



UNIVERSITY OF CALGARY  
FACULTY OF SCIENCE  
DEPARTMENT OF GEOSCIENCE  
COURSE OUTLINE  
WINTER 2016

1. **Course:** Geology 607, Advanced Physical Hydrology

Lecture Sections:

L01: Th, 12:30-15:15, SS008

Instructor, Dr. M. Hayashi, Office ES 278, Tel. No. 403-220-2794, e-mail address, [hayashi@ucalgary.ca](mailto:hayashi@ucalgary.ca),

Office Hours: By appointment

Geoscience Department ES 118, 403-220-5841, [geoscience.ucalgary.ca](http://geoscience.ucalgary.ca), [geoscience@ucalgary.ca](mailto:geoscience@ucalgary.ca)

2. **Prerequisites:** Mathematics 253 or 267 or 277 or 283 or Applied Mathematics 219 and Geography 415 and Geology 401. See section 3.5.C in the Faculty of Science section of the online Calendar ([www.ucalgary.ca/pubs/calendar/current/sc-3-5.html](http://www.ucalgary.ca/pubs/calendar/current/sc-3-5.html))

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:

Assignments (5) 100% (20 % each)

Letter Grade/ Percentage conversions

A+ 96 - 100	C+ 66 - 69
A 90 - 95	C 62 - 65
A- 85 - 90	C- 58 - 61
B+ 80 - 84	D+ 54 - 57
B 75 - 79	D 50 - 53
B- 70 - 74	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:** Suggested reading to be announced in the class.

6. **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.

7. **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) **Student Accommodations:** 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 [http://www.ucalgary.ca/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities\\_0.pdf](http://www.ucalgary.ca/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities_0.pdf). Students needing an Accommodation in relation to their coursework or to fulfil requirements for a graduate degree, based on a Protected Ground other than Disability,

should communicate this need, preferably in writing, to the Associate Head of Geoscience, Dr. E.S. Krebs by email [krebs@ucalgary.ca](mailto:krebs@ucalgary.ca) or phone 403-220-5850.

- (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](mailto:suvpaca@ucalgary.ca)  
SU Faculty Rep. Phone: 403 220-3913 Email: [science1@su.ucalgary.ca](mailto:science1@su.ucalgary.ca), [science2@su.ucalgary.ca](mailto:science2@su.ucalgary.ca) and [science3@su.ucalgary.ca](mailto:science3@su.ucalgary.ca);  
Student Ombuds Office: 403-220-6420 Email: [ombuds@ucalgary.ca](mailto: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](http://www.ucalgary.ca/usri)). Your responses make a difference – please participate in USRI Surveys.

Department Approval: ORIGINAL SIGNED

Date: December 18, 2015

Associate Dean's Approval for  
Alternate final examination arrangements: ORIGINAL SIGNED

Date: December 22, 2015

## GLGY 607    ADVANCED PHYSICAL HYDROLOGY

**Instructor:** Masaki Hayashi (ES278, 220-2794, [hayashi@ucalgary.ca](mailto:hayashi@ucalgary.ca))

**Class time:** Thursday 12:30-15:15

**Class room:** SS008

**Grading:** There will be five homework assignments, weighted 20 % each. No exams.

**Textbooks** (available in Gallagher Library Reserve):

- (1) Jury, W.A. and Horton, R., 2004. *Soil physics*, 6<sup>th</sup> edition. John Wiley & Sons.
- (2) Brutsaert, W., 2005. *Hydrology: an introduction*. Cambridge University Press.
- (3) Dingman, S.L., 2002. *Physical hydrology*, 2<sup>nd</sup> edition. Prentice Hall.
- (4) McCuen, R.H., 2005. *Hydrologic analysis and design*, 3<sup>rd</sup> edition. Pearson Education.

**Supplementary reading:**

- Please acquire a good textbook on applied differential equations.
- Relevant journal papers will be assigned every week for enhanced study.

**Computer software:**

MATLAB will be used throughout the course. It is installed on all computers in Geoscience Computer Labs (ES 254 and 924), and a student version is also available from Micro Store. A freeware version of MATLAB is available as FreeMat (<http://freemat.sourceforge.net/>). All homework assignments can be done using FreeMat.

**Weekly contents** (tentative)

Jan. 14: Watershed as a leaky reservoir (Dingman, p.389-406, 435-440; McCuen, p.520-561)

Hydrograph analysis, linear reservoir theory, linear ordinary differential equations (ODE), unit hydrograph approach, convolution integral.

Jan. 21-Feb. 4: Vadose zone hydrology (Jury and Horton, p.37-147)

Water retention characteristics, soil water potential, hydraulics of soil water, Richards equation, Green-Ampt infiltration, Philip infiltration, numerical solution of non-linear partial differential equations (PDE).

Feb. 11, 25: Soil heat transfer (Jury and Horton, p.176-200)

Soil thermal property, heat conduction, linear PDE, Fourier transform, complex variables

Mar. 3-24: Evapotranspiration (Brutsaert, p.23-72, 117-151)

Energy balance, aerodynamic resistance and mass transfer approach, Penman-Monteith equation and canopy resistance, eddy covariance method, stochastic processes.

Mar.31-Apr.7: Hillslope hydrology (Dingman, p. 407-424; Brutsaert, p.366-431)

Conceptual runoff processes, Dupuit approximation and Boussinesq equation, baseflow recession analysis.

Week 13 (to be scheduled): Watershed hydrology (Brutsaert, p.465-493)

Semi-distributed model, distributed model, model parameterization and up-scaling