EOSC 350 (2019)

Course Goals, Syllabus and Marking

August 29, 2019

BACKGROUND

When solving environmental, geotechnical or exploration problems, there is a need to obtain information about the earth without direct sampling. A remote sensing or non-invasive method is required. In a geophysical survey, energy is input to the earth and data are recorded. The received data depend upon the distribution of physical properties as well as the details about the field experiment. Processing of the field data yields information about the distribution of a physical property. This information, in turn, can help solve the particular geoscience problem of interest. Central to the success of this methodology is an understanding of how your particular geoscience problem is related to the physical properties of the subsurface. This course will have served its purpose if you are able to decide if, when, and how to use geophysics for a given geologic or geotechnical problem.

It is not enough to simply learn about the physics and the measurements. In this course we focus on the following:

1. The role of applied geophysics
    (a) Explaining **how** geophysics contributes in mineral exploration, geology, water, geotechnical, and related disciplines.
    (b) Discussing **strengths** and **weaknesses** of some geophysical methods in any given context.
    (c) Using a **framework** to help focus your thinking & learning about new geophysical situations not explicitly encountered in this course.

2. Key concepts include:

   (a) how **physical properties** relate to the geoscience task;

   (b) which geophysical **surveys** are appropriate;

   (c) what measurements, or **data**, are obtained;

   (d) how **data** are manipulated (ie processed) to produce useful information;

3. During the course you will develop skills by focusing upon different physical properties and the surveys used to extract information about them.

   (a) **Magnetic susceptibility** (magnetic survey)

   (b) **Density** (gravity, seismic surveys)

   (c) **Elastic parameters** (seismic surveys)

   (d) **Electrical permittivity** (ground penetrating radar)

   (e) **Electrical conductivity and chargeability** (DC, IP, electromagnetic surveys)

4. Increase your ability to work **professionally**

   (a) Contribute to, and benefit from, the work of a team.

   (b) Assess how well you have accomplished individual and team-based goals.

   (c) Confidently extend your knowledge in the future, based upon foundations established in this course.

5. It is not expected that students who complete EOSC 350 will be "geophysicists". However, you will

   (a) Become familiar with some of the commonly used geophysical surveys

   (b) Understand the crucial step of relating your problem to physical properties

   (c) Be able to make decisions about whether geophysical surveys will help solve your problem.

(d) Be able to talk to geophysical contractors about matters of field acquisition, data processing and final interpretation

(e) Be able to meaningfully integrate geophysical information with your other knowledge (geological/engineering) to help solve your problem

GENERAL SYLLABUS

- Foundations (physical properties, fundamentals and a framework for understanding applied geophysics): 3 lectures, 1 lab, 1 quiz and 1 TBL.
- Magnetic: 4 lectures, 2 labs, 1 quiz and 1 TBL.
- Seismic (refraction, reflection and surface wave methods): 5 lectures, 2 labs, 1 quiz and 1 TBL.
- GPR (Ground penetrating radar): 3 lectures, 1 lab, 1 quiz and 1 TBL.
- Midterm exam: foundations, magnetic, seismic and GPR.
- DCR (Direct current resistivity): 3 lectures, 1 lab and 1 quiz.
- EM (Electromagnetics): 4 lectures, 2 labs, 1 quiz and 1 TBL.
- IP (Induced polarization): 1 lecture and 1 TBL
- Final exam: foundations, magnetic, seismic, GPR, DC, EM and IP.

For each topic there are four modes by which students can learn and interact with the material. These are:

1. Lectures. These provide basic understanding of geophysical surveys and their applications. Where possible, we use interactive software apps that allow students to ask and answer questions that promote physical insight. These apps are also an integral component of lab exercises.

2. Team Based Learning (TBL). For each topic above, a case history of the method is given before the end of that particular topic. Students are required to read the publication and answer the questions on the

worksheet individually and submit their answers online. The last portion of class time of that topic is then used for students to work on more open-ended questions regarding that case history as a team. The teams submit their worksheet by the end of class for group assessment.

3. Laboratory: These have been designed to integrate closely with the Lectures and TBL. The lab worksheets have been designed to be completed, and turned in, by the end of the lab period. Access to the PC lab computers is required. Make sure you register so that you have a login account prior to your first lab.

4. Quizzes. The multiple choice quizzes at the end of each topic are answered individually. After students turn in their individual quizzes, they also revisit the quiz questions within the TBL environment and turn in the team quiz sheet.

LECTURE AND LAB TIMES

1. Meeting times:

   - Lectures Mon Wed Fri 13:00 - 14:00 (ESB 2012)
   - Lab section L1A Mon 15:00 - 17:00 (EOS Main 203)
   - Lab section L1B Tue 13:00 - 15:00 (EOS Main 203)

2. Office hours: This will be set up if necessary. Appointments can be made by email.

3. Textbook:

   - The main resource for material is the GPG (Geophysics for Practicing Geoscientists) http://gpg.geosci.xyz
   - Other required readings available through the course website

MARKING METHODOLOGY

- All exams, quizzes and team-based learning exercises are marked based on the percentage of questions correctly answered.
- Labs are are marked based on an overall word grade basis. No correction or comment will be made on the papers, but the answers will be made available after the lab has been completed. A word grade is then converted to percentage using the following scheme. The average of grade is between BRILLIANT and COMPETENT.
  - AWE-INSPIRING = 95% (you did all the work very well and very clearly understand the material)
  - BRILLIANT = 80% (you did the work and understand all of the concepts)
  - COMPETENT = 65% (you did the work and understand most of the concepts)
  - DECENT = 50% (you did the work but don't quite understand all the concepts)
  - FALL-SHORT = 0% (you didn't do the work, or only some of it)

Mark breakdown:

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Final ..............  40%
Midterm ............  20%
Lab ................  20%
Quizzes ............  10%
TBL ................  10%
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RULES

- A medical note is required if there are medical reasons for not taking a university scheduled exam.

MISSED QUIZ PROCEDURES:

You will receive zero if you miss a quiz without providing warning, or an acceptable medical excuse. If suitable warning is provided, we can try to schedule an alternate time. There are three lab periods. If you cannot attend your regular lab section, coordinate with the TA's to complete your lab by attending other sections.

Ground rules for classroom and laboratory behavior:

- **Since you will be working as a member of a team, attendance is mandatory in all team based exercises.**
- Late arrivals are disruptive to all. Please avoid arriving late.
- **Electronic equipment (smart phones, laptop, tablets etc) are to be used only for items related to the relevant geophysical material.**

CONTACT INFORMATION

Instructor: Devin Cowan
Email: dcowan@eoas.ubc.ca
Office: ESB 4035. Go in and turn right
Office hours: TBD

GPG

(Geophysics for Practising Geoscientists) This is an open source resource module that will help elevate the understanding and application of geophysics to a wide variety of geoscience problems.
http://gpg.geosci.xyz