SAN LEANDRO UNIFIED SCHOOL DISTRICT
COURSE PROPOSAL

SECTION A. COVER PAGE

1. Course Title:
Environmental Science Honors

7. Action
☒ New Course
☒ Course Revision
☐ Title Change Only

2. Date Submitted: 10/13/14

8. Grade Level
☐ 9 ☐ 10
☒ 11 ☒ 12

3. Transcript Title/Abbreviation(s)

9. Prerequisites (Please list.)
☒ Required
Geometry
☐ Recommended

4. Transcript Course Code/Course Number :

10. Seeking Program Distinction?
☒ YES (Check one below.) ☐ NO
☒ Honors ☐ AP ☐ Other

5. Subject Area
Laboratory Science

11. Is this a CTE course?
☐ YES
☒ NO
If YES, complete Section C

6. Department
Science

12. Previously approved by UC?
☐ YES ☒ NO
Year approved
Year removed

13. UC ELIGIBILITY
Already eligible? ☐ YES ☐ NO
a ☐ b ☐ c ☐ d ☐ e ☐ f ☐ g ☐

Proposing eligibility? ☒ YES ☐ NO
a ☐ b ☐ c ☐ d ☒ e ☐ f ☐ g ☐
Please mark one for approved eligibility or proposed eligibility.

14. Unit Value/Course Credit/Length of Course
☐ 0.5 (semester or half-year
☒ 1.0 (one year equivalent)
☐ 2.0 (two-year equivalent)
☐ Other

15. School Contact:
Name:Marc Gordon
Phone:(510) 628-4600 ext 2345
Email:mgordon@slusd.us
Position:Teacher

16. Signatures:
Department Chair
Principal:

DISTRICT OFFICE USE ONLY
Date approved by Board Curriculum Committee 10-27-14
Date approved by Board

SECTION B. COURSE CONTENT

17. Course Description

The "real science" behind environmental problems and issues will be explained in this interdisciplinary course. It will scientifically examine and analyze in great detail 4 main spheres: Biosphere, Atmosphere, Hydrosphere, Lithosphere. The global impact of human on the environment in attempts to secure and utilize Earth's resources will be of central focus. Significance of population, use of resources, energy, and conservation will be stressed. Current events, case studies, simulations, and laboratory experiments will be utilized. Focus will be made for students to better be able to apply information acquired to their own community environmental needs as well as the broader context of society at large. This course will be significantly more rigorous than other general science college prep courses but slightly less so than the AP course.

18. Course Goals and/or Major Student Outcomes

Students will utilize scientific principles, concepts and methodologies required to understand 6 foundational interdisciplinary themes. Students will utilize laboratory investigation and field investigation to study topics:

1. Science as a process.
2. Energy conversions underlie all ecological processes.
3. The Earth itself is one interconnected system.
4. Humans alter natural systems.
5. Environmental problems have a cultural and social context.
6. Human survival depends on developing practices that will achieve sustainable systems.

19. Course Objectives (standards)

Students are to understand at the synthesis and evaluative levels that:

-Science is a method of learning more about the world.
-Science constantly changes the way we understand the world.
-Energy cannot be created; it must come from somewhere.
-As energy flows through systems, at each step more of it becomes unusable.
-Natural systems change over time and space.
-Biogeochemical systems vary in ability to recover from disturbances.
-Humans have had an impact on the environment for a very long time.
-Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment.
-Understanding the role of cultural, social, and economic factors is vital to the development of solutions.
-A suitable combination of conservation and development is required.
-Management of common resources is essential.

20. Course Outline

I. Earth Systems and Resources (10-15%)

A. Earth Science Concepts

Geologic time scale; plate tectonics, earthquakes, volcanism; seasons, solar intensity and latitude

B. The Atmosphere

Origin & evolution; composition; weather and climate; atmospheric circulation and the Coriolis Effect; atmosphere-ocean interactions

C. Global Water Resources and Use

Freshwater/saltwater; ocean circulation; agricultural, industrial, and domestic use; surface and groundwater issues; global problems; conservation

D. Soil and Soil Dynamics

Rock cycle; formation; composition; physical and chemical properties; main soil types; erosion and other soil problems; soil conservation

II. The Living World (10-15%)

A. Ecosystem Structure

Biological populations and communities; ecological niches; interactions among species; keystone species; species diversity and edge effects; major terrestrial and aquatic biomes

B. Energy Flow

Photosynthesis and cellular respiration; food webs and trophic levels; ecological pyramids

