MATH*1090 (OnLine) Elements of Calculus II - W21
Department of Mathematics and Statistics, CEPS
University of Guelph, Guelph Campus

Course Description - ***This online course is managed entirely via MS Teams & CourseLink.***
(0.5 credit) This course will expand on integration techniques, and introduce students to difference and differential equations, vectors, vector functions, and elements of calculus of two or more variables such as partial differentiation and multiple integration. The course will emphasize content relevant to analyzing biological systems, and methods will be illustrated by application to biological systems.

- Prerequisite(s): 1 of IPS*1500, MATH*1080, MATH*1200
- Restriction(s): IPS*1510, MATH*1210, MATH*2080

Required & Reference Study Materials

- REQUIRED SOFTWARE:
  - ***CourseLink*** at https://courselink.uoguelph.ca/shared/login/login.html (**You have this**.)
    1) For students that are granted a deferred final examination privilege, CourseLink access is extended to allow for preparation.
    2) For all students, CourseLink access is extended through to the end of the first week of classes of the following semester to allow for a review of your final examination grade in order to decide about requesting a final examination re-grade.
  - ***MS OneNote*** at https://teams.microsoft.com/_#/school//?ctx=teamsGrid (**You have this**.)
    1) Online lecture and lab notes are developed & hosted here. Links are posted in CourseLink.
  - ***MS Teams*** (**You have this**.)
    1) Online meeting spaces for lectures, labs and office hours are conducted via Teams. Links are posted in CourseLink.
- REQUIRED TEXT BOOK: (**You need this. Maybe try the bookstore or online**.)
  - *Calculus for Biology and Medicine, 4th. Edition.* Author: Claudia Neuhauser and Marcus Roper. Publisher: Pearson Publishing, © 2018.
  - https://www.amazon.ca/Calculus-Biology-Medicine-Claudia-Neuhauser/dp/0134070046/ref=asc_df_0134070046/?tag=googleshopc0c-20&linkCode=df0&hvadid=296000230213&hvpos=&hvnetw=g&hvrand=16769957922685668879&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9001009&hvtargid=pla-569208973405&psc=1
  - Important homework & readings are referenced from this text.
- REFERENCE TEXT BOOK: (**You might have it re: MATH*1080F20. Not required**.)
  - *Calculus: Early Transcendentals*, 2nd Edition. Author: Michael Sullivan and Kathleen Miranda. Publisher: W.H. Freeman Macmillan Learning, © 2019.
  - https://www.amazon.ca/Calculus-Early-Transcendentals-Michael-Sullivan/dp/1319018351/ref=asc_df_1319018351/?tag=googleshopc0c-20&linkCode=df0&hvadid=378366144916&hvpos=&hvnetw=g&hvrand=9678295024539661831&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9001009&hvtargid=pla-697034558636&psc=1

Learning Outcomes

- Display a capability to apply substitution (& trig substitution), integration by parts, and partial fractions. Solve indefinite and definite integrals. Explain *principle angles* as applied to trig substitution. Explain the Fundamental Theorem of Algebra applied to partial fractions.
- Display a capability to solve definite improper integrals, integrate over a discontinuity and to apply L'Hôpital's rule.
- Explain, setup and compute bio-availability as an integral.
- Display a capability to classify and solve first order homogeneous/non-homogeneous difference equations.
- Describe and explain the discrete logistics equation, its set of equilibria, stabilities, and steady states (in terms of a parameter).
- Describe and explain the set of solutions of a quadratic equation leading to distinct real roots, repeated real roots and complex conjugate roots. Explain a complex number.
- Display a capability to classify and solve second order linear constant coefficient homogeneous/non-homogeneous difference equations. Explain and describe corresponding homogeneous and particular solutions.
- Display a capability to solve separable first order differential equations.
- Describe, explain and solve the logistics equation. Describe and explain its set of equilibria, stabilities, and steady states (in terms of a parameter).
- Display a capability to solve first order linear differential equations via integrating factors. Describe and explain corresponding homogeneous and particular solutions.
- Display a capability to classify and solve second order linear constant coefficient homogeneous differential equations. Describe how to extend these techniques to higher order differential equations. Describe corresponding homogeneous and particular solutions.
- Describe, explain and solve a two-compartment drug model.
- Display a capability to compute distances, equations of lines and tangent planes in $\boldsymbol{R}^3$.
- Explain a function $z = f(x,y)$, its limit at a point and continuity over an open, connected, convex region. Display a capability to compute partial derivatives and the total differential.
- Explain how to compute the volume of an object using triple integrals in $\boldsymbol{R}^3$.
- Display a capability to compute volumes of intersecting solids as the solution of a definite triple integral. Display a capability to change the order of integration in $\boldsymbol{R}^3$.
- Explain higher order partial derivatives and compute a Taylor series of degree 2 in $\boldsymbol{R}^3$.

