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Course Syllabus
**GEL 4970 Undergraduate Research in
Geology**
- A Senior Experience Course -
Spring 2021

sec. 001 - 33761: TR 10:30am - 12:45pm Synchronous Meeting Time
Microsoft Teams Meeting Code: mmyww6g [Meeting Link](#)

COURSE(S) ADMINISTERED THROUGH THE CANVAS PLATFORM

Please log in through your MSU DENVER account!
Ancillary Course URL: <http://college.earthscienceeducation.net/UR/index.html>

Professor
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Office Hours
Teams call-in Office Hours: M, T, W, R 12:30 - 1:30pm
Other times by appointment!

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This syllabus may be modified at any time without prior notice.

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Course Description

This course is a senior-level capstone course for geoscience majors that will focus on independent research investigating a selected geological problem involving field and/or laboratory observations. Presentation of results at an undergraduate research conference as well as submittal of a paper for publication is required. (Senior Experience)

Prerequisites:

MTH1210, GEL3050, senior standing or permission / override of instructor.

Highly Recommended Courses: 4 hrs GEL field coursework, 9 hrs upper-division GEL courses, or written permission of instructor; completion of all Level I and Level II General Studies course requirements

Outline of Course Content**Major Topics & Subtopics**

- | | |
|---|--|
| <ul style="list-style-type: none"> I. Introduction to Undergraduate Research <ul style="list-style-type: none"> A. Designing a research question B. Field / laboratory investigations and techniques C. Writing a scientific paper D. Getting published and presenting E. Working individually or with one or multiple partners II. Library Resources <ul style="list-style-type: none"> A. Library research B. Internet research C. Citations D. Plagiarism III. Project Prospectus <ul style="list-style-type: none"> A. Research proposal B. Research groups or individualized research? <ul style="list-style-type: none"> 1. Lead researcher 2. Contributions contract 3. First author C. The timeline D. Budget, funding, grants IV. Lab & Field Equipment <ul style="list-style-type: none"> A. Overview of available instrumentation Instrument training Liability V. Data Collection <ul style="list-style-type: none"> A. Sampling techniques B. Precision, accuracy and error - when to redo your analysis. C. Field time / Field visits VI. Data Evaluation and Compilation <ul style="list-style-type: none"> A. Nominal vs. Ordinal Data B. Simple Statistics C. Regression analysis D. Correlation analysis VII. Graphic Arts <ul style="list-style-type: none"> A. Beyond simple graphs B. Presentation aesthetics | <ul style="list-style-type: none"> C. Map and poster making VIII. Oral / Written Presentation Preparation <ul style="list-style-type: none"> A. Writing an abstract B. Research posters C. Effective PowerPoints - beyond writing D. Paper rough drafts and formatting E. Writing and proof reading F. In-class "peer-review" IX. Project Presentations <ul style="list-style-type: none"> A. Presenting at an undergraduate conference <ul style="list-style-type: none"> 1. Registration 2. Abstracts and deadlines 3. Attendance B. Submitting the paper <ul style="list-style-type: none"> 1. Revisions |
|---|--|

Specific (Measurable) Student Behavioral Learning Objectives

Upon completion of the course the student should be able to:

1. Select a focused and definite research project in the geosciences that can be concluded within a specified time frame.
2. Compose a project prospectus which includes a written investigation outline and timeline, hypotheses, methodology, budget if applicable, and expected contribution of each group member if applicable.
3. Plan and execute publication research relevant to the project using library resources.
4. Prepare and conduct detailed laboratory and/or field investigations utilizing multiple research specific equipment and techniques.
5. Evaluate collected data from investigations according to precision, accuracy, and standard statistical methods.
6. Construct useful figures, charts, graphs from collected data and results from associated computational analytical approaches.
7. Prepare a complete report of the research which includes introduction, methods, results, discussion, and conclusion, as well as any pertinent tabulated or graphic displays and submit the report in the correct format to a pertinent publication of choice (e.g.; science journal accepting student work).
8. Design a professional oral and/or poster presentation and present at a conference of choice (e.g.; Metropolitan State University of Denver Undergraduate Research Conference).

