Math 2130: Engineering Mathematical Analysis
Fall 2019

Welcome to Math 2130: Engineering Mathematical Analysis! This semester we will cover a range of topics in differential and integral multivariable calculus. This class may not be held for credit with MATH 2720, MATH 2750, or the former MATH 2110. The official prerequisite courses are MATH 1210 or MATH 1211 and MATH 1710 (C).

Section:	A01
Lecture:	M.W.F. 8:30-9:20 in 223 Wallace
Tutorial:	Th. 11:30-12:45 in 100 St. Paul's
Instructor:	*Dr. Sergio Da Silva*
Office:	450 Machray Hall
Office Hours:	M.W. 9:30 - 10:30 or by appointment
Email:	`sergio.dasilva@umanitoba.ca`

Section:	A02
Lecture:	Tu.Thu. 8:30-9:45 in 110 E2 EITC
Tutorial:	Tu. 11:30-12:45 in 100 St. Paul's
Instructor:	*Dr. Kirill Kopotun*
Office:	422 Machray Hall
Office Hours:	Tu.Thu. 9:50-10:50 or by appointment
Email:	`Kirill.Kopotun@umanitoba.ca`

The best way to contact your instructor is by e-mail.

WEBSITE: The general website for the course based on your section is

Section A01: `https://server.math.umanitoba.ca/~dasilv14/math_2130.html`.
Section A02: `http://home.cc.umanitoba.ca/~kopotunk/2130-fall2019.shtml`.

Course announcements will be posted on your section webpage. Your instructor will also post lecture notes for the class. Please note that posted notes may have typos and that more is often said during lectures than what has been written down, so it is important to also regularly attend class.

TEXTBOOK: Calculus for Engineers fourth edition, Don Trim, Prentice-Hall

IMPORTANT DATES:

Last day to register:	September 18
Thanksgiving (university closed):	October 14
Term Test:	5:45-6:45pm, November 7 (location TBA)
Remembrance Day (university closed):	November 11
Fall break (no classes):	November 12-15
Last day for VW (with no refund):	November 18
Last day of classes:	December 6

COURSE OUTLINE:

1. Vector Algebra; three-dimensional geometry including lines, planes, cylinders and quadratic surfaces; lengths and tangent vectors for space curves.
2. Limits, partial derivatives, gradients, chain rules, implicit differentiation, directional derivatives, tangent lines and planes, relative and absolute extrema.
3. Double and triple integrals applied to area, volume, centers of mass, moments of inertia, fluid pressure, and surface area; iterated integrals in polar, cylindrical, and spherical coordinates.

More specifically, the following sections of the textbook will be covered:

- 11.1: Rectangular Coordinates in Space
- 11.2: Curves and Surfaces
- 11.5: Planes and Lines
- 11.6: Geometric Applications of Scalar and Vector Products
- 11.9: Differentiation and Integration of Vectors
- 11.10: Parametric and Vector Representations of Curves
- 11.11: Tangent Vectors and Lengths of Curves
- 12.1: Multivariable Functions
- 12.2: Limits and Continuity
- 12.3: Partial Derivatives
- 12.4: Gradients
- 12.5: Higher-Order Partial Derivatives
- 12.6: Chain Rules for Partial Derivatives
- 12.7: Implicit Differentiation
- 12.8: Directional Derivatives
- 12.9: Tangent Lines and Tangent Planes
- 12.10: Relative Maxima and Minima
- 12.11: Absolute Maxima and Minima
- 13.1: Double Integral and Double Iterated Integrals
- 13.2: Evaluation of Double Integrals by Double Iterated Integrals
- 13.3: Area and Volumes of Solids of Revolution
- 13.4: Fluid Pressure
- 13.5: Centres of Mass and Moments of Inertia
- 13.6: Surface Area
- 13.7: Double Iterated Integrals in Polar Coordinates
- 13.8: Triple Integrals and Triple Iterated Integrals
- 13.9: Volumes
- 13.11: Triple Iterated Integrals in Cylindrical Coordinates
- 13.12: Triple Iterated Integrals in Spherical Coordinates

GRADE COMPONENTS: The final grade in this course is determined by the marks earned on a final exam, a term test, and approximately 9 quizzes (note: the number of quizzes may change):

FINAL EXAMINATION	**50%**
TERM TEST	**35%**
∼9 QUIZZES	**15%**

Note: Re-weighting of final grade or make-ups will not be considered for poor performance on any assessment.

