the class; what you put into a class is directly related to what you get out. I will ask you many questions in the course of a class and for many different reasons. Your learning is substantially enhanced if you offer an answer, or at least formulate one. Do not come to class for the sole purpose of taking notes; that does not contribute to your learning. In order to answer many of the questions that I will pose, it is necessary for you to be familiar with what has transpired in recent classes. Try to keep up. Even better would be for you to read ahead. Part of this syllabus is the order in which sections are to be covered. If you pre-read material, you will get far more out of class.
- be courteous when others are speaking. Only one person should be speaking at any given time during class. If you repeatedly have conversations with your neighbour while others are discussing course material, I will ask you to leave the room.
- complete all requirements of the course.
- use college-level, mathematical writing, legible and with correct format. There are many worked out examples in the notes; these should guide you on how to write solutions to problems on tests.
- be honest. Test and examination submissions must be your own work.
- have the courage to ask questions in class if something is not clear. If you have a problem, it is quite possible that someone else has the same problem. I will attempt to

clear the difficulty immediately. Should I not be able to do so, I may ask you to see me after class for further clarification.

- discuss difficulties that you are having with course material as quickly as possible. The longer you leave a difficulty unresolved, the more unbearable it becomes, and the further and further behind you become. I have plenty of office hours, or you can see me immediately before or after class to set up a special appointment.
- turn off cell phones when entering class.