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Course Description

A. COVER PAGE

Date of Submission (Please include Month, Day and Year) January 31, 2008	
1. Course Title Mission To Planet Earth Systems (MTPES)	9. Subject Area <input type="checkbox"/> History/Social Science <input type="checkbox"/> English <input type="checkbox"/> Mathematics <input checked="" type="checkbox"/> Laboratory Science <input type="checkbox"/> Language other than English <input type="checkbox"/> Visual & Performing Arts <input type="checkbox"/> Intro <input type="checkbox"/> Advanced <input type="checkbox"/> College Prep Elective
2. Transcript Title(s) / Abbreviation(s) MTPES (Earth & Space Science Lab Course)	
3. Transcript Course Code(s) / Number(s)	
4. School Orcutt Academy	
5. District Orcutt USD	
6. City Orcutt, CA 93455	10. Grade Level(s) for which this course is designed <input checked="" type="checkbox"/> 9 <input type="checkbox"/> 10 <input type="checkbox"/> 11 <input type="checkbox"/> 12
7. School / District Web Site www.orcutt-schools.net	11. Seeking "Honors" Distinction? <input type="checkbox"/> Yes <input type="checkbox"/> No
8. School Course List Contact Name: Dr. Ken Parker Title/Position: Assoc. Superintendent Phone: (805) 938-8933 Ext.: E-mail: kparker@orcutt-schools.net	12. Unit Value <input type="checkbox"/> 0.5 (half year or semester equivalent) <input checked="" type="checkbox"/> 1.0 (one year equivalent) <input type="checkbox"/> 2.0 (two year equivalent) <input type="checkbox"/> Other: _____
13. Is this an Internet-based course? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If "Yes", who is the provider? <input type="checkbox"/> UCCP <input type="checkbox"/> PASS/Cyber High <input type="checkbox"/> Other _____	
14. Complete outlines are not needed for courses that were previously approved by UC. If course was previously approved, indicate in which category it falls. <input type="checkbox"/> A course reinstated after removal within 3 years. Year removed from list? _____ Same course title? <input type="checkbox"/> Yes <input type="checkbox"/> No If no, previous course title? _____ <input type="checkbox"/> An identical course approved at another school in same district. Which school? _____ Same course title? <input type="checkbox"/> Yes <input type="checkbox"/> No If no, course title at other school? _____ <input type="checkbox"/> Approved Advanced Placement (AP) or International Baccalaureate (IB) course <input type="checkbox"/> Approved UC College Prep (UCCP) Online course <input type="checkbox"/> Approved CDE Agricultural Education course <input type="checkbox"/> Approved P.A.S.S./Cyber High course <input type="checkbox"/> Approved ROP/C course. Name of ROP/C? _____ <input type="checkbox"/> Approved A.V.I.D. course <input type="checkbox"/> Approved C.A.R.T. course <input type="checkbox"/> Approved Project Lead the Way course <input type="checkbox"/> Approved CSU Early Assessment Program (EAP) course <input type="checkbox"/> Other. Explain: _____	

Funding provided by Department of Labor, Employment & Training Administration: WIRED Initiative



15. Is this course modeled after an UC-approved course from another school outside your district? Yes No

If so, which school(s)? _____

Course title at other school _____

16. Pre-Requisites

17. Co-Requisites

Enrolled in Algebra I

18. Is this course a resubmission? Yes No

If yes, date(s) of previous submission? _____

Title of previous submission? _____

19. Brief Course Description

This is an applied science and engineering , project-based Earth and Space Science lab course. Students undertake study of Astronomy, Geology, Oceanography and Meteorology from an Earth Systems Science perspective. Laboratory, project work, and research are carried out to gain understanding of Earth Systems and to apply that knowledge, and an appreciation of how this science can be applied to planetary and other bodies. An integrated project finishes the year where students design and implement an Earth Science Systems mission. All California Earth Science content standards are also covered in the course.

