ASTR 110    INTRODUCTION TO ASTRONOMY
CRN 63010, Credits: 3
MW 10:00-11:15AM, Imiloa 133

INSTRUCTOR:  Marvin Kessler
OFFICE:  Hale Imiloa 136
OFFICE HOURS:  MW, 11:30AM-12:30PM
TELEPHONE:  222-6573  EMAIL: mkessler@hawaii.edu
EFFECTIVE DATE:  Spring, 2015

WINDWARD COMMUNITY COLLEGE MISSION STATEMENT
Windward Community College offers innovative programs in the arts and sciences and opportunities to gain knowledge and understanding of Hawai‘i and its unique heritage. With a special commitment to support the access and educational needs of Native Hawaiians, we provide O‘ahu’s Ko‘olau region and beyond with liberal arts, career and lifelong learning in a supportive and challenging environment — inspiring students to excellence.

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. Substitution must be approved by instructor.

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 TASKS

1. **Division of time**
   Class on **Monday** will be devoted to lecture and assignments. Important sections of the textbook also will be highlighted. The focus of this first class of the week will be to listen, take direction, and read. Between Monday and Wednesday the student should read the assigned pages of the textbook, outline them, do the homework, and answer the pertinent questions at the end of the chapter.
   Class on **Wednesday** will be devoted to reports by students on the assignments that were given on Monday. Extensive use will be made of the workbook, *Lecture Tutorials for Introductory Astronomy*. There will be use of dyads and small groups for discussion. This is a day that will focus on active learning. At the end of the class there will usually be time to write a “one minute paper” or take a short quiz, which will be handed in to the instructor. Some of these will be used for grading. Students will be informed in advance if the paper or quiz will be graded.

2. **Audio-Visuals**
   Several videos will be shown to the class. These videos are chosen for their excellence of presentation and accuracy. The Imaginarium will be used to demonstrate the motion of the stars and the arrangement of constellations.

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. **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.

5. **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.

ASSESSMENT TASKS AND GRADING

1. There will be **four 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. These tests will be closely coordinated with the classroom discussion and assignments.
2. **One Minute Papers** will be worth 5 points each. There will be four such papers. The purpose of these short essays is to help students formulate in their own words what they have learned. The papers will be written responses to a video.
3. **Homework.** Homework will be assigned on Monday and handed in at the beginning of class on Wednesday. The purpose of homework is to highlight important topics in order to assist students in their study. **Late homework will not be accepted.** Students who do not hand in homework on time are still expected to complete the homework as a preparation for tests. In general, mathematical problems will not be assigned.
4. **Quizzes.** There will be about five short quizzes, worth 5 points each, for a total of 25 points.
5. **Attendance.** 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 100 points. It will cover select sections of the entire course. It will not be open-notes. Study guide will be provided.

This adds up to a total of 260 possible points, as follows:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Four Tests (25 points each)</td>
<td>100</td>
</tr>
<tr>
<td>Four One Minute Papers (5 points each)</td>
<td>20</td>
</tr>
<tr>
<td>Five Quizzes (5 points each)</td>
<td>25</td>
</tr>
<tr>
<td>Wednesday Star Show</td>
<td>10</td>
</tr>
<tr>
<td>Final Exam</td>
<td>100</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>255</strong></td>
</tr>
</tbody>
</table>

None of the quizzes or one minute papers may be taken late. The four 25 point tests may be taken late, **only if** Mr. Kessler is contacted the day of the test or before, and he agrees to this. This may be done by telephone (222-6573) or by email (mkessler@hawaii.edu). Points earned on tests, quizzes, and one minute papers will be recorded on Laulima in the grade book for this course. Laulima will also report student course 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 2013-2015 Windward Community College Catalog, page 28, will be followed. The Catalog allows for other assigned grades. **Students are encouraged to consult the instructor at any time about their grade.** As indicated above, grades are also available on Laulima.

**LEARNING RESOURCES**

REQUIRED TEXT: *The Essential Cosmic Perspective, Custom Edition*, by Bennett, Donahue, Schneider, and Voit. This is a loose leaf printing of the book. It is identical in content to the bound sixth edition of the book.


The text and workbook are available as a single package in the WCC bookstore. The cost to the student is less in this bundled version.
Additional Information

Students are strongly encouraged to spend time outside under the stars, identifying constellations, planets, the moon and their motions across the sky. There are some excellent applications that can be downloaded to smartphones and used for this.

