Broadening Student Exposure to Sustainability: New Course Development

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ABSTRACT

Incorporating sustainability into non-major science classes has been a focus of curriculum development at Red Rocks Community College. New labs have been written for physics classes of all levels that deal with sustainability. In addition to infusing existing curriculum, we developed several new course offerings to expand student exposure to sustainability and energy issues. Energy Science and Technology (PHY107) is an introductory level, lab-based course exploring many aspects of energy. Introduction to Climatology (MET151) is a new lecture course for non-science majors. Science and Society (SCI105) is a lecture course that focuses heavily on energy and climate change. Field Studies in Energy (PHY208) is a field course that will allow students to study energy topics in locations such as Iceland, Colorado, and Wyoming. These new offerings are generating student interest and excitement about energy, climate, and the relevance of sustainability in their lives.

A College-wide Focus on Sustainability

Red Rocks Community College has a history of commitment to the national challenge of creating and sustaining a green workforce. In conjunction with our partners, the National Science Foundation, Colorado School of Mines, the National Renewable Energy Laboratory, and Jefferson County Schools, we have created a campus-wide focus on sustainability. The science department has led the effort in developing more sustainability focused course offerings.

As educators we know that no matter where our students go after they attend college, the issues of Energy, Environmental Stewardship, and Renewable Resources will face them. We realize these issues will affect how productive they can be on the job or at home. Therefore, we have made the commitment to teach these issues specifically in physics classes as well as across the curriculum. We developed many new courses that specifically address these issues;

PHY 107: Energy Science and Technology

PHY 208: Field Studies in Energy

PHY 227: Energy for Engineers

MET 151: Introduction to Climatology

SCI 105: Science and Society

Curriculum Development

PHY 107 is an introductory level lab based course (4 credits). The only pre-requisite for the course is that the student has completed or tested out of any remedial coursework. This course is required of all students in our renewable technology certificate programs. It has been approved as a guaranteed transfer (GT) course to all four-year schools in Colorado and can be taken to fulfill the general science requirement for an AA degree.

PHY 208 is a field course (4 credits). The only pre-requisite for the course is that the student has completed or tested out of any remedial coursework. The course is designed so it can change depending on the destination of the trip. Two trips that are currently being planned are Yellowstone and Glacier National Parks to study geothermal processes and climate change and Iceland to study renewable energy practices and climate change.

PHY 227 is an upper level lecture course (3 credits). The pre-requisites for the course are Calculus I and Physics I. This course is not a GT course at this time. The course counts as an elective, but for students transferring to Colorado School of Mines, fulfills a course requirement for their Energy minor.

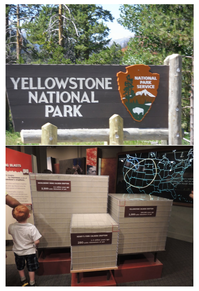
MET 151 is an introductory science course (3 credits). The only pre-requisite for the course is that the student has completed or tested out of any remedial coursework. It is in the process of being approved for guaranteed transfer (GT) course to all four-year schools in Colorado. The class focuses on regional and global climate topics. It is a lecture course, but is taught in a very interactive way.

SCI 105 is an introductory science course (3 credits). The only pre-requisite for the course is that the student has completed or tested out of any remedial coursework. This course is required of all students in our renewable technology certificate programs. It has been approved as a guaranteed transfer (GT) course to all four-year schools in Colorado and can be taken to fulfill the general science requirement for an AA degree.

Field courses provide interdisciplinary and experiential learning opportunities that spark students interest in sustainability and science.

PHY 208: Yellowstone and Glacier NP summer field opportunity

Students will study the impact of natural hazards on society, geothermal energy as a resource and the effects of climate change. Students will perform field data collection, learn how to take field notes in journal and assimilate connections between field observations and climate trends.



PHY 208: Iceland summer field opportunity

Students will study glacial retreat as a consequence of global climate change. Iceland is an excellent location to study renewable energy, as most of the country utilizes hydropower and geothermal. Students will visit a geothermal power plant and geothermally powered greenhouses for sustainable food production. Students will also study the impact of geology on society via the recent volcanic activity on the island.

PHY 107: Energy Science and Technology

*Designed for non-science majors, suitable for students in career and technical programs

Course Description: Lecture and lab format

Provides an in-depth look at the science of energy and energy technologies, with a focus on renewable energy resources and clean technologies. The state of world energy use will provide a context to discuss the need for expansion of renewable energy technology. The course will provide a background in the physics of energy, non-renewable energy methods, the problems of energy transfer and loss and the current state of technology. The students will then explore renewable energy technologies, evaluate efficiency and look at the future utilization of these technologies. This lab based course will provide the student with the opportunity to explore energy through hands-on activities. Student learning activities may include labs concerning conservation of energy; testing mechanical, electrical, heat and fluid power systems; energy transfer and loss; understanding energy audits; testing solar collectors and wind generators; investigating hydrogen fuel cells.

PHY 227: Energy for Engineers

*Designed for science majors, suitable for students in physics and engineering programs

Course Description: Lecture only format

Provides an in-depth look at the science of energy and energy technologies, with a focus on renewable energy resources and clean technologies. Survey of human-produced energy technologies including steam, hydro, fossil (petroleum, coal, and unconventionals), geothermal, wind, solar, biofuels, nuclear, and fuel cells. Explores the current state and possible future of energy transmission and efficiency. Includes an evaluation of different energy sources in terms of a feasibility matrix of technical, economic, environmental, and political aspects. The state of world energy use will provide a context to discuss the need for expansion of renewable energy technology.

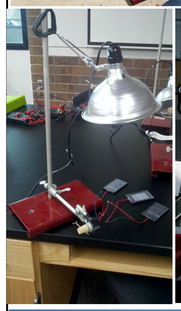
MET 151: Introduction to Climatology

*Designed for non-science majors, suitable for students in career and technical programs

Course Description: Lecture only format

To introduce the physical mechanisms responsible for the spatial and temporal variability in Earth's climate, and the human-climate relationship. This course is designed to help students gain a scientific understanding of the physical aspects of Earth's climate system, climate system dynamics and the factors that influence climate change. The course explores the global balance of energy and transfer of radiation in the atmosphere, major climatic controls, climatic classifications and comparisons of major climatic types and an overview of current climate issues such as global warming and El Niño.

An important component to the PHY 107 course is the lab. Labs have been designed for the class to incorporate examples of renewable technologies and test basic physics concepts. Pictured to the left: flat panel solar heating, energy conversion solar to mechanical, solar intensity and reflectivity testing of solar ovens.



Semester project: Build a passive solar home model. Test the design and present findings to the class in an oral presentation.

Students also visit the working solar arrays on campus during an on-campus field trip. Guest lecturers provide expert knowledge on the state of the art in technology and industry.

SCI 105: Science and Society

Course Description: Lecture only format

The course is designed to cover a wide array of science topics that appeal to the students interests and everyday lives. Examines issues relating to the way science affects society. Students will investigate issues in information technology, the environment, physics and astronomy, biology, medicine and the interaction of science with politics. The class will focus on gathering accurate scientific information and applying critical thinking skills and the scientific method to analyze how science plays both positive and negative roles in society. Emphasis will be on student research, inquiry and analysis of science related issues.
The course is arranged into four units:

UNIT 1: What is Science?

Selected topics: Science vs. pseudoscience, scientific method

UNIT 2: Earth Systems Science

Selected topics: Climate change, natural disasters

UNIT 3: Biology and Medicine

Selected topics: Evolution, GMOs

UNIT 4: Modern Physics, Astronomy and Cosmology

Example Activities

Carbon cycle