LSC Use Only Proposal No:	UWUCC Use Only Proposal No: 13-151
LSC Action-Date: App-3/13/14	UWUCC Action-Date: AP-4/8/14 Senate Action Date: App-4/29/14

Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

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Proposing Department/Unit Geoscience	Phone 7-7650

Check all appropriate lines and complete all information. Use a separate cover sheet for each course proposal and/or program proposal.

1. Course Proposals (check all that apply)

- [ ] New Course
- [x] Course Revision
- [ ] Course Prefix Change
- [ ] Course Number and/or Title Change
- [ ] Course Deletion
- [ ] Catalog Description Change

Current course prefix, number and full title: SCI 103 Fundamentals of Earth and Space Science

Proposed course prefix, number and full title, if changing:

2. Liberal Studies Course Designations, as appropriate

This course is also proposed as a Liberal Studies Course (please mark the appropriate categories below)

- [ ] Learning Skills
- [x] Knowledge Area
- [ ] Global and Multicultural Awareness
- [ ] Writing Across the Curriculum (W Course)
- [ ] Liberal Studies Elective (please mark the designation(s) that applies – must meet at least one)
  - [ ] Global Citizenship
  - [ ] Information Literacy
  - [ ] Oral Communication
  - [ ] Quantitative Reasoning
  - [ ] Scientific Literacy
  - [ ] Technological Literacy

3. Other Designations, as appropriate

- [ ] Honors College Course
- [ ] Other: (e.g. Women's Studies, Pan African)

4. Program Proposals

- [ ] Catalog Description Change
- [ ] Program Revision
- [ ] Program Title Change
- [ ] New Track
- [ ] New Degree Program
- [ ] New Minor Program
- [ ] Liberal Studies Requirement Changes
- [ ] Other

Current program name:

Proposed program name, if changing:

5. Approvals	Signature	Date
Department Curriculum Committee Chair(s)	Kenneth S. Coles	2/14/2014
Department Chairperson(s)		2/14/14
College Curriculum Committee Chair		2/19/14
College Dean		2/19/14
Director of Liberal Studies (as needed)	~~Edel~~	4/1/14
Director of Honors College (as needed)		
Provost (as needed)		
Additional signature (with title) as appropriate	Edel Reilly (TECC) Tara Leathers	3/24/14
UWUCC Co-Chairs	Gail Sechrist	4/14/14

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Part II. Description of Curricular Change

1. SYLLABUS OF RECORD

I. Catalog Description

SCI 103 Fundamentals of Earth and Space Science **2c-2l-2.5cr**
Prerequisite: ECSP major

Earth science course for Early Childhood Education/Special Education majors. Introduces concepts and applications of astronomy, geology, oceanography, and meteorology. Includes both lecture and laboratory components with an emphasis on how the Earth sciences impact the natural environment. Does not fulfill the Liberal Studies requirement except for majors in Early Childhood Education/Special Education (ECSP).

II. A. Course Outcomes

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

Objective 1

Use the scientific method to create and test hypotheses about impact craters, plate motion, geologic time, ocean circulation and weather prediction.

Expected Student Learning Outcomes

Informed and Empowered Learners

Rationale

Students will not only learn what the scientific method is, they will also apply it in several astronomy, geology, oceanography and meteorology labs. Students will also practice both inductive and deductive reasoning – observing some processes before generating a hypothesis while other processes are approached with a hypothesis first before making observations.

Objective 2

Interpret stellar classification based on brightness and color, and be able to predict the future of each major group of stars on the main sequence.

Expected Student Learning Outcomes

Informed Learners

Rationale

Students will use the H-R diagram to classify and predict how stars evolve through time, into final states such as white dwarfs, supernovae, black holes and stellar nebulae. They will relate this knowledge to evidence showing that our own Solar System was preceded in space by a supernova explosion.

Objective 3

Identify the main plate boundaries on Earth and correlate them to the specific rock types that they create in order to gain the ability to reconstruct the Earth's past.