B. COURSE CONTENT

Please refer to instructions

20. Course Goals and/or Major Student Outcomes

1. Develop an understanding of Earth Systems, how they are linked and the natural cycles that affect them.
2. Develop laboratory science tools and skills so as to investigate the Earth Systems Science.
3. Design and build a series of mission systems to investigate a range of Earth Systems and Space Science facets.
4. Understand and investigate how renewable energy can be looked at globally and in terms of the research in Earth Systems Science.
5. Develop an Earth Systems Science mission to carry out an investigation, designing, building, testing/evaluating and reporting on the mission system.

21. Course Objectives

By the end of this course students will be able to:

1. Use a model to describe the location and motion of the Earth and its Moon in the solar system.
2. Identify the other planets in the solar system on a diagram or in the night sky, and describe their motions, as well as the motion of the planetary moons and comets.
3. Describe the characteristics of Earth and other planets in the solar system in terms of their ability to support life.
4. Describe the current scientific theory relating to the origin and geologic evolution of the Earth and the solar system.
5. Explain phases of the Moon in terms of relative positions of the Earth, Moon, and Sun.
6. Draw inferences from celestial and terrestrial observations relating frames of reference for time and Earth motion.
7. Use maps and globes to identify surface features of the Earth.
8. Establish a correlation between different locations using rock and fossil evidence.
9. Identify common soil conservation methods.
10. Relate common cycles such as the water cycle, the nitrogen cycle, and the carbon cycle to each other.
11. Describe the motions of ocean waters and identify their causes and effects on climate.
12. Identify the composition and physical characteristics of the atmosphere.
13. Explain the roles of water and weather in distributing the Sun's heat energy.
14. Explain weather-related phenomena such as thunderstorms, tornados, hurricanes, drought, or acid precipitation.
15. Use a variety of weather measurement instruments and recording methods such as barometers, anemometers, and charts.

16. Relate observed weather conditions to large and small-scale weather systems, e.g. highs, lows, and fronts.
17. Demonstrate how living things alter the Earth's atmosphere, lithosphere, and hydrosphere.
18. Describe the relationship of plate tectonics to earthquakes and volcanism.
19. Investigate how human activities such as reducing the amount of forest cover and increasing the amount and variety of chemicals released into the atmosphere have changed the Earth's land, ocean, and atmosphere.
20. Cite evidence that our fresh water supply is essential for life and also for most industrial processes.
21. Describe possible consequences of reducing or eliminating some of the Earth's natural resources.
22. Identify natural, as well as human-induced factors, which contribute to changes in the Earth's systems.
23. Put into practice an understanding of laboratory tools to produce systems that will carry out a range of investigations in Earth Science systems
24. Demonstrate an understanding of Earth Systems and Mission Systems developed for investigation and experimentation.

22. Course Outline

Unit 1 - Earth Systems Science

1. Students understand the nature of Earth Systems science.
 - a. They can describe how Earth Systems science differs from earlier approaches to the Earth sciences.
 - b. They can describe the five major systems found on Earth.
 - i. The atmosphere, hydrosphere, cryosphere, geosphere and biosphere.
 - c. They can describe each of the four main Earth sciences.
 - i. Astronomy, geology, oceanography and meteorology.
 - d. They can describe the interactions between these five systems.
 - e. They can describe how mankind interacts with these five systems.
2. Students are aware of how experimental science is used in Earth Systems science.
 - a. Can list experimental techniques used in the study of the five major Earth systems.
 - b. They have carried out experiments from each branch of Earth Systems science.
 - i. Astronomy, geology, oceanography and meteorology.
3. Students are aware of Earth System science quantities and their measurement.
 - a. Units of measure.
 - b. Scientific, prefix and decimal notations.
 - c. Measurement tools

Unit 2 - The Universe and Earth's Place In It

1. A study of the universe
 - a. Students understand the different theories on the origin on the Universe.
 - i. The "Big Bang" theory, the "Steady State" theory, the "Oscillating Universe" theory.
 - b. Students understand key characteristics of the Universe
 - i. Background radiation, red shift.
 - ii. Galaxies.
 - (1) Their formation, and types.
 - (2) Clusters of galaxies.
 - iii. Stars.
 - (1) What a star is, and how they are formed.
 - (2) Types of star.
 - c. Students understand a range of tools used for studying the Universe.
 - i. Remote sensing.
 - (1) Telescopes - Reflecting, refracting, and radio telescopes.
 - (2) Other remote sensing devices - Satellite probes, landers and rovers.
 - ii. Mathematical models.
 - (1) Orbital mechanics, Newton, Kepler et al
 - (2) Simulations (Celestia and/or Orbiter)
 - d. Students are aware of the procedures used to determine astronomical distances.
 - i. What is a light year?
 - ii. Parallax methods.
 - iii. Apparent brightness versus absolute brightness.
2. The Solar system
 - a. The sun and planets.
 - i. Nuclear fusion in the sun.
 - b. Formation of the sun and planets.
 - c. Characteristics of the sun and planets.
 - d. Artificial satellites and spacecraft.
 - i. A brief history of space exploration.

