ERTH - Earth Systems

ERTH 101IN. Earth System Sciences. 4 Credits. (3 Lec, 1 Lab) F,S,Su
Examination of basic geologic processes, Earth and planets through geologic time, internal geosystems, and surficial geosystems.

ERTH 201IN. Honors Earth System Science. 4 Credits. (3 Lec, 1 Lab) F
PREREQUISITE: Enrollment in the MSU Honors Program. This Honors course explores the complex interactions occurring at all scales between the Earth’s geosphere, biosphere, hydrosphere, atmosphere, and anthroposphere. The goal of the course is to understand the Earth as a “system” of interconnected sources of energy through deep geologic time and space.

ERTH 212RN. Yellowstone: Scientific Lab. 4 Credits. (3 Lec) F
The Yellowstone region is an unparalleled laboratory for earth scientists. The volcanic, glacial, climatic, and ecologic processes that shaped the region will be introduced through lecture, discussions, and projects. Recitation sections and field trips provide additional hands-on experiences.

ERTH 303. Weather and Climate. 3 Credits. (3 Lec) F
PREREQUISITE: ERTH 101IN. The climates of the continents, and their classification, characteristics and interrelationships with other factors of the physical and human environment.

ERTH 307. Principles of Geomorphology. 4 Credits. (3 Lec, 1 Lab) F
PREREQUISITE: ERTH 301IN; familiarity with spreadsheets and word-processing is assumed; Junior standing. Framework, process, system, and time as factors which control the generation of land forms. Laboratories involve field trips and map interpretation, and computer modeling.

ERTH 432R. Surface Water Resources. 3 Credits. (2 Lec, 1 Lab) On Demand
PREREQUISITE: Junior Standing, ERTH 101IN and STAT 216Q or STAT 332 and PHSX 205 or PHSX 220. Physical analysis of the surface portion of the hydrologic cycle: climate, evapotranspiration, precipitation, runoff, flooding, stream channels, sediment production, sediment transport and drainage basins. The surface-water resource in terms of regional supply and human use and intervention. Laboratory fee required.

ERTH 450R. Snow Dynamics and Accumulation. 4 Credits. (1 Lec, 3 Lab)
PREREQUISITE: Ability to Ski/Board at intermediate level in back country alpine terrain. Junior or Senior standing; STAT 216Q, PHSX 205 or PHSX 220, ERTH 101IN, ACT 160 (or equivalent), or consent of instructor. Senior capstone for the Snow Science Option. The accumulation, redistribution, and metamorphism of snow as related to humans. Avalanche, recreation, agriculture, silviculture, runoff, and the alpine environment. Field studies are conducted on a regular basis under rigorous field conditions.

ERTH 484. Quaternary Environment. 3 Credits. (3 Sem) F even years
PREREQUISITES: ERTH 101IN and Junior standing. This course is an opportunity to learn about the history of the western US over the last 2 million years through a critical analysis of current and historic literature. It will provide an overview of the tools and approaches used to study past environmental change, significant events in the climate history of the region, the geologic record of ice-age environments, including glaciation, pluvial lakes, and vegetation, the evolution of the postglacial landscape, and important biotic and human events during the Holocene. Co-convened with ERTH 384.

ERTH 490R. Undergraduate Research. 1-6 Credits. (1 Ind; 12 cr max) F,S,Su
PREREQUISITE: Consent of instructor. Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

ERTH 491. Special Topics. 1-4 Credits.

ERTH 494. Seminar. 1 Credit. (1 Sem; 4 cr max) F,S
PREREQUISITE: Junior standing and as determined for each offering. Topics at the upper division level not covered in regular courses. Students participate in preparing and presenting discussion material. Co-convened with ERTH 594.

ERTH 498. Internship. 2-12 Credits. (2-12 Ind; 12 cr max) On Demand
PREREQUISITE: Junior standing, consent of instructor, and approval of department head. An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field.