Expected Student Learning Outcomes

Informed and Empowered Learners

Rationale

Students will discover how plate boundaries create distinctive signatures in the form of different rocks, volcanoes and mountain types. They will also gain the ability to interpret the historical rock record in terms of ancient environments, tectonic events and global climate changes.

Objective 4

Determine the past history of rock units using principles of both lithostratigraphy and biostratigraphy.

Expected Student Learning Outcomes

Informed Learners

Rationale

Students will learn how to use fossil content and physical layers to determine the order in which past rocks formed over time. They will also create interactive visualizations to represent geologic time and discover where major events such as mass extinctions and mountain building occur throughout the Earth's history.

Objective 5

Connect the different parts of the Earth's water cycle to each other, and understand how the global circulation of the ocean controls the Earth's climate through time.

Expected Student Learning Outcome

Informed and Empowered Learners

Rationale:

Students will investigate how the Earth's water is distributed across different reservoirs and will understand the impact that ocean currents such as El Nino and the Gulf Stream have on both normal and abnormal weather events.

Objective 6

Examine the structure and chemistry of the Earth's atmosphere and discover how atmospheric changes have caused Ice Ages as well as current trends of climate change.

Expected Student Learning Outcome

Informed and Empowered Learners

Rationale:

Students will discover how the Earth's thin atmosphere has enormous impact on climate and weather trends over time. They will also use their understanding of basic atmospheric measurements such as temperature, humidity and wind direction to make their own weather forecasts for parts of the United States.

II. B. Student Outcomes Assessment Matrix

Danielson Domains	NSTA Program Objectives	Course Objectives	Assessment Technique (* = selected for NCATE / KARS reports)
I, II, III	1.a., 1.b.	1	**Lab Journal Entry***, Groupwork, Exam 1
I, II, III	1.a., 1.b.	2	Lab Journal Entry, Groupwork, Exam 1
I, II, III	1.a., 1.b.	3	Lab Journal Entry, Groupwork, Exam 2
I, II, III	1.a., 1.b.	4	**Lab Journal Entry***, Groupwork, Exam 2
I, II, III	1.a., 1.b.	5	Lab Journal Entry, Groupwork, Exam 3
I, II, III	1.a., 1.b.	6	**Lab Journal Entry***, Groupwork, Exam 3

***Lab Journal Entries 5, 11 and 14 will be used as Key Assessments for this course.**

III. Course Outline

Lecture Topics	Lecture Hours	Labs (2 hours each / 28 hours total)
Introduction	3 hours	Lab 1: Constellations
The Scientific Method		
The Universe		Lab 2: Planetarium Show
Stars	3 hours	Lab 3: Impact Craters
The Sun		
The Moon		Lab 4: The Phases of the Moon
The Solar System	3 hours	
Time & Seasons		Lab 5: Placing the Planets
Earth's Origin		
FIRST HOURLY EXAM (1 hour)		
Plate Tectonics	3 hours	Lab 6: Play-Doh Tectonics
Earthquakes		Lab 7: Virtual Earthquake
Volcanoes		
Minerals and Rocks	3 hours	Lab 8: Mineral Bingo
The Rock Cycle		
Geologic Time		Lab 9: Making Timelines
Ancient Life	3 hours	
Dinosaurs		Lab 10: Dinosaurs and Friends
Mammals & Ice Ages		
SECOND HOURLY EXAM (1 hour)		
The Ocean	2 hours	Lab 11: Blue Traveler Web Activity
The Ocean in Motion		
The Atmosphere	3 hours	Lab 12: Ocean Profiles
Humidity & Air Pressure		
Air Masses & Fronts		Lab 13: Wind Chill and Heat Index
Thunderstorms & Tornados	3 hours	
Hurricanes & Blizzards		Lab 14: EdHeads Web Activity
Climate Change		
Culminating Activity: THIRD HOURLY EXAM (Scheduled Final Exam Period)		

IV. Evaluation Methods

Each component of the course will contribute to the final grade according to:

Exam 1	20%
Exam 2	20%
Exam 3	20%
Lab Journal*	**20%**
Lab Participation	10%
In-Class Groupwork	10%
Total	100%

V. Example Grading Scale

The final grade for this course will be determined using the following schedule:

A=90-100%; B=80-89%, C=70-79%, D=60-69%, F=<60%

VI. Attendance Policy
The attendance policy will conform to IUP's undergraduate course attendance policy as outlined in the Undergraduate Catalog.

