ASTR 110  INTRODUCTION TO ASTRONOMY
CRN 60040, Credits: 3
MWF 9:30-10:20 AM, Imiloa 133

INSTRUCTOR:       Marvin Kessler
OFFICE:           Hale Imiloa 136
OFFICE HOURS:     MWF, 10:30AM-11:20AM
TELEPHONE:        222-6573      EMAIL: kesslerm002@hawaii.rr.com
EFFECTIVE DATE:   Spring Semester, 2009

WINDWARD COMMUNITY COLLEGE MISSION STATEMENT

Windward Community College is committed to excellence in the liberal arts and career development; we support and challenge individuals to develop skills, fulfill their potential, enrich their lives, and become contributing, culturally aware members of our community.

CATALOG DESCRIPTION
Introduction to the astronomical universe for non-science students. (3 hrs. lect.)

Activities Required at Scheduled Times Other Than Class Times
One Star-Gazing show at the Imaginarium. These shows are held at 7:00 PM on the second Wednesday of each month. Substitution is permitted if student is unable to come at that time because of work commitment or similar serious impediment.

STUDENT LEARNING OUTCOMES
Upon successful completion of the course, the student will be able to:

• Outline the development of astronomy from ancient times to present and explain the role of the scientific method in this historic context.
• Describe and explain the apparent motions of the celestial bodies, especially as related to naked-eye observations.
• Identify the appropriate instruments used by astronomers to understand the universe.
• Outline the origins of our solar system and appraise the leading cosmological theories of the origin of the universe.
• Describe the physical and chemical properties of the objects in our solar system and apply the concept of comparative planetology.
• Describe the physical and chemical nature of stars, and especially our sun, and apply the astronomical techniques used to measure stellar properties.
• Outline the evolutionary stages in a star's life and compare and contrast the structure of our Milky Way and other galaxies.
• Apply astronomical concepts to the search for extraterrestrial life.
COURSE CONTENT

Concepts or Topics:

1. The night sky and how its appearance changes with time and position on Earth
2. Eclipses, phases of the Moon, and apparent retrograde motion of the planets
3. The history of astronomy and the development of scientific theory
4. The formation of the Solar System
5. The atomic nature of matter and the electromagnetic spectrum
6. Spectra
7. The Hertzsprung-Russell Diagram
8. The life cycle of the Sun and other stars
9. Types of galaxies and methods of measuring astronomical distances
10. Where the Earth and Solar System fit into the Universe and its evolution

Skills or Competencies: student will be able to:

1. Identify constellations and stars
2. Sketch the position of Earth, Sun, Moon, and Planets in explaining eclipses and retrograde motion
3. Identify the principal figures in the history of the Copernican revolution and their relationship to each other
4. Describe the nebular theory of the formation of the Solar System
5. Explain in non-mathematical terms the emission of light from the atom
6. Use a thermal spectrum to determine the temperature of a star
7. Determine the approximate mass, luminosity, and temperature of a star, based on its position on the H-R diagram
8. Differentiate between the stages in the life cycle of a low mass star and a high mass star
9. Know what method of measurement is adequate for determining distances to stars, nearby galaxies, and distant galaxies
10. Be able to rank astronomical objects according to size

COURSE TASKS

1. Division of time
About 40% of the class room time will be spent on interactive exercises, 40% on lecture and demonstration, and 20% on quizzes and tests.

2. Reading
The basic information source is the textbook (listed below). The class calendar (also listed below) gives dates on which each chapter of the textbook will be covered. Students should read the chapter before it is covered in class.

3. Participating
Students are expected to participate fully with the instructor and their classmates through lecture-tutorial exercises, asking questions in class, and contributing to discussion.

4. Calculating
Calculators are not required, but a ruler with both metric and English measurements on it will be needed. Calculators will be helpful for extra credit homework.
5. Using the Imaginarium
The Imaginarium will be used to demonstrate the motion of the stars and the arrangement of constellations.

**ASSESSMENT TASKS AND GRADING**

1. There will be four multiple-choice tests, which will be given on the dates indicated on the class calendar. Each test will be worth 25 points, for a total of 100 points for the semester. Study guides will be provided.

2. Quizzes will be worth 5 points each. They will consist of one or two essay-type questions. Sometimes they will be announced ahead of time and sometimes they will be given without notice. There will be about eight such quizzes.

