Disclaimer

The purpose of this handbook is to compile in one place information that may be useful for our graduate students and applicants, especially about the thesis and graduation requirements. The information compiled herein is deemed accurate at the time of the last update of the handbook. However, this is not an official university document, nor is it a contract: policies change constantly and we cannot guarantee that everything in the handbook is accurate and up to date. **Always refer to the University Catalog, the Office of Graduate Studies, or the Graduate Coordinator.**

*Graduate Students are strongly advised to purchase a copy of the CSUB Catalog in effect at the time of their admission to the graduate program and keep it for reference until they graduate.*
Welcome!

Welcome to the CSU Bakersfield Department of Geology Master’s program. This handbook has been redesigned to guide you through the various stages of the graduate program and to introduce you to many of the policies and procedures that you will have to navigate.

As Geology Graduate Coordinator I will be your advisor until you have agreed to work with a specific professor on a thesis topic. Until then, I encourage you to meet with me regularly to plan your courses, start the process of proposing a thesis research topic, etc. Use this handbook to familiarize yourself with the MS programs and their requirements, the list of available courses, and the thesis requirements.

Dr. Graham Andrews, 8/28/14

Contacts

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MS Geology Program at CSU Bakersfield

The Department of Geology offers two comprehensive graduate degrees leading to the Master of Science in Geology. The first is a thesis-based MS degree program. The second is a coursework and examination-based MS degree (i.e. non-thesis). Both “tracks” allow for optional concentrations in Petroleum Geology and in Hydrogeology.

Both MS degree tracks are designed as two-year (full-time) programs; students electing to study part-time should expect to graduate in no more than four years. All degree requirements must be completed within five years of initial enrollment.

The “MS with thesis” track is intended to prepare students for graduate studies at the doctoral level, and professional positions in the petroleum industry and government. Students interested in continuing their graduate studies beyond the MS level should enroll in the MS with thesis only. The “MS non-thesis” track is intended to prepare students for positions in the petroleum, environmental, and geotechnical consulting industries, and local government agencies. The “MS non-thesis” is considered a terminal degree.

In addition to the MS degrees, the Department of Geology offers a post-baccalaureate Certificate in Hydrogeology. The certificate is designed primarily to give professionals additional training in hydrogeology and hydrogeochemistry.

1. **The value of an MS in Geology from CSUB**

   The Master of Science in Geology degrees at CSUB are uniquely well-adapted to preparing students for careers in both the California oil industry and environmental consulting. The “MS with thesis” is designed to enable successful progression to doctoral research programs elsewhere. Our programs emphasize:

   - a diverse and comprehensive range of courses with a focus on learning and developing skills and knowledge for use in research and industry,
   - late afternoon and evening course offerings, making the program accessible for persons who work during the day (including part-time students),
   - close, individual guidance by a dedicated highly skilled, research-active faculty with diverse research interests and expertise,
   - strong ties between faculty and local industry through close proximity of petroleum industry offices, student internships, sponsorship, campus recruitment drives, invited lecturers, and local professional societies,
   - easy access to amazing and diverse geological environments and established research sites and facilities,
   - an impressive array of modern research facilities and equipment,
   - high graduate employment rate and high earning potential through training with the latest techniques and software.
2. Graduate Student Status and Classification

Classified Standing

Acceptance as a **Classified Student** indicates that *all prerequisite course work has been completed*, that a formal Plan of Study has been developed, and that the student’s progress in graduate level courses warrants continuation in the program. Specific requirements for Classified Status are listed below:

- Completion of 60 units in Geology; the last 40 units must be courses above the introductory level. Required courses (or their equivalents) are GEOL 303 Mineralogy, 309 Sedimentation and Stratigraphy, 306 Petrology and Petrography, 307 Structural Geology and a summer field course in Geology.

- Completion of the following prerequisite courses in cognate areas: CHEM 211 Principles of General Chemistry I, CHEM 212 Principles of General Chemistry II, PHYS 201 Basic Principles of Newtonian Physics, PHYS 202 Basic Principles of Maxwellian Physics, MATH 140 Elementary Statistics or PHYS 203 Basic Principles of Contemporary Physics, MATH 201 Calculus I, MATH 202 Calculus II, MATH 222 Laboratory Experience.