3. The Earth-Moon System
 - a. Students understand the basic aspects of the Earth-Moon system.
 - b. Students are aware of the how the Moon interacts with the Earth (Eclipses, and tides).
4. Students design and build a mission system.
 - a. Mission title, objectives, and the results expected from the mission.
 - b. A description of the complete mission system.
 - c. A mission proposal presentation
 - d. A scale model of the mission system.

Unit 3 – A Study of Earth’s Surface and its Interior

1. Students are aware of the properties and uses of rocks and minerals
 - a. Students understand the basic chemistry of rocks and minerals.
 - i. Students understand the mineral groups and their properties.
 - ii. Students are aware of the use of minerals and rocks.
 - b. Students have an understanding understand the properties of the three different rock types.
 - i. Formation, classification, common and local types of rock.
 - ii. The Rock Cycle.
2. Students understand the principals of geologic time and the dating of rocks
 - a. What is geologic time?
 - b. What is relative dating, and the methods used?
 - c. What is absolute dating, and the methods used?
3. Volcanoes are understood
 - a. In terms of their formation.
 - b. In terms of their types and properties.
4. Students understand that the Earth is a dynamic system
 - a. Students are aware of continental drift
 - b. Students are aware of convection cells and how they interact with the mantle.
 - c. Students understand the importance of tectonic plate boundaries, tectonic activity and earthquakes.
5. Students understand the forces affecting the Earth’s surface
 - a. Students understand the effects on the Earth’s surface of weathering and erosion.
 - b. Students understand the mechanisms involved in the formation and change of mountains.
 - c. Students understand how the surface of the Earth is deformed over time.
 - d. Students are aware of how the surface of the Earth is viewed.
 - i. Topographic maps.
 - ii. Imaging, infrared and other.
 - iii. Applying these techniques to other planets.
6. Happenings beneath the Earth’s surface
 - a. Earthquakes – types and processes involved.
7. Students design a remote sensing, mapping project
 - a. Propose a mapping/remote sensing mission for part of the Earth, or another planet
 - i. Build a model representing part of the Earth, or other planet.
 - ii. Use remote sensors to analyze and map the model.

Unit 4 – Oceanography and Water on Earth

1. Water, water everywhere. Students are aware of:
 - a. The distribution and properties of water
 - b. Groundwater, hot springs and geysers, wells, caverns and caves
 - c. Streams and Rivers, stream flow, drainage basins
2. The world’s oceans. Students are aware of:
 - a. Seawater: Composition, sources of minerals
 - b. The layered structure of the oceans
 - c. Marine life zones
 - d. Mapping the oceans
 - e. Features of the seafloor: Deep ocean trenches, Abyssal plains, Seamounts, Mid-ocean ridges and Continental margins
3. From the sea to the sky. Students understand how water affects each of the five Earth Systems.
 - a. Students understand the water cycle.
 - b. Students understand the processes that drive the water cycle.
4. Dynamic oceans
 - a. Surface currents: Ocean circulation patterns, Upwelling, Surface ocean currents and climatic patterns, El Niño and La Niña
 - b. Deep ocean circulation

- c. Tides: Causes of tides, Spring and Neap tides, Tidal patterns
 - d. Waves: Causes and characteristics of waves, Wave erosion and human efforts to counter it (Groins, Seawalls, Dunes and beach restoration)
5. Students design a remote sensing project
- a. Design and build a directly controlled ROV, or dipping buoys to perform an underwater investigation.
 - b. The investigation could involve mapping the underwater topography, the thermocline profile or the currents present or any other approved mission.