TUTORIALS/QUIZZES: You are required to register for and attend a tutorial (sometimes called lab) section. Each week, tutorial problems will be assigned and posted online. These problems will be based on the material taught during lectures from the previous week. Students are expected to work through these problems before the actual tutorial. During the first 45-60 minutes of your tutorial, your instructor will answer your questions, work through solutions for some of these tutorial problems (but it is unlikely that there will be enough time to discuss all of them), etc. You will then write a quiz during the last 15-30 minutes of the tutorial.

Quizzes will start on September 17 (section A02) and September 19 (section A01), and will take place every week except for the weeks of November 3, November 10, and December 1, for a total of 9 quizzes (this number may change). The lowest two quiz grades will be dropped. Make-up quizzes for missed tutorials are not available. Students who miss writing a quiz for a valid reason must contact and notify their instructor no later than 48 hours after their scheduled quiz (but preferably earlier).

MIDTERM EXAMINATION: There will be a term test on November 7 at 5:45-6:45 p.m (location: TBA). Students who miss writing it for valid medical or compassionate reasons (supporting evidence is needed) will have their final grade breakdown adjusted by re-weighting the final exam accordingly (i.e., increasing the weight of the final exam by 35%). Students who miss writing the term test must contact their instructor (email is acceptable) no later than 48 hours after their scheduled test (but preferably earlier). Otherwise, a mark of "zero" will be given. Note that there will be no make-up tests.

FINAL EXAMINATION: The date, time, and location of a 2-hour final examination will be set and published by the Registrar's Office. Students are reminded that they must remain available until all examination and test obligations have been fulfilled. The exam period is December 9-20, 2019. Students who miss the final exam should promptly contact their home faculty to discuss possible deferral arrangements.

CALCULATORS AND REFERENCE MATERIAL: No calculational aids of any kind (calculator, smartphone, abacus, etc.) and no reference materials of any kind are permitted during quizzes, tests or exams.

SUGGESTED HOMEWORK EXERCISES:

Week of	Sections and Suggested Even Numbered Exercises
September 2	§11.1: 2-12 , §11.2: 2-70
September 9	§11.5: 2-22 , §11.6: 2-30 , §11.9: 2-20
September 16	§11.10: 2-14 , §11.11: 2-16 , §12.1: 2-20, 26, 28
September 23	§12.2: 2-34 , §12.3: 2-34 , §12.4: 2-26
September 30	§12.5: 2-30 , §12.6: 2-20, 26-30
October 7	§12.7: 2-22 , §12.8: 2-30
October 14	§12.9: 2-36 , §12.10: 2-18
October 21	§12.11: 2-24 , §13.1: 2-28
October 28	§13.2: 2-28, 36-42 , §13.3: 2-40
November 4	§13.4: 2-16 , §13.5: 2-16, 22-34
November 11	Fall break
November 18	§13.6: 2-20 , §13.7: 2-22, 26
November 25	§13.8: 2-22 , §13.9: 2-18 , §13.11: 2-18, 24, 32-40
December 2	§13.12: 2-12, 18, 20

COURSE OBJECTIVES: At the completion of the course, the student is expected to be able to:

1. Sketch curves and surfaces in space, and their projections in the coordinate planes.
2. Find distances among points, lines, and planes in space.
3. Find the derivative and integral of vector-valued functions depending on a single variable.
4. Find tangent vectors to, and lengths of, curves in space.
5. Calculate limits, partial derivatives, gradients, and directional derivatives of functions of more than one variable.
6. Develop chain rules for multi-variable composite functions.
7. Use Jacobians to calculate partial derivatives of implicitly defined functions.
8. Find equations for tangent lines to curves and tangent planes to surfaces.
9. Find critical points of functions of multi-variable functions and classify them as giving relative maxima, relative minima, or saddle points for functions of two variables.
10. Find absolute maxima and minima of multi-variable functions.
11. Evaluate double and triple iterated integrals in Cartesian coordinates.
12. Use double integrals to find volumes of solids of revolution, fluid pressure, centres of mass, moments of inertia, and surface area.
13. Use triple integrals to calculate volumes in space.
14. Evaluate iterated integrals in polar, cylindrical, and spherical coordinates.

