

EARTH SCIENCES (EARTH)

EARTH 501: Contemporary Controversies in the Earth Sciences

3 Credits

Exploration of current areas of research in the Earth Sciences. EARTH 501 Contemporary Controversies in the Earth Sciences (3) Students will be introduced to a variety of topics from different disciplines within the Earth sciences with the aim of piquing their interest in topics of current research beyond the level found in typical secondary school or introductory college textbooks. The current topics will include subjects in which a consensus has recently been reached as well as scientific questions that are so far unanswered. Students will learn the appropriate state of the art scientific content relevant to each topic by performing basic data in order to complete the activities in each lesson. They will finally construct a plan to teach a selected topic to the audience of their choice. This course provides an entry into the other courses in the Master's Degree Program in Earth Science Education. Students will learn scientific content by completing activities in each of six lessons that will span either the 12-week or 15-week semester. These activities will be in the form of background reading and discussion that outlines a current scientific problem or debate, the collection and manipulation of appropriate data, and the assessment of the results of this work. By doing this, students will simultaneously become familiar with the content as well as the practice of science. Students will also participate in online discussions about how to teach this content to specific secondary school audiences. They will complete a capstone project in which they will construct a teaching plan based on the topic of their choice.

EARTH 520: Plate Tectonics and People: Foundations of Solid Earth Science

3 Credits

Solid Earth geophysics and geological hazards presented within the grand unifying theory of plate tectonics. EARTH 520 Plate Tectonics and People: Foundations of Solid Earth Science (3) This course will cover current areas of research in solid Earth geophysics, especially focusing on the human population's interaction with the solid Earth system. Students will be introduced to a variety of current topics of active research within the field of solid Earth geophysics. They will learn the appropriate state of the art scientific content relevant to each topic by performing basic data analysis (e.g. collection, interpretation and assessment) using publicly available data in order to complete the activities in each lesson. They will finally construct a plan to teach a selected topic to the audience of their choice. Students will learn scientific content by completing activities in each of nine lessons that will span either the 12-week or 15-week semester. These activities will be in the form of background reading that outlines a current scientific problem or debate, the collection and manipulation of appropriate data, and the assessment of the results of this work. By doing this, students will simultaneously become familiar with the content as well as the practice of science. Students will also participate in online discussions about how to teach this content to specific secondary school audiences. They will complete a capstone project in which they will construct a teaching plan based on the topic of their choice.

EARTH 530: Earth Surface Processes in the Critical Zone

3 Credits

Introduction to Earth surface processes including weathering and soils, geomorphology, erosion and sedimentation, hydrogeology, low-temperature geochemistry and Earth systems. EARTH 530 Earth Surface Processes in the Critical Zone (3) Rapid changes in Earth's surface largely in response to human activity have led to the realization that fundamental questions remain to be answered regarding natural functioning of the Critical Zone, the thin veneer at Earth's surface where the atmosphere, lithosphere, hydrosphere and biosphere interact. To understand these processes requires a broad array of scientific expertise spanning: geology, soil science, biology, ecology, geochemistry, geomorphology and hydrology. EARTH 530 will introduce students to the basic information necessary for understanding Earth surface processes in the Critical Zone through an integration of various scientific disciplines. Those who successfully complete EARTH 530 will be able to apply their knowledge of fundamental concepts of Earth surface processes to understanding outstanding fundamental questions in Critical Zone science and how their lives are intimately linked to Critical Zone health. EARTH 530 will combine digital video, audio, simulation models, virtual field trips to on-line data resources, text, and interactive quizzes that provide instantaneous feedback. The overarching goal of the course is to help secondary science teachers understand Earth surface processes at a level they can communicate to their students. These processes will be presented in a Critical Zone framework - the teachers and subsequent students will leave with a better knowledge of how their daily lives are impacted by natural processes, and conversely how their daily activities impact Earth's surface and the Critical Zone. Students will be required to complete weekly assignments. There are 12 lessons divided into 7 units in EARTH 530. Each unit will contain interactive exercises, links, animations, movies, and novel explanations of the basic scientific principles of Critical Zone science. Students will also be assigned four unit projects throughout the semester (Units 2-6). Projects require students to apply the principles they have learned to various scientific inquiries of Earth surface processes in the Critical Zone. A capstone Semester Project will require students to use the skills and knowledge they develop in the course to produce a learning module that they, in turn, will be able to use to teach course concepts to their own secondary school students.

EARTH 540: Essentials of Oceanography for Educators

3 Credits

Chemical and physical principles of the oceans and their interaction with the biosphere, atmosphere and the solid Earth. EARTH 540 Essentials of Oceanography for Educators (3) EARTH 540 introduces knowledge and broadens understanding of the oceans and their role in climate, coastal processes, and life within the fluid Earth. Students will gain insight into the physical and chemical processes that determine properties of the ocean and govern interactions between the ocean, atmosphere, groundwater, and the fluid/solid Earth. Topics will reinforce fundamental scientific principles such as heat transfer, chemical equilibrium, and conservation of energy. EARTH 540 will combine digital video, audio, simulation models, virtual field trips to on-line data resources, text, and interactive quizzes that provide instantaneous feedback.

EARTH 591: Individual Studies: Research Project

3 Credits

Development of a capstone project, supervised on an individual basis outside the scope of formal courses. EARTH 591 Individual Studies: Research Project (3)EARTH 591 broadens the content knowledge of students in the program, while deepening their understanding of a specific topic of their choosing. Students will gain insight into the essence and process of current scientific research by working with an academic advisor who is a member of the graduate faculty. They will practice transforming the results of their own investigations into modules that can then be taught to others. Students will design, develop, and conduct a project in consultation with an advisor. Appropriate projects are expected to combine basic scientific research and pedagogical techniques. Examples of projects could include (but of course are not limited to): development of a new curriculum appropriate for grades 7-12 based on a specific discipline in the Earth Sciences, such as meteorology; or an independent research project in a specific scientific subfield, such as a recent climate change, the results of which may then be taught to students.

Prerequisite: 24 credits in the Master's Degree program in Earth Science Education

EARTH 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

EARTH 801: Computation and Visualization in the Earth Sciences

3 Credits/Maximum of 999

Students practice data visualization and analysis using computational methods for Earth science data to build content knowledge and interpretation skills. EARTH 801 helps students to develop procedural programming skills in a programming language designed for visual artists and visualization while exploring Earth science topics. In particular, students learn and practice digital graphics capabilities in order to render Earth science concepts that are otherwise difficult to visualize due to complicated space and time scales. Both spatial and object visualization skills are key to success in the Earth sciences; students in this course will build an awareness of these skills and practice them with an eye to being able to teach them to their own secondary school students. In this course, students will interact with large, open, freely-available Earth science data sets by collecting, plotting, analyzing them using a variety of computational methods. Students will therefore be ready to teach their own secondary school students a range of Next Generation Science Standards skills involving data collecting, manipulation, analysis, and plotting. EARTH 801 students will also read and discuss current research regarding the teaching, learning, and evaluation of visualization skills in the Earth sciences, as well as exploring the theory of "multiple external representations" as applied to Earth science concepts and data sets.