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UNIVERSITY OF CALGARY
FACULTY OF SCIENCE
DEPARTMENT OF GEOSCIENCE
COURSE OUTLINE

1. **Course:** GOPH 619, Advanced Computational Methods for Geophysicists -- Winter 2018

   Lecture 01: (MWF, 16:00-16:50 in ST064)

Instructor Name	Email	Phone	Office	Hours
Brandon Karchewski	brandon.karchewski@ucalgary.ca	403-220-6678	ES 108	By appt

   Lab Schedule:
   B01:   W 17:00-19:50, ES 924

   Course Site:

   D2L: GOPH 419 (619) L01 - Winter 2018 - (Advanced) Computational Methods for Geophysicists

   Department of Geoscience: ES 118, 403 220-5841, geoscience@ucalgary.ca

   Students must use their U of C account for all course correspondence.

   Teaching Assistant:
   Katherine Biegel, E: katherine.biegel@ucalgary.ca

2. **Prerequisites:**

   See section 3.5.C in the Faculty of Science section of the online Calendar.

   Consent of the Department.
   Credit for Geophysics 619 and any of Geophysics 419, 599.09, or 699.09 will not be allowed.

3. **Grading:**

   The University policy on grading and related matters is described in F.1 and F.2 of the online University Calendar. In determining the overall grade in the course the following weights will be used:

Component(s)	Weighting %
iRAT/tRAT Quizzes*	20% (15%)
Lab Assignments/Reports*	25% (15%)
Term Project**	--- (20%)
Midterm Exam	25% (20%)
Final Exam**	30% (30%)

   Weights are given for GOPH 419 and for GOPH 619. The latter are indicated in parentheses. Note that the term project must only be completed by students registered in GOPH 619.
   *Lowest mark will be dropped in assessing these grade components
   **Students must achieve a minimum of 50% on the term project and/or final exam to obtain a passing grade.

   Each piece of work (reports, assignments, quizzes, midterm exam(s) or final examination) submitted by the student will be assigned a grade. The student's grade for each component listed above will be combined with the indicated weights to produce an overall percentage for the course, which will be used to determine the course letter grade.

   The conversion between a percentage grade and letter grade is as follows;

Letter Grade	A+	A	A-	B+	B	B-	C+	C	C-	D+	D
Minimum Percent Required	95	90	85	80	75	70	67	63	60	55	50

   Format of the course:

Lectures: The course will involve three (3) weekly lecture periods (3 hours), where the instructor will lead the students through a discussion of the topic for that week. The instructor will post the material for that week at least one week prior. Students are expected to review this content prior to the lectures.

Labs: There will be one (1) weekly lab period (3 hours). In the computer labs, you will complete assignments in which you will implement a numerical solution to a geophysics application problem in Matlab. There will be a total of four (4) lab assignments and you will have 2-3 lab periods to complete each assignment. Your submission of these assignments will include both the code that you used to generate your solution and a brief scientific report summarizing the background theory, methods, results and conclusions of the assignment. You can complete these assignments on your own or in pairs at your discretion. In assessing your lab assignment grade, the lowest mark will be dropped.

Quizzes: The lab periods will also involve a team-based learning activity centred on a pair of Readiness Assurance Tests, one individual quiz (iRAT) and one team quiz (tRAT). The content of the quiz will draw from the content from the previous module. The iRAT will be completed individually at the beginning of the lab period and should take approximately 30 minutes. The tRAT will be the same quiz, but you will be able to discuss the questions with a team of your peers. The tRAT should also take approximately 30 minutes.

The teams will be organized at the beginning of the term by your instructor based on the results of a self-scored questionnaire on your level of background knowledge and practical experience relevant to the course content, as well as your attitude toward working in teams.

Term Project (for GOPH 619 students only): To obtain graduate credit for the course, you will be required to complete an additional term project that will draw on your knowledge of the entire course content to solve a substantial problem in computational geophysics and present your results in a scientific report. You are encouraged to select a topic based on your own interests, subject to instructor approval. You are also encouraged to discuss the topic with your graduate advisor, as it is likely possible to align this project with the research goals of your thesis. The project will be due at the end of the term, but you will have the opportunity to discuss your progress with the instructor throughout the term. The format of the report will be posted on D2L.

4. **Missed Components of Term Work:**

The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in Section 3.6. It is the student's responsibility to familiarize himself/herself with these regulations. See also Section E.3 of the University Calendar

5. **Scheduled out-of-class activities:**

There are no out-of-class activities scheduled for this course.

REGULARLY SCHEDULED CLASSES HAVE PRECEDENCE OVER ANY OUT-OF-CLASS-TIME-ACTIVITY. If you have a conflict with the out-of-class-time-activity, please contact your course coordinator/instructor no later than **14 days prior** to the date of the out-of-class activity so that alternative arrangements may be made.

6. **Course Materials:**

Optional Textbook(s):

S. Chapra and R. Canale. (2014)., Numerical Methods for Engineers, 7th ed, New York: McGraw-Hill

This text will be the reference for the content of this course, and it is recommended, but not required. The instructor will post supplemental notes on D2L (https://d2l.ucalgary.ca/login.asp). You will be expected to stay up-to-date with the online content of the course on a weekly basis.

For in-class quizzes and term tests, you may use course notes, online reference and any calculator (including Matlab or Excel). You can obtain a student license for Matlab for your personal computer by visiting the University of Calgary IT Software Distribution website (https://iac01.ucalgary.ca/SDSWeb/) and following the instructions provided.

