**ES302Q QUANTITATIVE METHODS**
**POLICIES AND PROCEDURES**
Spring 2017 Term - Western Oregon University
2 CR Natural Sciences Bldg, NS017, Wed. 1-3 PM, Fri. 1-2 PM

INSTRUCTOR: Dr. S. Taylor
OFFICE HOURS: T-R 1-2 PM; 4-5 PM
By Appointment

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## COURSE DESCRIPTION:

Class focuses on quantitative techniques in geology, applied mathematics, basic statistics, software applications, technology integration and field mapping techniques. Three hours of active learning per week. Additional field trips outside of scheduled class time may be required. PREREQ: Introductory Geology course, or consent of instructor. May be taken concurrently with introductory geology course.

## COURSE GOALS AND LEARNING OBJECTIVES:

ES302 learning objectives are aligned with WOU Earth Science program outcomes and select components of the LEAP (Liberal Education and America's Promise; http://aacu.org/leap) learning outcomes developed by the Association of American Colleges and Universities. Upon successful completion of ES302 Quantitative Methods students will be able to demonstrate minimum competency in the following program areas:

1. Apply algebraic, trigonometric, and statistical principles to geologic data collection and analysis (Q)
2. Utilize surveying equipment, measurement instruments and map principles to collect and organize geologic data (PO2)
3. Use computer hardware and software to collect and analyze geologic data (PO2)
4. Employ 2-D and 3-D visualization techniques to organize geologic data and identify spatial patterns (PO2)

## THE PROFESSOR'S PHILOSOPHY ON UPPER DIVISION EARTH SCIENCE / GEOLOGY COURSES:

The upper division Earth Science / Geology course sequence is designed for mature, serious students who are willing to work hard, play hard, have fun, and learn in-depth skills / concepts in a professional academic setting. By default, our student population is very diverse with a wide array of skills, interests, and career goals. The student population ranges from serious Earth Science majors with focused career objectives, to Geology / Earth Science minors to Geography and Science Education majors. As such, the professor is charged with serving a diverse array of student interests and career goals in the most professional manner possible. The problem-solving and technical skills acquired via training in the Earth Sciences are highly valuable (and marketable), regardless of career track. Students are expected to actively participate in the learning process and make a significant contribution to the academic integrity of the Earth Science program at Western Oregon University. The ultimate goal of the program is to provide graduates with the academic skills that will enable them to be highly competitive in graduate school or the career marketplace. *GO TEAM!*

## REQUIRED TEXT (available on moodle class site):

Waltham, D., 2000, Mathematics – A Simple Tool for Geologists, 2nd Edition: Blackwell Science, 201 p.
***(**We will be working problems out of this book)***

## ADDITIONAL READING:

Tutorials, journal articles, and text readings to be provided by the instructor.

## CLASS NOTES:

A comprehensive set of instructor class notes are available for download via the internet. The class web site is at URL http://www.wou.edu/taylor ... and follow the links to the "ES302" home page. The class notes are available as Adobe Acrobat Reader files (*.pdf file). Acrobat Reader is free and is installed on many campus PC's. For home installation, Acrobat Reader is also available for download at the class web site, but you will

be responsible for properly installing the software (and will do so at your own risk!).

Based on prior student suggestions, I have assembled my class notes and made them available. These notes may be freely printed at any campus internet station (e.g. ITC Bldg - Student Lab, Library, local department computer labs). The notes are in outline form and are very comprehensive. "Exam Study Guides" will also be posted on the web site as the term progresses.

**EVALUATIONS AND EXPECTATIONS**:
Student performance will be evaluated on the basis of quizzes (pop quizzes, mid-term, final), class/lab exercises, and weekly attendance/class participation. The following is a breakdown of evaluation points, dates, and letter grades:

| | |
|---|---|
| Pop Quiz 1 | 15 pts |
| Midterm Quiz 1 | 45 pts |
| Pop Quiz 2 | 25 pts |
| Final Quiz 2 | 70 pts |
| Class / Lab Exercises | 135 pts |
| Weekly Class Participation | 10 pts |
| TOTAL: | 300 pts |

Final Grading Scale

| Percent Range of Total Points | Letter Grade | Percent Range of Total Points | Letter Grade |
|---|---|---|---|
| 94-100% | A | 77-79% | C+ |
| 90-94% | A- | 73-76% | C |
| 87-89% | B+ | 70-72% | C- |
| 83-86% | B | 67-69% | D+ |
| 80-82% | B- | 63-66% | D |
| | | 60-62% | D- |
| | | <60% | F |

**Quizzes:** Quizzes will largely consist of homework-type problems with an emphasis on practicum-style demonstration of skills developed each week. Pop quizzes will be administered prior to midterm quiz 1 and final quiz 2, respectively.