- Satisfactory completion of the Graduate Record Examination (Advanced Test in Geology) and other examinations or course work which may be assigned by the Graduate Committee of the Department.

- Formal acceptance of the student’s Plan of Study by the Graduate Committee of the Department.

Conditionally Classified Standing

Applicants may be admitted as **Conditionally Classified Graduate Student** if, in the judgment of the Graduate Committee, the applicant has potential for successful completion of all the “conditions” specified by the faculty committee for admission as a Classified Graduate Student and potential for successful completion of all the requirements for the graduate program. Upon satisfactory completion of all “conditions” specified by the Committee, the student’s status will be administratively changed to Classified Graduate Student.

**Note:** No more than three courses (15 units) may be taken for graduate credit until all prerequisites have been satisfied.
3. Critical Information

Transitioning from your undergraduate education to graduate school is a big step and there are many important differences. This is especially true if you have been out of full-time education for some time or were educated in another country.

Maintaining Your Grades

All graduate students must maintain an overall GPA of 3.0 and earn at least a C (2.0) in all courses, except those graded credit/no credit. Students who are conditionally classified (see below) because of GPA deficiencies may not earn less than a B (3.0) in those courses. Any student whose overall GPA falls below 3.0 for two consecutive quarters, or who receives more than three grades of C (2.0) or lower in any graduate course, will be placed on academic probation or dismissed from the program.

Financial Aid

To be eligible for financial aid you must enroll full-time (8 units or more). All other questions regarding financial aid should be directed to the Financial Aid Office (661.654.3016). It is not the responsibility of the Geology Department to monitor or interfere in your Financial Aid status.

Time Limits

Time limits have been set for completion of requirements at each level of status:

- Advancement to Classified Status must be accomplished within two calendar years after acceptance as a Conditionally Classified Student.
- All requirements, and graduation, must be completed within five calendar years after formal acceptance to the graduate program.
- The five-year time limit may be extended to seven years by petition to the Geology Graduate Coordinator. The seven-year time limit is absolute and cannot be extended further (2013-2015 course catalog, p. 198).

Leaves of Absence

Students must maintain their enrollment status at CSUB. Students who need to take two or more consecutive quarters away from study must seek approval from the Graduate Coordinator and together they will complete a plan of future study including when the study will resume their enrollment. Failure to be approved for an extended absence will constitute a withdrawal from the University and the MS Geology program. Students seeking to return after an non-approved absence, or who were absent beyond that time that had been approved, will (1) have to reapply to CSUB, (2) reapply to the MS Geology program, (3) pay all necessary fees, and (4) apply to the Graduate Coordinator to have previous classes recredited. Students who have been absent (i.e. not enrolled) for five or more years will not be readmitted.
Continuous Enrollment (GEOL 700)

Students that have achieved *Classified Status* and only have their MS thesis to complete (GEOL 690B) are eligible to enroll in GEOL 700 and maintain their status without having to take additional classes. GEOL 700 “Continuous Enrollment” is a low-cost, zero-unit class that maintains student enrollment and thus avoids students having to (1) take unnecessary additional classes or (2) take an unsanctioned leave of absence.

Graduate Writing Assessment Requirement (GWAR)

Graduate students must satisfy the Graduation Writing Assessment Requirement (GWAR) as soon as possible in their graduate study, unless they have already done so ([http://www.csbsj.edu/academicprograms/gradprograms/gradwriting.shtml](http://www.csbsj.edu/academicprograms/gradprograms/gradwriting.shtml)). Graduate students who have not met this requirement may do so by passing the regularly scheduled GWAR examination (offered once a quarter) or by earning a “C” or better in one of the approved GWAR courses.

See [http://www.csbsj.edu/testing/gwar.shtml](http://www.csbsj.edu/testing/gwar.shtml) for up-to-date details and a list of courses that will satisfy the GWAR requirement.

