### GEOLOGY (GEOL)

**GEOL 1390  Introductory Environmental & Physical Geology  3 Credits**  
*Department: College of Arts and Sciences*

This course is an introduction to the relationship between human activities, geologic resources and processes and environmental quality. Topics include the relationship between human populations and geologic hazards, as well as how human activities may increase the chances of geologic hazards occurring. Emphasis will be from the geologic perspective, but will include all basic sciences. Field trips are an integral part of this course.  
*Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS*

**GEOL 1403  Geology I: Physical Geology  4 Credits**  
*Department: College of Arts and Sciences*

Earth materials, structures, tectonics, land forms, mineral resources and processes that formed them.  
*Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS*

**GEOL 1404  Geology II: Historical Geology  4 Credits**  
*Department: College of Arts and Sciences*

History of the development of our planet and its inhabitants.  
*Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS*

**GEOL 2373  Optical Mineralogy  3 Credits**  
*Department: College of Arts and Sciences*

In this course, the student will learn about light transmission in minerals, become familiar with the operation and care of the petrographic microscope, learn to identify minerals by optical properties and be able to recognize common and important minerals.  
*Prerequisite(s): GEOL 2471  
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS*

**GEOL 2376  World and Economic Geography  3 Credits**  
*Department: College of Arts and Sciences*

Regional, national, and continental units considered from the viewpoint of economic resources, resource development, organization, politics, economy, and physical landscape.  
*Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS*

**GEOL 2377  Physical Geography and Geomorphology  3 Credits**  
*Department: College of Arts and Sciences*

Fundamental concepts of local, regional, and global physical geography and geomorphology, including landform features and soils. Geology and Earth Science majors are required to take an additional laboratory component (GEOL 4101 - Geomorphology Lab) to meet degree requirements. (CC No. 1301).  
*Prerequisite(s): GEOL 1403  
Restriction(s): Students with a class of Freshman may not enroll.  
*Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS*

**GEOL 2471  Mineralogy Petrology  4 Credits**  
*Department: College of Arts and Sciences*

Classification, properties, occurrence and identification of rock-forming minerals.  
*Prerequisite(s): GEOL 1403  
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS*

**GEOL 3101  Physical Geology Lab Instruction  1 Credit**  
*Department: College of Arts and Sciences*

Advanced laboratory techniques in physical geology. May be repeated for credit. May be Repeated for a maximum of 3 hours  
*Prerequisite(s): GEOL 1403  
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS*

**GEOL 3315  Hydrogeology  3 Credits**  
*Department: College of Arts and Sciences*

This course is designed to introduce the student to the basic principles of hydrogeology – understanding the geologic factors that control the occurrence, movement, and chemistry of groundwater. We will also examine issues related to groundwater supply and contamination of groundwater.  
*Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS*

**GEOL 3316  Petroleum & Subsurface Geology  3 Credits**  
*Department: College of Arts and Sciences*

This course is to introduce the students to the methods used in petroleum exploration and production, including interpretation of subsurface data used in the oil industry, as well as the environmental and mining industries. Skills learned in this course include petrophysical interpretation of well logs, well log correlation, subsurface contour mapping, and determining what geologic conditions are necessary for the potential accumulation of oil and gas deposits. These methods will be taught, using both computer software and hand interpretation techniques. Other goals of this course include increasing the student's critical thinking, writing, and oral communication skills through problem sets, class discussions, and a final exploration play report and presentation. Assessment of how well students learned the skills taught in this course will take place through homework grades, two exams, and grades received on their exploration play report and presentation.  
*Prerequisite(s)/Corequisite(s): GEOL 3420 and GEOL 4410  
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS*
GEOL 3370  Engineering Geology  3 Credits
Department: College of Arts and Sciences
This course aims to provide the students with the tools required to understand and identify geologic features that could have short and long-term consequences to the environment and overall performance of various engineering structures. Emphasis is given in geologic site characterization techniques, technical writing, geologic map analysis, and the evaluation of geological and geotechnical conditions for the design, construction, operation, and maintenance of engineering structures. The course also intends to provide a key understanding of geological processes involved in natural hazards as well as the techniques used to “forecast” and/or mitigate such events. Fundamental knowledge on rock and soil mechanics, geomorphology, sedimentology, and structural geology are also included in this course for wholistic environmental and site characterizations.
Prerequisite(s): GEOL 4031 and MATH 2312
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

GEOL 3390  Environmental Geography and Geology  3 Credits
Department: College of Arts and Sciences
The relationship between human activities, geologic resources and processes, and environmental quality. Topics include the consumption of geologic resources and its impact on the environment. The relationship between human populations and geologic hazards. Field trip and special fee required.
Prerequisite(s): GEOL 1403 or GEOL 2377
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

