Revised: Fall 2015

NAS 132
Astronomy II

COURSE OUTLINE

Prerequisites:

Prerequisite: A placement recommendation for ENG 111, co-enrollment in ENF3/ENG 111, or successful completion of all developmental English requirements

Course Description:

VCCS description:

Studies the major and minor bodies of the solar system, stars and nebulae of the milky way, and extragalactic objects. Examines life and death of stars, origin of the universe, history of astronomy, and instruments and techniques of observation.

VWCC Description

This is an introductory astronomy course that emphasizes concepts rather than mathematics. The course is designed for non-science majors and there are no math prerequisites. The main goal of this course is for students to understand and appreciate the nature of science through the study of astronomy. After completing this class, students will have achieved basic understanding of: scientific method, patterns in the night sky, light and telescopes, nature of stars and galaxies, birth and death of stars, theories on beginning and end of the universe. Remote observatory viewing may be scheduled according to availability and time allowance. Telescope observations (at night) are a required component.

Semester Credits: 4 **Lecture Hours: 3 Lab/Recitation Hours: 3**

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Course Outcomes

At the completion of this course, the student should be able to:

1. Demonstrate improvement in critical thinking by applying the scientific method to fact and theory in classroom learning, activities, and assignments.
2. Distinguish science from pseudoscience.
3. Describe the overall structure and individual components of the Universe.
4. Describe the origin of the Universe.
5. Explain the historical development and multi-cultural aspects of the practice of science generally and astronomy specifically.
6. Outline the technical development of modern astronomy and space exploration.
7. Generate or expand global awareness by integrating astronomy's cosmic, worldwide and multi-cultural perspectives of earth with insights gained from its historical development and scientific and societal impacts.
8. Identify the contributions made to astronomy by the following people: Einstein and Hubble;
9. Describe the properties and causes of the follow:
    1. Black body curves,
    2. Spectral lines,
    3. Doppler shift,
    4. Electromagnetic spectrum;
10. Describe the structure, internal and atmospheric, and power source of the Sun and relate these to observed solar phenomena such as granulation, sunspots, and solar flares and prominences;
11. Understand and interpret the HR Diagram and its related properties: magnitude, luminosity, temperature, stellar radii, stellar power source, stellar evolution;
12. Compare the life cycles of low and high mass stars from birth to death. Account for differing end states;
13. Describe the observations and structure of the Milky Way; Locate the Sun within the Milky way;
14. Classify the types of galaxies found in the universe (elliptical, spiral, barred spiral, irregular);
15. Describe the leading evolutionary models of the universe and evidence in support of those models;
16. Read and interpret graphs, schematic pictures, and maps.

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Required Materials:

Scientific Calculator

Textbook:

Stars and Galaxies, Seeds/Backman, 9th edition, (2015) 10:1111990662

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Topical Description:

PART I: EXPLORING THE SKY.
1. Here and Now. Where Are You? When Is Now? Why Study Astronomy?
2. A User's Guide to the Sky. The Stars. The Sky and Celestial Motion. The Cycles of the Sun. Astronomical Influences on Earth's Climate.
3. Cycles of the Moon. The Changeable Moon. Lunar Eclipses. Solar Eclipses. Predicting Eclipses.
4. Light and Telescopes. Radiation: Information from Space. Telescopes. Observations on Earth: Optical and Radio. Airborne and Space Observatories. Astronomical Instruments and Techniques. Nonelectromagnetic Astronomy.

PART II: THE STARS.
1. Atoms and Spectra. Atoms. Interactions of Light and Matter. Understanding Spectra.
2. The Sun. The Solar Atmosphere. Solar Activity. Nuclear Fusion in the Sun.
3. The Family of Stars.
Star Distances. Apparent Brightness, Intrinsic Brightness, and Luminosity. Stellar Spectra. Star Sizes. Star Masses--Binary Stars. A Census of the Stars.
4. The Interstellar Medium. Studying the Interstellar Medium. Components of the Interstellar Medium. The Gas-Stars-Gas Cycle.
5. The Formation and Structure of Stars. Making Stars from the Interstellar Medium. The Orion Nebula: Evidence of Star Formation. Young Stellar Objects and Protostellar Disks. Stellar Structure. The Source of Stellar Energy.
6. Stellar Evolution. Main-Sequence Stars. Post-Main-Sequence Evolution. Star Clusters: Evidence of Evolution. Variable Stars: Evidence of Evolution.
7. The Deaths of Stars Lower-Main-Sequence Stars. The Evolution of Binary Stars.
8. Neutron Stars and Black Holes. Neutron Stars. Black Holes. Compact Objects with Disks and Jets.

PART III: THE UNIVERSE.
1. The Milky Way Galaxy. Discovery of the Galaxy. Structure of the Galaxy. Spiral Arms and Star Formation. The Nucleus of the Galaxy. Origin and History of the Milky Way Galaxy.
2. Galaxies. The Family of Galaxies. Measuring the Properties of Galaxies. The Evolution of Galaxies.
3. Active Galaxies and Supermassive Black Holes. Active Galactic Nuclei. Supermassive Black Holes.
4. Modern Cosmology. Introduction to the Universe. The Big Bang Theory. Space & Time; Matter & Energy. Twenty-First-Century Cosmology.

PART IV: LIFE.
1. Astrobiology: Life on Other Worlds. The Nature of Life. Life in the Universe. Intelligent Life in the Universe.

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Notes to Instructors

1. The construction of simple astronomical instruments can be accomplished with a minimum of resources. These can include: Astrolabe, Planisphere, Sundial, Solar Viewer,and Spectroscope. Most of these instruments can be taken home by students.

2. The use of a telescope is essential to engage students in astronomy. VWCC has one rather antiquated instrument and other scopes may be owned by students. The Roanoke Valley Astronomical Society can provide access to instruments as they often have evening viewing sessions and meetings throughout the year. http://www.rvasclub.org/

3. **Course Grade:** Grades from some combination of the following will be used to determine each student's final course grade: Laboratory exercises, class participation, homework assignments, papers, projects, oral presentations, and exams. Exams may be multiple choice, some combination of multiple choice and short answer or essay, or purely essay and/or short answer. A final exam is required and must constitute no less than 25% of the course grade. Individual instructors may determine the relative weightings of the other components in determining the grade the grade for the course, and must state the weightings to be used in determining student grades in the course syllabus.

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