New Course

Proposal Reference Number : 10340
PRN Alias : 15-16#161
Version No : 3
Submitted By : Dr Yajing Liu
Edited By : Dr Yajing Liu

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	New Data
Program Affected?	Y
Program Change Form Submitted?	N (Simple Change) - This course is added to EPSC complementary courses in a revised version of the Major in Physics and Geophysics (submitted by Physics). In Honours in Planetary Sciences, which include the pre-requisites, it is added as a complementary course. In the Major in Geology, and the Honours in Geology, it must be listed as "specialization" among complementary courses.
Subject/Course/Term	EPSC 520 • one term
Credit Weight or CEU's	3 credits
Course Activities	Schedule Type: A - Lecture; Hours per week: 3 Total Hours per Week : 3 Total Number of Weeks : 13
Course Title	Official Course Title : Earthquake Physics and Geology Course Title in Calendar :
Rationale	This course provides an advanced understanding of earthquake processes beyond the basics presented in EPSC 320 Elementary Earth Physics and EPSC 435 Applied Geophysics. The introduction to earthquake theory and seismic data analysis has applications in exploration for fossil fuels as well as seismic hazard assessment, and prepares students for graduate level research. Team teaching by a geophysicist and a geologist offers complementary perspectives and expertise in the field.
Responsible Instructor	Yajing Liu
Course Description	What are earthquakes and how do we study them? Fundamental mechanics of faulting and earthquake source processes are explored from theoretical and observational perspectives. The lectures cover concepts of earthquake source mechanism, including seismic waves, earthquake energy budget, fracture and friction mechanics, earthquake cycle deformation, earthquake triggering and prediction, and seismic hazards. This is complemented by in-class discussion on recent major discoveries and challenges in the field. Students learn to investigate earthquake source process by using seismic, geodetic and geological data in computer labs and course projects supervised by the instructor(s).
Teaching Dept.	0289 : Earth & Planetary Sciences
Administering Faculty/Unit	SC : Faculty of Science

Prerequisites	EPSC320 Elementary Earth Physics and MATH222 Calculus 3 or their equivalents Web Registration Blocked? : N
Corequisites	
Restrictions	None
Supplementary Calendar Info	
Additional Course Charges	
Campus	Downtown
Projected Enrollment	10
Requires Resources Not Currently Available	N
Explanation for Required Resources	
Required Text/Resources Sent To Library?	
Library Consulted About Availability of Resources?	
Consultation Reports Attached?	
Effective Term of Implementation	201701
File Attachments	• EPSC_550_455_201301_Text_Report.pdf View • EPSC_550_455_201501_Text_Report.pdf View • EPSC520_Syllabus_v3.pdf View
To be completed by the Faculty	
For Continuing Studies Use	

Approvals Summary

Show all comments

Version No.	Departmental Curriculum Committee	Departmental Meeting	Departmental Chair	Other Faculty	Curric/Academic Committee	Faculty	SCTP	Version Status
3								Submitted to Curriculum/Academic Committee for approval Edited by: Yajing Liu on: Oct 21 2015
2								Submitted to Curriculum/Academic Committee for approval Edited by: Yajing Liu on: Oct 19 2015
1								Submitted to Curriculum/Academic Committee for approval Created on: Oct 14 2015

M C G I L L U N I V E R S I T Y C O U R S E E V A L U A T I O N

End-of-course evaluations results, as one indicator of teaching effectiveness, are used to:

a. to help instructors improve future offerings of courses;
b. to inform students about courses and instructors;
c. as a component of the teaching dossier; and
d. to help administrators and faculty committees in their decision-making processes.

Written comments are treated as confidential and are not made available to the McGill community.

The course ratings reported here are only one indicator of teaching effectiveness and these results should be treated with caution since they represent reports on only one particular course.

COURSE: EPSC550 001 : Selected Topics 1
TERM CODE: 201301 MERCURY
INSTRUCTOR: Christen Danielle Rowe; Dr Yajing Liu
COMPLETED EVALUATIONS / TOTAL REGISTERED : 7 / 8 = 87.5%

The departmental means are calculated from the Earth and Planetary Sciences - Multiple Instructors questionnaire.