VII. Required textbooks, supplemental books and readings

Text: McConnell, David, Steer, David, Owens, Katharine and Knight, Catherine, 2009, The Good Earth: Introduction to Earth Science 2nd Edition: McGraw Hill, 529 pages.

Supplemental Reading: Johnson, George, 2005, Miss Leavitt's Stars: The Untold Story Of The Woman Who Discovered How To Measure The Universe: W.W. Norton, 162 pages.

Supplemental Reading: Emling, Shelley, 2011, The Fossil Hunter: Dinosaurs, Evolution, and the Woman Whose Discoveries Changed the World: Palgrave McMillan, 256 pages.

VIII. Special resource requirements
There are no special resource requirements for this course.

IX. Bibliography
In addition to the required textbooks, the following will be used to develop the course curriculum:

Chaisson, Eric and McMillan, Steve, 2009, Astronomy: A Beginner's Guide to the Universe: Benjamin Cummings, 592 pages.

Grant, Maria C. and Fisher, Douglas B. (eds), 2009, Reading and Writing in Science: Tools to Develop Disciplinary Literacy: Corwin Press, 120 pages.

Humphreys, Sheila, 1981, Women and Minorities in Science: Strategies for Increasing Participation: Westview Press, 218 pages.

Lutgens, Frederick K., Tarbuck, Edward J and Tasa, Dennis, 2012, The Atmosphere: An Introduction to Meteorology 12th Edition: Prentice Hall, 528 pages.

Marcarelli, Kellie (ed), 2010, Teaching Science With Interactive Notebooks: Crown Press, 192 pages.

Tarbuck, Edward J., Lutgens, Frederick K., and Tasa, Dennis, 2011, Earth Science 13th Edition: Prentice Hall, 768 pages.

Trujillo, Alan P. and Thurman, Harold V., 2010, Essentials of Oceanography 10th Edition: Prentice Hall, 576 pages.

2. SUMMARY OF PROPOSED REVISIONS

1. The course catalog description was updated to reflect changed title and abbreviation of relevant Professional Studies in Education major programs.

2. The course objectives were modified from the most recent syllabus of record and aligned with the Expected Undergraduate Student Learning Outcomes (EUSLO).

3. Common Learning Objectives for a laboratory Natural Science course were incorporated into the content of the course. These objectives include: understand a body of knowledge in a science domain; understand that science knowledge is generated by an empirical approach to nature and analyze problems from the perspective of a natural scientist; demonstrate an understanding of intellectual honesty in the context of scientific methodology, and contrast science with pseudoscience; understand how science knowledge is relevant to non-scientists and use critical thinking skills and scientific methodology.

4. Updated texts to more current books and also updated the bibliography to reflect current resources used to develop the course.

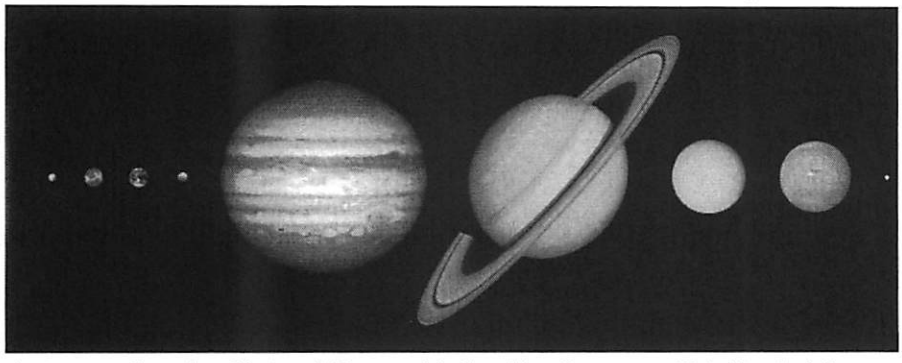
3. JUSTIFICATION/RATIONALE FOR REVISIONS

The course is currently approved for Liberal Studies Laboratory Natural Science for Early Childhood / Special Education (ECSP) majors (along with two additional companion courses selected from SCI 101, 102, and 104). This sequence of three 2.5 credit classes only satisfies the Liberal Studies Natural Science requirement for ECSP majors. State PDE requirements for the ECSP program in conjunction with PASSHE total credit limits require these SCI courses to be offered in their current format.