C. Ecosystem Diversity

Biodiversity; natural selection; evolution; ecosystem services

D. Natural Ecosystem Change

Climate shits; species movement; ecological succession

E. Natural Biogeochemical Cycles

Carbon, Nitrogen, Phosphorus, Sulfur, Water, Conservation of Matter

III. Population (10-15%)

A. Population Biology Concepts

Population ecology; carrying capacity; reproductive strategies; survivorship

B. Human Population

1. Human population dynamics

Historical population sizes; distribution; fertility rates; growth rates and doubling times; demographic transition; age-structure diagrams

2. Population size

Strategies for sustainability; case studies; national policies

3. Impacts on population growth

Hunger; disease; economic effects; resource use; habitat destruction

IV. Land and Water Use (10-15%)

A. Agriculture

1. Feeding a growing population

Human nutritional requirements; types of agriculture; Green Revolution; genetic engineering and crop production; deforestation; irrigation; sustainable agriculture

2. Controlling pests

Types of pesticides; costs and benefits use; integrated pest

management; relevant laws

B. Forestry

Tree plantations; old growth forests; forest fires; forest management; national forest

C. Rangelands

Overgrazing; deforestation; desertification; rangeland management; federal rangelands

D. Other Land Use

1. Urban land development

Planned development; suburban sprawl; urbanization

2. Transportation infrastructure

Federal highway system; canals and channels; road less areas; ecosystem impacts

3. Public and federal lands

Management; wilderness areas; national parks; wildlife refuges; forests; wetlands

4. Land conservation options

Preservation; remediation; mitigation; restoration

5. Sustainable land-use strategies

E. Mining

Mineral formation; extraction; global reserves; relevant laws and treaties

F. Fishing

Fishing techniques; overfishing; aquaculture; relevant laws and treaties

G. Global Economics

Globalization; World Bank; Tragedy of the Commons; relevant laws and treaties

V. Energy Resources and Consumption (10-15%)

A. Energy Concepts

Energy forms; power; units; conversions; Laws of Thermodynamics

B. Energy Consumption

1. History

Industrial Revolution; exponential growth; energy crisis

2. Present global energy use

3. Future energy needs

C. Fossil Fuel Resources and Use

Formation of coal, oil, and natural gas; extraction/purification methods; world reserves and global demand; synfuels; environmental advantages & disadvantages of sources

D. Nuclear Energy

Nuclear fission process; nuclear fuel; electricity production; nuclear reactor types; environmental advantages & disadvantages; safety issues; radiation and human health; radioactive waste; nuclear fusion

E. Hydroelectric Power

Dams; flood control; salmon; silting; other impacts

F. Energy Conservation

Energy efficiency; CAFÉ standards; hybrid electric vehicles; mass transit

G. Renewable Energy

Solar energy; solar electricity; hydrogen fuel cells; biomass; wind energy; small-scale hydroelectric; ocean waves and tidal energy; geothermal; environmental advantages & disadvantages

VI. **Pollution** (25-30%)

A. Pollution Types

1. Air pollution

Sources-primary and secondary; major air pollutants; measurement units; smog; acid deposition-causes and effects; heat islands and temperature inversions; indoor air pollution; remediation and reduction strategies; Clean Air Act and other relevant laws

2. Noise pollution

Sources; effects; control measures

3. Water pollution

Types; sources, causes, and effects; cultural eutrophication; groundwater pollution; maintaining water quality; water purification; sewage treatment/septic systems; Clean Water Act and other relevant laws

4. Solid waste

Types; disposal; reduction

B. Impacts on the Environment and Human Health

1. Hazards to human health

Environment risk analysis; acute and chronic effects; dose-response relationships; air pollutants; smoking and other risks

2. Hazardous chemicals in the environment

Types of hazardous waste; treatment/disposal of hazardous waste; cleanup of contaminated sites; biomagnification; relevant laws

C. Economic Impacts

Cost-benefit analysis; externalities; marginal costs; sustainability

VII. **Global Change** (10-15%)

A. Stratospheric Ozone

Formation of stratospheric ozone; ultraviolet radiation; causes of ozone depletion; effects of ozone depletion; strategies for reducing ozone depletion; relevant laws and treaties

B. Global Warming

Greenhouse gases and the greenhouse effect; impacts and consequences of global warming; reducing climate change; relevant laws and treaties

C. Loss of Biodiversity

1. Habitat loss; overuse; pollution; introduced species; endangered and extinct species
2. Maintenance through conservation
3. Relevant laws and treaties

21. Instructional Materials:
Board approved required text

"Environment" 2008 Edition or later
Arms, Karen; Holt, Rinehart, Winston

Supplementary materials

*Miller "AP Environmental Science" Textbook
*Various Laboratory Materials
*Online Computer Access

22. Key Assignments

Examples Include:

1. Ecological Footprint Analysis Project - Students will analyze many variables and characteristics of developed vs. developing nations. Students will analyze data comparing and contrasting the ecological footprints of such countries. Students will make graphs of such data. Students will analyze their own use of resources (i.e. water, energy, transportation, space necessary for recreation activities, clothing, etc.) to calculate their own ecological footprints in units of acres and hectors. Students will construct posters that identify ways for average persons to reduce their ecological footprint hence their global impact in terms of the use of Earth's natural resources.