Unit 5 – The Study of Our Atmosphere, Weather and Climate

1. The study of our atmosphere, weather and climate
 - a. Students are aware of the composition and structure of the atmosphere
 - i. Physical properties
 - ii. Views on atmospheric layers
 - (1) Homosphere and heterosphere
 - (2) Troposphere, stratosphere, mesosphere, thermosphere, exosphere
 - b. Students understand the Earth-Sun relationships
 - i. Solstices, Equinoxes and Seasons
 - ii. Solar radiation
 - iii. Albedo and re-radiated energy
 - iv. The greenhouse effect
 - c. Students understand the movements of the atmosphere
 - i. Convection currents and cells
2. How is the air up there?
 - a. Students understand the atmosphere's composition
 - b. Students understand the cycles that affect the atmosphere
3. Climate and climatic zones
 - a. Climate definition
 - b. Global climatic patterns
 - c. Factors affecting climate
 - d. The importance of vertical motion
 - e. Global climatic zones
 - i. Inter-tropical convergence zones
 - ii. Horse latitudes
 - iii. Polar storm track
 - iv. Polar subsidence
 - f. Climate patterns in the USA
 - g. Climate changes
 - i. Natural changes
 - ii. Human impact on local and global climate
4. Moisture, pressure and wind
 - a. Moisture
 - i. Relative humidity
 - ii. Dew point
 - iii. Latent heat
 - b. Clouds and fog
 - i. Composition
 - ii. Formation
 - iii. Types of cloud
 - iv. Atmospheric stability
 - c. Precipitation
 - i. How precipitation forms
 - ii. Forms of precipitation
 - iii. Measuring precipitation
 - d. Air pressure
 - i. Measuring air pressure
 - ii. Lows and highs
 - e. Winds
 - i. Relationship between air pressure and wind
 - ii. Factors affecting winds
5. Weather and weather systems
 - a. Cyclones and anticyclones
 - i. Air masses and their characteristics

- ii. Fronts
 - b. Cyclogenesis
 - i. Formation of a mid-latitude storm system
 - ii. Development of a cyclone
 - iii. Precipitation patterns associated with a cyclone
 - iv. Dissipation of a cyclone
 - c. Other forms of severe weather
 - i. Thunderstorms and Lightning
 - ii. Tornadoes
 - iii. Tropical weather systems
 - (1) Tropical storms and hurricanes
 - (2) Storm surge
6. Students design carry out a mission with the focus of airborne pollution
- a. Students use a sun photometer to analyze air quality
 - b. Students determine a system for evaluation of local air quality
 - i. Prepare a local map, showing areas of interest
 - ii. Design a detection grid for taking readings
 - iii. Collect data and report findings to the local community

Unit 6 – Renewable Energy

1. Students can identify the energy sources available from the Earth Systems
 - a. Solar, Wind, Wave, Biomass, Fossil fuels, Geothermal etc
2. Students understand how Science and Engineering give us access to the energy available from the Earth Systems
 - a. Conventional and alternative technologies (for example fuel cells, solar and wind generators)
3. Students understand the materials science relating to:
 - a. Solar/Photovoltaic cell technology
 - b. Battery technologies and related chemistry
 - c. Magnetism and electric generators
4. Students can design and construct simple alternate energy devices
 - a. They evaluate device/system power requirements
 - i. Stored energy capacity
 - ii. Power output
 - iii. Forces consideration in terms of system inputs and outputs
 - iv. They can select appropriate materials and technology
 - (1) Based in energy needs
 - (2) Based on working parameters
 - (3) Based on environment
 - b. Carry out calculations for power, and energy efficiencies of the device(s).
 - i. Drive train, Sensors, Communications load
 - ii. Active/rest cycles
 - c. Evaluate system and materials requirements
 - i. Task constraints
 - ii. Environmental constraints
5. Students should be able to review and comment constructively on the advantages and disadvantages of energy technologies
 - a. Non-renewable energy
 - b. Sustainable energy
 - c. Renewable energy

Unit 7 – Mission To Planet Earth

1. Students choose a mission for their team to undertake.
 - a. The mission may be review/extension and Earth based, or based on another planetary body.
2. Students produce a mission proposal.
 - a. A mission title and a clear set of objectives, and the results that would be expected from the mission.
 - i. The mission proposal must be unique, and teacher approved.
 - b. A description of the scope of the mission.
 - i. Is the mission new, a test, a confirmation or an application?
 - ii. What is being investigated, or applied?
 - iii. Where is the mission targeted?
 - iv. What is the duration of the mission?
 - v. What are the criteria for success?