ERTH 499. Senior Thesis/Capstone. 3 Credits. (3 Rct) F,S
PREREQUISITE: Senior standing; minimum 3.0 cum gpa; faculty recommendation. Senior thesis provides an opportunity to conduct research under the supervision of a faculty member leading to the production of a research paper ("mini-thesis") and an oral presentation to the department or at a professional meeting. Excellent preparation for graduate school and professional work.

ERTH 502. Fluvial Geomorphology. 3 Credits. (3 Lec) On Demand
PREREQUISITE: ERTH 307 or other introduction to fluvial systems or instructor permission. This course provides a foundation for understanding fluvial processes, interpreting fluvial forms, and teaches basic tools for use in watershed and river assessment. Course will cover drainage networks, channel form, and apply these concepts to a river assessment problem.

ERTH 505. Geomicrobiology. 3 Credits. (3 Sem) S alternate years, to be offered every even years.
The course examines geochemical and microbial interactions that control earth surface processes and ultimately major biogeochemical cycles. The course focuses on how integrated approaches using geochemistry, stable isotope geochemistry, and microbial techniques are applied to research problems.

ERTH 512. Mt. & Pinnip持有的 Riparian ProC 2 Credits. (2 Lec, 2 Sem) Su, On Demand
PREREQUISITE: ERTH 101IN, secondary teaching certification plus two years teaching experience; recommended ERTH 516 and access to the world wide web. Riparian hydrologic and geomorphic processes with examples drawn from the mountains and plains. Ground-water recharge and discharge; Horton overflow; partial variable runoff areas; riparian best management practices; sapping, types of springs; sediment from slopes. K-12 riparian science education.

ERTH 516. North Rocky Mt Geology. 2 Credits. (1 Lab) Su
PREREQUISITE: ERTH 101IN, early history and evolution (GEO 211); graduate standing; secondary teaching certification plus two years teaching experience; a computer with modern, Geologic history of Northern Rocky Mountains, and landscapes. Structural, tectonic, and surficial elements. Field examination of geologic evidence for history of the Gallatin Range, Bridger Range, and Yellowstone National Park. Exploration and development of teaching methods and resources for the K-12 classroom.

ERTH 519. Watershed Hydrology for Teachers. 3 Credits. (1 Lec, 1 Lab, 1 Rec) S
Alternate Even Years Watershed hydrology for teachers explores the relationship of water quality and water quantity. Students in the course will learn about the relationships among watershed hydrology, including water quality, water quantity, water inputs and outputs, effects of modification of watersheds and more.

ERTH 520. Fundamentals of Oceanography for Teachers. 3 Credits. (3 Lec) S, Su
PREREQUISITES: Graduate standing; science educator; interest in science/ This course will provide students with an introduction to the chemical, physical, biological and geological properties of the ocean. Students will learn the interrelationships of these processes and the impacts of humans on these processes.

ERTH 521. Geology of the Moon for Teachers. 3 Credits. (3 Lec) F
PREREQUISITES: Graduate standing; science educator; interest in science Geology of the Moon is an on-line course designed for educators interested in learning about the Moon and its history and relationship to Earth. We will explore theories for its formation and the geologic processes that have helped it evolve, including, differentiation, volcanism, impact cratering, and the impacts of humans on these processes.

ERTH 522. Teaching Middle School Earth System Science. 3 Credits. (3 Lec) S
PREREQUISITES: Participants must have minimum of a Bachelor’s degree, and three years teaching experience at the middle school level to include having taught science unit(s) on Earth Sciences, Earth System Sciences, or landforms. This course for middle school teachers uses Problem Based Learning (PBL) to explore the processes and interactions between the geosphere, hydrosphere, atmosphere, and biosphere. Teachers will examine processes within and among the four major Earth systems and increase pedagogical skills through modeling PBL, teacher networking, and sharing of ideas and resources.

