BLINN COLLEGE

MASTER COURSE SYLLABUS

PHYSICS 1411

CIP# 40.0201.51 03

CIP Area: Physical Sciences

Fall, 2005

Prepared by:

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Bryan Campus / Date

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PHYS 1411 - Introduction to Astronomy

This course is in the core curriculum.

PURPOSE STATEMENT

The purpose of the natural sciences component in the core curriculum is to enable the student to understand the basic concepts in the natural sciences and to apply that understanding to the analysis of current issues in society. In particular, mastering astronomy develops a broad appreciation for the role of physics, chemistry and mathematics in the evolution of man's understanding of the Universe and his place in it.

COURSE DESCRIPTION

This course is a survey of astronomy. Discussion topics include the techniques and methods of modern astronomy, our Solar system, the stars, our galaxy and other galaxies, the large-scale structure of the Universe, and cosmology (the origin and evolution of the Universe). Also included are aspects and applications of spectroscopy, atomic structure, optics, mechanics, gravitation, and relativity. The class is mostly descriptive in nature, with a minimum of mathematics. **Prerequisite**: None. Three lecture hours and three laboratory hours per week. **Credit:** four semester hours

The expanded course description is:

A. SCIENCE OF ASTRONOMY
   1) Charting the Heavens and the Copernican Revolution
   2) Matter and Energy
   3) Radiation and Spectroscopy
   4) Telescopes

B. THE SOLAR SYSTEM
   1) The Formation of Planetary Systems
   2) Terrestrial and Jovian Planet Systems
   3) Moons and Rings, Asteroids and Comets

C. THE STARS
   1) The Sun, Giants, Dwarfs and Main Sequence Stars
   2) The Interstellar Medium
   3) Star Formation and Evolution
   4) Novae, Supernovae, Neutron Stars and Black Holes

D. GALAXIES AND BEYOND
   1) The Milky Way
   2) Other Galaxies
   3) Cosmology

This is a Core Course in the 42-hour Core of Blinn College; more can be found at www.blinn.edu/corecurriculum/. As such, students will develop proficiency in the following:

A. INTELLECTUAL COMPETENCIES
   1) Reading: The ability to analyze and interpret a variety of printed materials, books, documents and articles – above the 12th grade level.
   2) Writing: The ability to produce clear, correct and coherent prose adapted to purpose, occasion and audience – above the 12th grade level.
   3) Listening: The ability to analyze and interpret various forms of spoken communication, possess sufficient literacy skills of writing, reading – above the 12th grade level.
   4) Critical Thinking: The ability to think and analyze at a critical level.
   5) Computer Literacy: The ability to understand our technological society; use computer-based technology in communication, solving problems, and acquiring information.

B. EXEMPLARY EDUCATIONAL OBJECTIVES
   1) To understand and apply method and appropriate technology to the study of natural sciences.
   2) To recognize scientific and quantitative methods and the differences between these approaches and other methods of inquiry and to communicate findings, analyses, and interpretation both orally and in writing.
   3) To identify and recognize the differences among competing scientific theories.
   4) To demonstrate knowledge of the major issues and problems facing modern science, including issues that touch upon ethics, values, and public policies.
   5) To demonstrate knowledge of the interdependence of science and technology and their influence on, and contribution to, modern culture.

C. CURRICULUM PERSPECTIVES
   1) Establish broad and multiple perspectives on the individual in relationship to the larger society and world in which he or she lives, and to understand the responsibilities of living in a culturally and ethically diversified world.
   2) Stimulate a capacity to discuss and reflect upon individual, political, economic, and social aspects of life in order to understand ways in which to be a responsible member of society.
   3) To develop a capacity to use knowledge of how science and technology affect their lives.
   4) To use logical reasoning in problem solving.
   5) To integrate knowledge and understand the interrelationships of the scholarly disciplines.

COURSE OBJECTIVES AND STUDENT LEARNING OUTCOMES

Upon completing this course students should have a grasp of the listed concepts. Lecture and laboratory work will focus on the following learning outcomes in which the student shall show competence:

Explain the concept of the celestial sphere; angular measurement conventions; the motions of the Earth, the Sun, the Moon and the stars; lunar and solar eclipses; and the simple geometric determination of distances and sizes of faraway objects.

Relate the early Earth-centered and modern Sun-centered solar system models. Describe history of astronomy from Renaissance science to the major contributions of Galileo, Kepler, and Newton. Be able to state the laws of Kepler and Newton and understand how they are useful in describing motion and measuring masses of astronomical bodies.

Have a basic understanding of electromagnetic (e-m) radiation, its sources and how it transfers energy and information through interstellar space. Describe the major regions of the e-m spectrum; continuous, emission, and absorption spectra; and the kinds of information that can be obtained by analyzing the spectra of astronomical objects.

Discuss basic optical telescope designs, the need for very large telescopes, atmospheric effects and modern technological improvements, the advantages and disadvantages of using radio and other non-visible radiation for astronomical observations.