FINAL GRADES: Numbers will be converted to letter grades in such a way that the following minima will apply:

Letter	Minimum Percentage to Guarantee	Final Grade Point
A+	92	4.5
A	82	4.0
B+	75	3.5
B	69	3.0
C+	63	2.5
C	57	2.0
D	51	1.0

USING COPYRIGHTED MATERIALS: Please respect copyright. We will use copyrighted content in this course. We have ensured that the content we use is appropriately acknowledged and is copied in accordance with copyright laws and University guidelines. Copyrighted works, including those created by your instructor, are made available for private study and research and must not be distributed in any format without permission. Do not upload copyrighted works to a learning management system (such as UM Learn), or any website, unless an exception to the Copyright Act applies or written permission has been confirmed. For more information, see the University's Copyright Office website at `http://umanitoba.ca/copyright/` or contact `um_copyright@umanitoba.ca`.

RECORDING CLASS LECTURES: Course materials, presentations and lectures that form part of this course are copyrighted material. No audio or video recording of lectures or presentations is allowed in any format, openly or surreptitiously, in whole or in part without permission. Course materials (both paper and digital) are for the participant's private study and research.

STUDENT ACCESSIBILITY SERVICES: If you are a student with a disability, please contact SAS for academic accommodation supports and services such as note-taking, interpreting, assistive technology and exam accommodations. Students who have, or think they may have, a disability (e.g. mental illness, learning, medical, hearing, injury-related, visual) are invited to contact SAS to arrange a confidential consultation.

Student Accessibility Services `http://umanitoba.ca/student-supports/accessibility`
520 University Centre
204 474 7423
`student_accessibility@umanitoba.ca`

Statement on Academic Dishonesty

The Department of Mathematics, the Faculty of Science and the University of Manitoba all regard acts of academic dishonesty in quizzes, tests, examinations or assignments as serious offences and may assess a variety of penalties depending on the nature of the offence.

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 section 7 (Academic Integrity) and section 4.2.8 (Examinations: Personations) in the General Academic Regulations and Requirements of the current Undergraduate Calendar. 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.

All students are advised to familiarize themselves with the Student Discipline Bylaw, which 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.

Mathematics Academic Resources:

- **LevelUp**

  LevelUp is a self-paced program of online modules on UMLearn (instructional videos, exercises, and quizzes) to get students refreshed on basic mathematical skills. Everything from basic number sense and fractions to Trigonometry and Logarithmic functions is covered, and students can do as little or as much as they wish to be prepared for any introductory mathematics course (or other science course requiring basic math skills).

  For more information: `https://www.math.umanitoba.ca/undergrad-info/level-up/`

- **Math Bootcamp**

  Formerly known as 'PreCalculus Refresher', the Math Bootcamp reviews high school material directly relevant to MATH 1500, MATH 1510 or MATH 1520. The Bootcamp is scheduled on:

FRI 06 SEPT 4:30PM to 8:30PM
SAT 07 SEPT 10:00AM to 2:00 PM

Registration available in the Mathematics office (420 Machray Hall).

- **Saturday Series**

  A series of three 3-hour lectures, scheduled early in the term, to help students review topics that are relevant background knowledge for our first year courses. Students may attend any or all of these sessions. **Registration is required, as space is limited.**

  SAT 14 SEPT 12:00PM to 3:00PM
  SAT 21 SEPT 12:00PM to 3:00PM
  SAT 28 SEPT 12:00PM to 3:00PM
  Registration available in the Mathematics office (420 Machray Hall).

- **Math Help Centre**

  The department has a help centre, located 412 Machray Hall, available to students registered in first year math courses. Beginning on MON 09 SEPT, the Math Help Centre hours are:

  MON to FRI 9:00AM to 6:00 PM

  For details: `https://www.math.umanitoba.ca/undergrad-info/help-centre/`

  Contact person:
  Clifford Allotey
  425 Machray Hall
  E-mail: Clifford.Allotey@umanitoba.ca

Governing Documents, student rights and responsibilities

A list of University governing documents pertaining to students can be found at
`http://umanitoba.ca/admin/governance/governing_documents/students/index.html`

As a student of the University of Manitoba you have rights and responsibilities. It is important for you to know what you can expect from the University as a student and to understand what the University expects from you. Become familiar with the policies and procedures of the University and the regulations that are specific to your faculty, college or school.

