UNIVERSITY OF CALGARY

DEPARTMENT OF GEOSCIENCE
COURSE OUTLINE

1. **Course:** GLGY 663 & PHYS 663, Applications of Stable Isotopes

   Lecture Sections:

   L01: We, 16:00-17:50, SA 013
   Dr. B. Mayer, Office: ES 506A, Ph. 403-220-5389, bmayer@ucalgary.ca, Office Hours: Wednesday 15:00-15:45 or by appointment

   Course website or Desire 2 Learn (D2L) course name: tbd

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

2. **Prerequisites:** Consent of the Department. See also Geology Course Descriptions of the University Calendar.
   Also known as: (Physics 663)

3. **Grading:** The University policy on grading and related matters is described 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:

Independent Project	**25%**
Assignments	**15%**
Midterm Examination	**25%** (October 15, 2014)
Final Examination	**35%** (To be scheduled by the Registrar)

The Midterm and Final examinations are intended to test for comprehension of the material, not memorization of definitions and formulas. Questions will focus on explaining concepts and/or making simple calculations and/or drawing concepts/diagrams.

A passing grade on the final lab exam is necessary to pass the course as a whole.

The aim of this course is to provide a thorough background in stable isotope hydrology and geochemistry and hence an understanding of the potential and the limitations of the application of stable isotope techniques in Hydrology, Geology, and Environmental Sciences.

This course is accompanied by a lab sessions that will be conducted as an independent project. Topics for independent study projects will be assigned to individual students. Most projects will require several hours of laboratory work in the UofC Isotope Science Laboratory (ES 513). Project results must be summarized in a short report (max. 5 pages) describing objective, methods, results, discussion and conclusions of the study. The final grade for the independent project will be determined based on the written report.

Each piece of work (assignment, independent lab project, midterm test or final examination) submitted by the student will be assigned a percentage score. The student's average percentage score for the various components 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, bearing in mind that an F grade will result if the student does not pass the Final Examination. The conversion between course percentage and letter grade is given below.

Letter Grade	Percent	Letter Grade	Percent
A+	97-100	C+	67-70
A	91-96	C	63-66
A-	86-90	C-	59-62
B+	81-85	D+	55-58
B	76-80	D	50-54
B-	71-75	F	0-49

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:**

There is no textbook, which covers all topics presented in this course. Hence, we will rely mainly on the lecture notes and it is not essential to buy a textbook for this course. However, graduate students with a strong isotope component in their thesis research may want to invest in one of the following excellent books:

For Hydro(geo)logists: **I. Clark & P. Fritz (1997)**: Environmental Isotopes in Hydrogeology. Lewis Publishers, Boca Raton – New York (US$ 75).
For Geologists: **Sharp, Z.** (2007): Stable Isotope Geochemistry. Pearson Prentice Hall, Upper Saddle River NJ (~$100).
For Physicists: **Criss, R. E.** (1999): Principles of Stable Isotope Distribution. Oxford University Press New York (US$ 69).
For Ecologists: **Fry, B.** (2006): Stable Isotope Ecology. Springer, New York ($60)
Some of these books are on reserve in the Gallagher Library throughout the winter term. Other books of potential interest are:

For Hydro(geo)logists:
Mook, W. G. (2000): Environmental Isotopes in the Hydrological Cycle: Principles and Applications. – International Hydrological Programme IHP-V, Technical Documents in Hydrology, No 39 Vol. 1-6: also available on the internet at: http://www.iaea.org/programmes/ripc/ih/volumes/volumes.htm
C. Kendall & J. J. McDonnell (1998): Isotope Tracers in Catchment Hydrology. Elsevier Science BV, ISBN 0-444-50155-X (US$ 80)
Aggarwal, P., Gat, J. & Froehlich, K. F. O. (2005): Isotopes in the Water Cycle: Past, Present & Future of a Developing Science. Springer, Dordrecht, Netherlands.

For Geologists:
Kyser, K. (1987): Short Course in Stable Isotope Geochemistry of Low Temperature Fluids (volume 13). Mineralogical Association of Canada (CDN$ 22).
Valley, J. W. & Cole, D. R. (2001) Stable Isotope Geochemistry. Reviews in Mineralogy & Geochemistry, Volume 43, 662 pages. Mineralogical Society of America, Washington DC. (~$50).

Other books:
J. Hoefs (1997): Stable Isotope Geochemistry (4th completely revised, updated, and enlarged edition). Springer, Berlin (US$ 60).
De Groot, P. A. (2004)**:** Handbook of Stable Isotope Analytical Techniques, Vol. I. Elsevier, Amsterdam (ISBN: 0 444 51114 8).

6. **Examination Policy**: Calculators and rulers are permitted, but no textbooks or course notes. 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: Calendar entry on students with disabilities and Student Accessibility Services.

(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: 220-3911 Email: suvpaca@ucagary.ca.
SU Faculty Rep. Phone: 220-3913 Email: sciencerep@su.ucalgary.ca; Student Ombudsman

(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) 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 5 2014

TENTATIVE SCHEDULE

The topics covered in the course are given in the table below. This is intended as a general guideline and the schedule of topics may change slightly as the course transpires.

Week	Dates	Lecture topic(s)	Lab
1	10 September 2014	Introduction (discussion of course requirements, lecture times, literature, project proposals etc.), Fundamentals, Terminology, Definitions, Isotope Fractionation, Standards, Measurements,	
2	17 September 2014	Introduction to Stable Isotopes in the Hydrological Cycle: Ocean water, precipitation	By appointment
3	24 September 2014	Hydrogen and oxygen isotopes in the water cycle: more precipitation, glaciers	By appointment
4	1 October 2014	Hydrogen and oxygen isotopes in the water cycle: seepage water, groundwater, surface water, etc	By appointment
5	8 October 2014	Oxygen isotopes in the lithosphere & biosphere: application to studying paleoclimate	By appointment
6	15 October 2014	**Midterm Examination**	By appointment
	22 October 2014	**No lecture**	
7	29 October 2014	Carbon isotopes and the global carbon cycle: atmosphere and biosphere	By appointment
8	5 November 2014	Carbon isotopes and the global carbon cycle: hydrosphere and lithosphere (incl. oil, gas)	By appointment
9	12 November 2014	Nitrogen isotopes and the global nitrogen cycle: atmosphere, biosphere, pedosphere, and hydrosphere	By appointment
10	19 November 2014	Sulfur isotopes and the global sulfur cycle: atmosphere, biosphere, pedosphere, lithosphere, and hydrosphere	By appointment
11	26 November 2014	Spare lecture if required	By appointment
12	3 December 2014	Submission of reports	By appointment
	To be scheduled	**Final Examination**	**Scheduled by Registrar**