You will be exempt from the GWAR if you meet any of the four criteria below:

a. You graduated from a CSU or a UC since 1980.

b. You earned a high enough score on one of these tests:

   GMAT 4.5 or higher on the writing portion of the GMAT
   
   CBEST 41 or higher on the writing portion of the CBEST
   
   GRE 4.5 or higher on the analytic writing portion of the GRE General Test

  c. An article that you have already published as first author in a refereed professional journal is judged by the Chair of the GWAR committee (Faculty Towers 102-D) to satisfy the requirement.

  d. The thesis or project you have already completed to earn an MA or MS in any discipline is judged the Chair of the GWAR committee to satisfy the requirement.

Students from campuses other than a CSU or UC may be considered to have met this requirement by taking a course at that university. Such students must submit a transcript with the course, the course description, and a syllabus for the course to the Composition Coordinator for evaluation.

Registration for the GWAR exam or course requires English 110 (C or higher), its equivalent (see list on [http://www.csbsj.edu/testing/gwar.shtml](http://www.csbsj.edu/testing/gwar.shtml)), or a passage of the waiver examination.

Commencement and Graduation

**Walking at the Commencement Ceremony and graduating ARE NOT the same thing.** It is possible, although strongly ill-advised, to walk at commencement before graduating.

Students **need to apply** to the University for Graduation and pay a fee. More information on university graduation application deadlines can be found at: [http://www.csbsj.edu/admissions/graduation/](http://www.csbsj.edu/admissions/graduation/). The application for graduation is due to the university well before (6 to 8 weeks) the expected quarter of
graduation. Students should make sure that they are checking these deadlines and they submit their application into the university on time. Applying to attend the Commencement Ceremony and “walk” is a different, independent process.

Who walks at the Commencement Ceremony is beyond the control of CSUB faculty. Students that apply to attend the Ceremony are not vetted for their academic status: in other words, the Ceremony is meaningless as an academic or professional activity. Geology faculty will NEVER approve students graduating before they have completed ALL their required work, including submission of the final thesis to the library.
4. **CSUB Information Technology**

**myCSUB**

As a new student, make sure to log onto myCSUB and review your To-Do list. This site will give you important information about your plan of study, residency status, and financial account information. myCSUB is always on-line and available to you, except during occasional maintenance periods. Read through the myCSUB Self Service Guide for Students to become familiar with the system.

The Student Center is displayed after you log into myCSUB. The Student Center shows you a summary of your

- Academics,
- Finances,
- Personal Information,
- Holds,
- To Dos,
- Enrollment Dates, and
- Advisor Information.

From the Student Center, you can search for classes, manage your enrollments, inquire about your finances, view your financial aid awards, and update your personal information, such as emergency contacts, names, and addresses. The Student Center provides you a single entry point from which to begin navigation to student-related transactions.

**RunnerCard**

The CSUB RunnerCard is more than just an ID card – it is also your library card, photocopy card, and meal card. Obtain a new RunnerCard as soon as you arrive by completing the application (if you have done so already) and having your photograph taken.

**email**

After registering, be sure to check your e-mail regularly. CSUB will use e-mail for all written correspondence to you. If you change your e-mail address, you must immediately update it in myCSUB. **The email address on file must be one that you check regularly!**

**Facebook**

The CSUB Geology Club maintains an active Facebook page. This is often the first place that new information is posted.
Geology Faculty and Research

Dr. Jan Gillespie (Professor) jgillespie@csub.edu subsurface architecture of petroleum reservoirs and groundwater aquifers and the movement of fluids through them, as well as using the aquifer/reservoir architecture to reconstruct past depositional environments and tectonic settings.

Dr. Dirk Baron (Professor and Department Chair) dbaron@csub.edu aqueous geochemistry and hydrogeology; research on the behavior of trace elements like Cr and As in pristine and contaminated soils and groundwater, and the chemistry of CO₂ sequestration.

Dr. Bob Horton (Professor Emeritus) rhorton@csub.edu diagenesis and porosity development in San Joaquin basin sandstone reservoirs, director of the CA Well Sample Repository.