4. INFORMATION FOR LIBERAL STUDIES APPROVAL

A. Sample Course Assignment and Rubric

Lab 5: Planetary Size and Distance Comparison



Assignment based on National Geographic Teaching Resources Web Site Activity
http://education.nationalgeographic.com/education/activity/planetary-size-and-distance-comparison/

1. Review planet order and relative sizes in our solar system.
Using a wall poster and matching floor puzzle of the solar system, familiarize students with the order of the planets, outward from the sun (left to right): inner planets Mercury, Venus, Earth, Mars; outer planets Jupiter, Saturn, Uranus, Neptune, and Pluto. Ask students why Pluto is no longer considered a planet in our solar system to integrate material from previous SCI 103 lecture. Have students compare the poster to the floor puzzle and note the differences (puzzle illustrations are not to scale while the poster is.)

2. Have students gather data and compare planet sizes.
Divide students into small groups. Distribute one copy of the worksheet Planetary Size Comparison to each group. Have groups use the Planet Size Comparison interactive to find and record data on planet diameters and ratios. Ask:

- *What do you notice about the size of the planets?*
- *How do you think the sizes of the planets compare?*
- *What everyday objects could represent planets and the sun?*

Based on their worksheet, ask students to measure and cut out cardboard circles, choosing the colors to correctly represent each of the major planets.

3. Build background about the astronomical unit (AU).
An astronomical unit, or AU, is a simplified number used to describe a planet's distance from the sun. It is a unit of length equal to the average distance from Earth to sun, approximately 149,600,000 kilometers (92,957,000 miles). Only Earth can be assigned AU 1. Planets farther away would have AU greater than 1; planets closer would have AU less than 1. Scientists created the astronomical unit so they could easily compare distances of objects in the solar system (for

example, planet Jupiter is 5.2 AU (5.2 Earth distances) away from the sun while Pluto is nearly 40 AU (40 Earth distances) away.

4. Introduce the modeling activity.
Tell students that they are going to measure lengths of yarn to represent the distance in AU for their assigned planet. Use floor tiles as a scale for 1 AU. Ask the following questions during the exercise to ensure students have correctly set up their mathematical ratios:

- *Which planets will end up less than one floor tile away from the Sun?*
- *Which planets will end up many floor tiles away from the Sun?*

5. Have groups create models of relative planetary distances.
Using the door at the end of the hall as the surface of the Sun, ask each student group to stretch out their length of yarn and tape their planet onto the floor at its correct position. Once all planets are placed, ask students to describe what they notice about planetary distances from the model. Are any of the planets in the wrong order from the poster or floor puzzle? Are any of the planets incorrect in terms of size?

Informal Assessment

Using the chalkboard, have students volunteer facts that they learned about our solar system, to be used as the basis for a future test question. These facts should include:

- *locations of planets in relation to the sun and one another*
- *relative sizes of planets, including Earth*
- *relative distances of planets from each other and from the Sun*

Formal Assessment: Lab Journal Entry (on LMS such as D2L)

In lab today, we used the floor tiles as a measuring guide for placing the planets of our solar system in the correct scale for their relative sizes and distance from each other and from the Sun. For your lab journal entry, you should use the same mathematical ratios to create a Google Maps driving guide to the solar system. You will need to find towns in Pennsylvania which can represent each of the planets in our solar system, using their distance from each other as a substitute for actual planetary distance. At each stop, you should describe an object or building that would represent the size of the planet there, in the correct scale to the starting size you assign to the Sun.

