



COURSE OUTLINE

1. **Course:** GOPH 517, Time Series Analysis and 1D Data Processing - Fall 2019

Lecture 01: MWF 09:00 - 09:50 in TI STUDIOC

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

Teaching Assistant:

Sarah Reid, *Email:* reism@ucalgary.ca

Course Site:

D2L: GOPH 517 L01-(Fall 2019)-Time Series Analysis and 1D Data Processing

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

2. **Requisites:**

See section [3.5.C](#) in the Faculty of Science section of the online Calendar.

Prerequisite(s):

Geophysics 355, Mathematics 211 and 415.

Calendar Description:

Analysis of geophysical time series, especially real and synthetic seismic signals, is introduced using theoretical concepts and their practical application in a computational lab using commercial computational software.

Course Learning Objectives:

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

1. **Explain the concepts and equations** associated with continuous and discrete geophysical signals and time series analysis (e.g. convolution, correlation, Fourier transforms, frequency spectra, Nyquist frequency, sampling, aliasing, frequency filters, minimum-phase wavelets, inverse filters, deconvolution)
2. **Calculate results** using appropriate equations associated with 1D discrete and continuous signals.
3. **Use the equations and formulae** from basic time series analysis and 1D data processing, and the related mathematics, to solve problems and derive other equations and formulae.
4. **Implement computer programs** and **use commercial mathematical and computational software** to perform the calculations associated with CLOs 1 and 2 above.
5. **Communicate** the results of 1D data processing to peers in the geophysics/scientific community and **critically evaluate** the work of peers.

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 %	Date
Quizzes	15%	See Schedule, in lab
Lab Assignments/Reports	25%	See Schedule, to D2L dropbox
Midterm Exam	25%	Tue Oct 29, in lab
Final Exam	35%	Schedule by Registrar

The course is divided into 7 modules or topics (see course schedule on D2L). Each module will consist of two to three lectures introducing the module content, one class period for completing practice problems and one quiz. The quiz will take place during the lab period and will have two parts: one completed individually and one completed with a team. This modular format is designed to give students appropriate background and practice with each of the course topics. There will also be three (3) lab assignments (approx. every 2-3 modules), which will include significant computation and a written report. The lab assignment topics will be as follows: 1) Wave propagation, convolution and synthetic seismograms, 2) Fourier transforms, frequency spectra and filtering and 3) Correlation, minimum phase, attenuation and deconvolution. The lab periods will provide an opportunity for students to work on the lab assignments and reports, collaborate with peers and discuss difficulties with TAs.

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.

	A+	A	A-	B+	B	B-	C+	C	C-	D+	D
Minimum % Required	95 %	90 %	85 %	80%	75%	70 %	65 %	62%	60%	55 %	50 %

This course has a registrar scheduled final exam.

4. Missed Components Of Term Work:

In the event that a student misses the midterm or any course work due to illness, supporting documentation, such as a medical note or a statutory declaration will be required (see [Section M.1](#); for more information regarding the use of statutory declaration/medical notes, see [FAQ](#)). Absences must be reported within 48 hrs.

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 themselves with these regulations. See also [Section E.3](#) of the University Calendar.

5. Scheduled Out-of-Class Activities:

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

6. Course Materials:

Recommended Textbook(s):

W.M. Telford, L.P. Geldart, R.E. Sheriff, *Applied Geophysics, 2nd Ed*: Cambridge University Press, 1990.

The course D2L site will contain all of the handouts for labs, as well as other resource material. In addition to course notes provided by the instructor, the following text and course notes are available on the CREWES website (<https://www.crewes.org/ResearchLinks/FreeSoftware/>) as supplementary material:

Margrave, G.F. (2003). *Numerical Methods of Exploration Seismology*, University of Calgary.

Margrave, G.F. (2005). *Methods of Seismic Data Processing*, University of Calgary.

Reading the course D2L page is not a substitute for attendance at lectures. In addition to explanations of the course text/notes, the lecture time will include team-based active learning exercises where students will have the opportunity to practice course material and discuss with their peers and the instructor. There will also be a quiz following each module (see course schedule) held during the lab period. Therefore, attendance at both the lecture and lab periods is critical to success in the course.

