## AGI PLED 576 Earth and Space Science

The American Geosciences Institute is pleased to offer a course in *Earth and Space Science* through the Illinois Institute of Technology. The 2016 course is targeted to begin on August 22nd for a duration of 15 weeks. Instruction is entirely online.

## Course Description

This intensive course will provide basic content material concerning geology, astronomy, oceanography, and meteorology. Topics include the origin of the universe and the life cycle of stars; the origin of the solar system and its components; the composition and structure of the Earth; plate tectonics; the rock cycle, water cycle, and associated resources; the atmosphere, weather, and climate; and Earth's oceans. Demonstration lessons and application assignments supplement the comprehensive video and audio/ slide presentations. Participants will have the opportunity to learn and apply systems thinking skills as outlined in the Next Generation Science Standards.

Participants will be guided to register for the course at the Illinois Institute of Technology online system. Following registration, participants will receive a confirmation letter and be assigned an ID. Upon completion, the course offers 3 continuing education credits from the Illinois Institute of Technology.

The costs of participation in this year's program will be $1000. A limited number of full and partial scholarships are available from the American Association of Petroleum Geologists Foundation. (Applications can be made by following the PLED 576 link at www.americangeosciences.org/education/k-12-professional-development-programs). We hope that participants will offer feedback to help AGI to continue to develop the course. AGI would also like to assist teachers in the classroom by providing access to the film and CGI materials used in the course.

**Course Professor:** Rebecca L. Dodge, Ph.D. a certified petroleum geologist and a licensed professional geoscientist. Currently, Dr. Dodge serves as associate professor in the Department of Geosciences at Midwestern State University – Wichita Falls, Texas, where she teaches environmental science and geology. She was previously an associate professor at the University of West Georgia, where she served as director of the GLOBE Teacher Training Partnership. She also has been involved in international exploration for oil and minerals with several oil companies, including Eastward Oil Company, Hunt Overseas Oil Company, and Exxon. Dr. Dodge holds a doctorate and Master of Science degrees in geology from the Colorado School of Mines and a Bachelor of Science degree in geology from the University of Texas at Arlington. A research scientist and author of numerous scientific papers, Dr. Dodge is currently serving as an associate editor for the *Journal of Applied Remote Sensing*, assigning reviewers for submitted manuscripts.

**Associate Instructor:** Mark Carpenter, M.Sc., educated in geosciences in the U.K. at Exeter University during the "systems revolution," and later at Wilfrid Laurier and University of Waterloo, Ontario, Canada. He has pursued various geoscientific interests, including; high magnitude landsides and glacial environments in the Karakorum and Nepal Himalaya, drainage basin hydrology in southern Ontario, and the design of instructional lab materials. For more than a decade, Mr. Carpenter has worked in education at the American Geosciences Institute (AGI), writing Earth system science curricula, designing models, training teachers, and making short films and computer generated imagery. He is also the author of the Geoscience Handbook (5th Edition).

Mark was a designer on AGI's Science Channel series "Faces of Earth," and producer of the DVD series "Visions of Earth," both part of this course.

## Online Instructional Delivery

Instruction is provided in an online format that is interactive and collaborative. Technology standards aligned to the International Society for Technology in Education (ISTE) National Educational Technology Standards are integrated throughout the coursework. Online course components include video lectures; PowerPoint lectures with narration, video documentary resources with guiding questions, authentic application assignments; formative, summative, and diagnostic assessments; self-evaluations; and reflections. Readings in each course provide students current, relevant research on evidence-based practices in education. Students communicate with their instructors and each other in an online discussion forum. The forum provides opportunities to debate, reflect on, and share knowledge and skills. Application assignments and assessments demonstrate the integration of technology.

## Course Textbook

The reading and lab component will use:

Tarbuck, E. J., Lutgens, F. K., & Pinzke, K. G. (2015). *Applications and Investigations in Earth Science*. (8th Edition). Upper Saddle River, NJ: Pearson Prentice Hall.

This latest edition contains excellent content and lab exercises suitable for this course and for adaptation by teachers to their classrooms.

## Course Outcomes

At the conclusion of this course, students should be able to demonstrate the following competencies:

| Course Objectives |
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| 1. Evaluate the differing theories that explain the structure, scale, composition, origin, and history of the universe.<br>2. Describe the solar nebular accretionary disk model.<br>3. Cite evidence that shows how Earth's atmosphere, hydrosphere, and geosphere formed and changed through time.<br>4. Explain how Earth's interior is differentiated chemically, physically, and thermally.<br>5. Identify plate tectonics as the global mechanism for major geologic processes, and describe how heat transfer as governed by the principles of thermodynamics serves as the driving force for those processes.<br>6. Describe how the geosphere continuously changes over a range of time scales and the impact of dynamic and complex interactions among Earth's subsystems on that process. |

7. Explain the process of scientific dating to determine the age of fossils and rock sequences and how that process is used to construct a chronology of Earth's history.

8. Identify the hydrosphere, cryosphere, and atmosphere subsystems of fluid Earth, and describe how the subsystems interact on various time scales with the biosphere and geosphere.

9. Describe the process by which Earth's global ocean stores solar energy and serves as a driving force for weather and climate through complex atmospheric interactions.

10. Explain how interactions among Earth's five subsystems influence climate and resource availability, which affect Earth's habitability.

11. Describe how the use of energy, water, mineral, and rock resources impacts Earth's subsystems.

Successful participants will demonstrate the ability to:

**Performance Objectives**

1. Recognize the value of aerial photographs and topographic maps as research tools.

2. Examine the physical properties and motions of the planets and the various degrees of order and patterns exhibited in the solar system.

3. Explore the natural processes that shape Earth and other terrestrial planets.

4. Use observation skills to examine the results of geologic processes at work on Earth and its moon.

5. Use data to draw conclusions about patterns that exist in our solar system.

6. Examine evidence that has been used to verify the theory of plate tectonics.

7. Identify techniques that are used by seismologists to determine the location of earthquakes and to investigate the structure of Earth's interior.

8. Examine agents and processes that modify Earth' surface and the consequences of human interactions with these natural systems.

9. Describe the landforms and processes that shaped Earth's arid and glacial landscapes.

10. Describe the physical properties of minerals, and apply techniques to identify minerals as preparation for the study of rocks.

11. Classify the origins of rock as igneous, sedimentary, or metamorphic.

12. Investigate techniques and procedures used by scientists to interpret the geologic history of Earth.

13. Explain the relationships that exist between the density of seawater and salinity and temperature.

14. Investigate the causes, mechanics, and results of ocean-water movements.

15. Identify the reasons that the amount of solar radiation intercepted by Earth varies for different latitudes and changes throughout the year at particular locations.

16. Describe the journey of solar radiation and how it is influenced and modified by air, land, and water.

17. Examine the impact of changes in atmospheric moisture, pressure, and wind on Earth's weather.

18. Investigate world climates using a system of climate classification.