**Make-Up Quizzes**: Under NO circumstances will make-up quizzes be administered without prior arrangement (at least five days) and good reason. Please show up on quiz day!

**Weekly Class Participation:** ES302 is a methods course that emphasizes hands-on activities and skill building. It is not a traditional “lecture” course, but one in which students are expected to engage active learning modules with their peers and instructor. Successful completion of the course is based on in-class student participation and collective interaction. As such, student work activities and progress will be spot checked at the end of select class periods. Students will be assigned weekly lab activities with a short introduction and overview of required methodology. Assessment will involve one-on-one debriefing with the instructor and clear demonstration of student achievement. Class participation points are available to students who demonstrate adequate weekly progress on their in-class assignments.

**Class and Lab Assignments:** Class and lab assignments will be worked BOTH during class time and outside of class time each week. You will have lab, reading, and homework assignments that **may** take up to

3 or 4 hours to complete outside of class time, maybe more in some cases, depending on your skill levels and ability. Please plan your schedule accordingly. Due dates for class exercises will be prescribed by the instructor. Late work will be accepted up to 1 week after the due date, but will be automatically assessed a penalty of -20% of the point total.

Due to the volume of students assigned to the instructor each term, he will not be able to grade the lab exercise work in detail. The homework and lab assignments will be checked for completeness, with questions randomly chosen for content and accuracy. Grade points will be assigned on the basis of these two criteria. Exercise answer keys will be posted on the class web site by the instructor. **It is your responsibility to: (1) check your work against the lab / homework keys, (2) make sure you understand how to complete the exercises, (3) find help if you have trouble with lab exercises, and (4) study / learn the exercise skills and material for the exams.**

**Learning Resources and Grade Outcomes:** The class knowledge base will be derived from a combination of the following: (1) independent student reading outside of class; (2) independent student engagement of take-home lab exercises and quantitative problem solving; (3) independent student reading of web resources linked from the class web site; (4) systematic review and memorizing of class notes and ancillary reading materials, as directly linked from class web site and handed out in hard copy during class time; and (5) successful attendance, note taking, and engagement of in-class lectures delivered by the instructor. Instructor lectures are designed as interpretive translations to assist students in understanding the class content and to stay on track with the weekly schedule. Lectures are not intended as the primary knowledge transfer mechanism. Independent student engagement of readings, class notes and lab work outside of class time is the most important pathway to success.

**DIGITAL LAB REPORTS:** Weekly lab exercises represent a significant component of the class. Exercises are based on scientific observation, data analysis, and problem solving. Students will compile a Digital Lab Report consisting of a well-organized Acrobat *.PDF file containing completed lab exercises. Students will complete approximately one (1) long-format lab exercise per week of the term, multiple short-format “in-class” exercises, and reading/field trip summaries. Some of the completed work will be in digital format that can easily converted to a *.PDF file directly using Windows 7 tools or Creative Suite Adobe Acrobat software available in the NS218A computer lab. Other lab work that is completed by hand/pencil/paper will be digitally captured by students using scanners in the NS218A and NS017 computer labs, or other available resources on campus. All individual lab exercises and summaries will be converted to PDF formats and combined with the others in the prescribed order, and assembled into one, single, merged PDF Digital Lab Report and uploaded to the Moodle Online Class Management System (moodle.wou.edu). Portfolio checklists will be provided before due dates, so that students can organize, assemble and label their portfolio sections in an orderly manner. The order of portfolio sections must follow the assigned check list!

General Lab Report Outline:
I. Cover Page with student name, class, creative artwork;
II. Table of Contents;
III. Lab Work in checklist order with each task having its own cover page so work is clearly identifiable.