Describe the solar system: the overall scale, structure and its formation; the basic differences between the terrestrial and jovian planets; and the major non-planetary components. Describe some of the spacecraft missions that contributed to this knowledge.

Discuss the overall properties of the Sun, how energy is produced and travels from the core out into space. Name and describe the inner and outer regions, how the composition and temperatures are determined, and the various types of solar activity.

Discuss measurements of stellar distances and motions of stars. Discuss classification of stars by luminosity, brightness, colors, surface temperatures, spectral characteristics, mass and size. Describe an H-R diagram.

Discuss composition and properties of the interstellar medium, the nature of emission nebulae and dark interstellar clouds, and the techniques to determine these characteristics.

Summarize and discuss the stages of star formation, how it depends on mass, and the importance of star clusters. Explain and outline the events of stellar evolution off the main sequence. Contrast evolutionary histories of high-mass and low-mass stars.

Describe novae and supernovae events, how each are produced, the end products, and the origin of heavy elements. Describe the origin and properties of neutron stars, pulsars, and other strange stellar objects. Discuss the phenomena of black holes, their formation and effects on matter and radiation, and methods of detecting their presence.

Describe the Milky Way Galaxy: the overall structure, the different regions, importance of variable stars, explanations of spiral arms, size and mass, dark matter, and phenomena at the center.

Discuss normal and active galaxies, quasars, the large-scale distribution in the Universe, formation and evolution theories, distance-measurement techniques, and Hubble's Law.

State the cosmological principle and discuss the models of the origin and evolution of the Universe. Discuss the uncertainties and the observational evidence.

Laboratory work will be chosen to re-enforce the above lecture topics.

By the end of the course the student will maintain a minimum grade of **D** (60%) for completion of the course. This grade will include both lecture and laboratory components.

COURSE REQUIREMENTS

This physics course is a survey of the fundamental concepts of astronomy as listed above. Therefore, all topics in the basic course material should be presented and discussed, along with available supporting laboratory exercises. The Instructor should consider a library assignment on topics relating to the course. The assignment may require both written and oral reports by the student. This may or may not be used for additional credit.

GRADING SYSTEM

The following areas will be clearly outlined by the Instructor in the Course Information Sheet given to the students in the first week of the semester:

1. Major Exams: Three or four major exams covering the lecture material.
2. Laboratory: May be included on major exams or quizzes covering lab material.
3. Final Exam: A comprehensive final exam will be given during the scheduled periods for final exams.
4. Minor Exams/Quizzes/Homework: Given at the discretion of the instructor.
5. Additional Reports or projects: Given at the discretion of the instructor.

OUTCOMES INVENTORY

Methods used to evaluate the effectiveness of this course:

1. Comparison of pre-test and post-test scores. A class average post-test grade of double the class average pre-test grade would be minimum improvement.

2. A 70% success rate [grade of C or better] of students finishing the course. A success rate of 55% would seem excessively low.

3. Less than a 30% withdrawal rate of students from the course, based on the 12-day class roll.

4. Student evaluation and comments on the effectiveness of the course.

5. Each Intellectual Competency listed above will be evaluated to measure its attainment:
   a. To measure reading:
      1. Pre- and post-test, exams, and/or quizzes over assigned textbook readings OR
      2. Lab assignments and/or quizzes over lab book readings.
   b. To measure writing:
      Written assignments, quizzes over laboratory, term paper, internet assignments, and/or journal articles.
   c. To measure listening:
      1. Pre- and post-test, written assignments, exams, and/or quizzes over lecture material OR
      2. Written assignments, exams, and/or quizzes over video/simulations viewed.
   d. To measure critical thinking:
      Pre- and post-test, written assignments, exams, and/or quizzes involving problem solving.
   e. To measure computer literacy:
      Internet or lab assignment and/or quiz over software simulations.

CALENDAR

The instructor will ensure that the course content is covered in a manner that fulfills the course objectives. The instructor will also provide Course Information Sheets to the students and the administration during the first week of the semester. Important details including tentative examination dates and due dates for assignments are provided.

The following is an approximate time-line for the introduction of various topics within the course during a full semester:

Week	Lecture Topic
1	Charting the Heavens
2	The Copernican Revolution
3	Radiation
4	Spectroscopy
5	Telescopes
6	The Solar System
7	The Formation of the Solar System
8	The Sun; Measuring the Stars
9	The Interstellar Medium; Star Formation
10	Stellar Evolution; Stellar Explosions
11	Neutron Stars, Black Holes; The Milky Way Galaxy
12	Normal Galaxies; Active Galaxies and Quasars
13	Cosmology; The Early Universe
14	Life in the Universe

MATERIALS REQUIRED

TEXTBOOK:
Horizons Exploring the Universe, 9th Ed. ., Michael Seeds, Thompson-Brooks/Cole Publ., 2006

LABORATORY MANUAL:
Student Observation Guide with Laboratory Exercises, 2nd Ed., Michael Seeds and Joseph Holzinger, Prentice Hall, N.J., 1995. Bring to both sessions each meeting

OPTIONAL MATERIALS

Bryan campus: any scientific calculator
Brenham campus: none