2. Formal Laboratory Report of Experimental Method and Statistical Procedures – Students will write an exhaustively detailed collegiate styled laboratory report of an investigation that includes experimental vs. control groups, independent vs. dependent variables, an analysis of statistical variables, graphing of data, and a justified evaluation of data as it relates to the investigative problem question. A repertoire of labs are utilized to teach scientific investigation and experimentation skill.

3. Atmosphere Poster Project – Students will construct detailed models of Earth's atmosphere. Models will display layer's of Earth's atmosphere according to altitude, the variation in absorption of solar radiation according to altitude, electromagnetic phenomena in the ionosphere, the presence and function of ozone region between the stratosphere and lower mesosphere, the greenhouse affect, conduction at surface level, and convection currents in the troposphere. Students will contrast features of Earth's atmosphere to neighboring planets Venus and Mars. Students will gain an understanding of the delicate balance that enables Earth's atmosphere to sustain life not being too thick as Venus or too thin as Mars.

4. Carbon Dioxide Absorption in Organisms Project – Students will test the ability of plants and other photosynthetic organisms that serve as biological processes in the removal of carbon dioxide (excess) from Earth's atmosphere. Students will use algae, water plants (i.e. Elodea), germinating seeds, and land plants as test subjects. Where applicable students will use titration type apparatus methods to calculate amounts of carbon dioxide in a given volume of suspension using an indicator. Students may also explore the influence of temperature and heat flow on absorption rates. Students will identify the flow of carbon between systems. Students will identify the flow & pathways of carbon in biogeochemical cycles esp. the carbon cycle.

5. Global Warming Project – Students will generate multimedia presentation (i.e. PowerPoint, iMovie) summarize a week's long focus on the science of global warming including an assembly featuring presentation by the Alliance for Climate Education, an analysis of the science in Al Gore's film "An Inconvenient Truth," and a collaboration of lessons and activities with Strategic Energy Innovations. In depth students will explore the energy potential of various greenhouse gases including carbon, methane, and CFCs. Students will make oral presentations of their multimedia project to classmates.

6. Extreme Transportation Challenge – Students will conduct research about automobile engine types currently available as well as alternative technologies still in development. They will explore fossil fuel consumption and gas mileage rates of various types of vehicles on the market.

Students will explore specific chemical air pollutants that result from the burning of gasoline in vehicles. Students will analyze the environmental cost according to vehicle/engine type and mileage rates. Students will explore the relationship of such chemicals to health and disease. Students will examine relative carbon footprint of vehicles in possession by their family and/or self. Students will compare data gathered.

7. Biodiversity Hotspots Fair – Students will research data about 25 internationally recognized and designated ecological hot spot regions on Earth. Students will gather data about the sensitive nature of fauna and animal life in the region. Students will explore aspects of human culture in the regions that may be contributing to the loss of biodiversity. Students will prepare poster or multimedia presentation of a particular hotspot region. They will prepare a food dish from the regions and communicate aspects of human culture in that region. They will present to other students and adults who have been invited to participate in the fair.

8. Chemistry of Water Pollution Project – Students will conduct chemical analysis of water at home and at school. Students will test for the concentration of hydroxide ions relative to pH scale, dissolved salts/minerals, organic molecules, and electrical conductivity. Students will explore the significance of carbon bonding characteristics to organic matter ranging from simple hydrocarbons to complex polymers. Students will learn how to use spectral analysis to identify chemical elements in a solution differentiating between transition lines and electron energy levels.

9. Healthiness of Nearby Water Systems Project – Students will chemically analyze water from nearby river, lake, and bay. Students will test for nitrates, dissolved oxygen vs. carbon dioxide levels, dissolved salts. Students will compare data obtained with known historical data of area water systems also regional/national norms. Students will identify bonds of molecules as covalent or ionic understanding of electronegativity and ionization energy relate to bond formation.

10. Eutrophication Project – Students will explore the relationship between fertilizer use, household/industrial cleansers and the overgrowth of algae in nearby waterways. Students will explore chemistry of water from nearby water systems. Students will test for oxygen and other chemical nutrient levels. Students will explore the role of a catalyst in terms of reaction rates as it relates to water ways i.e. phosphorous, nitrogen. Students will contrast natural vs. artificial eutrophication effects to an ecosystem. In the classroom students will set up a controlled experiment in which they observe the effects of nitrates and phosphates on an aquatic system. They will explore the effects to the growth of microorganisms in control vs. experimental group.