A model example lab report of the required quality and formatting may be downloaded at the following URL:
http://www.wou.edu/las/physci/taylor/g302/example_lab_portfolio.pdf

Digital Lab Reports will be graded once at Midterm and once at Final time. A total of four Moodle upload submissions will be scheduled at even increments throughout the term: Week 2 Moodle Test Upload, Week 5 Digital Lab Report 1, Week 9 Digital Lab Report 2, and Week 11 Final Lab Report. Lab reports will be checked for completeness and formatting at the prescribed due dates. An exercise task-list will be maintained as assignments evolve throughout the term. It is important to complete assignments on schedule, as they are designed to help students understand lecture concepts and aid in successfully achieving positive results on the exams.

Special Note: Do not use the Adobe Acrobat “Assemble Portfolio” tool. This tool appends all of the PDF documents as separate sub-files in random order. When combining PDF documents, the result should be one seamless PDF file, in the order prescribed, with no additional sub-menu management necessary. Any “Adobe Acrobat Portfolios” submitted in the improper format will be returned without grade for subsequent correction and resubmission.

**A NOTE ABOUT INCOMPLETES:** No incomplete grades will be given during the last week of class. If you have a problem that warrants an incomplete, make arrangements prior to the last week (no exceptions!!).

**A NOTE ABOUT LOST OR MISSING WORK**

The instructor will only grade work that is received and physically visible. Any missing work (lab assignments, homework, quiz/test answer sheets) will receive a “0” on the grade sheet. This policy applies to work lost by the student or instructor. If the student demonstrates that the work was turned in, but is missing due to the instructor’s incompetence, then the student will be afforded an opportunity to make up the work and resubmit it for graded credit. Otherwise, the student will not receive credit for lost or missing work.

**CHANGE OF SYLLABUS - POP QUIZZES - UNANNOUNCED HOMEWORK ASSIGNMENTS**

The instructor reserves the right to modify the syllabus and class schedule at any time during the term. Students will be notified of such changes in a timely manner. The instructor also reserves the right to administer pop-quizzes and assign unscheduled homework / class assignments at any time. All students will be responsible for completing this work and it will comprise part of the final class grade.

**FIELD TRIP(S):**

Local field trips and field exercises may be scheduled during the term as time permits. Some of these field trips will be around campus and spontaneously planned. Please wear/bring appropriate outdoor clothing (boots, raincoat, etc) for field activities during class time. Also be aware that additional scheduling and personal time may be required as the course develops.

**STUDENT HONOR POLICY:**

Plagiarism and cheating will not be tolerated. Cheating includes copying others work, cutting-and-pasting computer results, and using cheat sheets on exams. However, students are encouraged to interact in small groups during class assignments, i.e. you can freely discuss concepts in all portions of the class, except exams. Students ARE NOT permitted to photo copy or cut-and-paste peer work. If you work on labs together, complete your own work independently and print out your own results in a format that differs from your colleagues. If you directly copy or cut-and-paste another student’s work, you and your collaborator will receive a “0” for the exercise.

**OTHER REQUIRED MATERIALS:**

Students will also need access to a scientific calculator, colored pencils, ruler, and protractor. You will be required to use these materials during lecture, lab, and exams. Please plan accordingly, or you will have trouble successfully completing the class.

**STUDENTS WITH DISABILITIES**:

Any student who has a disability that requires accommodation, please make an appointment to see me.

**A NOTE ABOUT THE LAST WEEK OF CLASS:**

Given that the Oregon University System employs the "quarter method" of academic scheduling, upper division courses are by nature "compressed" with much detailed information to cover in a relatively short period of time. Please note that most upper division text books are geared for courses at universities with a 16 week semester system (i.e. we are truly trying to pack 10 pounds of equations into a 5 pound calculator). As such, the 10th week of class is as critical to content coverage as the 1st week. Students should anticipate a full slate of "normal" activities during the last week of class, including lectures, lab exercises, written reports, etc. The class is not over until after the final exam! **Plan your schedule accordingly!**

**A NOTE ABOUT COMPUTER-BASED COURSES:**

This class will use technology, hardware, software, and the campus network. As such, there are endless possibilities for software glitches, system failure, and total confusion. Your patience with lab exercises, assignments, course content, and software / hardware glitches will be greatly appreciated. **Our motto for this term: "expect the worst and hope for the best".**

**INSTRUCTOR TIMELINE FOR GRADING EXAMS AND LAB MATERIALS:**

The instructor's class grades are due the Tuesday after final's week. All exams, lab materials, and assignments submitted by students throughout the term will be graded by that time, however the professor will make an effort to return graded materials within two weeks of the assigned due date.

