FAIRMONT STATE UNIVERSITY™

Office of the Provost
1201 Locust Avenue • Fairmont, West Virginia 26554
Phone: (304) 367-4101 • Fax: (304) 367-4902
www.fairmontstate.edu

MEMORANDUM

TO: Faculty Senate

FROM: Dr. Susan Ross

DATE: February 25, 2021

SUBJECT: Curriculum Proposal #20-21-14

An introductory Astronomy course entitled "Life in the Cosmos" is proposed that will fulfill the Natural Science 4 credit hour requirement of the FSU Core-Curriculum. (See Core-Curriculum Outcome 8.):

cc: Richard Stephens
Lori Schoonmaker
Stephanie Gabor
Laura Ransom
Galen Hansen

CURRICULUM PROPOSAL (Submit one hard copy and an electronic copy to the Associate Provost by the second Tuesday of the month.)

Proposal Number:	#20-21-14
School/Department/Program:	College of Science & Technology / Natural Science Dept.
Preparer/Contact Person:	Galen J Hansen
Telephone Extension:	x4176
Date Originally Submitted:	10/30/2020
Revision (Indicate date and label it Revision #1, #2, etc.):	Revision 1
Implementation Date Requested:	Fall 2021

I. **PROPOSAL**. Write a brief abstract, not exceeding 100 words, which describes the overall content of the proposal.

An introductory Astronomy course entitled "Life in the Cosmos" is proposed that will fulfill the Natural Science 4 credit hour requirement of the FSU Core-Curriculum. (See Core-Curriculum Outcome 8.):

II. **DESCRIPTION OF THE PROPOSAL**. Provide a response for each letter, A-H, and for each Roman Numeral II–V. If any section does not apply to your proposal, reply N/A.

A. Deletion of course(s) or credit(s) from program(s)

Total hours deleted. NA

B. Addition of course(s) or credit(s) from program(s)

Total hours added. NA

C. Provision for interchangeable use of course(s) with program(s)

Core-Curriculum: new 4 credit Natural Science course

D. Revision of course content. Include, as an appendix, a revised course description, written in complete sentences, suitable for use in the university catalog.

NA

E. Other changes to existing courses such as changes to title, course number, and elective or required status.

NA

F. Creation of new course(s). For each new course

1. Designate the course number, title, units of credit, prerequisites (if any), ownership (FSU or shared) and specify its status as an elective or required course. If you are creating a shared course, attach a memo from the Deans of the affected Schools explaining the rationale for the course being shared.

SCIE 1250 "Life In The Cosmos"; 4-credits; no prerequisite; FSU
Meets the course requirements of Core-Curriculum Outcome 8: Natural Science.

Course Number	Title		Credit	Prerequisites	Ownership	Status
SCIE 1250	Life in The Cosmos		4	None	FSU	Elective

2. Include, as an appendix, a course description, written in complete sentences, suitable for use in the college catalog.

See Appendix A

3. Include, as an appendix, a detailed course outline consisting of at least two levels.
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See Appendix B

4. In order to meet the requirements as outlined in Goal One of the Strategic Plan, please include Outcome Competencies and Methods of Assessment as an appendix. Examples are available upon request from the Chair of the Curriculum Committee.

See Appendix C

G. Attach an itemized summary of the present program(s) affected, if any, and of the proposed change(s).

Describe how this proposal affects the hours needed to complete this program. Specifically, what is the net gain or loss in hours? Use the format for Current and Proposed Programs in Appendix A.

Core-Curriculum Outcome 8: – new 4 credit Natural Science course

III. **RATIONALE FOR THE PROPOSAL**.

A. **Quantitative Assessment**: Indicate the types of assessment data, i.e., surveys, interviews, capstone courses, projects, licensure exams, nationally-normed tests, locally developed measurements, accreditation reports, etc., that were collected and analyzed to determine that curricular changes were warranted. Quantitative data is preferred.

No astronomy class is presently offered for FSU Core-Curriculum credit. The SCIE 1199 Basic Astronomy course offered during the Fall 2019 semester had 15 students to begin with. It is anticipated that the course will be full when included as an accepted SCIE four-credit course.