- vi. What are the requirements, considerations and obstacles that will be met?
- vii. NO SCIENCE FICTION, ONLY SCIENCE FACT!
- c. A description of the complete mission system.
 - i. What is the mission platform?
 - ii. What are the sub-systems? What makes up the system, and what is each part's function? How will they operate?
 - iii. What data will be collected and how will it be collected?
 - iv. Describe the systems operation. What will it do, and how does it work?
 - v. How will it be known that the mission systems function correctly?
 - vi. What capability for system and sub-system maintenance will there be?
- 3. A working mission system model
 - a. Produce scale drawings. Front, side and top views on graph paper.
 - b. Produce an isometric drawing of the system. Use Isometric "dot paper."
 - c. A working model, from a budget for materials of \$150 per team.
- 4. A mission proposal presentation
 - a. The presentation should cover the same content as the mission systems report.
 - b. It should be time limited to 30 minutes per team.
 - c. It must include a "sales pitch."
 - i. Why should your team's proposal be the one to choose?
 - (1) Use science and engineering for justification, not emotions.
 - (2) Provide supporting evidence for your mission proposal's importance.
 - d. It must include a design report covering: Problem Analysis, Concept Generation, Design Synthesis, Manufacture, Testing and Review

19. Texts & Supplemental Instructional Materials

Text:

Earth Science 11/e (Prentice Hall, Tarbuck and Lutgens), OR

Earth Science: Geology, the Environment, and the Universe (Glencoe, Hess)

Supplemental Materials:

Science 101: Cosmology, Oceans, Weather, Geology (Harper Collins, Smithsonian)

The Blue Planet: An Introduction to Earth System Science (Wiley, Skinner, Porter, Botkin)

Earth Science the Easy Way (Barrons)

DVD Sets

- Blue Planet set
- Planet Earth and the Universe set
- Faces of Earth set
- Miracle Planet set

The Unofficial LEGO MINDSTORMS NXT Inventor's Guide

The LEGO MINDSTORMS NXT Idea Book: Design, Invent, and Build

NASA (<http://www.nasa.gov>)

National Oceanic and Atmospheric Administration (<http://www.noaa.gov/>)

The GLOBE program (<http://www.globe.gov>)

Kids Only Earth Enterprise (<http://kids.earth.nasa.gov/>)

Earth Science, Virtual Library (<http://vlib.org/EarthScience>)

USGS Education (<http://education.usgs.gov/>)

Earth Science World (<http://www.earthscienceworld.org/>)

Ocean Motion and Surface Currents (<http://oceanmotion.org/>)

Physical Oceanography (<http://www.es.flinders.edu.au/~mattom/IntroOc/newstart.html>)

Ocean in Motion (<http://www.onr.navy.mil/focus/ocean/motion/default.htm>)

Renewable Energy (<http://www.fsec.ucf.edu/en/education/k-12/curricula/index.htm>)

US Dept of Energy – Energy Efficiency and Renewable Energy (<http://www1.eere.energy.gov/education/>)

20. Key Assignments

Unit 1 - Earth Systems Science

Lab 1 – Making and calibrating a Barometer

Lab 2 – Making and calibrating a Thermometer

Lab 3 – Making and calibrating a Hair Hygrometer

Lab 4 – Making and calibrating a Fan Psychrometer

Lab 5 – Making a Seismograph

Vocabulary Assignments 1 and 2 – Grouping and defining terms, Earth Systems research

Assignments 1 and 2 – Unit Conversions and Scientific notation

Quiz 1 – Unit Conversions and Scientific notation

Unit 2 - The Universe and Earth's Place In It

Lab 6 – Building a refracting telescope

Lab 7 – Building a simple spectrometer

Lab 8 – The Herschel experiment (infrared radiation)

Lab 9 – The Ritter experiment (ultraviolet radiation)

Lab 10 – How far is it to the moon?