**UPDATED CLASS SCHEDULE (4/6/17)**: This outline should be considered tentative at best. The following schedule may be modified as class ideas evolve throughout the term.

| Week | Dates | Class Content | Class Exercises | Readings |
|---|---|---|---|---|
| 1 | Apr. 5, 7 | Class Policies, Introduction, Math/Algebra Review, Unit Conversions, Map Review | See checklist below | Instructor Handout |
| 2 | Apr. 12, 14 | Algebraic Problem Solving<br>Use of Engineer's Scale | See checklist below | Instructor Handout<br>Waltham Chap. 1 |
| | **Moodle Test Upload Due by Friday April 14, 11 PM** | | | |
| 3 | Apr. 19, 21 | Functions and Geologic Variables, Location, Bearings | See checklist below | Waltham Chap. 2 |
| | **Be Prepared for Pop Quizzes on Friday of this week.** | | | |
| 4 | Apr. 26, 28 | Brunton Compass<br>Basics of Map Navigation<br>Strike and Dip | See checklist below | Compton's Manual |
| 5 | May 3, 5 | Mapping, Surveying | See checklist below | Instructor Handout |
| | **Moodle Upload, Lab Report 1, Due by Friday May 5, 11 PM** | | | |
| 6 | May 10, 12 | Digital Imagery<br>Planimetry, watersheds | See checklist below | Instructor Handout |
| | **Lab Practicum / Quiz 1**<br>**Friday May 12, Last Day to Drop Without Grade Penalty** | | | |
| 7 | May 17 | Applied Trig<br>Three Point Problems | See checklist below | Waltham Ch. 5 |
| | **May 19 – No Class / Out-of-Class Assignments** | | | |
| 8 | May 24 | Intro to Graphing,<br>Rose Plots, Ternary Diagrams<br>Stereonets | See checklist below | Waltham Ch. 6 |
| | **NO CLASS FRIDAY MAY 26 – MEMORIAL DAY WEEKEND**<br>**Be Prepared for Pop Quizzes** | | | |
| 9 | May 31, June 2 | Geostats, Data Analysis<br>Intro to Final Project | See checklist below | Waltham Ch. 7 |
| | **Moodle Upload, Digital Lab Report 2, Due by Friday June 2, 11 PM** | | | |
| 10 | June 7, 9 | Final Project | TBD | Class Notes |
| 11 | Week of June 12 | Finals Week Check Schedule; Final Exam Practicum | | |
| | **Moodle Upload, Final Project / Lab Report, Wed. June 14, 11 PM** | | | |

**ES302 Quantitative Methods Spring 2017**
**Tentative Lab Exercise Checklist** *(to be finalized as term progresses; Draft 1 April 5, 2017)*

**Week 1**

1-1. Unit Algebra Exercise http://www.wou.edu/las/physci/taylor/g302/unit_alg.pdf
1-2. In-Class Earth Beer-Ball Volume Calculation
1-3. Introduction to Map Scales http://www.wou.edu/las/physci/taylor/g302/mapscale.pdf
1-4. Introduction to Topographic Maps http://www.wou.edu/las/physci/taylor/g302/intro_map_ex.pdf
1-5. Map Scale Problem (Part 2) http://www.wou.edu/las/physci/taylor/g302/map_photo_scale_ex.pdf

**Week 2**

2-1. Introduction to Solving Geologic Problems (Waltham Chap. 1: Q 1.1, 1.2, 1.3, 1.4, 1.7, 1.12, 1.1)
http://www.wou.edu/las/physci/taylor/g302/waltham1.pdf
2-2. Applying Algebra to Hydrology Problems (Q. 1,2,3,4,5,6)
http://www.wou.edu/las/physci/taylor/g302/hydro_prob.pdf
2-3. Overview of Using Engineer's Scale http://www.wou.edu/las/physci/taylor/g302/engineer-architect-scales.pdf
2-4. Map Measurement Engineer's Scale
http://www.wou.edu/las/physci/taylor/g302/map_measurement_exercise.pdf
2-5. In-Class Exercise: On-the-Fly Scaling and Gradient Measurement on Monmouth Quad