Instructor, eMail, Virtual Office & Office Hours	**Virtual Lecture Times**
S. Gismondi, gismondi@uoguelph.ca, CourseLink "Help" tab ➔ "Office Hours"	MWF 12:30–13:20

TA, eMail, Virtual Office & Office Hours	**Virtual Lab Times**
K. Kypke, kkypke@uoguelph.ca, CourseLink: "Help" tab ➔ "Office Hours"	F 15:30 – 16:20
T. Kielstra, ikielstr@uoguelph.ca, CourseLink: "Help" tab ➔ "Office Hours"	F 15:30 – 16:20
M. Kreitzer, mkreitze@uoguelph.ca, CourseLink: "Help" tab ➔ "Office Hours"	F 15:30 – 16:20
Z. Lou, zluo04@uoguelph.ca, CourseLink: "Help" tab ➔ "Office Hours"	F 15:30 – 16:20
M. Pupulin, mpupulin@uoguelph.ca, CourseLink: "Help" tab ➔ "Office Hours"	F 15:30 – 16:20
H. Tahir, hamdah@uoguelph.ca, CourseLink: "Help" tab ➔ "Office Hours"	F 15:30 – 16:20

About Lecture and Lab Procedures

Lectures: There are three live online lectures presented each week, 12 weeks in all (Gismondi). See the last page of this outline for a schedule of dates and activities. Attend all lectures. **Click on "Join Live Lecture (Teams)" from the pull down menu tab called "Lectures & More"**, at the assigned lecture date and time. Lectures are also recorded and linked from within CourseLink. Lecture notes are developed live during lecture via MS OneNote, and are also linked from within CourseLink.

Labs: There are six simultaneous live online lab presentations (same material) each week, 12 weeks in all. That is, six TAs present the same material each week – an assignment that you are to attempt to complete first. Solution are posted. TAs answer questions online, in virtual class sizes of about 40 students. See the last page of this outline for a schedule of dates and activities. Attend all labs. **Click on "Join Live Lab Section 1-6 (Teams)" from the pull down menu tab called "Labs & More"**, at the assigned lab date and time. Students are free to choose the lab section they prefer. Labs may or may not be recorded and linked within CourseLink, according to the TA's discretion. Lab notes may or may not be developed live during lab. However, solutions to problem assignments are available and linked from within CourseLink. Labs "drive" the assessment portion of the course. Lab presentations and notes are supported by lecture materials, reading assignments and homework. This is primarily the material that make up your assignments. See below.

- *Attempt each practice assignment before attending lab, and be sure to attend a lab session every week. Seek answers to all your questions i.e. ask questions, refer to lecture notes, come to Gismondi's office hours, your TA's office hours, do your assigned homework and text readings AND concentrate and focus on your TA's lab presentation including the posted practice assignment / solutions. Work together with classmates, myself (Gismondi) and a TA. When it comes time to attempt the UNIT assignment,* ***you are expected to be able to answer questions about the details of each question / solution on each practice assignment****.*

About Assessment Procedures

- There are five online UNIT assignments - in correspondence with each of the five units of material presented in lecture. Online assignments 1 through 4 are comprised of 18 questions each. Online assignments 1 through 4 occur biweekly, based upon material presented in lecture and lab from the previous two weeks. Each assignment counts 18% towards your final grade. Online assignment 5 is comprised of 28 questions, is based upon material presented in the last four weeks of lecture and lab, and counts 28% towards your final grade. ***There is no final examination.***