Vocabulary Assignments 3 and 4 – Reading/Reaction papers

Assignment 3 – Star Trekkin' (a tour of the solar system and beyond)

Quiz 2 – The Universe and Earth's Place in it

Mission 1 – Design a space-based Earth Systems Science mission (prepare a mission system model)

Unit 3 – A Study of Earth's Surface and its Interior

Lab 11 – Making sandstone and conglomerate

Lab 12 – Liquefaction

Lab 13 – Measurement in the field

Lab 14 – Rock and mineral properties

Vocabulary Assignments 5 and 6 – Reading/Reaction papers

Quiz 3 – Rocks and Minerals

Assignment 4 – Weather and Erosion

Assignment 5 – Mass wasting

Mission 2 – Topographical Mapping

Unit 4 – Oceanography and Water on Earth

Lab 15 – Streams and tables

Lab 16 – The tools of Oceanography

Lab 17 – Count Marsili's solution

Lab 18 – Beach erosion

Lab 19 – Erosion control

Lab 20 – The physical properties of sea, salt and fresh water

Lab 21 – Ocean buoys, tides and waves

Lab 22 – Wave/current energy

Vocabulary Assignment 7 – Writing Assignment (The future of oceanography)

Assignment 6 – The water cycle

Quiz 4 – The water cycle

Mission 3 – Design/equip an ROV, or dipping buoys to perform an underwater investigation.

Unit 5 – The Study of Our Atmosphere, Weather and Climate

Lab 22 – Greenhouse heat

Lab 23 – Aerosol counts in the local community

Lab 24 – Measuring the oxygen content of air

Lab 25 – Ozone content of local air

Lab 26 – Atmospheric conditions and local weather

Lab 27 – Wind energy, turbine design

Vocabulary Assignment 8 – Writing assignment (The early atmosphere)

Vocabulary Assignment 9 – Writing assignment (Global climate change)

Assignment 7 – Solar radiation and the Earth

Assignment 8 – Earth's climate systems

Assignment 9 – Global climate change

Assignment 10 – Atmospheric Systems

Mission 5 – A study of local air quality using a sun photometer

Unit 6 – Renewable Energy

Lab 28 – Solar Power generation

Lab 29 – Wind Power generation

Lab 30 – Wave Power generation

Lab 31 – Electric motors and generators

Vocabulary Assignment 9 – Renewable Energy and Earth Systems Cycles Reading/Reaction paper

- Assignment 11 – Energy resources and mission systems
- Assignment 12 – Generator efficiency
- Quiz 5 – Basic Electronics
- Mission 6 – Renewable Energy and Mission Systems

Unit 7 – Mission to Planet Earth Systems

- Vocabulary Assignment 9 – Mission System vocabulary/bibliography
- Assignment 13 – Mission System proposal
- Assignment 14 – Mission System report
- Assignment 15 – Mission System design/building
- Assignment 16 – Mission System testing/evaluation
- Assignment 17 – Mission System presentation/PowerPoint

21. Instructional Methods and/or Strategies

- Lecture
- Laboratory work
- Lab equipment building and calibrating
- Mission systems proposals and development
- Slide shows
- Outside Activities (fieldtrips)
- Instructor made videos
- Internet and Library research
- DVDs
 - Blue Planet set
 - Planet Earth and the Universe set
 - Faces of Earth set
 - Miracle Planet set
- Library and internet research
- Student projects
- Student PowerPoint presentations

22. Assessment Methods and/or Tools

- | | |
|--|-----|
| Unit Work | 60% |
| • Vocabulary (Reading/Writing/Reaction papers) | |
| • Quizzes | |
| • Assignments | |
| • Laboratories | |
| • Mission Systems | |
| • Proposal | |
| • Mission System | |
| • Report | |
| • Presentation | |
| Semester Finals | 20% |
| Mission to Planet Earth Systems | 20% |
| • Proposal | |
| • Mission System | |
| • Report | |
| • Presentation | |

C. HONORS COURSES ONLY

Please refer to instructions

D. OPTIONAL BACKGROUND INFORMATION

Please refer to instructions



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