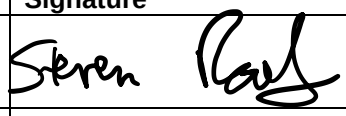
B. **Qualitative Assessment**: Based upon the assessment data above, indicate why a curricular change is justified. Indicate the expected results of the change. Be sure to include an estimate of the increased cost, or reduction in cost of implementation. FOR EXAMPLE: Will new faculty, facilities, equipment, or library materials be required?

Astronomy is a popular topic of study that can be used to teach basic principles and tools of science as specified by the FSU Core-Curriculum requirements, as well as

provide an in-depth understanding of the historical development of science and the social and intellectual evolution of mankind.

IV. Should this proposal affect any course or program in another school, a memo must be sent to the Dean of each school impacted and a copy of the memo(s) must be included with this proposal. In addition, the Deans of the affected schools must sign below to indicate their notification of this proposal.

By signing here, you are indicating your college's/school's notification of this proposal.

College/School	Dean	Signature
Science and Technology	**Steven Roof**	

V. Should this proposal affect any course to be added or deleted from the general studies requirements, a memo from the chair of the General Studies Committee indicating approval of the change must be included with this proposal.

VI. ADDITIONAL COMMENTS.

Appendix A
Course Outline

Credit Hours: 4
Lectures w/ Lab Activities

This Astronomy course guides students in observing and understanding the make-up and evolution of the universe. Observations and comprehension of the cosmos are examined historically from ancient civilizations to modern exploration, as well as scientifically, from the human view of the heavens to the role of galaxies and beyond. This course allows students to discover how nature works and is modeled by science so they can see how the entire cosmos has been necessary to make possible our life on earth. Occasional night sessions.

Appendix B
Course Outline

I. Introduction: Where are we now?
- Day 1 – Location of Earth
  - Dimensions, general makeup of the university
- Day 2 – View from Earth
  - Earth Coordinates, viewing the sky, mapping the stars

II. Effects of Space on Earth Life
- Day 3 – The Celestial Sphere
  - Celestial coordinates, cosmic views
- Day 4 – The Ecliptic Plane
  - Zodiac constellations, seasons, climate
- Day 5 – Time
  - Clocks, time zones, calendars

III. Our Nearest Neighbors
- Day 6 – The Moon
  - Phases, Eclipses, Tides
- Day 7 – The Planets
  - The wanderers, roots of astronomy, retrograde motion
- Day 8 – Tests 1

IV. The Ascent of Man
- Day 9 - The Copernican Revolution
  - The roots of science, Kepler's laws
- Day 10 – Galileo's Advances in Science
  - Telescopes, changing theories, power struggles
- Day 11 - Newton's Laws
  - Gravity, force, laws of motion
- Day 12 – Light
  - Electromagnetic spectrum, energy & temperature

V. Discovering the Nature of Matter
- Day 13 – Matter
  - Atoms, molecules
- Day 14 – The Sun
  - Solar spectrum, solar structure and properties
- Day 15 – Fusion
  - Hydrostatic equilibrium, energy output
- Day 16 – Test 2

VI. Discovering the Nature of Stars
- Day 17 – Determining Distance in Space
  - Apparent and absolute magnitude, luminosity
- Day 18 – HR Diagram
  - Star temperature, size, mass
- Day 19 – Types of stars
  - Main sequence, massive, median, red dwarf
- Day 20 – Lifetime of Stars
  - Interstellar medium, birth, life, death

VII. Evolution toward Mankind – (A) The Universe
- Day 21 – Age of The Universe
  - Big bang, red-shift, universe expansion, Hubble constant
- Day 22 – Galaxies
  - Structure, types, motion, dark matter
- Day 23 – Age of Galaxies
  - Main-sequence turn-off, open and globular clusters
- Day 24 – Test 3

VIII. Evolution toward Mankind – (B) Earth Matter
- Day 25 – Star Dust
  - Massive stars, supernovas, planetary nebula, stellar birth revisited
- Day 26 – Stellar Nurseries
  - Interstellar medium, protostars
- Day 27 – Origin of Our Solar System
  - Protostars, protoplanets, radioactivity
- Day 28 – Life on Earth Begins
  - Goldilocks zone, circular orbit, neighbors
- Day 29 - Development of Life on Earth
  - Geological time, photosynthesis, carbon cycle
- Day 30 – <u>Continuing Ascent or Ride the Wave?</u>
  - Role of science, education, culture and Faith in the continuing evolution of humans

Final Exam – Test 4

Appendix C
Course Outcome and Measures

Core-Curriculum Outcome 8: Students will demonstrate proficiency with scientific content and data analysis to address real world problems, and recognize the limitations of the scientific process.