GEOL 3420  Structural Geology  4 Credits
Department: College of Arts and Sciences
Rock deformation and geologic structures. Field trip and special fee required.
Prerequisite(s): GEOL 2471
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

GEOL 3450  Petrology  4 Credits
Department: College of Arts and Sciences
Classification, properties, occurrence and origin of rocks. Macro and micro techniques for the identification of rocks. Field trip and special fee required. Prerequisite: GEOL 2471 Offered: Fall
Prerequisite(s): GEOL 2471 and GEOL 2373
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

GEOL 3600  Summer Field Camp  6 Credits
Department: College of Arts and Sciences
Description of stratigraphic sections, preparation of geologic maps and field reports. Conducted off-campus at various field locations. Special field trip fees required. May be Repeated for a maximum of 6 hours
Prerequisite(s): GEOL 3420 and GEOL 3450 and GEOL 4420
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

GEOL 4101  Special Topic Earth Science  1 Credit
Department: College of Arts and Sciences
An individual library, laboratory, or field project. To receive credit, an acceptable report is required. May be repeated for credit. May be Repeated for a maximum of 9 hours
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

GEOL 4301  Special Topic Earth Science  3 Credits
Department: College of Arts and Sciences
An individual library, laboratory, or field project. To receive credit, an acceptable report is required. May be repeated for credit. May be Repeated for a maximum of 12 hours
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

GEOL 4303  GPS Methods and Applications  3 Credits
Department: College of Arts and Sciences
This course is designed to train students in using several types of GPS instruments to gather field position data for a variety of applications, including GIS. Lectures on GPS fundamentals will be augmented with hands-on training using GPS equipment; including survey-grade GPS, mapping-grade GPS, GPS base stations, hand-held GPS and smartphone GPS.
Prerequisite(s): GEOL 4311 or GEOL 3311
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

GEOL 4311  Fundamentals of GIS  3 Credits
Department: College of Arts and Sciences
This course is designed to provide students with an applied understanding of the concepts and theory behind GIS including spatial data structures, data sources and transfer methods, projections and coordinate systems, georeferencing, geocoding, geodatabase design and management, how to start a GIS project, as well as fundamentals of spatial analysis techniques such as overlay, extraction and interpolation. Concepts presented in lecture will be put into practice through tutorials using the GIS software product ArcGIS 10.x (ESRI, Inc.). The culmination of the course is the presentation of your research project employing the methods learned.
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS

GEOL 4312  Advanced GIS  3 Credits
Department: College of Arts and Sciences
This course is designed to advance a student’s knowledge in the rapidly developing field of Geographic Information Science and Systems (GIS). This course is built on the techniques learned in the Fundamentals of GIS course (GEOL 3311) by exposing the student to more advanced methods in developing and utilizing GIS data. Students will gain skills and knowledge of design, planning and error within GIS data management, analytical decision-making techniques and advanced spatial and statistical analysis. Python Script and Model Builder, web mapping and collector, digital image processing and analysis in ArcGIS, and working with LiDAR datasets. Students will gain deep understanding of the potential value of GIS through lectures, exercises of the latest versions of ArcGIS software and research in a broad range of applications.
Prerequisite(s): GEOL 4311 or GEOL 3311
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS
GEOL 4313 GIS Research Project  3 Credits  
Department: College of Arts and Sciences  
This course is designed to advance a student's knowledge to design, manage and complete a research project that emphasizes the use of Geographic Information Systems (GIS). This course is built on the techniques learned in GEOL 3311. Undergraduate students will work in groups of 2 to 4. Student groups will agree with the instructor on a suitable problem and then solve it by acquiring, organizing and analyzing data using a GIS. Projects must include a substantive analytical component where GIS is central to the methods used.  
Prerequisite(s): GEOL 3311 and GEOL 4311  
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS  

GEOL 4314 Fundamentals of Remote Sensing  3 Credits  
Department: College of Arts and Sciences  
Remote sensing is a rapidly-evolving science and technology with numerous contributions to the Earth, environmental and ocean sciences, such as monitoring of natural hazards including droughts, floods, landslides, volcanic eruptions, earthquakes and forest fires. This course introduces students to the principles of remote sensing with its wide applications in the Earth and environmental sciences. Fundamental knowledge is offered on the physics of remote sensing, photogrammetry, remote sensing data acquisition, remote sensing data types (multispectral, hyperspectral, RADAR and LiDAR), and numerous applications. The course will also cover digital image processing and analysis techniques using ENVI software.  
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS  

GEOL 4317 GIS Seminar  3 Credits  
Department: College of Arts and Sciences  
A seminar series on topics related to principles, techniques and applications of Geospatial Sciences, Geographic Information Systems (GIS), Remote Sensing, and Drone Photogrammetry. It is meant to expose students to current research and developments in these rapidly advancing fields. Bi-weekly seminars presented on selected topics by students, and speakers from within and outside Lamar University. A student is required to study and discuss and write a summary of at least five out of the 10 seminar topics.  
Prerequisite(s): GEOL 4311 and GEOL 3311  
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS  

