University of Houston-Downtown

Course Prefix, Number, and Title: PHYS 1302: Introduction to Stellar and Galactic Astronomy

Credits/Lecture/Lab Hours: 3/2/2

Foundational Component Area: Life and Physical Sciences

Prerequisites: Credit or enrollment in MATH 1301 or MATH 1310
Co-requisites: None

Course Description: An integrated lecture/laboratory course for non-science majors. This course surveys stellar and galactic systems, the evolution and properties of stars, galaxies, clusters of galaxies, the properties of interstellar matter, cosmology and the effort to find extraterrestrial life. Competing theories that address recent discoveries are discussed. The role of technology in space sciences, the spin-offs and implications of such are presented. Visual observations and laboratory exercises illustrating various techniques in astronomy are integrated into the course. Recent results obtained by NASA and other agencies are introduced. Up to three evening observing sessions are required for this course, one of which will take place off-campus at George Observatory at Brazos Bend State Park.

TCCNS Number: N/A

Demonstration of Core Objectives within the Course:

Assigned Core Objective	Learning Outcome Students will be able to:	Instructional strategy or content used to achieve the outcome	Method by which students' mastery of this outcome will be evaluated
Critical Thinking Empirical & Quantitative Reasoning	Utilize scientific processes to identify questions pertaining to natural phenomena.	Star Property Correlations – students will form and test hypotheses to explain the correlation between a number of properties seen in stars. Working in small groups, students will discuss and formulate hypotheses to explain the correlations between physical properties seen in stars. They will be given data on properties of stars such as temperature, brightness, mass, distance from the Earth, abundance of star types etc and make various plots of the data. Dark Matter, Dark Energy, the Expanding Universe – students will form and test hypotheses about	They will be instructed to prioritize these properties in terms of their relevance in deciding between competing hypotheses. They will present their findings orally and in a written report/worksheet that will be evaluated using a rubric. Working in small groups, students will discuss and formulate hypotheses about the current big unknowns in astronomy, including the nature of dark energy and dark matter and their relationship to the expansion of the Universe. They will

		the big outstanding issues in Astronomy	present their findings orally and in a written report/worksheet that will be evaluated using a rubric.
Critical Thinking Empirical & Quantitative Reasoning	Utilize scientific processes to develop hypotheses, collect and analyze data using quantitative and qualitative measures.	Star Property Correlations – students will form and test hypotheses to explain the correlation between a number of properties seen in stars. Working in small groups, students will discuss and formulate hypotheses to explain the correlations between physical properties seen in stars. They will be given data on properties of stars such as temperature, brightness, mass, distance from the Earth, abundance of star types etc and make various plots of the data. Dark Matter, Dark Energy, the Expanding Universe – students will form and test hypotheses about the big outstanding issues in Astronomy	They will be instructed to prioritize these properties in terms of their relevance in deciding between competing hypotheses. They will present their findings orally and in a written report/worksheet that will be evaluated using a rubric. Working in small groups, students will discuss and formulate hypotheses about the current big unknowns in astronomy, including the nature of dark energy and dark matter and their relationship to the expansion of the Universe. They will present their findings orally and in a written report/worksheet that will be evaluated using a rubric.
Critical Thinking Empirical & Quantitative Reasoning Communication	Utilize scientific processes to effectively communicate the analysis and results using written, oral and visual communication.	Star Property Correlations – students will form and test hypotheses to explain the correlation between a number of properties seen in stars. Working in small groups, students will discuss and formulate hypotheses to explain the correlations between physical properties seen in stars. They will be given data on properties of stars such as temperature, brightness, mass, distance from the Earth, abundance of star types etc and make various plots of the data. Dark Matter, Dark Energy, the Expanding Universe – students will	They will be instructed to prioritize these properties in terms of their relevance in deciding between competing hypotheses. They will present their findings orally and in a written report/worksheet that will be evaluated using a rubric. Student performance in the debate will be evaluated using a rubric. Students will turn in written reports for all lab exercises, including the examples given in previous sections.

		form and test hypotheses about the big outstanding issues in Astronomy. Working in small groups, students will discuss and formulate hypotheses about the current big unknowns in astronomy, including the nature of dark energy and dark matter and their relationship to the expansion of the Universe. They will present their findings orally and in a written report. Working in teams, students will analyze the arguments for the competing hypotheses for the layout of the Universe (now understood to be the solar system), utilizing work from previous lab exercises, lectures and assigned reading. The teams will present the arguments in an oral debate format. Working in teams, students will analyze photographic and other data from spacecraft missions from several different planets (one planet per team).	
Teamwork	Collaborate in the evaluation of the quality of scientific evidence from multiple perspectives toward the goal of reaching a shared objective.	Astronomical Funding Review – students will consider proposals for various scientific projects.	Students will work in small groups to assess competing proposals (supplied) for astronomical research projects. Students will rank their proposals and be evaluated on their ability to rank proposals based on merit, cost, feasibility, etc.

Additional Course Outcomes:

Upon completion of this course, students will be able to:

- Understand the scientific method and the use of observational evidence in constructing and testing scientific models
- Appreciate the historical development of astronomy and the discoveries and controversies which lead to the modern view of the solar system and the position of the Earth and humanity within the Universe
- Discuss the evidence for the modern theories of star formation and evolution
- Give an account of the role of interstellar matter in the evolution of galaxies
- Compare the Milky Way Galaxy with other Galaxies
- Discuss the theories of Relativity and Universe Expansion

Course Outline:

- Introduction
- The Scale of the Universe
- Charting the Heavens
- Birth of Modern Astronomy
- Radiation
- Spectroscopy
- Telescopes
- The Sun
- Red Giants and White Dwarfs
- The Interstellar Medium
- Star formation
- Stellar Evolution
- Neutron Stars and Black Holes
- The Milky Way Galaxy
- Galaxies
- Galaxies and Dark Matter*
- Cosmology*
- The Early Universe*

*Oral Presentations will occur within the last two weeks of class.

Grading/Course Content which Demonstrates Student Achievement of Core Objectives:

Course Grade ***A: 90-100*** ***B: 80-89*** ***C: 70-79*** ***D: 60-69*** ***F: 0-59***

Summary of Course Exams, Quizzes, Activities, and Final	
Exams given during the semester including the final	75%
Online homework assignments and in-class exercises	20%
Oral Presentation	5%