Course Outcomes:

1. Students will demonstrate proficiency with the scientific content of astronomy, including retention of terms, definitions and concepts.

   Assessments: Tests, quizzes homework.

2. Students will demonstrate proficiency with data collection and analysis using appropriate equipment and record-keeping during class and lab activities.

   Assessments: Various activities and investigations. For example:
   "Navigating by the Stars" activity – Exploration section. Students will demonstrate capability with data collection and analysis using their own astronomical data of Polaris (north star) and the time of sunset to determine approximately their latitude and longitude.

   "HR Diagram and Stellar Life Cycles" Investigation – HR Diagram section. Students will demonstrate proficiency using astronomical data of stars to establish graphs and relationships useful for answering questions about stellar evolution, the universe and our lives in it.

3. Students will demonstrate proficiency with using analyzed data to analyze models of nature (theories) and develop and test hypotheses that address real world problems.

   Assessments: Various activities and investigations. For example:
   "Navigating by the Stars" activity – Concept Development section. Students will use their data analysis to orient themselves on the earth and be able to communicate their location without reference to objects or landmarks.

   "HR Diagram and Stellar Life Cycles" Investigation – Stellar Life Cycles section. Students will demonstrate proficiency using analysis of data to model stellar activity and evolution in the universe and to understand the origins of matter that makes up life.

4. Students will demonstrate proficiency with using scientific content and data analysis to recognize the limitations of the scientific process.

   Assessments: Various activities and investigations. For example:
   "Navigating by the Stars" activity – Reflections section. Students will include some error analysis to determine basic uncertainty in their data collection and analysis as applied to finding their location on the earth if they get lost. This will be guided by answering a set of questions.

   Post-Investigation "Reflections" of the HR Diagram and Stellar Life Cycles" Investigation. Students will answer questions reflecting on the limitations of scientific observations, models of nature, and human knowing related to use of the HR Diagram to model stellar activity and evolution of matter and life on Earth.

Assessment Rubrics

Outcomes	Assessments		Measured Goals
Outcome 1: Scientific Content	Tests, quizzes, homework	3 Tests, multiple quizzes	70% of students achieve an average score of > 65%
Outcome 2: Data Collection and Analysis	Class/Lab Activities: **Navigating by the Stars – Exploration** section **HR Diagram & Stellar Life Cycles Investigation – HR Diagram** section	100 pts. Students receive full credit if they: (Navigating activity) 15 pts – Describe properly the relevant parameters to be measured to determine their local latitude and longitude 35 pts - Properly measure the relevant parameters & record data for determining their local latitude and longitude. (Stellar activity) 50 pts. Properly use the given astronomical data of stars to establish graphs and relationships regarding the nature of stars.	80% of students receive 70/100 pts or higher
Outcome 3: Application of Data Analysis to Hypotheses of Real-World Problems	Class/Lab Activities: **Navigating by the Stars – Concept Development** section **HR Diagram & Stellar Life Cycles Investigation – Stellar Life Cycles** section	80 pts. Students receive full credit if they: 15 pts - Understand the relevant relationships necessary to properly use the collected data to calculate their local latitude and longitude 15 pts - Properly analyze the collected data using relevant relationships and parameters and successfully determine local latitude and longitude.	70% of students receive 13/20 pts or higher
Science Limitations	Class and Homework activities - for example: **Navigating by the Stars – Reflections on the Scientific Process** section **HR Diagram & Stellar Life Cycles Investigation – Post Reflections** (to be written)	20 pts. Students receive full credit if they: 10 pts – fully and correctly answer questions describing the uncertainty and scientific limitations in modeling nature and establishing their position on earth. 10 pts - fully and correctly answer questions regarding uncertainty and scientific limitations in the established model and relationships of stellar evolution, origins of matter and of life on earth	Total points scaled to 5 pts 70% of students will receive 7/10 points or higher