Grading Rubric	**Excellent (5 points)**	**Above Average (4 points)**	**Satisfactory (3 points)**	**Below Average (0-2 points)**
Mathematical Calculations	All ratios used to calculate distances are clearly stated and correct.	A few calculated ratios are wrong due to simple arithmetic errors.	Ratios show a consistent error due to incorrect formulation.	Ratios are unclear, or do not show any evidence of understanding.
Organization & Writing Skills	Descriptions of distances and sizes are well explained with vivid analogies.	Written summary of the distances and sizes is clear and concise.	Written summary of distances and sizes is too short or uses confusing descriptions.	Writing is unclear, with numerous grammar and spelling mistakes.

Liberal Studies Course Approval General Information

1. This course will generally be taught in one lecture and 2-3 lab sections by a single instructor.

2. Required non-text supplemental readings about Henrietta Leavitt (discoverer of Cepheid variable stars) and Mary Anning (discoverer of marine reptiles and many other fossils) will help students appreciate the contributions of women to the Earth sciences.

3. In addition to the textbook "The Good Earth" and the non-text readings, the class will also use a variety of government and university web-sites (updated each term) to engage in interactive learning about galaxies, stars, planets, plate tectonics, mineral resources, earthquakes, ocean currents, tornados and hurricanes as part of lab assignments.

4. This course introduces future elementary teachers to the essential concepts of Earth science, including astronomy, geology, oceanography and meteorology. This course is intended to give future teachers a thorough grounding in the scientific method and a confident understanding of Earth science principles that underlay the topics they will one day teach at the K-4 grade level.

OLD SYLLABUS OF RECORD (attached)

Course Syllabus

I. Catalog Description

SC 103 Earth and Space Science — 2.5 credits
2 lecture hours
2 lab hours
(2c-2l-2.5 sh)

Prerequisites: SC 101, SC 102

Introduction to geology, astronomy, oceanography and meteorology. Emphasis is placed on the understanding of large scale processes and how the Earth, Solar System and Universe work. Lab experiences include hands-on work with earth materials and with instruments from all four subjects, map, and field trips which may occur during class times, nights, and weekends.

II. Course objectives

1. Students will understand large scale processes and which operate in the earth and space sciences and will appreciate that many of these processes are linked and inter-dependent upon each other.

2. Students will be able to interpret and understand the processes which create our local environment and the Earth as a whole.

3. Students will be able to develop a personal philosophy and sense of ethics by studying the origin of the universe, the role of humankind in the health of planet Earth and specifically our local environments, and become aware that they may be able to influence national and local political decisions on these issues.

4. Students will learn to work cooperatively and will collaborate on the development of laboratory teaching exercises.

III. Course Outline

A. Geology: 9 lecture periods
1. Structure of the Earth, its internal layers and processes
2. Plate tectonics; relationships to earthquakes and volcanoes
3. Mineral resources; impact on human development
4. The rock cycle: weathering and soils
5. Geologic time and the rock record of Earth's past environments
6. The fossil record; dinosaurs and ancient mammals
7. Rivers and erosion; landscape development
8. Natural hazards: landslides, earthquakes, tsunamis
9. Geology exam

Geology: 5 labs
1. Minerals: identification techniques, mineral families, uses of minerals
2. Rock types: sedimentary, igneous, metamorphic
3. Fossils: plants, invertebrate and vertebrate animals
4. Maps: map reading, topographic contours, distances and directions

5. Synthesis exercise: design a teaching exercise with lab specimens

In addition, students will be required to attend and write-up notes from one of several optional field excursions.

B. Astronomy: 10 Lecture periods

1. Origin of time-keeping (day, week, month, year); calendars
2. Instrumental use: camera, spectroscope, telescope
3. Our satellite: Moon (phases and surface)
4. The Space Program: manned and unmanned, applications
5. The Planets: characteristics
6. Comets, meteors, and asteroids: characteristics
7. Sun: its impact on Earth, its characteristics
8. Properties of stars and the life of a star
9. Galaxies: our Milky Way, other galaxies
10. Astronomy Exam

Astronomy: 4 Lab periods

1. Constellations: origins, use, identification
2. Seasons: causes, effects
3. Planets: motion, characteristics
4. Stars: properties

In addition, students will be required to attend and write-up notes on one evening observation.