ERTH 523. Weather for Elementary Teachers. 1 Credit. (1 Lec)
PREREQUISITES: Students must be elementary school teachers, or must have completed a teacher education program and have graduate standing. The course is designed to increase content knowledge and understanding of weather processes. It exposes elementary level teachers to using kit-based, hands-on instruction to facilitate the teaching and learning of weather concepts (meteorology). Weekly discussions encourage reflection on learning and teaching and help solidify weather concepts. Participants will maintain a daily journal of manual weather observations for one week and compare them to automated observations from corresponding weather stations. Assignments and quizzes are included to help with knowledge acquisition.
### ERTH 524. K-14 Earth System Science. 2 Credits. (2 Lec.) F
PREREQUISITES: The course is designed primarily for Certified Teachers at the K-14 levels with an interest in integrating mathematics and science education with computer technology and Internet resources. Registrants must be Certified Teachers, or permission of the instructor is required. Participants will learn to find the Internet's abundant digital Earth Systems Science (ESS) resources and use these resources to create Earth Science lessons that integrate the use of Earth Science specific skills, math, and content. Participants will learn to adapt online resources to their own instructional environments at the K-14 levels.

### ERTH 525. Landforms for Elementary Teachers. 1 Credit. (1 Lec.) F
PREREQUISITES: Graduate standing; educator. In this 8-week online course we will investigate landform science. We will look at a variety of landscapes and how they came to look like they do. We will model landforms and encourage sharing and discussions of teaching ideas in our course. This course intends to: 1) strengthen and deepen the elementary teacher's understanding of basic concepts of landforms and landform analysis; 2) increase the K-6 teacher's level of landform content knowledge and science principles; and 3) increase the K-6 teacher's pedagogical skills in teaching science in general and landform science in particular.

### ERTH 527. Weather & Climate for Teachers. 3 Credits. (3 Lec.) S
PREREQUISITES: Bachelor's degree, two years of teaching experience, and an introduction to physical geography course or equivalent. This graduate course uses weekly readings, discussions, and hands-on activities to build a physical understanding of weather and climate, and to equip our teachers and educators with the tools to better prepare and motivate the next generation of Earth scientists.

### ERTH 528. Climate Change for Teachers. 3 Credits. (3 Lec.) Su
PREREQUISITES: Graduate standing; ERTH 527: Weather and Climate for Teachers. The science of climate change is a complex subject that balances the physical record and scientific fact with politics, policy, and ethics. This course, specially designed for practicing science teachers at the upper middle to high school level, explores the science of climate change.

### ERTH 551. Snow Science Seminar. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: Corequisite: M 172Q or equivalent. The course will provide students an in-depth examination of recent developments in snow science based upon current literature, newly published or about to be published literature, field methods and modeling regarding snow science. Topics will depend partially upon the interests of the instructor and student in the course.

### ERTH 562. Advanced Geomorphology. 3 Credits. (3 Lec.) S
PREREQUISITES: ERTH 307. Corequisite: M 172Q or equivalent. This course will provide students an advanced view into active, ongoing research in geomorphology. The course is designed for advanced undergraduates and graduate students who have taken a previous course in geomorphology. Emphasis will be placed on the tools available to analyze and interpret geomorphic processes, active research in the field, and the interactions of geomorphic processes with other fields of geology, geography, hydrology, chemistry, etc.

### ERTH 582. Quaternary Paleoclimatology. 3 Credits. (3 Sem) F
PREREQUISITE: ERTH 101N or BIOL 170N or equivalent. The course will provide students an advanced view into active, ongoing research in Quaternary paleoclimatology. The course will focus on the evolution of vertebrate life throughout Earth's history. As a result of this course, students will demonstrate an understanding of evolutionary processes, and will become familiar with class discussions and assignments.

### ERTH 583. Topics in Paleoclimatology. 3 Credits. (3 Sem) F
PREREQUISITE: ERTH 101N or BIOL 170N or equivalent. The course will provide an in-depth examination of recent developments in Quaternary paleoclimatology in the western U.S. The seminar will be centered around weekly discussions of the primary literature, hands-on experience with international data bases, and class paper and presentation. Co-convened with ERTH 484.