23. Instructional Methods and/or Strategies

Multiple instructional methods will be utilized to meet the multi-modal needs of a diversity of students including:

1. Lecture – The teacher will outline key concepts for students to focus their attention. The teacher will explain new phenomena often with examples to facilitate concept attainment.

2. Discussion – The teacher will lead students into verbal discussion of the various content covered throughout the course.

3. Audiovisual incl. PowerPoint Presentation – The teacher will regularly use LCD display to facilitate auditory and visual learning. Organized and detailed PowerPoint outlines of specific content standard information per chapter.

4. Demonstrations – Teacher will model or display key processes often prior to students working independently on related phenomena.

5. Group Work – Teacher will facilitate group work in which students take shared responsibility for task completion.

6. Laboratory Investigation – Students will use the experimental method to test hypothesis for a wide variety of content standard phenomena. Students will set up controlled experiments, identify variables, analyze data, and reach logical conclusion relying on actual factual data.

7. Online Research - Students will use computer lab to conduct research about current events related to topics covered in class. They will write developed essays using appropriate MLA format to site references.

8. Models – Teacher will assist students in creating various types of models to represent scientific phenomena where possible. Presentations will often be made to classmates of these models.

9. Constructivist Learning – Teacher will often lead students into constructing their own learning by doing. Teacher will provide opportunities for students to practice new concepts with activities when possible.

24. Assessment Methods and/or Tools

Assessment will include thorough evaluation of assigned coursework as well as formative assessments including quizzes, tests, and term exams.

Homework will be assigned 4 nights a week including making collegiate formatted outlines of assigned text material, 4-step vocabulary research assignments, lab reports, essays, etc. All homework is graded by instructor and provides students with written feedback to facilitate skills growth.

Quizzes are to occur weekly or bi-weekly depending on the length of the section covered. Quizzes provide instructor with formative knowledge as to how well students are progressing through the unit. Chapter and unit test will occur as appropriate to assess more comprehensive understanding.

Midterm exam to be administered at end of 1st and 3rd quarters. Final exams to be administered at end of 2nd and 4th quarters (Fall Semester Final, Spring Semester Final). Some test will include constructed response questions and at times a laboratory procedure.

25. Grading Policy

Grading will take into account the quantity and quality of assignment completion including lab reports also quizzes/tests/exams. 50% of grade will take into account assigned work and 50% will be based solely on formative assessment scores.

SECTION C

26. Context for Course (optional)

REQUIRED FOR CTE COURSES

NOTE: In order to understand the context for a new course, sometimes it is helpful to understand the broader educational program and/or reform efforts of the school. How does this course fit into broader departmental and/or pathway structure? How does it fit into the overall school restructuring plans? Is the course intended to be a core course or supplemental? What are the student/school/community needs met by this course?

This course will add another opportunity for high school students to opportunity to explore their world from a variety of perspectives. Emphasis will be given to local issues in environmental science. The environment is a relatively high interest science topic for many high schoolers and it is expected that many traditionally underserved populations (i.e. African American, Latino) would find interest in signing up for this course. This Honors version of the course will provide opportunity for many advanced level students who in particular seek AP and/or Honors course work to sufficiently challenge their potentiality. The rigor and higher expectations of the Honors course targeting more mature upper division students should distinguish itself CP course which is of less rigor also includes less mature sophomores. Successful completion of the Honors course will require a much more in-depth level of understanding as demonstrated by the quality of assigned work completed and greater emphasis placed on formative assessment scores.

27. History of Course Development (optional)

REQUIRED FOR CTE COURSES

NOTE: Likewise, it is sometimes helpful know the origins of a course and who was involved in its development. Was this course modeled after another course at another school? If so, is that course UC approved? How does the course being submitted differ from the course after which it was modeled? Has this course received any special recognitions, designations or awards? Has it been articulated to local community colleges or universities?

Environmental Science is a popular and common science course offered at many if not the majority of high schools in California. Courses at high schools throughout the state from Napa to San Diego were examined in preparing this proposal. In 2009 Marc Gordon supplied paperwork and rationale to add Environmental Science AP and CP to the San Leandro High School offering of classes. Both courses were approved but the implementation of the AP delayed indefinitely. As such it is intended that the Honors course would satisfy the requisite higher rigor and expectations of the population of students at SLHS who wish to take the AP course but are presently unable as the course is not offered. It is desired that he Honors course would demonstrate rigor adequate to qualify for both the D "Laboratory Science" and the G "College Preparatory Elective" as the AP course has.