Required Course Materials:

Reading material will be provided by instructor according to selected and individualized research topics.

Grading in GEL4970

	Max. Points
Undergraduate Research Contract	25
9 MODULE PROGRESS REPORTS w/ Time Log (25pts ea)	225
RESEARCH QUESTION	50
Phase Ia: LITERATURE REVIEW	100
Phase Ib: PROSPECTUS	100
Phase IIb: TABLES & FIGURES	100
Phase III: 1 st Draft Presentation - Product Presentation to Class for Peer Review.	140
1 st Draft Presentation Grade from Peer Review	40
Peer Reviewer Grade for completion of Peer Reviews	40
Phase III: Final Product <i>Product to present</i> (check ONE): <input type="checkbox"/> Oral Presentation: PPT plus written Presentation Abstract <input type="checkbox"/> Poster Presentation: Completed quality print large scale poster <input type="checkbox"/> Journal Paper: w/ abstract & figures, maps, photos, tables, etc.	140
Oral Defense (Video chat)	40
TOTAL	1000

Final Grade Distribution Scale by Points

A+ > 990	A = 900-990	A- = 895-899
B+ = 870-894	B= 800-869	B- = 795-799
C+ = 770-794	C = 700-769	C- = 695-699
D+ = 670-694	D = 600-669	D- = 595-500
F = ≤ 500 points		

Deadlines & Checking Your Course Grade

All exercises and grades are processed through CANVAS. Please log in to see your grade updates as they become available. Please go to the course CANVAS site to see assignment deadlines!

Note: You may ALWAYS turn in an assessment EARLY, which is preferred! Deadlines are the LAST possible turn-in option before due date penalties are invoked.

LATE WORK:

General Late Work Penalty is -10% / day processed automatically through the CANVAS grading system!

YOU DO NOT HAVE TO WAIT FOR THE DEADLINE TO TURN IN YOUR ASSIGNMENTS!!! I will accept work any day, any time up to the deadline. Turn things in early and you will not run into trouble with uncooperative electronics or sudden work / family conflicts. *Hint: Turn your work in early and there will be NO problems!*

MODULE REPORTS (225 pts): <http://college.earthscienceeducation.net/UR/URmodulereport.pdf>

During the course of the semester you will submit 9 module reports (25 pts ea.) addressing your week's activities, including highlights, accomplishments, breakthroughs and problems, drawbacks, glitches encountered during the execution of your project. A completed Time Log must also be compiled and attached every week. Complete according to instruction and submit through CANVAS by the deadline.

UR CONTRACT (25 pts): <http://college.earthscienceeducation.net/UR/URcontract.pdf>

Complete a SIGNED Undergraduate Research contract and submit by the deadline.

RESEARCH QUESTION (50 pts): <http://college.earthscienceeducation.net/UR/URresearchquestion.pdf>

The core idea or question around which you center your research. It is the heart of your project and needs to be well written and defined early on. Complete according to instruction and submit as a HARDCOPY by the deadline.

PHASE IA: LITERATURE REVIEW (100 pts): <http://college.earthscienceeducation.net/UR/URLitreview.pdf>

Please download [Zotero](#), a free, easy-to-use tool to help you collect, organize, cite, and share your research sources. Use [Zotero](#) to generate a complete list of possible sources to be used in your research. Do not forget maps, figures, photographs, software, and similar (e.g.; Google Earth w/ Geology kmz plug in). Complete according to instruction and submit through CANVAS in PDF format by the deadline.