SUMMARY OF EVALUATION RESULTS

QUEST-NO.	VALID REPLIES	RESPONSE BREAKDOWN						PERCENT BREAKDOWN						MEAN	STD DEV	DEPT MEAN	DEPT COURSE MEAN	FIRST LINE OF QUESTION TEXT
		1	2	3	4	5	N/A	1	2	3	4	5	N/A					
Q001	7	1			2	4		14			29	57		4.1	1.5	4.2	4.1	OVERALL, THIS IS AN EXCELLENT COURSE.
Q002	7	1			2	4		14			29	57		4.1	1.5	4.4	4.3	OVERALL, I LEARNED A GREAT DEAL FROM THIS COURSE.
Q010	7	1			3	3		14			43	43		4.0	1.4	4.1	4.1	Y.L. : OVERALL, THIS INSTRUCTOR IS AN EXCELLENT TEACHER.
Q011	7	1			3	3		14			43	43		4.0	1.4	4.1	4.0	Y.L. : OVERALL, I LEARNED A GREAT DEAL FROM THIS INSTRUCTOR.
Q012	7	1			2	4		14			29	57		4.1	1.5	3.9	3.8	Y.L. : THE INSTRUCTOR S LECTURES WERE WELL-ORGANIZED, AND THE INSTRUCTOR S PACE OF LECTU
Q013	7	1		1	3	2		14		14	43	29		3.7	1.4	4.0	3.8	Y.L. : THE INSTRUCTOR S EXPLANATIONS WERE CLEAR AND UNDERSTANDABLE.
Q014	7	1			3	3		14			43	43		4.0	1.4	4.2	4.2	Y.L. : THE INSTRUCTOR COMMUNICATED HIS/HER ENTHUSIASM TO THE CLASS.
Q015	7	1			2	4		14			29	57		4.1	1.5	4.2	4.2	Y.L. : THE INSTRUCTOR PROVIDED ADEQUATE OPPORTUNITY FOR QUESTIONS AND DISCUSSION.
Q016	7	1			4	2		14			57	29		3.9	1.3	3.8	3.7	Y.L. : THE INSTRUCTOR GRADED STUDENT WORK PROMPTLY, CONSIDERING THE SIZE OF THE CLASS, A
Q017	7	1	1	1	2	2		14	14	14	29	29		3.4	1.5	3.8	3.7	THE EVALUATION METHODS APPROPRIATELY REFLECTED THE IMPORTANT ASPECTS OF THE COURSE.
Q018	7	1		1	5			14		14	71			3.4	1.1	3.9	3.8	THE ASSIGNMENTS WERE HELPFUL TOWARDS MY UNDERSTANDING OF KEY CONCEPTS.
Q019	7	1	1	1	4			14	14	14	57			3.1	1.2	3.5	3.5	THIS COURSE WAS MORE DIFFICULT THAN MY OTHER COURSES.
Q020	7	1			3	3		14			43	43		4.0	1.4	3.9	3.8	IN THIS COURSE, I FELT MOTIVATED TO LEARN.
Q022	5			1	4					20	80			3.8	0.4	3.5	3.6	THE GRADING OF TESTS, ASSIGNMENTS AND/OR LAB REPORTS WAS FAIR, OF HIGH QUALITY, AND WAS
Q023	5					5							100		0.0	3.8	3.8	THE TA WAS WELL-PREPARED FOR THE LAB SESSIONS. (CHOOSE N/A IF THIS COURSE DID NOT INCLUD
Q024	2			2						100				3.0	0.0	3.2	3.2	THE TA PROVIDED SATISFACTORY ANSWERS TO STUDENTS' QUESTIONS.

7 questions were skipped because they belong to another instructor.

*** DEPT MEAN = Sum of all valid responses for this question in all courses in the department/number of such responses
*** DEPT COURSE MEAN = Sum of the means for this question for all courses in the department/number of courses in the department

M C G I L L U N I V E R S I T Y C O U R S E E V A L U A T I O N

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COURSE: EPSC550 001 : Selected Topics 1
TERM CODE: 201501 MERCURY
INSTRUCTOR: Dr Rebecca Harrington; Dr Yajing Liu
COMPLETED EVALUATIONS / TOTAL REGISTERED : 6 / 8 = 75.0%

The departmental means are calculated from the Earth and Planetary Sciences - Multiple Instructors questionnaire.