Dr. Rob Negrini (Professor) mnegrini@csub.edu behavior of the earth's magnetic field, paleoclimatology, shallow subsurface geophysical exploration, structure and tectonics, director of the CREST program (http://www.csub.edu/crest/).

Dr. Graham Andrews (Assistant Prof. & Graduate Program Coordinator) gandrews1@csub.edu physical volcanology, petrology structural geology, and tectonics of the Cordillera.

Dr. Chris Krugh (Assistant Professor) wkrugh@csub.edu neotectonics, tectonic geomorphology, and thermochronology.

Dr. Junhua (Adam) Guo (Assistant Professor) junhua_guo@csub.edu sedimentology, marine geology, diagenesis

Mrs. Elizabeth Powers (Instructional Support Technician) epowers@csub.edu

Mrs. Sue Holt (Administrative Assistant) sholt3@csub.edu

Mrs. Andrea Medina (CREST Administrator and NSME Grant and Award Coordinator) amedina4@csub.edu

Mr. Charles James (California Well Core Repository curator) cjames1@csub.edu

Research facilities include:

- a PC lab with software including GeoGraphix, Petrel, and ArcGIS for petroleum reservoir modeling and geospatial analysis, and industry provided seismic datasets,
- the California Well Core Sample Repository, containing cores and samples from more than 5,000 wells from both onshore and offshore California and 1,500 catalogued micropaleontological samples,
- a new lab dedicated to the CREST program hosting analytical equipment, open workspace, and PCs,
- a geochemistry lab and chemical store,
- rock preparation (crushing, cutting, polishing, etc.), and mineral separation and digestion facilities, and
• a petrography lab equipped with several petrographic microscopes including those for luminescence and epifluorescence analysis, and point-counting stages.

Analytical equipment includes:

• a Hitachi S-3400 variable pressure scanning electron microscope equipped with Oxford Inca energy dispersive (EDS) and wavelength dispersive (WDS) X-ray spectrometers, a micro-XRF source, and a Gatan ChromaCL live color catholuminescence imaging system,

• a Perkin Elmer Elan 6100 ICP-MS with a Cetac LSX-200 Laser Ablation system,

• a PANalytical X-ray diffractometer (XRD) [purchased in Fall 2014],

• an array of geophysics equipment including a paleomagnetism lab, 12-channel seismograph, magnetometer, gravimeter, and electrical resistivity meter,

• a wide range of field hydrology equipment,

• a Giddings coring unit for shallow drilling,

• a laser particle size analyzer,

• a GigaPan panoramic photography system, and

• a single-cell helium pycnometer for measuring porosity.
Funding Opportunities and Financial Support

The Bad News

School costs money; for most students financial hardship is the number one reason to struggle or withdraw from higher education. We faculty wish that you didn’t have to pay tuition, and that we could financially support all of you at a satisfactory (i.e. humane) level – but we can control neither. Expect to pay for tuition (in the region of $10,000 per year) and DO NOT expect to receive a stipend nor to receive a teaching assistantsship - we cannot guarantee financial support. The faculty can only guarantee to pay for your research costs, including necessary travel.

The Good News

Students can apply for financial aid by completing your Free Application for Federal Student Aid online.

There are additional funding sources including NSF, GSA, AAPG, Sigma Xi, etc., that have multiple grants (ranging in value from a few hundred to several thousands) to aid graduate students. Please discuss these opportunities with your advisor and colleagues, and do some research online to see if you are eligible. Be aware that grant deadlines are spread throughout the year, and typically only once a year.

In addition, you may be eligible for the following CSU programs:

- **Graduate Equity Fellowship**: Graduate Equity Fellowships are renewable for a maximum of six academic terms, pending available monies and satisfactory performance in one's graduate program. The fellowships are based upon financial aid eligibility. Fellows are expected to be full-time graduate students (however, I know of part-time students who have been successful!) and to complete their degree requirements within the one- or two year time frame of their respective Master's program. Applicants are also encouraged to pursue advanced degrees (PhD, etc.) upon completion of study at CSUB, an issue worth consideration in the development of the Personal Statement. Fellows may be expected to participate in some special activities during the academic year. Although renewable, students must reapply for the fellowship in spring term for the next academic year.

