

GEOGRAPHY, GEOLOGY, and the ENVIRONMENT (GEO)

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Chairperson: Dagmar Budikova

Programs Offered

M.S. in Hydrogeology and the Hydrogeology Geographic Information Systems (GIS) Graduate Certificate.

Program Requirements

Master's degree candidates may choose either of two options.

Option I—Thesis: This 32 hour option requires:

- 18 hour core: GEO 360*, 410, 435, 439, 456, and 488
- 8-10 hours of electives
- GEO 499 (4-6 hours)

Option II—Comprehensive Exam: This 32 hour option requires:

- 18 hour core: GEO 360, 410, 435, 439, 456, and 488
- 14 hours of electives
- a comprehensive examination

* Students who are admitted into the program with undergraduate credit in GEO 360 will be required to take an additional graduate course.

All master's degree programs require a minimum of 50 percent of the non-thesis credit hours applied to the degree to be 400-level courses or above.

Hydrogeology Geographic Information Systems (GIS) Graduate Certificate

Graduate students in the Department of Geography, Geology, and the Environment may elect to pursue a Hydrogeology GIS Graduate Certificate. To earn the certificate, the student must take and successfully complete GEO 303, 304, and 305.

Hydrogeology Courses

303 INTRODUCTION TO GEOGRAPHIC INFORMATION SYSTEMS

4 sem. hrs.

Fundamental principles of geographic information systems; emphasis on raster and vector based systems and their applications to spatial analysis. Lecture and lab. Formerly GEOGRAPHIC INFORMATION SYSTEMS. Prerequisite: Minimum of 30 hours completed or GEO 138 or consent of the instructor.

304 GEOGRAPHIC INFORMATION SYSTEMS APPLICATIONS

3 sem. hrs.

Advanced applications in geographic information systems (GIS) with an emphasis on problem solving, advanced GIS analysis techniques, and a survey of vector- and raster-based GIS software and databases. Prerequisite: GEO 303; MAT 120 is recommended.

305 REMOTE SENSING I

3 sem. hrs.

Basic principles of remote sensing, image interpretation, photogrammetry, and digital image processing. Prerequisites: GEO 238, or consent of the instructor.

306 REGIONAL AND AREA STUDIES

1-9 sem. hrs.

Intensive on-site study of particular lands, environments, cultures, and people. Field work required. Prerequisite: Consent of the instructor.

306A15 REGIONAL AND AREA STUDIES: WEST TEXAS/NEW MEXICO

1-9 sem. hrs.

Intensive on-site study of particular lands, environments, cultures, and peoples. Field work required. Prerequisite: Consent of the instructor.

306A19 REGIONAL AND AREA STUDIES: PETROLEUM GEOLOGY OF ILLINOIS

2-4 sem. hrs.

Intensive on-site study of particular lands, environments, cultures, and peoples. Field work required. Prerequisite: Consent of the instructor.

306A22 REGIONAL AND AREA STUDIES: GEOGRAPHY OF CHICAGO

3 sem. hrs.

Intensive on-site study of particular lands, environments, cultures, and peoples. Field work required. Prerequisite: Consent of the instructor.

308 STATISTICS FOR GEOGRAPHERS II

3 sem. hrs.

Use and interpretation of basic statistical techniques in geographical problems. Formerly QUANTITATIVE METHODS IN GEOGRAPHY II. Prerequisites: GEO 238; MAT 120 or higher recommended.

311 POLITICAL GEOGRAPHY

3 sem. hrs.

An advanced course in the spatial dimensions of politics and political phenomena. Formerly GEO 208. Prerequisite: GEO 135 or 142 or consent of the instructor.

313 ENERGY AND SUSTAINABILITY

3 sem. hrs.

Human geographic study of energy, covering political, economic, environmental, and societal aspects of energy. Includes sustainability and energy security. Prerequisite: GEO 205 or consent of the instructor.

341 CLIMATE AND GLOBAL ENVIRONMENTAL CHANGE

3 sem. hrs.

Overview of concepts, methods, theory, and debates surrounding climate and global environmental change. Prerequisite: GEO 100 or consent of the instructor.

342 ECONOMIC GEOGRAPHY

3 sem. hrs.

This course investigates the dynamics of the global economy as well as the processes and actors that shape its spatial organization. Prerequisites: GEO 135 or 142 or consent of the instructor.

344 BIOGEOGRAPHY: DISTRIBUTION OF LIFE

3 sem. hrs.

Theory and application of the geographic distribution of plants and animals and processes that cause these distributions. Lecture and Lab. Prerequisite: GEO 100 or consent of the instructor.

360 GROUNDWATER GEOLOGY**3 sem. hrs.**

Groundwater occurrence and movement, aquifer evaluation, field and lab measurements, contamination and other applications. Field trips. Prerequisites: GEO 202 or 203 and MAT 146.

361 HYDROLOGY**3 sem. hrs.**

Introduction to hydrology, including all components of the hydrologic cycle, field and lab measurements, data acquisition, and quantitative problem solving. Three Saturday field trips required. Prerequisite: MAT 145 or consent of the instructor.

362 ENGINEERING GEOLOGY**3 sem. hrs.**

Engineering applications of geology, construction problems of geologic origin and their engineering solutions. Field trips required. Prerequisites: GEO 203; MAT 146; and PHY 108 or consent of the instructor.

363 GIS APPLICATIONS IN GEOLOGY**3 sem. hrs.**

Introduction of geographic information systems applied to geology problems. Includes vector and raster analyses of geologic, environmental, and subsurface features. Prerequisites: GEO 203 required; at least one of the following is recommended: GEO 290, 296, 360, or 380.