SUMMARY OF EVALUATION RESULTS

QUEST-NO.	VALID REPLIES	RESPONSE BREAKDOWN						PERCENT BREAKDOWN						MEAN	STD DEV	DEPT MEAN	DEPT COURSE MEAN	FIRST LINE OF QUESTION TEXT
		1	2	3	4	5	N/A	1	2	3	4	5	N/A					
Q001	6				3	3					50	50		4.5	0.5	3.7	3.9	OVERALL, THIS IS AN EXCELLENT COURSE.
Q002	6				3	3					50	50		4.5	0.5	4.2	4.2	OVERALL, I LEARNED A GREAT DEAL FROM THIS COURSE.
Q010	6				1	5					17	83		4.8	0.4	4.3	4.5	Y.L. : OVERALL, THIS INSTRUCTOR IS AN EXCELLENT TEACHER.
Q011	6				3	3					50	50		4.5	0.5	4.2	4.2	Y.L. : OVERALL, I LEARNED A GREAT DEAL FROM THIS INSTRUCTOR.
Q012	6				3	3					50	50		4.5	0.5	4.1	4.2	Y.L. : THE INSTRUCTOR S LECTURES WERE WELL-ORGANIZED, AND THE INSTRUCTOR S PACE OF LECTU
Q013	6				4	2					67	33		4.3	0.5	4.2	4.2	Y.L. : THE INSTRUCTOR S EXPLANATIONS WERE CLEAR AND UNDERSTANDABLE.
Q014	6				3	3					50	50		4.5	0.5	4.5	4.5	Y.L. : THE INSTRUCTOR COMMUNICATED HIS/HER ENTHUSIASM TO THE CLASS.
Q015	6					6						100		5.0	0.0	4.3	4.6	Y.L. : THE INSTRUCTOR PROVIDED ADEQUATE OPPORTUNITY FOR QUESTIONS AND DISCUSSION.
Q016	6				1	5					17	83		4.8	0.4	4.0	4.2	Y.L. : THE INSTRUCTOR GRADED STUDENT WORK PROMPTLY, CONSIDERING THE SIZE OF THE CLASS, A
Q017	6				3	3					50	50		4.5	0.5	3.7	4.2	THE EVALUATION METHODS APPROPRIATELY REFLECTED THE IMPORTANT ASPECTS OF THE COURSE.
Q018	6				1	5					17	83		4.8	0.4	4.0	4.2	THE ASSIGNMENTS WERE HELPFUL TOWARDS MY UNDERSTANDING OF KEY CONCEPTS.
Q019	6		1	1	3	1			17	17	50	17		3.7	1.0	3.4	3.0	THIS COURSE WAS MORE DIFFICULT THAN MY OTHER COURSES.
Q020	6				4	2					67	33		4.3	0.5	3.8	4.0	IN THIS COURSE, I FELT MOTIVATED TO LEARN.
Q022	5				3	2					60	40		4.4	0.5	3.6	4.0	THE GRADING OF TESTS, ASSIGNMENTS AND/OR LAB REPORTS WAS FAIR, OF HIGH QUALITY, AND WAS
Q023	5					5						100			0.0	3.3	3.6	THE TA WAS WELL-PREPARED FOR THE LAB SESSIONS. (CHOOSE N/A IF THIS COURSE DID NOT INCLUD
Q024	4			3	1					75	25			3.3	0.5	3.6	3.7	THE TA PROVIDED SATISFACTORY ANSWERS TO STUDENTS' QUESTIONS.

7 questions were skipped because they belong to another instructor.

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*** DEPT COURSE MEAN = Sum of the means for this question for all courses in the department/number of courses in the department

Course proposal: **Earthquakes Physics and Geology (EPSC 520)**

Instructor/coordinator: Yajing Liu and Rebecca Harrington (or Christie Rowe)

Description

What are earthquakes and how do we study them? Fundamental mechanics of faulting and earthquake source processes are explored from theoretical and observational perspectives. The lectures cover concepts of earthquake source mechanism, including seismic waves, earthquake energy budget, fracture and friction mechanics, earthquake cycle deformation, earthquake triggering and prediction, and seismic hazards. This is complemented by in-class discussion on recent major discoveries and challenges in the field. Students learn to investigate earthquake source process by using seismic, geodetic and geological data in computer labs and course projects supervised by the instructor(s).

Prerequisites

EPSC 320 Elementary Earth Physics and MATH 233 Calculus 3 or their equivalents

Course website: http://eps.mcgill.ca/~courses/c550 (to be updated with the new course number)

Class meetings

One 3-hour meeting per week, consisting of 2-2.5 hours of lecture and 0.5-1 hours of group discussion on research articles relevant to the lecture topic. See attached *Weekly Schedule.*

Assessment

- Computer laboratory exercises (2 labs, 20% each), 40%
    - Students can work in teams on these computer laboratory exercises, but are required to acknowledge their collaborators in the turned-in assignments.
    - See the attached *Weekly Schedule* for details of each computer lab exercise.
- Presentations (lead discussion of 2 papers, 5% each, term project presentation 10%), Total: 20%
    - Each week 2-3 papers relevant to lecture topics are assigned as reading materials. Student form groups (typically, 2-3 per group; group members can change each week). Each student will lead discussions of 2 papers assigned to their group, and is expected to demonstrate ability to synthesize articles and stimulate discussion with insightful questions. 10%.
    - The end-of-term presentation will be based on the term project conducted by each student. Presentations will be 20 minutes each, plus 10 minutes for questions and discussion, in a similar format to those at scientific meetings and professional conferences. Students will be evaluated upon logical organization, effective communication and ability to address questions and comments from the audience. 10%.
- Term paper: 40%