**Week 3**

3-1. In-Class Exercise: Conversion of Longitude and Latitude
http://www.wou.edu/las/physci/taylor/g302/lat_long_decimal_conversion_in_class.pdf
3-2. Measuring Compass Bearings on the Monmouth Quad
http://www.wou.edu/las/physci/taylor/g302/in_class_compass_bearings_Monmouth_Quad.pdf
3-3. Student Pace and Occular Height http://www.wou.edu/las/physci/taylor/g302/Pace_Ocular_height_worksheet.pdf
3-4. Relationships Between Geologic Variables (Waltham Ch. 2: Q 2.1, 2.2, 2.3, 2.8, 2.11)
http://www.wou.edu/las/physci/taylor/g302/waltham2.pdf

**Week 4**

4-1. Introduction to Brunton Compass Exercise http://www.wou.edu/las/physci/taylor/g302/intro_brunton_lab.pdf
4-2. Campus Tape and Compass Mapping http://www.wou.edu/las/physci/taylor/g302/brunt_lab.pdf
4-3. In-Class Strike and Dip Exercise http://www.wou.edu/las/physci/taylor/g302/trig_map_ex.pdf

**Week 5**

5-1. Introduction to Triangulation
http://www.wou.edu/las/physci/taylor/g302/introduction to Triangulation_ver3_sp2015.pdf
5-2. Scaling and Map Drawing http://www.wou.edu/las/physci/taylor/g302/Intro_scale_map_drawing.pdf
5-3. Scaled Map of Classroom (Jackson St. Alternative Version)
http://www.wou.edu/las/physci/taylor/g302/class_map_exercise.pdf
5-4. Large Scale Format Photo Scale Exercise http://www.wou.edu/las/physci/taylor/g302/large_format_photo_ex.pdf

**Week 6**

Midterm Quiz / Practicum
6-1. Introduction to Digital Images and Spatial Scale Resolution
http://www.wou.edu/las/physci/taylor/g302/Spatial_Resolution_exercise.pdf
6-2. UTM Location Exercise
http://www.wou.edu/las/physci/taylor/g302/utm_exercise.pdf
6-3. Measuring Map Areas Using the Planimeter
http://www.wou.edu/las/physci/taylor/g302/measuring_scaled_map_areas.pdf
6-4. Watershed Delination and Map Area Measurement
http://www.wou.edu/las/physci/taylor/g302/watershed_delineation_drainage_area_exercise.pdf

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**Week 7**

7-1. Waltham Chapter 5 Problems Trigonometry Applications (Q. 5.1, 5.2, 5.3, 5.5, 5.6)
http://www.wou.edu/las/physci/taylor/g302/waltham_chap5_trig.pdf
7-2. Introduction to the Three-Point Problem
http://www.wou.edu/las/physci/taylor/g302/three_pt_problem_intro.pdf
7-3. Pittsburgh Coal Three-Point Problem
http://www.wou.edu/las/physci/taylor/g302/three_pt.pdf
7-4. Introduction to Contouring and Interpolation
http://www.wou.edu/las/physci/taylor/g302/ES302_contour_interpolation.pdf

**Week 8**

8-1. Introduction to Rose Plots

http://www.wou.edu/las/physci/taylor/g302/intro_rose_plots.pdf

8-2. Application of Ternary Diagrams to Geologic Problems (Part 1 QFL Diagram, and Question 6.4)

http://www.wou.edu/las/physci/taylor/g302/ternary.pdf

8-3. Introduction to Stereographic Projections

http://www.wou.edu/las/physci/taylor/g302/stereo_graphic_projections.pdf

http://www.wou.edu/las/physci/taylor/g302/ES302_In_class_ex_intro_stereonets.pdf

**Week 9**

9-1. Introduction to Geostatistics and Data Analysis

http://www.wou.edu/las/physci/taylor/g302/stat_ex.pdf

http://www.wou.edu/las/physci/taylor/g302/dataanal.pdf

9-2. In-Class Introduction to Excel and Equation Functions

Siltstone-Sandstone Hillslope Data Summary

Excel Analysis of Sandstone Point-Count Data and Ternary Plot

**Week 10**

Final Project / Integrated Geologic Problem Solving (TBD)