The material on each assignment is based upon the same material relating to the same set of questions on the corresponding UNIT practice assignment – but with variations in numbers AND variations in the questions e.g. scenario style questions i.e. 'What if instead …' style of questions. **You'll have your notes including your practice assignment notes that you make in lab, together with the original posted solutions – these are required – questions on unit assignments relate to these practice assignments and solutions.** Ideally, you'll have already asked plenty of questions and gained a full understanding about these questions. There are no limits on the number of assignment attempts, other that as many as you can manage in an 18 hour time interval for assignments 1 – 4, and a 42 hour time interval for assignment 5. There are no limits on the amount of time for each assignment attempt, other than as long as you can manage in an 18 hour time interval for assignments 1 – 4, and a 42 hour time interval for assignment 5. A suggested strategy might be for you to start an assignment, work as hard as you can for a long enough time until you are very sure about your answers. Submit the assignment. Then repeat this process until you are satisfied, exhausted or both. Your final assignment score for each assignment is the highest score across all

attempts made on a particular assignment that were submitted during the 18 or 42 hour time interval. Answers are released a few days later. Assignments 1 – 4 are designed to take about 90 minutes each. Assignment 5 is designed to take about 3 hours.

- **Assignment 1. 18%. 6:00 – 23:59 THURSDAY January 28 (Wks 1 & 2)**
- **Assignment 2. 18%. 6:00 – 23:59 THURSDAY February 11 (Wks 3 & 4)**
- **Assignment 3. 18%. 6:00 – 23:59 THURSDAY March 4 (Wks 5 & 6)**
- **Assignment 4. 18%. 6:00 – 23:59 THURSDAY March 18 (Wks 7 & 8)**
- **Assignment 5. 28%. 6:00 SUNDAY April 11 -- 23:59 MONDAY April 12 (Wks 9,10,11,12)**

Total = 100%

University Policies

E-mail Communication
As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

When You Cannot Meet a Course Requirement
When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. See the undergraduate calendar for information on regulations and procedures for Academic Consideration.

Drop Date
Courses that are one semester long must be dropped by the end of the last day of classes; two-semester courses must be dropped by the last day of classes in the second semester. The regulations and procedures for Dropping Courses are available in the Undergraduate Calendar.

Copies of out-of-class assignments
Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

Accessibility
The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required, however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to make a booking at least 7 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests, assignments and exams must be approved at least a week ahead of time.

More information: www.uoguelph.ca/sas

Academic Misconduct
The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes

academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy is detailed in the Undergraduate Calendar.

Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.

Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings and academic schedules. Any such changes will be announced via CourseLink and/or class email. All University-wide decisions will be posted on the COVID-19 website https://news.uoguelph.ca/2019-novel-coronavirus-information/ and circulated by email.

Illness

The University will not require verification of illness (doctor's notes) for the fall 2020 or winter 2021 semesters.