- **Graduate Student Tuition Fee Waiver (GSTFW) Program**: A minimal number of graduate student tuition fee waivers are available each year. The goals of the GSTFW program include:
  - increasing the number of CSUB graduate students who would otherwise not attend without financial assistance,
  - to provide student assistant support to graduate programs that have demonstrated notable enrollment growth, and,
  - to assist graduate programs to recruit students from underrepresented groups.

Nominations by faculty are requested toward the end of spring quarter.
- **Graduate Assumption Program of Loans for Education (Graduate APLE):** Once a Graduate APLE participant has obtained a graduate degree, the California Student Aid Commission (Commission) may assume a total of $6000 in outstanding educational loans in return for a cumulative total of three consecutive full-time years of eligible teaching service at one or more colleges or universities in California.

Check the [Financial Aid Home Page](#) for additional information and programs.

**Graduate Teaching Assistantships**

A small number (2 to 3) of Teaching Assistantships (T.A.) are typically awarded each year in which students will get hands-on teaching experience running lab sections for 100 and 200 level classes, and helping faculty with fieldtrips. These opportunities will greatly benefit those who plan to teach in the future and/or pursue a PhD. T.A.s will receive a salary, and may be eligible for a tuition waiver. Preference will be given to students engaged in the “MS with thesis” track.
Overview of the Masters in Geology

The MS in Geology programs offer two very different “tracks”. The first is the “MS with thesis” track and the second is the “non-thesis” track. Both allow for optional concentrations in Petroleum Geology or Hydrogeology. Both MS tracks are designed as two-year (full-time equivalent) programs, and you should plan accordingly.

Pre-requisites:

1. Completion of 60 undergraduate units in Geology; the last 40 units must be courses 300-level or above. Required courses (or their equivalents) are GEOL 303, 309, and 306 and 307, and a summer field course in Geology.

2. Completion of the following prerequisite courses in cognate areas: CHEM 211, 211L, 212, 212L, PHYS 201 or 221, PHYS 202 or 222, MATH 140 or PHYS 203, MATH 201 or 211, MATH 202 or 212.

Classes taken for undergraduate credit (i.e. towards the 60 U/G units) cannot be used for graduate credit.

As a general rule-of-thumb, when a class is offered, take it! Very few classes will be offered every year, and we cannot guarantee that every class listed in the catalog will be offered during your time at CSUB. A minimum of 45 units of course work is required for the MS in Geological Sciences. All courses are 5 units credit unless noted.

1. MS with Thesis

1. The following courses are required of all thesis students: GEOL 601 (1 unit), 604, and the three thesis classes 585 (4), 690A (4), and 690B (2) (see below).

2. All thesis students need at least 25 additional units from the following: GEOL 420, 450, 460, 475, 477 (variable credit), 515, 525, 555, 570, 575, 577 (variable credit), 580 (variable credit), 605, 606, 607, 609, 610, 625, 650, 675, 677, 678 (3 units), 700 (0 units), MATH 415, 440. Appropriate graduate level classes in related fields subject to approval. GEOL 496 and 497 are not eligible for graduate credit.

Students taking the Petroleum Geology concentration are required to take both GEOL 460 and 570 as part of their 25 additional units. Hydrogeology concentration students are required to take both GEOL 475 and 555 as part of their 25 additional units.

The Thesis

A master’s thesis is required; research leading to the thesis will be the culminating experience for each student in the Master's program. The thesis will be a substantial product of original empirical research carried out under the close supervision of the student’s advisor. It is expected that the student and his/her advisor will work closely together to identify elective courses and possible research topics for a thesis.

An oral defense of the thesis is also required. The defense will include questions regarding the thesis and questions of a more general nature related to knowledge in the earth sciences.
The thesis will be judged by the extent to which a student attempts to solve a scientific problem by employing methods appropriate to the task. The thesis must meet certain minimum standards, which include the following:

- thoughtful consideration of and reference to prior work in the field of study;
- a peripheral understanding of the broader scientific value or societal implications of the work, as appropriate; and
- a demonstration of originality and critical thinking.