Academic Calendar
`http://umanitoba.ca/student/records/academiccalendar.html`

Grade appeals
If you have questions about your grades, talk to your instructor. There is a process for term work and final grade appeals. Note that you have the right to access your final examination scripts. See the Registrar's Office website for more information including deadlines related to appeals and the appeal form:
`http://umanitoba.ca/registrar/`

Student Advocacy
Contact Student Advocacy if you want to know more about your rights and responsibilities as a student, have questions about policies and procedures, and/or want support in dealing with academic or discipline concerns.

http://umanitoba.ca/student/advocacy/

Science and Technology Library

http://libguides.lib.umanitoba.ca/science_library/sciencesandtechnologylibrary

Health & Mental Health Resources

For 24/7 mental health support, contact the Mobile Crisis Service at 204-940-1781.

Student Counselling Centre

Contact SCC if you are concerned about any aspect of your mental health, including anxiety, stress, or depression, or for help with relationships or other life concerns. SCC offers crisis services as well as individual, couple, and group counselling. Student Counselling Centre:

http://umanitoba.ca/student/counselling/

Student Support Case Management

Contact the Student Support Case Management team if you are concerned about yourself or another student and don?t know where to turn. SSCM helps connect students with on and off campus resources, provides safety planning, and offers other supports, including consultation, educational workshops, and referral to the STATIS threat assessment team.

http://umanitoba.ca/student/case-manager/

University Health Service Contact UHS for any medical concerns, including mental health problems. UHS offers a full range of medical services to students, including psychiatric consultation.

http://umanitoba.ca/student/health/

Health and Wellness

Contact a Health and Wellness Educator if you are interested in information on a broad range of health topics, including physical and mental health concerns, alcohol and substance use harms, and sexual assault.

http://umanitoba.ca/student/health-wellness/

For comprehensive information about the full range of health and wellness resources available on campus, visit the Live Well @ UofM site:

http://umanitoba.ca/student/livewell/

http://umanitoba.ca/student/saa/accessibility/

Copyright and Intellectual Property Resources

Copyrights and intellectual property must be respected by all students. For more information, visit

http://umanitoba.ca/copyright/

https://umanitoba.ca/admin/governance/governing_documents/community/235.html

Academic Integrity Resources

The Faculty of Science takes academic integrity very seriously. Any evidence of academic dishonesty on assignments, labs and/or tests will be forwarded to the appropriate authorities for potential disciplinary actions. Information from the Faculty of Science regarding Academic Integrity can be found at

https://www.sci.umanitoba.ca/undergraduate-students/academic-resources/academic-integrity-2/

The University Student Discipline By-Law may be accessed at:

http://umanitoba.ca/admin/governance/governing_documents/students/student_discipline.html.

Respectful Behaviour Resources

Students are expected to act in a respectful manner. Policies regarding respectful work and learning environment and sexual assault can be found here:
http://umanitoba.ca/admin/governance/governing_documents/community/230.html

Violent or Threatening Behaviour

http://umanitoba.ca/admin/governance/governing_documents/community/669.html
If you experience Sexual Assault or know a member of the University community who has, it is important to know there is a policy that provides information about the supports available to those who disclose and outlines a process for reporting. The Sexual Assault policy may be found at:
http://umanitoba.ca/admin/governance/governing_documents/community/230.html

More information and resources can be found by reviewing the Sexual Assault site:
http://umanitoba.ca/student/sexual-assault/

Final Examinations, Grades and Grade Appeals Resources

Information from the Faculty of Science regarding Exams and Appeals can be found at:

https://www.sci.umanitoba.ca/undergraduate-students/academic-resources/exams-and-appeals/

Final examination and grades policies at the University can be found here:
http://umanitoba.ca/admin/governance/governing_documents/academic/1299.html

Students intending to appeal their term work grade can do so through the Registrar's office. A fee is charged for each appeal. More information can be found here:
http://umanitoba.ca/student/records/grades/690.html

To view your final examination, please check with the department offering the course for policies. More information can be found here:
http://umanitoba.ca/faculties/science/undergrad/resources/895.html

To appeal your final grade, you can initiate the process at the Registrar's office. A fee will be charged for each appeal. See the Registrar's office for more information:
http://umanitoba.ca/student/records/

Limited Access and VW Resources

Students who fail or VW from a course will be subject to limited access to that course in future terms. That is, students will not be able to register for a course (for which they have VWed or failed) during the limited access registration period. For more information, please see the policy document for repeated courses.

http://www.umanitoba.ca/admin/governance/media/Repeated_Course_Policy_-_2016_09_01.pdf

Last updated: September 3, 2019