Topics & Schedule Updates by Week	Assignment Schedule
Week 1: Jan. 11-15 • Lectures as regularly scheduled. Integration techniques e.g. substitution, trig inverse and trig substitution, integration by parts, and partial fractions. Readings and homework posted online. • Lab Friday Jan. 15. Preparation for UNIT 1 assignment, e.g. attend lab, download & work practice assignment & solutions. Prepare notes you might need. **Week 2:** Jan. 18-22 • Lectures as regularly scheduled. Continuing integration techniques. Readings and homework posted online. • Lab Friday Jan. 22. Preparation for UNIT 1 assignment, e.g. attend lab, download & work practice assignment & solutions. Prepare notes you might need.	
Week 3: Jan. 25-29 • Lectures as regularly scheduled. Improper integrals and l'hopital. Readings and homework posted online. • Lab Friday Jan. 29. Preparation for UNIT 2 assignment, e.g. attend lab, download & work practice assignment & solutions. Prepare notes you might need. **Week 4:** Feb. 1-5 • Lectures as regularly scheduled. Continuing improper integrals, l'hopital, bio-availability and introduction to two-compartment drug model. Readings and homework posted online esp. first order repeated drug dosing model • Lab Friday Feb. 5. Preparation for UNIT 2 assignment, e.g. attend lab, download & work practice assignment & solutions. Prepare notes you might need.	**THURSDAY JANUARY 28: Online UNIT 1 Assignment (18%). Usually covers all material from weeks 1 & 2. BUT the instructor will advise with certainty. Always attend lecture!**
Week 5: Feb. 8-12 • Lectures as regularly scheduled. Repeated drug dosing for two-compartment drug model. First and second order linear constant coefficient homogeneous/non-homogeneous difference equations. Readings and homework posted online. • Lab Friday Feb. 12. Preparation for UNIT 3 assignment, e.g. attend lab, download & work practice assignment & solutions. Prepare notes you might need.	**THURSDAY FEBRUARY 11: Online UNIT 2 Assignment (18%). Usually covers all material from weeks 3 & 4. BUT the instructor will advise with certainty. Always attend lecture!**
**** READING WEEK, February 15-19. NO CLASSES and NO LABS. ****	
Week 6: Feb. 22-26 • Lectures as regularly scheduled. Continuing difference equations. Complex numbers. Readings and homework posted online. • Lab Friday Feb. 26. Preparation for UNIT 3 assignment, e.g. attend lab, download & work practice assignment & solutions. Prepare notes you might need.	
Week 7: Mar. 1-5 • Lectures as regularly scheduled. Discrete logistics-like model. Intro to differential equations, classification. Solution of first order. • Lab Friday Mar. 5. Preparation for UNIT 4 assignment, e.g. attend lab, download & work practice assignment & solutions. Prepare notes you might need. **Week 8:** Mar. 8-12 • Lectures as regularly scheduled. Continuing with differential equations, solution of second order and higher. Readings and homework posted online. • Lab Friday Mar. 12. Preparation for UNIT 4 assignment, e.g. attend lab, download & work practice assignment & solutions. Prepare notes you might need.	**THURSDAY MARCH 4: Online UNIT 3 Assignment (18%). Usually covers all material from weeks 5 & 6. BUT the instructor will advise with certainty. Always attend lecture!**
Week 9: Mar. 15-19 • Lectures as regularly scheduled. Continuous logistics growth model (to finish off DEs and tie into logistics growth and recall our into techniques for integrating – a capstone to our single variable calculus). Introduction to $z = f(x,y)$, pictures and the idea of multivariate calculus. Area and volume via double and triple integrals. Computing volumes of solids and intersecting solids. Readings and homework posted online.	**THURSDAY MARCH 18: Online UNIT 4 Assignment (18%). Usually covers all material from weeks 7 & 8. BUT the instructor will advise with certainty. Always attend lecture!**

Topics & Schedule Updates by Week	Assignment Schedule
• Lab Friday Mar. 19. Preparation for UNIT 5 assignment, e.g. attend lab, download & work practice assignment & solutions. Prepare notes you might need. **Week 10:** Mar. 22-26 • Lectures as regularly scheduled. Continuing with volumes and integration. Readings and homework posted online. • Lab Friday Mar. 26. Preparation for UNIT 5 assignment, e.g. attend lab, download & work practice assignment & solutions. Prepare notes you might need.	
Week 11: Mar. 29 – Apr. 1 • MW Lectures as regularly scheduled. Multivariate limits, continuity and partial derivatives. Readings and homework posted online. • No lecture Apr. 2. No lab Apr. 2. * HOLIDAY * on Friday Apr. 2 (Good Friday) **Week 12:** Apr. 5-9 • Lectures as regularly scheduled. Continuing multivariate. Total differential, tangent planes, higher order partial derivatives and maybe Taylor series. Readings and homework posted online. • Lab Friday Apr. 9. Preparation for UNIT 5 assignment, e.g. attend lab, download & work practice assignment & solutions. Prepare notes you might need.	
Monday April 12: (running a Friday schedule to make-up for the April 2 holiday) • No lecture. No lab.	**SUNDAY April 11 through MONDAY APRIL 12: Online UNIT 5 Assignment (28%). Usually covers all material from weeks 9, 10, 11 & 12. BUT the instructor will advise with certainty. Always attend lecture!**