# Course Outline Form: Fall 2017

## General Information

**Course Code:** ENVS\*6300

**Course Title:** Quantitative Pedology

**Course Description:**

Pedology considers the morphology, survey, geography, characterization and analysis, development, classification, and interpretation of soil. This course focuses on the quantification of pedology, employing modern digital instrumentation, computational capacity and analytical strategies. Students explore how such multi-scale, spatial-temporal information is used in critical zone modeling.

**Credit Weight:** 0.50

**Academic Department:** School of Environmental Sciences

**Campus:** Guelph

**Semester Offering:** F17

**Class Schedule and Location:** TTh 15:30 to 17:00, ALEX 339

## Instructor Information

**Instructor Name:** Dr. Richard J Heck, P.Ag.

**Instructor Email:** rheck@uoguelph.ca

**Instructor Phone and Extension:** 519-824-4120, ext. 52450

**Office Location and Office Hours:** Rm 140, Alexander Hall. By appointment.

## Course Content

**Specific Learning Outcomes (at the end of this course successful students will be able to):**

|  |  |
| --- | --- |
| Course Learning Outcomes | U of G Graduate Learning Outcomes Met |
| 1) Summarize the various facets of pedology | Critical and Creative Thinking; Literacy; Global Understanding |
| 2) Differentiate among types of pedological data, considering the permissible manipulations and analysis | Critical and Creative Thinking; Literacy |
| 3) Provide examples of the challenges associated with quantifying soilscapes and pedofeatures | Critical and Creative Thinking; Literacy; Global Understanding |
| 4) Generate and interpret morphometric parameters of landforms and soils | Critical and Creative Thinking; Literacy; Global Understanding |
| 5) Identify and use appropriate techniques for the interpretation of spatial soil data | Critical and Creative Thinking; Literacy; Global Understanding |
| 6) Apply and interpret common technical classifications of soils and land | Critical and Creative Thinking; Literacy; Global Understanding |
| 7) Access and properly use web-based soil information | Critical and Creative Thinking; Literacy; Global Understanding |
| 8) Identify and interpret original research and review papers, on quantitative pedology, as they apply to select issues in the critical zone | Critical and Creative Thinking; Literacy; Global Understanding; Communicating; Professional and Ethical Behaviour |

**Approximate Schedule of Lectures:**

|  |  |  |
| --- | --- | --- |
| **Date** | **Topic** | **Evaluation** |
| 1 Soil & Pedology | | |
| Sep 12 | 1.1 Soil as a Spatial-Temporal Phenomena  *e.g. Lin 2011 SSSAJ 75: 2049–2070* | Review recent article #1 |
| Sep 14 | 1.2 The Nature & Evolution of Pedology  *e.g. Brevik et al 2016 Geoderma 264B: 256-274* | Review recent article #2 |
| 2 Measurement Theory Applied to Pedology | | |
| Sep 19 | 2.1 Levels of Measurements  *e.g. Chrisman 1998 Cart. & Geographic Information Systems 25:231-242* | In-class Exercise #1 |
| Sep 21 | 2.2 Accuracy/Precision & Error Propagation  *e.g. van Reeuwijk 1998. Guidelines for quality management in soil and plant laboratories. FAO Soils Bulletin 74* | Assignment #1 |
| 3 Quantifying Soil Morphology | | |
| Sep 26 | 3.1 Conventional Pedon Characterization  *e.g. Schoeneberger et al 2012 Field book for describing and sampling soils, v3. NRCS-NSSC, Lincoln, NE* | Assignment #2 |
| Sep 28 | 3.2 Soil Micromorphology  *e.g. Kapur et al 2008. New Trends in Soil Micromorphology, Springer* | Assignment #3 |
| Oct 3 | 3.3 Soil Morphometrics  *e.g. Hartemink & Minasny 2014 Geoderma 230-231: 305-317* | Assignment #4 |
| Oct 5 | 3.4 Pedotransfer Functions  *e.g. Ghanbarian et al 2017 Catena 149: 374-380* | Review recent article #3 |
| 4 Quantifying Soil Development | | |
| Oct 12 | 4.1 Profile Development Indices  *e.g. MInasny et al 2016 in ‘Digital Soil Morphometrics’ p.225-240* | Assignment #5 |
| Oct 17 | 4.2 Pedogenic Indices  *e.g. Buggle et al 2011 Quaternary International 240: 12-21* | Assignment #6 |
| Oct 19 | 4.3 Entropy Analysis  *e.g. Quijano & Lin 2014 Entropy 16: 3482-3536* | Review recent article #4 |
| 5 Quantifying Soilscapes | | |
| Oct 24 | 5.1 Conventional Soil Surveys (guidelines & techniques)  *e.g. Mapping System Working Group 1981 A Soil Mapping System for Canada: Revised. LRRI. # 142. Research Branch. Agric. Can.* | Assignment #7 |
| Oct 26 | 5.2 Digital Elevation Models & Landform Segmentation  *e.g. Maynard & Johnson 2014 Geoderma 230-231: 29-40* | Assignment #8 |
| Oct 31 | 5.3 Remote Sensing (spatial, spectral, radiometric & temporal resolution) & Image Analysis (pixel-based vs object-based classification)  *e.g. Mulla 2013 Biosystems Engineering 114: 358–371* | Review recent article #5 |
| Nov 2 | 5.4 Proximal Sensing (contact & non-contact electrical techniques) & Inversion Modelling  *e.g. Dadfar et al 2011 Precision Agriculture 12: 623-638* | Review recent article #6 |
| 6 Multi-scale Analysis of Soil | | |
| Nov 7 | 6.1 Geostatistics (Structure Function & Semivariance, analysis and interpretation)  *e.g. Balaguer-Beser et al 2013 Computers & Geosciences 50: 115-127* | Review recent article #7 |
| Nov 9 | 6.2 Fractal-Multifractal & Wavelet Techniques  *e.g. Morato et al 2017 Geoderma 287: 54-65* | Review recent article #8 |
| Nov 14 | 6.3 Interpolation/Extrapolation of Point Data (deterministic vs stoichastic techniques)  *e.g. Li & Heap 2014 Environemental Modeling & Software 53: 173-189* | In-class Exercise #2 |
| 7 Quantitative Soil Classification | | |
| Nov 16 | 7.1 Conventional Taxonomic Classification (Canadian & International Systems)  *e.g. Micheli et al 2016 Geoderma 264B: 340-349* | Review recent article #9 |
| Nov 21 | 7.2 Numeric Classification  *e.g. Rossiter et al 2017 Geoderma 292:118-127* | Review recent article #10 |
| Nov 23 | 7.3 Technical Classification (Canada Land Inventory & other land evaluation systems)  *e.g. Gasser et al 2016 Can J Soil Sci 96:256-269* | Assignment #9 |
| 8 Soil Information Systems | | |
| Nov 28 | 8.1 CanSIS - Legacy Surveys of Canada & Soil Landscapes of Canada  *sis.agr.gc.ca/cansis/publications/surveys/index.html*  *sis.agr.gc.ca/cansis/nsdb/slc/index.html* | Assignment #10 |
| Nov 30 | 8.2 Global Soil Map & WoSIS  *e.g. www.isric.org/projects/global-soil-mapnet*  *& Batjes et al 2017 Earth Syst. Sci. Data 9: 1–14* | Assignment #11 |