7. **Examination Policy:**

The midterm and final exams will be open book, open notes and you will be allowed to use a lab computer or a personal laptop. Internet access will be allowed, but verbal, written or electronic communication is not allowed during the exam. Students should also read the Calendar, Section G, on Examinations.

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8. **Approved Mandatory and Optional Course Supplemental Fees:**

There are no mandatory or optional course supplemental fees for this course

9. **Writing across the Curriculum Statement:**

For all components of the course, in any written work, the quality of the student's writing (language, spelling, grammar, presentation etc.) can be a factor in the evaluation of those reports. See also Section E.2 of the University Calendar.

In this course, the quality of the studentâ€™s writing in laboratory reports will be a factor in the evaluation of those reports. See also Section E.2 of the University Calendar.

10. **Human studies statement:**

Students will not participate as subjects or researchers in human studies.

11. **Reappraisal of Grades:**

A student wishing a reappraisal, should first attempt to review the graded work with the Course coordinator/instructor or department offering the course. Students with sufficient academic grounds may request a reappraisal. Non-academic grounds are not relevant for grade reappraisals. Students should be aware that the grade being reappraised may be raised, lowered or remain the same. See Section I.3 of the University Calendar.

1. **Term Work:** The student should present their rationale as effectively and as fully as possible to the Course coordinator/instructor within **15 days** of either being notified about the mark, or of the item's return to the class. If the student is not satisfied with the outcome, the student shall immediately submit the Reappraisal of Graded Term work form to the department in which the course is offered. The department will arrange for a re-assessment of the work if, and only if, the student has sufficient academic grounds. See sections I.1 and I.2 of the University Calendar

2. **Final Exam:** The student shall submit the request to Enrolment Services. See Section I.3 of the University Calendar.

12. **OTHER IMPORTANT INFORMATION FOR STUDENTS:**

a. **Misconduct:** Academic misconduct (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under Section K. Student Misconduct to inform yourself of definitions, processes and penalties. Examples of academic misconduct may include: submitting or presenting work as if it were the student's own work when it is not; submitting or presenting work in one course which has also been submitted in another course without the instructor's permission; collaborating in whole or in part without prior agreement of the instructor; borrowing experimental values from others without the instructor's approval; falsification/ fabrication of experimental values in a report. **These are only examples**.

b. **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on assembly points.

c. **Academic Accommodation Policy:** Students needing an accommodation because of a disability or medical condition should contact Student Accessibility Services in accordance with the procedure for accommodations for students with disabilities available at procedure-for-accomodations-for-students-with-disabilities_0.pdf.

Students needing an accommodation in relation to their coursework or to fulfill requirements for a graduate degree, based on a protected ground other than disability, should communicate this need, preferably in writing, to the Sr. Instructor of the Department of Geoscience, Dr. Rudi Meyer by email rmeyer@ucalgary.ca or phone 403-210-7848. Religious accommodation requests relating to class, test or exam scheduling or absences must be submitted no later t h a n **14 days** prior to the date in question: http://www.ucalgary.ca/pubs/calendar/current/e-4.html

d. **Safewalk:** Campus Security will escort individuals day or night (www.ucalgary.ca/security/safewalk/) . Call 403-220-5333 for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.

e. **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). Students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information, see also www.ucalgary.ca/legalservices/foip.

f. **Student Union Information:** VP Academic, Phone: 403-220-3911 Email: suvpaca@ucalgary.ca. SU Faculty Rep., Phone: 403-220-3913 Email: sciencerep@su.ucalgary.ca. Student Ombudsman, Email: suvpaca@ucalgary.ca.

g. **Internet and Electronic Device Information:** Unless instructed otherwise, cell phones should be turned

off during class. All communication with other individuals via laptop, tablet, smart phone or other device is prohibited during class unless specifically permitted by the instructor. Students that violate this policy may be asked to leave the classroom. Repeated violations may result in a charge of misconduct.

h. **Surveys:** At the University of Calgary, feedback through the Universal Student Ratings of Instruction (USRI) survey and the Faculty of Science Teaching Feedback form provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses. Your responses make a difference - please participate in these surveys.

i. **SU Wellness Center:** The Students Union Wellness Centre provides health and wellness support for students including information and counselling on physical health, mental health and nutrition. For more information, see www.ucalgary.ca/wellnesscentre or call 403-210-9355.

Calendar Description:
Topics in numerical analysis emphasizing geophysics applications. Topics will include error analysis, Taylor series, root finding algorithms, linear system solver algorithms, LU decomposition, curve fitting, numerical differentiation and integration, numerical solution of ODEs, introduction to PDE solvers.

Learning Objectives:
By the end of this course, students should be able to:

1. ***Explain*** and ***implement*** numerical solution algorithms to some of the most fundamental problems in applied mathematics (root finding, solution of linear systems, numerical integration, solution of ODEs/PDEs), applied within a geophysics context.
2. ***Perform*** error analyses of approximate numerical solutions and ***discuss*** whether the solutions are acceptable.
3. ***Explain*** the advantages and limitations of the numerical techniques examined in the course.
4. ***Distinguish*** between and ***select*** the most applicable of available numerical techniques for an analysis task in geophysics.
5. ***Use*** software packages (spreadsheet tools such as MS Excel and programming languages such as Matlab) to compute numerical solutions.
6. ***Communicate*** the results of numerical analysis to peers in the scientific community and ***critically evaluate*** the work of peers.

Department Approval: Electronically Approved   **Date:** 2017-12-22 19:32