GEOL 4318 Drone Photogrammetry  3 Credits  
Department: College of Arts and Sciences  
Drones, aka "Unmanned Aerial Systems" (UASs) or "Unmanned Aerial Vehicle" (UAV), refer to an unpiloted aircraft or spacecraft. This course is specifically designed to teach students the ins and outs of operating drones. Topics covered include drone safety and current policies, principles of photogrammetry, cameras and imaging systems, georeferencing, flight planning and how to take aerial photos and videos.  
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS  

GEOL 4330 Geophysics  3 Credits  
Department: College of Arts and Sciences  
Application of the principles of physics to geologic problems. Use of geophysical techniques in exploration.  
Prerequisite(s): MATH 2312  
Prerequisite(s)/Corequisite(s): PHYS 1401 or PHYS 2425  
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS  

GEOL 4360 Field Geology of Texas  3 Credits  
Department: College of Arts and Sciences  
Geologic history, topography, physiography, structure and mineral deposits of Texas observed on location at classic geologic exposures across Texas and adjacent states. Camping on and hiking across geologic outcrops will be an integral part of this field experience. Field trip and special fee required. May be repeated for credit as field trip locations change.  
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS  

GEOL 4361 Geochemistry  3 Credits  
Department: College of Arts and Sciences  
Application of chemistry to the solution of geological problems.  
Prerequisite(s): CHEM 1412 and GEOL 2471  
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS  

GEOL 4370 Meteorology  3 Credits  
Department: College of Arts and Sciences  
Composition and processes of the atmosphere. Weather and climate and their effect on human activities. Air pollution and other human induced changes to the atmosphere.  
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS  

GEOL 4380 Oceanography  3 Credits  
Department: College of Arts and Sciences  
Structure, properties and processes of the hydrosphere emphasizing geologic aspects. Role of the seas and oceans in the total environment.  
Corequisite(s): GEOL 4101  
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS  

GEOL 4390 Rocks and Stars  3 Credits  
Department: College of Arts and Sciences  
A conceptual introduction to space science with emphasis on planetary exploration. Visual programs and guest speakers from NASA and other space research facilities are included. For both non-science and science majors.  
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS  

GEOL 4410 Stratigraphy and Sedimentology  4 Credits  
Department: College of Arts and Sciences  
Fundamental principles of outcrop, subsurface and sequence stratigraphy. Derivation and deposition of sediments, and environmental interpretation of sedimentary strata.  
Prerequisite(s): GEOL 1404  
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS  

GEOL 4420 Paleontology  4 Credits  
Department: College of Arts and Sciences  
Principles of paleontologic interpretation including classification, morphologic analysis and identification of invertebrate and vertebrate fossils. Application of paleontology to stratigraphic correlation. Field trip and special fee required.  
Prerequisite(s): GEOL 1404  
Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS
GEOL 5101  Institutes in Earth Science  1 Credit  
Department: College of Arts and Sciences  
Sumner, in service, or other institutes for earth science teachers. Credit varies with duration. The description of the area of study of each institute will appear on the printed schedule. May be repeated for credit when nature of institute differs sufficiently from those taken previously.  
Offered: Other  
May be Repeated for a maximum of 2 hours  
Restriction(s):  
Undergraduate level students may not enroll.  

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS  

GEOL 5301  Special Topic Env Geo  3 Credits  
Department: College of Arts and Sciences  
Summer, in service, or other institutes for earth science teachers. Credit varies with duration. The description of the area of study of each institute will appear on the printed schedule. May be repeated for credit when nature of institute differs sufficiently from those taken previously.  
May be Repeated for a maximum of 99 hours  
Restriction(s):  
Undergraduate level students may not enroll.  

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS  

GEOL 5303  Advanced GPS methods and Applications  3 Credits  
Department: College of Arts and Sciences  
This course is designed for graduate students to demonstrate a clear understanding of the GPS signal, codes and biases, describe the differences between relative and autonomous GPS positioning, code phase carries phase, DGPS and RTK. Students will learn the practical applications of GPS and the implications of its modernization. Lectures on GPS fundamentals will be augmented with hands-on training using GPS equipment. Students will use GPA equipment to perform survey and mapping. Final project is required.  
May be Repeated for a maximum of 3 hours  
Prerequisite(s): GEOL 5311  
Restriction(s):  
Undergraduate level students may not enroll.  