**Approximate Schedule of Labs:** not applicable

**Approximate Schedule of Field Exercises:** not applicable

**Course Assignments and Tests:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Assignment or Test** | **Due Date** | **Contribution to Final Mark (%)** | **Learning Outcomes Assessed** |
| In-Class Exercises (2) | same day | 5 | 2, 3, 4, 5, 6 |
| Reviews of Recent Articles (best 8 of 10) | subsequent class day | 20 | 1, 2, 3, 4, 5, 6 |
| Exercises (best 10 of 11) | subsequent class day | 25 | 2, 3, 4, 5, 6, 7 |
| *Preliminary Outline* of Review Paper | Sep 26’17 | 5 | 1, 2, 7, 8 |
| *Detailed Outline* of Review Paper | Oct 10’17 | 10 | 1, 2, 3, 4, 5, 7, 8 |
| *Final Draft* of Review Paper | Nov 09’17 | 20 | 1, 2, 3, 4, 5, 6, 7, 8 |
| *Summary* of Review Paper | Nov 16’17 | 5 | 1, 2, 3, 4, 6, 7, 8 |
| *Oral Presentation* of Review Paper | tbd | 10 | 1, 2, 3, 4, 5, 6, 7, 8 |
| *Total* |  | *100* |  |

**Seminars:** not applicable

**Final Examination Date and Time:** not applicable

**Final Exam Weighting:** not applicable

## Course Resources

**Required Texts:** none

**Recommended Texts:** none

**Lab Manual:** not applicable.

**Other Resources:**

This course relies heavily on recent original and review articles published in peer-reviewed journals. Citation for such articles will be provided through course link. Where relevant, specific extracts of reference texts will be posted to CourseLink.

For certain assignments, students will have to either access online resources or download specialized freeware (integrity verified).

**Field Trips:** not applicable.

**Additional Costs:** none

## Course Policies

### Late Submissions:

Late assignments will generally be penalized 10% per day and will no longer be accepted a week after the due date. Exceptions will be granted for bona fide medical or other academic consideration reasons.

### Group Work:

While students are encouraged to discuss concepts related to this course, material to be submitted for evaluation must be the work of individual student.

### Submitting Written Work:

In this course, your instructor will be using Turnitin, integrated with the CourseLink Dropbox tool, to detect possible plagiarism, unauthorized collaboration or copying as part of the ongoing efforts to maintain academic integrity at the University of Guelph.

All submitted assignments will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. Use of the Turnitin.com service is subject to the Usage Policy posted on the Turnitin.com site.

A major benefit of using Turnitin is that students will be able to educate and empower themselves in preventing academic misconduct. In this course, you may screen your own assignments through Turnitin as many times as you wish before the due date. You will be able to see and print reports that show you exactly where you have properly and improperly referenced the outside sources and materials in your assignment.