364 EXPLORATION GEOPHYSICS**3 sem. hrs.**

Principles of exploration geophysics and the techniques that are used to study subsurface environments. Subjects reviewed include: stress and strain, information theory, seismic, gravity, magnetics, electrical resistivity, electromagnetic conductivity, ground penetrating RADAR, and borehole logging. Prerequisites: GEO 203; MAT 146, and PHY 108 or consent of the instructor.

380 GEOMORPHOLOGY**3 sem. hrs.**

Origin, classification, description, and interpretation of landforms. Field trips required. Prerequisite: GEO 100 or 102.

382 GLACIAL AND QUATERNARY GEOLOGY**3 sem. hrs.**

Development of glaciers, glacial movements, deposits, and landforms as background for discussion of present landscapes. Field trips required. Prerequisite: GEO 100 or 102.

385 INVERTEBRATE PALEONTOLOGY**4 sem. hrs.**

Examination and analysis of major fossil invertebrate phyla; emphasis on groups with paleoecologic and stratigraphic significance. Lecture and lab. Field work required. Prerequisite: GEO 203; BSC 196 is recommended.

395 FIELD GEOLOGY**6 sem. hrs.**

Application of geologic principles to field mapping and interpretation in the Black Hills and Central Rocky Mountains. Offered in the summer only. Prerequisites: Grade of C or better in GEO 280, 285, 290, 295, and 296.

410 SEMINAR IN HYDROGEOLOGY RESEARCH**3 sem. hrs.**

How research is conducted in hydrogeology; formulating questions, designing experiments, writing and evaluating research proposals, and obtaining funding. Prerequisite: Graduate standing in Hydrogeology.

435 INTRODUCTION TO GROUNDWATER MODELING**3 sem. hrs.**

Advanced study of the mathematics of fluid flow and the formulation of groundwater systems by computer modeling. Methods of computer modeling of pumping tests and groundwater flow systems. Materials charge optional. Prerequisites: GEO 360.

439 AQUEOUS GEOCHEMISTRY**3 sem. hrs.**

Examination of processes controlling chemical composition of groundwater from a thermodynamic point of view. Display and interpretation of geochemical data, and geochemistry of contaminants. Prerequisites: GEO 360, CHE 140, 141 or consent of the instructor.

444 APPLIED GROUNDWATER MODELING**3 sem. hrs.**

Applications of groundwater computer models to simulate flow, optimize development strategies, and remediate pollution problems in actual aquifers systems. Students assemble available information, develop and run computer simulations, and prepare professional reports. Prerequisite: GEO 435.

456 PROBLEMS IN ENVIRONMENTAL GEOLOGY**3 sem. hrs.**

Students gain first-hand experience in collecting hydrogeologic data, reducing and displaying data, making interpretations and drawing conclusions, and producing a professional report of findings. Offered in summer only. Field trip and field work required. Prerequisite: Consent of the instructor.

488 GRADUATE TOPICS IN HYDROGEOLOGY**3 sem. hrs.**

Specific topics having hydrogeologic consequences. See the following topics.

488A01 WATER RESOURCE AND ENVIRONMENTAL LAW**3 sem. hrs.**

A review of the federal and state laws focusing on water resources.

488A02 AQUIFER SYSTEMS IN CLASTIC AND CARBONATE ROCKS**3 sem. hrs.**

Discussion of current scientific literature focusing on aquifer systems of North America.

488A03 ANALYTICAL METHODS IN GROUNDWATER GEOCHEMISTRY**3 sem. hrs.**

Overview and practical application of field and laboratory analysis of surface and groundwater samples.

488A04 STATISTICS FOR GEOLOGISTS**3 sem. hrs.**

Overview of statistical methods used in geoscience research.

488A06 KARST HYDROGEOLOGY**3 sem. hrs.**

Focus on the geology and hydrogeology of karst areas, with focused discussion on current scientific literature.

499 MASTER'S THESIS**1-6 sem. hrs.** Refer to General Courses.

**499A90 INDEPENDENT RESEARCH FOR THE
MASTER'S THESIS FINAL YEAR**

1-6 sem. hrs.

Refer to General Courses.

The following Geography, Geology, and the Environment courses are appropriate to master's students in programs other than Hydrogeology.

300 CARTOGRAPHY

3 sem. hrs.

Theory and techniques regarding graphic representation of statistical data, including compilation, drafting, and reproduction of various types of thematic maps. Drafting supplies required.

310 FIELD GEOGRAPHY

3 sem. hrs.

Techniques for the systematic acquisition and interpretation of geographic field data. Includes an introduction to Orienteering. Field work required. Prerequisites: 9 hours of Geography coursework and fieldwork is required.

331 SOCIAL AND CULTURAL GEOGRAPHY

3 sem. hrs.

An advanced course on the topics, methods and theories of social and cultural geographers. Formerly CULTURAL GEOGRAPHY. Prerequisite: GEO 135 or 142 or consent of the instructor.

334 POLITICAL ECOLOGY

3 sem. hrs.

Critical examination of how socio-political and economic systems, processes, and practices are linked globally with contemporary environmental problems. Prerequisite: GEO 205 or consent of the instructor.

336 URBAN GEOGRAPHY

3 sem. hrs.

Internal morphology, external relationships, and other spatial aspects of cities. Prerequisite: A minimum of 45 hours completed.

351 CARTOGRAPHIC DESIGN

3 sem. hrs.

Advanced techniques in design, production and reproduction of maps. Formerly CARTOGRAPHIC PROCESSES. Materials charge optional. Prerequisite: Grade of B or better in GEO 300.

366 VOLCANIC PROCESSES

3 sem. hrs.

Semester-long seminar course. Nature, behavior, and origin of volcanoes. Magmatic and eruptive processes and volcano construction. Impact of volcanism on Earth's environment. Prerequisites: GEO 280 and 285 or consent of the instructor.