3. Homework will be assigned using the textbook. A detailed study guide will be given out in class. This guide will list what chapters are to be read, what questions at the end of the chapter are to be answered and handed in to the instructor, and what quizzes will be given in class. Not all of the homework will be collected for grading. Some of the homework is assigned to help students focus their study. Mathematical problems will not be assigned. Some such problems may be recommended for extra credit. Other assignments will be recommended for extra credit.

4. Attendance at one Wednesday evening Star Show in the Imaginarium will be obligatory. It will be worth 10 points. A brief report must be submitted within one week. In writing this report, use the form that is attached at the end of this syllabus. If the student cannot attend the Star show because of work or other serious commitment, a substitute is available.

5. The Final Exam will be worth 50 points. It will cover select sections of the entire course. Study guide will be provided. This adds up to a total of 300 possible points, as follows:

<table>
<thead>
<tr>
<th>Task</th>
<th>Points</th>
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<tbody>
<tr>
<td>Four Tests (25 points each)</td>
<td>100</td>
</tr>
<tr>
<td>Eight Quizzes (5 points each)</td>
<td>40</td>
</tr>
<tr>
<td>Homework</td>
<td>100</td>
</tr>
<tr>
<td>Wednesday Star Show</td>
<td>10</td>
</tr>
<tr>
<td>Final Exam</td>
<td>50</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td>300</td>
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If a student is unable to take a test at the scheduled time, the student is responsible for scheduling a time with the teacher for a make-up test. The student must contact the teacher no later than the day of the missed test. **If this is not done, the test may not be made up.** Quizzes may not be made up under any circumstances.

On tests and quizzes, points earned will be reported to the student. At mid-term a letter grade will be given, and the final grade for the course will be a letter grade.

Correspondence between points and letter grade will be as follows:

- A- 90% to 100% of points,
- B- 80% to 89% of the points,
- C- 70% to 79%,
- D- 60% to 69%,
- F- 0 to 59%.
The grading standards given in the 2008-2009 Windward Community College Catalog, page 23, will be followed. The Catalog also allows for other assigned grades. Students are encouraged to consult the instructor at any time about their grade. If a student wishes to be informed of his/her final grade in advance of the official posting of grades, he/she should request this via email or should provide the instructor with a stamped, self-addressed postcard or envelope on the day of the Final Exam.

LEARNING RESOURCES

REQUIRED TEXT: *The Essential Cosmic Perspective, Fourth Edition*, by Bennett, Donahue, Schneider, and Voit
WEBSITE: www.masteringastronomy.com

Additional Information

Students are strongly encouraged to spend time outside under the stars, identifying constellations, planets, the moon and their motions across the sky.

They also are encouraged to visit WCC’s **AEROSPACE LAB**, located in Hale Imiloa, Room 135. Besides a large collection of astronomy related resource materials which the student may borrow, there is a hands-on physical science museum. Phone 235-7321 for availability.

Students are directed to the **IMAGINARIUM** (planetarium) to avail themselves of the programs presented there on the second Wednesday of the month at 7:00 PM and the second Friday of the month at 7:00 PM. Reservations are recommended. Call 235-7433 for the Friday program and 235-7321 for the Wednesday program. Scheduled events are also listed on the college website.

The textbook contains a **CD-ROM** that can be used as a planetarium in the student’s computer at home or at one of the campus computer labs. This CD also has some animated graphics that help to understand seasons, eclipses, and retrograde motion.

- There is a table in the main hallway of Hale Imiloa that contains handouts (monthly star charts and astronomical events) and a list of internet sites for learning about constellations.
CLASS CALENDAR FOR SPRING 2009

Jan.  12 Monday.  Introduction.  *Astronomy Diagnostic Test*
    14 Wednesday.  Chapter 2, *Discovering the Universe for Yourself*.  **Note: we are**
                  **beginning with chapter 2, not with chapter one.**
                  Lecture-Tutorial, page 1: “Position”
    16 Friday.  Continue Chapter 2.  
                  Lecture-Tutorial, page 3: “Motion”

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19 M  **HOLIDAY**
21 W  Continue chapter 2.  
                  Lecture-Tutorial, p. 7: “Seasonal Stars”
23 F  **IMAGINARIUM:**  Constellations and the Celestial Sphere

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26 M  Continue chapter 2.  From *masteringastronomy* website, Tutorial on seasons.
28 W  Continue chapter 2.  
                  LT, p. 13, Ecliptic.
30 F  Continue chapter 2.  From website, Tutorial on moon phases.  
                  LT, p.79: “The Cause of Moon Phases”

Feb.  2 M  Continue chapter 2.  Tutorial on eclipses.
        4 W  Continue chapter 2.  Retrograde motion.
        6 F  Continue chapter 2.

