MISSOURI WESTERN STATE UNIVERSITY

DIVISION OF LIBERAL ARTS AND SCIENCES

DEPARTMENT OF COMPUTER SCIENCE, MATHEMATICS, AND PHYSICS

COURSE NUMBER: PHY 104

COURSE NAME: Introduction to Astronomy

COURSE DESCRIPTION:

Basic course in astronomy, mostly descriptive in nature; solar system, stellar astronomy, structure of galaxy and universe.   Three hours lecture plus two hours lab.

This course is an introduction to our modern view of the universe, its contents, and how they got to be the way they are. Among the topics we will discuss are galaxies, quasars, stars, and black holes. For each of these objects, we will talk about what they are, how they are observed, how they form, and how they fit into the overall scheme of things in the universe. Due to the constraints of time, there are a number of topics that we will not be able to discuss in detail. These omissions are made not because the subjects are of no interest to astronomers, but rather because we will not have time to discuss all of the interesting and important topics in astronomy.

PREREQUISITE:

None

TEXT:
Pathways to Astronomy Connect Access, Schneider, MCG, ISBN 9780077515324
Pathways to Astronomy w/Connect Access, Schneider, MCG, ISBN 9781259669101

COURSE OBJECTIVES;

This course is intended to serve as a course option in the natural sciences category of the general studies requirements for a baccalaureate degree. The primary goal for this course is to introduce students to the basic concepts and principles of the physical world and to involve them in hands-on laboratory experiences which convey the true nature of the scientific enterprise and which reinforce the underlying principles. In accomplishing these goals, the student will meet the following requirements:

1.   State and explain basic principles of the physical world (*VIII C*).

2.   Relate those principles to their application in practical situations (*III A, III B, III C, VIII A, VIII B*).

3.   Become familiar with numerical and graphical methods for displaying data (*III E, VII E*).

4.   Interpret graphical and numerical experimental data (*I G, II D, III A, III B, VII C, VII D, VII E*).

5.   State and apply the basic components of the scientific method (*VIII A, VIII B*).

6.   State and give examples of the applications of Newton's laws of motion and Kepler's Laws of Planetary Motion (*I G, VII E, VIII A, VIII B, VIII C, VIII D*).

7.   Define energy and momentum and distinguish between them, and explain celestial situations in which these concepts are important (*VIII A, VIII B, VIII C, VIII D*).

8.   Discuss and contrast the three major theories of the atom developed during the Twentieth Century ands state the advantages of each model, including how light is produced (*VIII A, VIII B, VIII C, VIII D*).

9.   State and explain the theory and design of telescopes (*VIII A, VIII B, VIII C, VIII D*).

10.   Explain the consequences of the postulates of special relativity, including time dilation and length contraction (*VIII A, VIII B, VIII C, VIII D*).

11.   State and discuss the basic laws governing star formation (*VIII A, VIII B, VIII C, VIII D*).

12.   State the postulate of the quantum theory of matter and the consequences for modern technological development (*I A, VII D, VII E, VIII A, VIII B, VIII C*).

13.   Discuss the development of nuclear reactions and the role they play as an energy source for stars and galaxies (*I A, VIII A, VIII B, VIII C, VIII D*).

14.   Explain the nature of chemical bonding and chemical reactions which are important in planet evolution and in interstellar space (*VIII A, VIII B, VIII C*).

15.   Understand humanity's responsibility to maintain the environment in a state that life will flourish on the earth and in extraterrestrial environments (*VIII A, VIII C, VIII E*).

STUDENT COMPETENCIES:

Students who have met the objectives listed above will be competent to perform the following:

1.   To identify problems where laws of physics are applicable to astronomical and astrophysical situations and to apply those principles at an elementary level (*I G, II D, II E*).

2.   To graphically analyze numerical and symbolic information and to draw accurate conclusions from that analysis (*I G, III E*).

3.	To apply the laws of thermodynamics to astronomical situations and explain how those laws govern the development of planets, stars, and galaxies (*VIII A, VIII B, VIII C*).

4.	To list the sources of energy used in the development of technology and the advantages and disadvantages of each type (*I G, III E, VIII A, VIII B, VIII C*).

5.	To apply the concepts of energy and momentum conservation to particle collision problems (*I G, III E, VIII A, VIII B, VIII C*).

6.	To apply Newton's three laws of motion to practical situations involving forces and accelerations in planetary and stellar orbits (*I G, III E, VIII A, VIII B, VIII C*).