7. Examination Policy:

All exams and quizzes are “open book”. During an exam or quiz, you may consult any course materials including notes and previous exams or quizzes *which you have made yourself*. You may not consult exams or quizzes from previous years. You may access the internet during an examination, but may not use email or other forms of communication (written, verbal, electronic) except to communicate with the course instructor or TAs. The use of calculators or computers for computation is encouraged.

Students should also read the Calendar, [Section G](#), on Examinations.

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 the work. See also Section [E.2](#) of the University Calendar.

10. Human Studies Statement:

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

See also [Section E.5](#) of the University Calendar.

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.

- a. **Term Work:** The student should present their rationale as effectively and as fully as possible to the Course coordinator/instructor within **10 business 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
- b. **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. **Mental Health** The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre, [Mental Health Services Website](#)) and the Campus Mental Health Strategy website ([Mental Health](#)).
- b. **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](tel:403-210-9355).
- c. **Sexual Violence:** The University of Calgary is committed to fostering a safe, productive learning environment. The Sexual Violence Policy (<https://www.ucalgary.ca/policies/files/policies/sexual-violence-policy.pdf>) is a fundamental element in creating and sustaining a safer campus environment for all community members. We understand that sexual violence can undermine students' academic success and we encourage students who have experienced some form of sexual misconduct to talk to someone about their experience, so they can get the support they need. The Sexual Violence Support Advocate, Carla Bertsch, can provide confidential support and information regarding sexual violence to all members of the university community. Carla can be reached by email (svsa@ucalgary.ca) or phone at [403-220-2208](tel:403-220-2208).
- d. **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.**

- e. **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on [assembly points](#).
- f. **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-accommodations-for-students-with-disabilities.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 than **14 days** prior to the date in question. See [Section E.4](#) of the University Calendar.
- g. **Safewalk:** Campus Security will escort individuals day or night (See the [Campus Safewalk](#) website). Call [403-220-5333](tel:403-220-5333) for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.
- h. **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 [Legal Services](#) website.
- i. **Student Union Information:** [VP Academic](#), Phone: [403-220-3911](tel:403-220-3911) Email: suvpaca@ucalgary.ca. SU Faculty Rep., Phone: [403-220-3913](tel:403-220-3913) Email: sciencerep@su.ucalgary.ca. [Student Ombudsman](#), Email: ombuds@ucalgary.ca.
- j. **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.
- k. **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.
- l. **Copyright of Course Materials:** All course materials (including those posted on the course D2L site, a course website, or used in any teaching activity such as (but not limited to) examinations, quizzes, assignments, laboratory manuals, lecture slides or lecture materials and other course notes) are protected by law. These materials are for the sole use of students registered in this course and must not be redistributed. Sharing these materials with anyone else would be a breach of the terms and conditions governing student access to D2L, as well as a violation of the copyright in these materials, and may be pursued as a case of student academic or [non-academic misconduct](#), in addition to any other remedies available at law.

Course Outcomes:

- Explain the various concepts and equations associated with continuous and discrete geophysical signals and time series analysis, e.g., convolution, correlation, the convolutional model of a seismic trace, Fourier transforms and frequency spectra, Z-transforms, the Nyquist frequency, sampling, aliasing, frequency filters, minimum-phase wavelets, inverse filters, deconvolution, predictive deconvolution, least-squares filters, and the discrete linear inverse method
- Mathematically calculate various quantities associated with 1D discrete and continuous signals, such as Fourier transforms, convolutions, correlations, Z-transforms, and filter components.
- Use the equations and formulas from basic time series analysis and 1D data processing, and the related mathematics, to solve problems and derive other equations and formulas.

- Write computer programs and use commercial mathematical and computational software to calculate various quantities, such as Fast Fourier transforms, convolutions, correlations, filter components, 1D synthetic seismograms from well logs, deconvolutions, and to solve problems in time series analysis and 1D geophysical data processing.

Department Approval:

Electronically Approved

Date: 2019-08-26 12:09