PHASE IB: PROSPECTUS - Experimental / Lab / Fieldwork Design (100 pts):

<http://college.earthscienceeducation.net/UR/URprospectus.pdf>

A Research Proposal, Outline and "Sales Pitch" of your proposed project. It is the equivalent of a marketing or business plan in the world of finance. This includes a completed design of your anticipated lab and field work. Don't forget simple things like lab access or materials list. Also transportation and lodging plans if applicable. Complete according to instruction and submit through CANVAS in PDF format by the deadline.

Note: This is a fairly involved assignment. Do NOT wait too long or procrastinate!

PHASE II: EXECUTING YOUR RESEARCH:

Much course time is devoted to your research, While NO formal lecture will be given during many of our meeting times, you should be ACTIVELY and CONSISTENTLY engaged in your research field and/or lab work. While you will not be graded on attendance and performance **do NOT, and I mean DO NOT, procrastinate!!!!** You MUST complete all your work by the end of the semester.

PHASE III: TABLES, FIGURES, EQUATIONS - Compiling your Results (100 pts):

<http://college.earthscienceeducation.net/UR/URtabfig.pdf>

Graphics and Data Presentation are the heart of any project. Your raw data can be much better interpreted through the use of visuals, such as graphs, charts and maps. Complete according to instruction and submit through CANVAS in PDF format by the deadline.

PHASE IIIA: FIRST PROJECT SUBMITTAL (140 pts):

<http://college.earthscienceeducation.net/UR/URproject.pdf>

Mandatory Submittal by Deadline! Submit the compilation of your paper, poster or power point through the CANVAS PLATFORM at the indicated date and present to your fellow students and instructor. You will receive feedback / critique and be graded by your instructor and selected PEER REVIEWER students.

PHASE IIIA: PEER REVIEWER (40 pts): <http://college.earthscienceeducation.net/UR/URPeerReviewer.pdf>

Mandatory Submittal! You are to complete a Peer Review for two students and will be graded on the quality of your review according to the linked document above. Your reviews are graded according to your evidence of thought, involvement and constructive criticism.

PHASE IIIA: FIRST PROJECT SUBMITTAL PEER REVIEWER GRADE (40 pts):

There is nothing to submit or do on your part. This grade of your first draft will be applied based on the grade you have received from the Peer Reviewers assigned to your project.

PHASE IIIB: FINAL PRODUCT (140 pts):

<http://college.earthscienceeducation.net/UR/URproject.pdf>

Your final product will be graded by the instructor. By then you have hopefully included the suggestions from the PEER REVIEWERS and the INSTRUCTORS from the 1st Draft to improve your grade.

PHASE IIIB: ORAL DEFENSE (40 pts):

You will need to schedule a 1 on 1 meeting with the instructor during finals week. You will need to explain and defend your research during an oral interview. Therefore, you will need to schedule a virtual meeting with your instructor during finals week. You will need to answer / explain the following during this interview and you will be graded accordingly:

1. Summarize your project in your own words without looking at written material and highlight accomplishments
2. How has this UR project impacted your career, continuing education, or profession and how will you use it for future endeavors?
3. Science related question specific to your project probing the understanding of your research!
4. Additional science related question specific to your project probing the understanding of your research!

LAB TIME:

This class requires a lot of lab time if you want to be successful. While some time for lab exercises will be given during the assigned course time block, there will NEVER be enough time to complete ALL labs during the scheduled course time. You will need to complete the labs in many instances outside the course time on your own. In this Senior Course you will have lab access. Use it wisely!

LAB RULES:

ALL STUDENTS WORKING IN THE LAB MUST SIGN IN, STATE THE PURPOSE OF THEIR ACTIVITIES AND WEAR AN APPROPRIATE NAME BADGE IDENTIFYING YOUR LEGITIMACY TO BE IN THE LAB. Students must follow instructions of the Lab Assistants and are responsible for thoroughly cleaning their work space and lab equipment used after the completion of the lab exercise. **BE AWARE: LAB INFRACTIONS CONCERNING EQUIPMENT & CLEAN-UP CARRY MINUS POINTS FOR THE COURSE!** ALL students must read and sign the following Liability Waiver:

Lab Liability Waiver

1. All students participating in lab activities taught by the Department of Earth and Atmospheric Sciences should be aware that there is always an element of risk involved when working with equipment, machinery and/or chemicals. These risks involve serious injury or death, especially if safety protocols are not followed and/or equipment, machinery, and chemicals are misused. Instructors and/or Lab Personnel will use all reasonable precautions and students need to exercise prudent behavior during such activities, but even then there exists the possibility of an accident or injury. Since many of these activities are to be undertaken in the field and outside of the classroom without the direct supervision of an instructor, students must be alert and aware of possible risks and dangers when using chemicals, equipment, and/ or machinery with or without supervision.
2. Neither the University, nor the instructor, nor any assigned Lab Personnel shall be liable for any damages, including but not limited to injuries, death, loss of property or profits, or incidental, consequential, exemplary, special or other damages that may result from use of chemical, equipment, and/or machinery used in conjunction with or outside the framework of this college course. This condition also expands to the use of procedures and formulations given in LAB texts.
3. The associated LAB instructions and described analytical procedures are intended for use by mature persons following the safety instructions precisely. Neither the author, nor the instructor, nor the University does accept liability or responsibility for any injury or damage to persons or property incurred by performing the experiments described in the LAB texts, nor for the content of any outside material referred to in class or manual, including linked websites.
4. EXPLICIT SAFETY RULES & REGULATIONS:
 - a. You **MUST** wear Safety Goggles when working with chemicals or using equipment or machinery.
 - b. You **MUST** read and follow instructions precisely.
 - c. Do **NOT** misappropriate chemicals, equipment or machinery other than its intended and prescribed use.
 - d. You must take care not to ingest, inhale, taste or otherwise orally contact chemicals or reactive products. **NO FOOD / DRINK IN LAB AREA!** You **MUST** wash hands after each experiment.
 - e. Some tests may include open flames. You **MUST** take precautions in hair and clothing to avoid accidental or intentional contact of persons and property with flames and fire.
 - f. You **MUST** take care when transporting equipment to avoid spillage and unintended contact with property and persons.
 - g. Students who violate any of the above rules, policies and stipulations which are written in this document or implied through instruction and professional laboratory behavior or who fail to conform to directives from the instructor or lab personnel **may be immediately dismissed from the course.** They may also be subject to a failing grade, be required to withdraw from the course, and be subject to disciplinary action by the University.
 - h. All participants **MUST SIGN** the following **LIABILITY WAIVER**.

In consideration of my being permitted to participate in this activity, I, the undersigned hereby release and hold harmless: the Trustees of the Metropolitan State Universities of Denver, the Earth and Atmospheric Sciences Department, and respective employees, from all claims, losses, damages, or expenses because of property damage or personal or bodily injury incurred or caused by me during or in conjunction with the above mentioned activity or activities. In filling out this form, I acknowledge that I fully understand the risk that is inherent with on and off campus laboratory procedures and/or equipment and/or machinery use. The undersigned also indicate with their signature that they will follow appropriate safety rules and regulations. Furthermore, I have fully read and understand the department policies and my liability and do accept the restrictions.

General Knowledge Prerequisites!

It is assumed that you have acquired the following general knowledge skills in the sciences, language, and math through your current education and similar venues. It is the students FULL responsibility to make-up ANY deficiencies in these areas, preferably before enrolling in the course. I will NOT teach, lecture, or tutor any student in these basic High School skills and general knowledge subjects and no further instruction on the topics listed below will be given.

Basic Office Software

Know how to properly use and command MS Word, MS Powerpoint, MS Excel. Graphing with Excel, putting figures / pictures into Word documents, compiling a short presentation using PowerPoint are expected skills in my course.