7.	To explain the application of atomic and nuclear physics to stars and planets (*I G, III E, VIII A, VIII B, VIII C, VIII D, VIII E*).

8.	To state the connections between quantum theory and common electron devices such as the diode and transistor (*VIII A, VIII B, VIII C*).

9.	To discuss the connection between the consequences of the postulates of special relativity theory and futuristic concepts such as space travel and time travel (*I G, III E, VIII A, VIII B, VIII C*).

10.	To discuss the role of chemical reactions in living organisms and in the transformation of energy used the formation of planetary ecosystems (*I G, III E, VIII A, VIII B, VIII C*).

11.	To relate greenhouse gases to a warming of the earth and the depletion of the earth's ozone layer to a rise in skin cancers (*I G, III E, VIII A, VIII B, VIII C*).

12.	To explain how radioactive wastes are injurious to biological organisms and how space physics may address these problems (*VIII A, VIII B, VIII C*).

COURSE OUTLINE:

1.	Introduction
	1.1 philosophy, science, appeal to authority
	1.2 the development of modern ideas
		1.2.1 idea earth at center
		1.2.2 teachings of Greek scientist-philosophers
			1.2.2.1 societal response
		1.2.3 the scientific method, Occam's Razor
		1.2.4 Kepler, Copernicus, Galileo, Newton
			1.2.4.1 societal response
	1.3 modern model of the solar system
	1.4 Kepler's laws, Newton's law of universal gravitation
	1.5 instrumentation
		1.5.1 optical telescopes
		1.5.2 radio telescopes

ASSESSMENT:

The stated course objectives and student competencies are assessed through the evaluation of homework exercises, worksheets, quizzes, exams, and in-class participation as determined by the instructor. (Note: The state-level goal and institutional competencies addressed by each course objective and student competency are identified in italics.)

LEGEND

I.   **Communicating**
      Students will demonstrate the ability to. . .
      A.   make formal written and oral presentations employing correct diction, syntax, usage, grammar, and mechanics.
      B.   focus on a purpose (e.g., explaining, problem solving, argument) and vary approaches to writing and speaking based on that purpose.
      C.   communicate effectively in groups by listening, reflecting, and responding appropriately and in context.
      D.   use mathematical, statistical, standard quantitative, or various graphical methods to present information with clarity, accuracy, and precision.

II.   **Higher-Order Thinking**
      Students will demonstrate the ability to. . .
      A.   recognize the problematic elements of presentations of information and argument.
      B.   formulate questions for clarifying issues and solving problems.
      C.   use linguistic, mathematical, or other symbolic approaches to describe problems, identify alternative solutions, and make reasoned choices among those solutions.
      D.   analyze and synthesize information from a variety of relevant sources and use the results to address complex situations and problems.
      E.   defend conclusions using relevant evidence and reasoned argument.
      F.   reflect on and evaluate their critical-thinking processes.

III. **Managing Information**
      Students will demonstrate the ability to. . .
      A.   assess and/or generate information from a variety of sources, including the most contemporary technological information services.
      B.   evaluate information for its currency, usefulness, truthfulness, and accuracy.
      C.   organize, store, and retrieve information efficiently.
      D.   reorganize information for an intended purpose, such as research projects.
      E.   present information clearly and concisely, using traditional and contemporary technologies.

IV.   **Valuing**
      Students will demonstrate the ability to. . .
      A.   recognize the ramifications of ones' value decisions on self and others.

B.   recognize conflicts within and between value systems.

V.   **Social and Behavioral Sciences**
    A.   explain social institutions, structures, and processes across a range of historical period.

VI.   **Mathematics**
    Students will demonstrate the ability to. . .
    A.   recognize and use connections within mathematics and between mathematics and other disciplines.
    B.   read, interpret, analyze, and synthesize quantitative data (e.g., graphs, tables, statistics, and survey data) and make reasoned estimates.
    C.   formulate and use generalizations based upon pattern recognition.
    D.   apply and use mathematical models (e.g., algebraic, geometric, statistical) to solve problems.

VII. **Life and Physical Sciences**
    Students will demonstrate the ability to. . .
    A.   explain how to use the scientific method and how to develop and test hypotheses
    B.   evaluate scientific evidence and argument.
    C.   describe the basic principles of the physical universe.
    D.   describe concepts of the nature, organization, and evolution of natural systems.
    E.   explain the effect of human interactions with natural systems.