### Use of Electronic Devices and Recording of Lectures:

Electronic recording of classes is expressly forbidden without consent of the instructor. When recordings are permitted, they are solely for the use of the authorized student and may not be reproduced, or transmitted to others, without the express written consent of the instructor.

## University Policies

### Academic Consideration:

The University of Guelph is committed to supporting students in their learning experiences and responding to their individual needs and is aware that a variety of situations or events beyond the student's control may affect academic performance. Support is provided to accommodate academic needs in the face of personal difficulties or unforeseen events in the form of Academic Consideration.

Information on regulations and procedures for Academic Consideration, Appeals and Petitions, including categories, grounds, timelines and appeals can be found in Section II (General Regulations) of the Graduate Calendar. <https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/sec_d0e2238.shtml>

### Academic Misconduct:

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community, faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring.

University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection. Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Detailed information regarding the Academic Misconduct policy is available in Section II (General Regulations) of the Graduate Calendar. <https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/sec_d0e2715.shtml>

### Accessibility:

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or a short-term disability should contact the Student Accessibility Services (SAS), formerly Centre for Students with Disabilities (CSD), as soon as possible.

For more information, contact SAS at 519-824-4120 ext. 56208 or email sas@uoguelph.ca or visit the [Student Accessibility Services website (http://www.uoguelph.ca/csd/)](http://www.uoguelph.ca/csd/).

### Course Evaluation Information:

End of semester course and instructor evaluations provide students the opportunity to have their comments and opinions used as an important component in the Faculty Tenure and Promotion process, and as valuable feedback to help instructors enhance the quality of their teaching effectiveness and course delivery.

For this course, the course evaluation will be conducted in-class, near the end of the semester; the specific time to be scheduled by the Director of the School of Environmental Sciences.

### Drop Period:

The drop period for single semester courses starts at the beginning of the add period and extends to the Fortieth (40th) class day of the current semester (the last date to drop a single semester courses without academic penalty) which is listed in [Section I (Schedule of Dates) of the Graduate Calendar](https://www.uoguelph.ca/registrar/calendars/graduate/current/sched/index.shtml).

The drop period for two semester courses starts at the beginning of the add period in the first semester and extends to the last day of the add period in the second semester.

Information about Dropping Courses can be found in [Section II (General Regulations – Registration – Registration Changes) of the Graduate Calendar](https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml).

**Term Literature Review Paper & Presentation**

**(Instructions)**

***Overview - this exercise constitutes 50% of the final course grade:***

Each student will conduct a review of the scientific literature examining the application of *quantitative pedology* in the modeling of a selected critical zone process.

\* Topic selection is to be confirmed with instructor by ***Sep 14’17.***

\* ***Preliminary Outline of Review Paper* (worth 5% of final grade) – *due by Sep 26’17*:**

*Structure:* title (no title page necessary), objectives, topics & subtopics, 5 key initial references.

*Formatting:* 2 pages; size 12 Times New Roman font; 1.5 line spacing; 1” margins; use ***referencing style of ‘Canadian Journal of Soil Science’ (CJSS).***

*Evaluation (by instructor) Criteria:* See relevant rubric. Feedback on Sep 28’17

\* ***Detailed Outline* *of Review Paper* (worth 10% of final grade) – *due by Oct 10’17*:**

*Structure:* title (no title page necessary); topics & subtopics, points to be elaborated on, at least 5 more key references.

*Formatting:* approximately 5 pages; size 12 Times New Roman font; 1.5 line spacing; 1” margins; use ***referencing style of CJSS.***

*Evaluation (by instructor) Criteria:* See relevant rubric. Feedback on Oct 12’17

**\* *Final Draft of Review Paper* (worth 20% of final grade) – *due by Nov 09’17*:**

*Structure:* title page; table of contents, introduction; objectives; review & synthesis of literature; summary & conclusions; list of references; appendices (**include feedback from instructor on *Preliminary* and *Detailed Outlines***).

*Formatting:* 10 to 12 pages (not including tables, figures and references); size 12 Times New Roman font (tables and graphics may use other); 1.5 line spacing; 1” margins; graphics and tables are to be inserted into text (not as appendices); use ***referencing style of CJSS.***

*Evaluation (by instructor) Criteria:* See relevant rubric. Feedback on Nov 14’17

**\* *Summary of Review Paper* (worth 5% of final grade) – *due by Nov 16’17*:**

*Structure:* title (no title page necessary); headings and subheadings as in the paper; key references (list only 5 of the most relevant sources of information).

*Formatting:* 2 pages maximum; size 12 Times New Roman font; single line spacing; 1” margins; use ***referencing style of CJSS.***

*Evaluation (by peers) Criteria:* See relevant rubric.

**\* *Oral Presentation of Review Paper* (worth 10% of final grade) – *tbd last two weeks of class*:**

*Time Slot:* 15 minutes per individual.

*Format:* PowerPoint (or similar)

*Evaluation (by instructor & peers) Criteria:* See relevant rubric. S*tudents who do not submit the evaluation forms, on the final day of presentations, will lose 2 points off their final grade.*