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9 M  **Test One**
     Explanation of Parallax
13 F  Chapter 6, *Our Solar System and Its Origin*

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16 M  **HOLIDAY**
18 W  Chapter 7, *The Terrestrial Planets*
20 F  Workshop on mystery of terrestrial planets

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23 M  Chapter 8, *Jovian Planet Systems*
25 W  Chapter 9, *Remnants of Rock and Ice: Asteroids, Comets, and Pluto*
27 F  Video: *Three Minutes to Impact*

Mar.  2 M  **Test Two**
     Review of “powers of 10”
        4 W  **IMAGINARIUM:**  Search for Life in the Universe
        6 F  **NO CLASS**
<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Activity</th>
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<tbody>
<tr>
<td>9 M</td>
<td></td>
<td>Chapter 4: <em>Making Sense of the Universe</em>. Law of gravity and Newton’s</td>
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<tr>
<td></td>
<td></td>
<td>version of Kepler’s third law</td>
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<tr>
<td>11 W</td>
<td></td>
<td>Chapter 4 continued. Atom and Energy Levels.</td>
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<tr>
<td>16 M</td>
<td></td>
<td>Chapter 5 continued.</td>
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<tr>
<td></td>
<td></td>
<td>LT on light and atomic energy levels</td>
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<tr>
<td>18 W</td>
<td></td>
<td>Chapter 5 continued.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LT on electromagnetic radiation</td>
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<tr>
<td>20 F</td>
<td></td>
<td>Chapter 5 continued.</td>
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<tr>
<td></td>
<td></td>
<td>Spectra</td>
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</tbody>
</table>

23-27     SPRING RECESS

Mar. 30 M |     | Chapter 5 continued. LT, p. 57: “Blackbody Radiation: Part I and II”    |

April 1 W |     | Chapter 5 continued. Thermal curves.                                    |
| 3 F      |     | Chapter 5 continued. Doppler effect.                                    |

6 M       Test Three
|          |     | LT, p. 33, “Apparent and Absolute Magnitude of Stars”.                   |
| 8 W      | IMAGINARIUM: Cosmic Perceptions                                         |
| 10 F     |     | HOLIDAY                                                                  |

13 M  Chapter 11: *Surveying the Stars*
|          |     | LT, p. 53: “Luminosity, Temperature, and Size: Part I and II”            |
| 15 W     |     | Continue chapter 11.                                                    |
|          |     | LT, p. 109: “H-R Diagram”                                                |
| 17 F     |     | Chapter 12, *Star Stuff*, the Lifeline of stars                          |

20 M      Continue chapter 12.
|          |     | LT, p. 111: “Star Formation and Lifetimes”                               |
| 22 W     |     | Continue chapter 12, Black Holes.                                       |
| 24 F     |     | Chapter 13, *The Bizarre Stellar Graveyard*.                            |

27 M      Test Four
| 29 W     |     | Chapter 14, *Our Galaxy*.                                               |
|          |     | LT, p. 123: “Milky Way Scales”                                           |


4 M       Chapter 15 continued.
|          |     | LT, p. 133, “Expansion of the Universe”                                  |
| 6 W      | Last Day of Instruction.                                               |
|          | Review                                                                 |
| 8 F      | No class.                                                              |
May 11 to 14  FINAL EXAM WEEK

   Final Exam: Monday, May 11, 9:30AM-11:20PM in Imiloa 133

   The above schedule has been carefully thought out and will be followed as much as possible, but there probably will have to be adjustments to it as the semester progresses. The Instructor will inform students of any changes at least one class day in advance. If a student is absent from class when changes are announced, it is the student’s responsibility to find out about the changes.
REPORT

This can be used to report on attendance at Star Shows in the Imaginarium and at Observing Sessions with the telescope. Obtain signature of the attending staff. **You may use the reverse side of this page.**

Attending Staff: __________________________    Date:______

Description of the show or observing session:

Sketches of Constellations, Planets, other objects seen in the session:

What I found most interesting:

Student Signature______________________________________