



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

1. **Course:** Geology 698, Reservoir Characterization for Field Development

Lecture Sections:

L01: TuTh, 21:00-23:45, EEEL 127

Instructor, K. Johnston, Office END 204C, e-mail address, johnstka@ucalgary.ca,

Office Hours: Tues Thu 1300 – 1400 hrs

Instructor, Dr. C. Clarkson, Office ES 254A, Tel. No. 403-220-6445, email address, clarksoc@ucalgary.ca,

Office Hours: Wed Fri, 10:00-11:00 hrs

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

2. **Prerequisites:** Chemical Engineering 621, Geology 697 or Chemical Engineering 661, and Human Resources and Organizational Dynamics 789 or equivalent. 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)

Note: This course is intended for graduate students in the Master of Engineering with Reservoir Characterization Specialization.

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:

Weekly presentations	70%
Oral Final Examination	30%

Notes: Each component must be passed to pass the course.

Each piece of work (weekly presentations and final examination) submitted by the student will be assigned a percentage score. The student's average percentage score for the components listed above will be combined with the indicated weights to produce an overall percentage for the course. Conversion from a score out of 100 to a letter grade will be done using a scale determined after the final examination has been marked. This allows the creation of a scale appropriate to the relative difficulty or easiness of the term's work and the final exam. The scale provided below is for guidance only - instructors may shift the numerical cut-off levels as appropriate.

Letter Grade	Percent	Letter Grade	Percent
A+	95-100	C+	64-67
A	89-94	C	60-63
A-	84-88	C-	56-59
B+	78-83	D+	53-55
B	73-77	D	50-52
B-	68-72	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. **Examination Policy:**

The following examination will be held in this course:

- Individual oral exam (~2 hours, date TBA) covering reservoir characterization procedures and all aspects of the work done by the team to characterize the field studied.
- The exam will be assessing the individual for the following:

- i. Detailed, in-depth understanding in one area (geology, geophysics, petrophysics, reservoir engineering) and its importance to the other areas
- ii. Detailed understanding of another area and its importance
- iii. Overview understanding of the other two areas and their importance

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

6. 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. 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 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
 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: January 5, 2016

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

Date: January 6, 2016

Additional Course Information:

Each student is a member of a team. Each team is assigned a field with the objective of developing a model which will accurately predict reserves and production performance on a well or sector basis. Each field is unique in terms of its characteristics, data, and flow process. One field may require considerable resources to develop the geological model, while another field may need more effort in obtaining a history match. Consequently, evaluation will focus primarily on the processes employed and their quality to achieve a result, rather than the result itself. Teams will be evaluated on the processes employed and results achieved to produce the following models:

1. Geologic description and interpretation
 - a. core review and description
 - b. facies description and distribution
 - c. interpretation of depositional environment
 - d. identification of major uncertainties
2. Reservoir characterization
 - a. review and interpret routine core data
 - b. gather additional data (time/lab permitting)
 - c. petrophysical log interpretation and calibration to core
 - d. seismic/microseismic interpretation (pending data availability)
 - e. production data analysis
3. Static model and uncertainties
 - a. create 3-D geocellular model using petrophysical, geophysical, and geological data
 - b. generate static property distributions
 - c. generate dynamic property distributions
4. Simulation (flow) model and uncertainties
 - a. Single-well (as appropriate)
 - i. construct single-well models (vertical and horizontal)
 - ii. initialize
 - iii. incorporate dynamic (flowing and pressure) data
 - iv. perform history-match
 - v. generate forecast
 - b. Field model (as appropriate)
 - i. initialize model using geological model from step 3
 - ii. incorporate dynamic (flowing and pressure) data
 - iii. perform history-match of multiple wells
 - iv. generate forecast
 - v. evaluate interwell connectivity
5. Field development planning. Using models above, construct a development plan including:
 - a. Data acquisition strategy
 - b. Well spacing and architecture
 - c. Completion (cased or openhole) and stimulation method (hydraulic fracture size and spacing)

At the start of the semester a schedule will be established for the team presentation of each of the models or parts thereof. The ongoing work will be graded following each of the corresponding presentations (each week counting as approximately 7% and ultimately adding up to 70% of the course grade). A final exam (30%) will form the remaining part of the evaluation. Each part must be passed in order to receive a passing grade for the class.

An expectation of this course is that **each** student demonstrates mastery of the integrated processes of geology, geophysics, and reservoir engineering, applied to reservoir characterization at each stage of their course project, and that all students contribute equally within their respective team.

TENTATIVE LECTURE SCHEDULE

Teams will be assigned at a meeting during first week of classes in January 2016 – this meeting will be scheduled by the instructor in mid-December 2015. At this first meeting, each team will be assigned a presentation slot that will take place each week during the term for 1.5 hours/slot. There will be a total of 10 presentation slots throughout the term.

The final exam for each will take place during the final two weeks in April 2016.