UNIVERSITY OF CALGARY

DEPARTMENT OF GEOSCIENCE
COURSE OUTLINE
FALL 2016

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

   Lecture Sections:

   L01: MoWeFr, 09:00-09:50, SB 142

   For a listing of all lab sections corresponding with this course, please see the following link:
   http://geoscience.ucalgary.ca/geoscience_info/courses/f16

   Instructor: Dr. B. Karchewski, *Office:* ES 108, *Ph:* 403-220-6678, Brandon.karchewski@ucalgary.ca,
   Office Hours: Email for appointment, or drop-in when office door is open ☺

   Teaching Assistants:
   Tyler Spackman, *Email:* TBA, *Office Hours:* TBA
   Matthew Eaid, *Email:* mveaid@ucalgary.ca, *Office Hours:* TBA
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   Geoscience Department ES 118, 403-220-5841, geoscience.ucalgary.ca, geoscience@ucalgary.ca

2. **Prerequisites:** Geophysics 355, Mathematics 211, and Applied Mathematics 415. See also Geology Course Descriptions of the University Calendar.

3. **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.

4. **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 sections F.1 and F.2 of the online University Calendar. In determining the overall grade in the course the following weights will be used:

Grade Component	Weight
iRAT/tRAT Quizzes (approx. 8-9, lowest score dropped)	15%
Lab Assignments/Reports (3)	25%
Midterm Exam – In lab, Tue Nov 1 2016	25%
Final Exam – To be scheduled by the Registrar's office	35%

The course is divided into approximately 8-9 modules or topics (see course schedule at the end of this document). Each module will consist of two lectures introducing the module content, one lecture period for completing practice problems and a set of Readiness Assurance Tests or "RATs". The RAT will have two parts: one completed individually (the iRAT) and one completed with a team (the tRAT). 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, e.g., assignment or exam(s), submitted by a student will be assigned a percentage score. The score for the exam(s) and the average score for the assignments/quizzes will be combined with the weights indicated above to produce an overall percentage for the course, rounded to the nearest integer percentage value. The conversion between course percentage and letter grade is given below.

Letter Grade	GPV	Percent	Letter Grade	GPV	Percent
A+	4.0	95-100	C+	2.3	65-69
A	4.0	90-94	C	2.0	62-64
A-	3.7	85-89	C-	1.7	60-61
B+	3.3	80-84	D+	1.3	55-59
B	3.0	75-79	D	1.0	50-54
B-	2.7	70-74	F	0.0	<50

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.6 of the University Calendar

5. **Course Materials:** 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 lecture period. Therefore, attendance at the lecture periods is critical to success in the course.

6. **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 not access the internet or use email during an examination. The use of calculators or computers for computation is encouraged. Students should also read the Calendar, Section G, on Examinations.

7. **Writing across the curriculum statement** In this course, the quality of the student's writing in laboratory reports will be a factor in the evaluation of those reports. See also Section E.2 of the University Calendar.

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

   (a) **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

   (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 with documentable disabilities are referred to the following links: Students with Disabilities: http://www.ucalgary.ca/pubs/calendar/current/b-1.html and Student Accessibility Services: http://www.ucalgary.ca/access/

   (d) **Safewalk:** Campus Security will escort individuals day or night (http://www.ucalgary.ca/security/safewalk/). Call 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). As one consequence, 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 http://www.ucalgary.ca/secretariat/privacy.

   (f) **Student Union Information:** VP Academic Phone: 403 220-3911 Email: suvpaca@ucalgary.ca
   SU Faculty Rep. Phone: 403 220-3913 Email: science1@su.ucalgary.ca,   science2@su.ucalgary.ca   and

science3@su.ucalgary.ca;
Student Ombuds Office: 403-220-6420 Email: ombuds@ucalgary.ca; http://ucalgary.ca/provost/students/ombuds

(g) **Internet and Electronic Device Information:** You can assume that in all classes that you attend, your cell phone should be turned off unless instructed otherwise. Also, communication with other individuals, via laptop computers, Blackberries or other devices connectable to the Internet is not allowed in class time unless specifically permitted by the instructor. If you violate this policy you may be asked to leave the classroom. Repeated abuse may result in a charge of misconduct.

(h) **U.S.R.I.:** At the University of Calgary, feedback provided by students through the Universal Student Ratings of Instruction (USRI) survey provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses (www.ucalgary.ca/usri). Your responses make a difference – please participate in USRI Surveys.

Department Approval: ORIGINAL SIGNED   Date: September 7, 2016