Graduate students conducting research in a foreign country are expected to be proficient in the language in which source materials are published.

Even though the thesis is only valued at 10 units, the research and writing of your thesis should take the majority of your time here with classes fit in where possible and when necessary. Remember that your thesis is your number one priority; classes are always secondary to the thesis.

The number one reason why students do not graduate promptly, or at all, is failure to complete their thesis.

The Thesis Classes

Every student is required to complete the following three seminar-type classes which are usually offered in the winter or spring quarter. In addition, seven regular 5-unit classes are required for a total of 45 units. See the catalog for more details and for a list of required and elective classes.

GEOL 585. Research Methods and Strategies I. (4 credits)
Preparation of proposal for research project and peer-reviewed presentation of initial results. Research project will consist of either laboratory or field investigation, or both, of sufficient scope and import as deemed. This course is to be taken by all first-year graduate students.

GEOL 690A. Master’s Thesis I. (4)
Peer-reviewed presentation of results of ongoing M.S. thesis research. This course is to be taken by all second-year graduate students. Prerequisite: GEOL 585.

GEOL 690B. Master’s Thesis II. (2)
Completion of research, writing and oral presentation of M.S. thesis, AND submission of final thesis copy to the CSUB library (i.e. physically handing-in a copy of the final, approved thesis to the librarian). Credit on acceptance of the thesis by thesis committee. Students cannot graduate without completing this step. Prerequisite: GEOL 690A.

MS Thesis Formatting Guidelines

The guidelines (i.e. rules) for thesis formatting are provided by the CSUB Library - http://www.csub.edu/library/MasterThesisApp.pdf. This includes a checklist, copyright forms, sample
Master’s Thesis Committee Composition Policy

All members of the thesis or project committee will be individuals with advanced degrees or relevant professional experience within the thesis research area.

Together the primary advisor and student will select and ask one to two additional members to serve on the graduate committee. A minimum of two committee members must be tenured or tenure-track faculty members in the Department of Geology. Upon approval, a faculty member from another department or a professional member from the community, or a faculty member from another university with pertinent background to the research topic and the appropriate terminal degree (e.g., M.S.) may sit on the committee as the third member. See below for more details.

In some cases a student will rely primarily on the advisor for thesis development; in other cases the committee members will be consulted more substantively. It is the student’s responsibility to keep all committee members informed of his/her progress and to ask their advisor for guidance in determining the appropriate level of involvement for the committee members. Students are encouraged to meet with their committee at least twice per year to discuss progress.

Each thesis committee will have a minimum of three members.

a. The chair of the thesis committee must be a tenure track CSUB faculty member from the program awarding the masters degree (i.e. the Department of Geology); she / he ensures that the thesis conforms to program and university standards. She / he must have knowledge and expertise in the field of study and is responsible for the intellectual integrity, rigor, and quality of research.

b. If possible or practical, the other committee members should be university / college faculty, preferably from the program awarding the master's degree. If the faculty member is not from the CSUB Department of Geology, then the faculty member's professional expertise must be related to the thesis research area. If a committee member is not faculty, then the person's professional expertise must be directly related to the thesis research area, and the person’s academic degree(s) should be equivalent to, or be beyond, a master’s degree.

The composition of the thesis committee must be approved by the appropriate Graduate Program Coordinator (Dr. Andrews), Dean of NSME (Dr. Houtman), and the Associate Vice President for Academic Programs (Dr. Kemnitz).

Philosophy

No longer is the goal simply to attend and finish classes in a timely order; in graduate school you are now expected to take a more active role in your studies and a big part of this is with the research involved in the production of your thesis. **The main goal of your Master’s degree is to learn how to do research at a level of quality that will add to the scientific community as a whole and produce a thesis.** Classes will add to your overall geologic understanding and will possibly fill in gaps that you
may have missed during your undergraduate education, but the focus will be on learning how to do a proper research project and how to write the results of that project into a powerful scientific synthesis. Laboratory or field research is an integral component of the program, which emphasizes a "hands-on" approach with close faculty mentoring. Research experience also enables students to hone investigative skills relating to experimental design, implementation, data analysis, and interpretation.