### ERTH 585. Advances in Geobiology. 1 Credit. (1 Sem) F
PREREQUISITE: To be offered even years. Discussion of recent developments in paleontology, paleoecology, biogeochimistry, and biogeography based on current literature and presentation of faculty and student works in progress.

### ERTH 588. Professional Development. 1-3 Credits. (1-3 Lec.; 3 cr max) On Demand
Max 3 cr. PREREQUISITE: Graduate standing, teaching experience and/or current employment in a school organization, consent of instructor and Dean of Graduate Studies. Courses offered on a one-time basis to fulfill professional development needs of in-service educators. Specific focus is given to each course which is appropriately subtitled. May be repeated.

### ERTH 589. Graduate Consultation. 3 Credits. (3 Ind.) F,S,Su
PREREQUISITE: Master's standing and approval of the Dean of Graduate Studies. This course may be used only by students who have completed all of their course work (and thesis if on a thesis plan) but who need additional faculty or staff time or help.

### ERTH 590. Master's Thesis. 1-10 Credits. (1 Ind.; max unlimited) F,S,Su
PREREQUISITE: Master's standing.

### ERTH 591. Special Topics 1-4 Credits. (1-4 Sem; 12 cr max)
PREREQUISITE: Upper division courses and others as determined for each offering. Topics not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

### ERTH 592. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand
PREREQUISITE: Graduate standing, consent of instructor, approval of Department Head and Dean of Graduate Studies. Directed research and study on an individual basis.

### ERTH 594. Seminar. 1-4 Credits. (1 Sem; 4 cr max) F,S
PREREQUISITE: Graduate standing, consent of instructor, or seniors by petition. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material. Co-convened with ERTH 494.

### ERTH 595. Historical Geology for Teachers. 3 Credits. (1 Lec. 1 Lab. 1 Rec) S
PREREQUISITES: Two years minimum experience as a teacher of science. The course will provide grade 7-12 science teachers with a rigorous overview of the evolution of the Earth and life and of the methods that geologists use to investigate the history of our planet.

### ERTH 596. Geology of Glacier National Park for Teachers. 2 Credits. (1 Lec. 1 Lab) Su
PREREQUISITES: Teacher of science with a minimum of two years teaching experience. A field course for teachers of science examining geologic evidence for the evolution of the rocks and landscape of Glacier National Park and surrounding areas over geologic time.

### ERTH 597. Vertebrate Paleontology for Teachers. 3 Credits. (2 Lec. 1 Lab) S
PREREQUISITE: Graduation. Alternate Odd Years PREREQUISITE: A minimum of 2 years teaching experience. This course will focus on the evolution of vertebrate life throughout Earth's history. As a result of this course, students will demonstrate an understanding of evolutionary processes, and will become familiar with class discussions and assignments.

### ERTH 598. Professional Development. 1-3 Credits. (1-3 Lec; 3 cr max)
PREREQUISITE: To be offered alternate even years. PREREQUISITE: Course limited to graduate students or senior undergraduates with permission. Weekly seminars examine the evolution of geological thinking through an exploration of its history and contributions to science. The course enables students to research the origin and importance of concepts in their area of scientific specialization.

### ERTH 605. History of Geological Concepts. 3 Credits. (3 Lec) F
PREREQUISITE: To be offered alternate even years. PREREQUISITE: Course limited to graduate students or senior undergraduates with permission. Weekly seminars examine the evolution of geological thinking through an exploration of its history and contributions to science. The course enables students to research the origin and importance of concepts in their area of scientific specialization.

### ERTH 690. Dissertation Research. 1-10 Credits. (1-10 Ind.; max unlimited) F,S,Su
PREREQUISITE: Doctoral candidate standing.

### ERTH 694. Doctoral Seminar. 1-3 Credits. (1-3 Sem; 6 cr max) F,S,Su
PREREQUISITE: Doctoral candidate standing.
Font Notice

This document should contain certain fonts with restrictive licenses. For this draft, substitutions were made using less legally restrictive fonts. Specifically:

Times was used instead of Adobe Garamond Pro.

The editor may contact Leepfrog for a draft with the correct fonts in place.