English Language

Students should be able to write in short, clear, concise sentences when answering questions. Proper syntax becoming to a college student is expected. In many instances you will also be graded on professionalism which includes expressing yourself accordingly in writing. Unless otherwise instructed, always use third person when writing for the sciences. Usage of "I", "we", "my", "mine", "our", is uncommon in technical writing and needs to be avoided.

Basic Mathematical Operations

Students should be able to do the following mathematical operations without any further instructions:

- Round answer to significant digits. (*If you have problems with this, watch the [video](#)*)
- Doing unit conversions (e.g.; continental drift happens at about 5.5cm/yr. How fast would this be in mph?)
- Percent calculations (e.g.; you measure 2.58g/cm³. The actual density is 2.65g/cm³. What is your percent error?)
- Using **units** in ALL your operations (*I am real stickler about that!*)
- Solving equations for an unknown value; manipulating equations (basic Algebra)
- Basic Geometry: surface areas, volumes, circumferences, areas, angles
- Scientific notations (e.g.; 1.8×10⁻⁹m/s) & scientific prefixes (milli-, mega-, terra-, micro-, etc.)
- Metric system & conversions within (μg, mg, g, kg, t, μm, mm, cm, m, km, m², km², cm³, m³, km³)
- Weights & Measurements (Both American and Metric)
- Operating a scientific calculator (e.g.; know how to switch between degrees and radians, know how to use the arctangent function) $\theta^\circ = \arctan(\text{rise/run})$ *Warning: NO cell phone calculators are allowed!*

Graphing

You are required to be able to differentiate between bar, line and scatter graphs and know how and when each one needs to be constructed. Students should be able to hand-draw curved graphs without being sloppy. Be able to extrapolate values from any graph given, no matter the scale and type.

Physics

Students should be familiar with basic Newtonian laws of motion and understand terms such as velocity, acceleration, inertia, mass vs. weight, force, gravitational constants, kinetic energy, potential energy. Being able to work with the following basic physics equations is a must (Middle School Physics!):

$$v=d/t \quad a=d/t^2 \quad a=(v_f-v_i)/t \quad F=ma \quad I=mv \quad KE=1/2mv^2 \quad PE=ma_g\Delta h \quad a_g=9.8m/s^2 \text{ or } 30ft/s^2$$

Chemistry

Background in basic High School chemistry is essential. Students should know element names and associated symbols, how to read atomic weight and atomic mass from the periodic table, difference between covalent, ionic, metallic and hydrogen bonding, meaning of chemical formulas and subscripts. Students also need to understand pH and the difference between oxidizing and reducing environments. Furthermore, a working knowledge of solutions, solubility, mixtures, homogenous and heterogenous systems, and precipitation is a must.

Geography

Students should know basic physical geography, which includes the location of countries, major mountain ranges, and major rivers.

Drawing & Drafting

While the world is moving rapidly to electronic PC drafting, sketching results by hand is an essential skill in geology. Students must be able to use a drawing compass and a protractor. Sketching curves through data points is another required skill.

Citations

Students should know how to properly format and include citations in their work. I highly recommend the FREE citation tracker and database [ZOTERO](#). It will automatically incorporate into your search engine and MSWord, can grab sources from the web at the click of a button and will make citing and creating correctly formatted references a breeze.

COLLEGE OF LETTERS, ARTS, AND SCIENCES SYLLABUS STATEMENTS – Spring 2021

The complete syllabus statement from the College of Letter, Arts, and Sciences can be downloaded from <https://www.msudenver.edu/media/content/collegeoflettersartsandsciences/forms/CLASSyllabusPolicyStatementSpring2021.pdf>

The COVID-19 addendum to the syllabus statement from the College of Letter, Arts, and Sciences can be downloaded from <https://www.msudenver.edu/media/content/collegeoflettersartsandsciences/forms/SyllabiAddendumforCOVID.pdf>

Important University Dates for Spring 2021 can be downloaded from <https://www.msudenver.edu/media/content/collegeoflettersartsandsciences/forms/DeadlineDatesSpring2021.pdf>