C. Fluid Environments: Oceanography and Meteorology: 10 Lecture periods

1-2. Properties and characteristics of water and air: similarities and differences
4-5. Water cycle, adiabatic processes, condensation, evaporation, and so on.
6-7. Understanding weather and climate: wind patterns and atmospheric circulation, Coriolis Effect.
8-9. Ocean currents: surface and thermohaline circulation, Ekman Transport
10. Marine geology and paleo-oceanography
11. Ocean and Met exam

Fluid Environments: 5 Lab periods

1. Measuring properties of air: pressure, temperature, wind direction and velocity
2. Measuring properties of water: temperature, salinity, current direction and velocity, depth
3. Maps and adiabatic diagram: understanding distribution of air temperature and pressure, cyclones and anticyclones
4. Maps and T-S diagram: understanding distribution of temperature, salinity, density of seawater; how water masses move and mix
5. Synthesis exercise: students will design a teaching exercise for elementary students to measure air or water temperature, salinity, pressure or to demonstrate wind and water currents.

In addition, students may choose to attend a 3-day field trip to the Marine Science Consortium at Wallops Island, Virginia.

IV. Evaluation Methods

The final grade for the course will be the average of the grades earned in geology, astronomy, and fluid environments. The individual professors teaching each portion will determine the grade by the following:

60% Tests which integrate lecture and lab material
40% Lab exercises and quizzes which may include book or article reviews

V. Required Textbooks, Supplemental Books and Readings

Textbook: Edward J. Tarbuck and Frederick K. Lutgens, 1988, Earth Science: 5th edition, Merrill Publishing Company, N.Y., 612 p.

Non-textbook readings: students will read a variety of childrens' science books and magazines such as "3-2-1 Contact," "Odyssey," and astronomy. The students will be required to critique these books and for their science content as well as how they might appeal to children and be used in the elementary science classroom. Students will read a children's book and a magazine for each of the three portions of this course.

VI. Special Resources Requirement
Instructional media such a 35 mm slide sets, videocassettes, subscriptions to magazines, mineral and rock specimens, star charts

VII. Bibliography

Abell, Geology and others, 1988, Realm of the Universe: Saunders Publ. (N.Y.), 528 p.

Ahrens, C. Donald, 1982, Meteorology Today: An Introduction to Weather, Climate, and the Environment: West Publ. (Minneapolis), 514 p.

Hartmann, William K., 1991, Astronomy: The Cosmic Journey: Wadsworth Publ. (Belmont, CA), 693 p.

Harvey, J.G., 1976, Atmosphere and Ocean: Our Fluid Environments: Artemis (Sussex), 143 p.

Levin, Harold L., 1991, The Earth Through Time: Harcourt-Brace-Jovanovich (N.Y.), 651 p.

Neshyba, Steve, 1987, Oceanography: Perspectives on a Fluid Earth: Freeman and Co. (N.Y.), 506 p.

Open University Course Team, 1989, Series of Volumes on Oceanography: Pergamon Press (Cambridge), about 600 pages in 5 volumes.

Pasachoff, Jay, 1989, Contemporary Astronomy: Saunders Publ. (N.Y.), 577 p.

Plummer, Charles C. and David McGeary, , 1991, Physical Geology: Brown Publishers (N.Y.), 543 p.

Press, Frank and Raymond Siever, 1986, Earth: Freeman and Co. (N.Y.), 656 p.

Spiegel, Herbert and Arnold Gruber, 1983, From Weather Vanes to Satellites: An Introduction to Meteorology: Wiley (N.Y.), 241 p.

Stanley, Steven M., 1989, Earth and Life Through Time: Freeman and Co. (N.Y.), 689 p.

Thurman, Harold V., 1991, Introductory Oceanography: MacMillan (N.Y.), 526 p.