2. **MS non-thesis**

1. The following courses are **required** of all non-thesis students: GEOL 601 (1 unit), 604, 607, 680 (1 unit), and either of 675 or 678 (3 units).

2. All non-thesis students need at least 35 additional units from the following: GEOL 420, 450, 460, 475, 477 (variable credit), 515, 525, 555, 570, 575, 577 (variable credit), 580 (variable credit), 605, 606, 609, 610, 625, 650, 675, 677, 678 (3 units), 700 (0 units), MATH 415, 440. Appropriate graduate level classes in related fields subject to approval. GEOL 496 and 497 are not eligible for graduate credit.

Students taking the Petroleum Geology concentration are required to take both GEOL 460 and 570 as part of their 35 additional units. Hydrogeology concentration students are required to take both GEOL 475 and 555 as part of their 35 additional units.

3. **Elective classes**

All MS students must take five or more elective classes, up to a minimum of 45 units (thesis) or 50 units (non-thesis) total, from the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOL 420</td>
<td>Environmental Geochemistry</td>
<td>5</td>
</tr>
<tr>
<td>GEOL 450</td>
<td>GIS for Natural Sciences</td>
<td>5</td>
</tr>
<tr>
<td>GEOL 460</td>
<td>Petroleum Geology</td>
<td>5</td>
</tr>
<tr>
<td>GEOL 475</td>
<td>Hydrogeology</td>
<td>5</td>
</tr>
<tr>
<td>GEOL 477*</td>
<td>Special Topics in Geology</td>
<td>1 to 5</td>
</tr>
<tr>
<td>GEOL 515</td>
<td>Paleoclimatology</td>
<td>5</td>
</tr>
<tr>
<td>GEOL 525</td>
<td>Applied Hydrogeochemistry</td>
<td>5</td>
</tr>
<tr>
<td>GEOL 555</td>
<td>Contaminant Hydrology</td>
<td>5</td>
</tr>
<tr>
<td>GEOL 570</td>
<td>Oilfield Development</td>
<td>5</td>
</tr>
<tr>
<td>GEOL 575</td>
<td>Basin Analysis</td>
<td>5</td>
</tr>
<tr>
<td>GEOL 577* / GEOL 677*</td>
<td>Advanced Topics in Geology</td>
<td>1 to 5</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
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<tr>
<td>GEOL 580</td>
<td>Advanced Research Participation</td>
<td>1 to 5</td>
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<td>GEOL 604</td>
<td>Advanced Sedimentation</td>
<td>5</td>
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<td>GEOL 605</td>
<td>Advanced Micropaleontology</td>
<td>5</td>
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<tr>
<td>GEOL 606</td>
<td>Advanced Sedimentary Petrology</td>
<td>5</td>
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<td>GEOL 607</td>
<td>Advanced Structural Geology</td>
<td>5</td>
</tr>
<tr>
<td>GEOL 609</td>
<td>Advanced Stratigraphy</td>
<td>5</td>
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<tr>
<td>GEOL 610</td>
<td>Low Temperature Geochemistry</td>
<td>5</td>
</tr>
<tr>
<td>GEOL 625</td>
<td>Shallow Subsurface Exploration Methods</td>
<td>5</td>
</tr>
<tr>
<td>GEOL 650</td>
<td>Groundwater Flow Modeling</td>
<td>5</td>
</tr>
<tr>
<td>GEOL 675</td>
<td>Subsurface Mapping of Petroleum Reservoirs</td>
<td>5</td>
</tr>
<tr>
<td>GEOL 678</td>
<td>Practical Petroleum Prospecting</td>
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<td>GEOL 700</td>
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*Note: GEOL 477 / 577 / 677 may be taken more than once as long as the topic of the class is different each time.*