- In the 1st week, through instructor suggestion and class discussion, a list of potential project ideas will be constructed and circulated among the class.
- Students are required to choose one project from the list and submit, by the end of 2nd week, a one-page proposal to briefly outline the outstanding questions, possible methodology and expected outcome of their projects. Instructors will review the proposals to assess their feasibility, and the students will revise and submit the final version by the end of 4th week.
- The initial version of the term paper, based on the term project, is due by 11th week, before "Student Presentation" week. Instructors will comment on the structure and content of this version and return it to students for revisions.
- The final version of the term paper is due in the 14th week, one week after student presentations.
- The term paper can be based on, but not limited to, the seismic/geodetic techniques learned and results obtained through one of the two computer laboratory exercises. Students are encouraged to conduct original research projects. They are indeed encouraged to discuss with the instructors how to acquire additional data, or conduct more model simulations, beyond those provided in the labs, or to develop their lab reports into term papers. Students are allowed to collaborate in groups, provided the final jointly written paper includes an addendum detailing the contributions of each author.
- The paper will be ~5000 words total (including references, captions, notes, etc. in Word count.), written in the style of a journal article such as Geology or Science with complete and proper citations.

References[1]:

1. Stein, S. and Wysession, M., "An introduction to seismology, earthquakes and earth structure", Wiley-Blackwell Publishing, 2003.
2. Scholz, C. H., "The mechanics of earthquakes and faulting", Cambridge University Press, 2nd edition, 2002.
3. Lay, T. and Wallace, T. C., "Modern global seismology", Vol. 58 in "International geophysics series", ed. by R. Dmowska and J. R. Holton, Academic Press, 1995.
4. Aki, K. and Richards, P. G., "Quantitative seismology", University Science Books, 2nd edition, 2002.
5. Weekly assignment of research articles from journals such as *Nature, Science, Geology, Geophysics Research Letters, Journal of Geophysical Research*.

[1] All reference books are available from Schulich Science and Engineering Library, and research articles are available through McGill eJournal subscription.

Weekly Schedule:

Week	Topics	Practical exercises	Timeline
1	1. Overview of earthquake studies, introduction of potential project topics, student discussion on their interests, examples of student projects from past year; 2. Review of elasticity, elastodynamics		Distribution of potential term project list
2	Introduction to earthquake source characteristics (1) focal mechanism and moment tensors, magnitude and moment, source spectra	Computer Lab Exercise I: (1) Basis seismic waveform processing: filters, convolution, Fourier transform, (2) Use source spectra fitting to calculate source parameters: moment, source dimension, stress drop, of selected earthquakes (e.g., Charlevoix seismic zone, Quebec, and western Canada sedimentary basin).	One-page project proposal due
3	Earthquake source characteristics (2) source parameter scaling, earthquake energy budget, earthquake statistics		
4	Introduction to seismic signal processing (Fourier transform, frequency filters, fitting of the spectra, error analysis)		Final version of proposal due
5	Earthquake rupture: (1) fracture mechanics (stress intensity factors, fracture energy)		
6	Earthquake rupture: (2) fault friction (laboratory experiments, numerical simulations, interpretation of fault slip), dynamic weakening mechanisms and geological signatures		
7	Earthquake cycle deformation (aseismic to seismic slip), brittle-ductile transition, effects of temperature and pressure at depths, interplate and intraplate earthquakes	Computer Lab Exercise II: (1) Geodetic inversion using Plate Boundary Observatory GPS time series, application to slow slip events in Cascadia subduction zone, (2) Earthquake stress transfer calculation using USGS Coulomb stress software.	
8	Observe an earthquake cycle (seismometers, GPS, InSAR, geology)		
9	Fault drilling projects, sedimentary records of earthquakes, paleoseismicity		
10	Triggered and induced earthquakes (remote dynamic triggering, hydraulic fracturing and waste water disposal induced events, reservoir earthquakes)		
11	Special topics: volcanic earthquakes, glacier earthquakes and transient ice sheet deformation, earthquake early warning system.		Term paper version 1 due
12	Student presentations (1)	Term project presentations	
13	Student presentations (2)		
14	Reading/Exam week		Term paper final version due