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS  

GEOL 5311  Principles of GIS  3 Credits  
Department: College of Arts and Sciences  
This course will provide graduate students with an applied knowledge in making professional GIS maps, cartography methods, types of geospatial data, choosing and applying analytical methods for geospatial data including density analysis, interpolation and overlay analysis. Each graduate student will be assigned a research project. You will choose a research topic for your project. You will work on designing your project, data collection, data processing and analysis. You must write a scientific report of your project and present the results to the class.  
Restriction(s):  
Undergraduate level students may not enroll.  

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS  

GEOL 5312  Advanced GIS Analysis and Applications  3 Credits  
Department: College of Arts and Sciences  
This course is designed to advance students' knowledge in the rapidly developing field of Geographical Information Science and Systems (GIS). This course is built on the techniques learned in the Fundamentals of GIS (GEOL 5311) course by exposing the student to more advanced methods in developing and utilizing GIS data. Students will gain skills and knowledge of design, planning and error within GIS data management, analytical decision-making techniques and advanced spatial and statistical analysis, Python Script and Model Builder, web mapping and collector, digital image processing and analysis in ArcGIS, and working with LiDAR datasets. Students will gain deep understanding of the potential value of GIS through lectures, exercises of the latest versions of ArcGIS software and research projects in a broad range of applications.  
Prerequisite(s): GEOL 5311  
Restriction(s):  
Undergraduate level students may not enroll.  

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS  

GEOL 5313  Geospatial Research project  3 Credits  
Department: College of Arts and Sciences  
This course is designed to advance a student's knowledge to design, manage and complete a research project that emphasizes the use of Geographic Information Systems (GIS). This course is built on the techniques learned in GEOL 3311. Undergraduate students will work in groups of 2 to 4. Student groups will agree with the instructor on a suitable problem and then solve it by acquiring, organizing and analyzing data using a GIS. Projects must include a substantive analytical component where GIS is central to the methods used.  
Prerequisite(s): GEOL 5311  
Restriction(s):  
Undergraduate level students may not enroll.  

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS  

GEOL 5314  Principles of Remote Sensing  3 Credits  
Department: College of Arts and Sciences  
This course will introduce fundamental concepts and develop basic skills related to the use of remote sensing data. The primary goal of the course is to introduce students to the principles of remote sensing, physics of remote sensing, spaceborne satellite systems and remote sensing data types including multispectral, hyperspectral and RADAR. Hands-on exercises will be provided to teach students how to obtain and process satellite imagery, analyze and synthesize information from remotely sensed data. Students will also be able to communicate findings. In addition, students will be assigned a research project for mastering digital image processing techniques for environmental applications. Each student will be required to give a 15 minute oral presentation on their research project and submit a final project report.  
May be Repeated for a maximum of 3 hours  
Restriction(s):  
Undergraduate level students may not enroll.  

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS
GEOL 5316  Remote Sensing Data and Applications  3 Credits
Department: College of Arts and Sciences
This course assumes students have a prior knowledge in the basics
of remote sensing and have experience with digital image processing
software, particularly ENVI. Students will develop a strong understanding
of the tools and techniques used to display, process and analyze remotely
sensed data. Upon completion of this course students will be able to
develop analytical workflows to derive products and extract information
from remotely sensed data for a broad range of applications that include
wetlands, water quality, coastal changes, vegetation analysis, mineral
resources, land use and land cover changes. Throughout the course
students confront realistic problem scenarios that will test their ability
to apply the tools and techniques covered in the course. The culmination
of this course is an independent final project in which students will
demonstrate their ability to apply new skills to a real-world situation of
personal or professional interest.
May be Repeated for a maximum of 3 hours
Prerequisite(s): GEOL 5314
Restriction(s):
Undergraduate level students may not enroll.

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS
GEOL 5317  Seminar in Geospatial Science  3 Credits
Department: College of Arts and Sciences
The seminar series will provide a forum for graduate students to learn
about current and cutting-edge activities in Geospatial Sciences,
GIS, Remote Sensing, and Drone Photogrammetry. To meet these
expectations, a student must conduct research on a current topic from
published papers, write an abstract that relates a general synopsis of the
research paper, develop a presentation based on the findings, and deliver
a presentation. A student is expected to create and present a PowerPoint
presentation on one of the seminar topics. Furthermore, a student is
expected to question speakers competently and probingly.
Prerequisite(s): GEOL 5311
Restriction(s):
Undergraduate level students may not enroll.

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS
GEOL 5318  Drone Photogrammetry & Apps  3 Credits
Department: College of Arts and Sciences
Drone technology is developing aggressively and many governments
and non-government agencies are considering acquiring such systems.
Throughout the course, students will learn about drone safety and current
policies, components, principles of photogrammetry, cameras and
imaging systems. A student will write and submit a scientific report and
prepare a Powerpoint presentation on the report followed by 5 minutes
for questions from the audience.
Restriction(s):
Undergraduate level students may not enroll.

Grade Mode(s): Standard Letter, Registrar do not use FN, Registrar do not use FS