Students 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. Tickets may be purchased at the Imaginarium box office 30 minutes before the show, or call 235-7433 to reserve tickets in advance. Reserved tickets must be picked up at the box office at least 15 minutes before showtime, otherwise they may be sold to waiting customers. Scheduled events are listed on the college website.

Also bundled with the textbook is a folder that contains an access code to the textbook website, www.masteringastronomy.com.

- 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.
- The bulletin board in Hale Imiloa 133 is used to post print-outs of current astronomical discoveries. Most of these are from http://spaceflightnow.com/news and http://skyandtelescope.com/news.

DISABILITIES ACCOMMODATION STATEMENT

If you have a physical, sensory, health, cognitive, or mental health disability that could limit your ability to fully participate in this class, you are encouraged to contact the Disability Specialist Counselor to discuss reasonable accommodations that will help you succeed in this class. Ann Lemke can be reached at 235-7448, lemke@hawaii.edu, or you may stop by Hale ‘Akoakoa 213 for more information.
CLASS CALENDAR FOR SPRING 2015

UNIT I    The Celestial Sphere

Week 1   January 12 and 14
Chapter 2, Discovering the Universe for Yourself. Note: we are beginning with chapter 2, not with chapter one.
Monday: Introduction to the course
    Review syllabus
    What would you most like to learn from this course?
    Homework from chapter 2, due on Wednesday
Wednesday: collect homework
    Imaginarium: the Celestial Sphere

Week 2   Jan. 19 and 21
Monday: no class. Dr. Martin Luther King Jr. Day
Wednesday:
    Go over homework from last week.
    Lecture-Tutorial workbook: “Position”, p. 1ff and “Motion”, p. 3ff
    The reason for seasons (very important)

Week 3   Jan. 26 and 28
Monday: turn in homework
    Imaginarium: Daily and Annual Motion
    Lecture-Tutorial workbook: “Seasonal Stars”, p. 7ff
Wednesday: Lecture-Tutorial workbook:
    “The Ecliptic”, p. 15 and “The Cause of Moon Phases”, p. 79ff

Week 4   Feb. 2 and 4
Monday: Continue chapter 2.
    Why do eclipses occur? What is apparent retrograde motion?
Wednesday: Test 1

UNIT II    The Solar System

Week 5   Feb. 9 and 11
Monday: Chapter 6, Our Solar System and Its Origin
    The four main characteristics of the Solar System
    The Nebular Theory of the formation of the Solar System
    New homework assignment. (Homework is assigned each Monday; no further mention will be made of this.)
Wednesday: Chapter 7, *The Terrestrial Planets*
Why are Earth, Venus, and Mars different from one another
Go over homework (This is done each Wednesday; no further mention of this will be made of this.)

**Week 6  Feb. 16 and 18**
Monday: **no class**; Presidents’ Day
Wednesday: **Video:** “Wonders of the Solar System: Dead or Alive?”
Write short essay on, “Why Earth, Venus, and Mars are so different from each other.”

**Week 7  Feb. 23 and 25**
Monday: Chapter 9, *Remnants of Rock and Ice: Asteroids, Comets, and Pluto*
History of impacts between Earth and Asteroids
Wednesday: **Test 2**
Review of scientific notation called “Powers of 10”.

**UNIT III  Physics**

**Week 8  Mar. 2 and 4**
Monday: Chapter 3, *The Science of Astronomy*
History of the Copernican Revolution
Wednesday: Quiz on Copernican Revolution
Chapter 4: *Making Sense of the Universe.*
Newton’s Laws: mass, velocity, acceleration

**Week 9  Mar. 9 and 11**
Monday: Universal Law of Gravity
Wednesday: Chapter 5: *Light: the Cosmic Messenger.*

**Week 10  Mar. 16 and 18**
Monday: Chapter 5 continued.
Wavelength, frequency, and speed of light
Thermal and Emission spectra
LT, p. 57, on Blackbody Radiation, Parts I and II
Wednesday: **Test 3**
Nuclear fusion in the Sun

**Spring Recess, March 23-27**
UNIT IV The Stars

Week 11 Mar. 30 and April 1
Monday: Chapter 11: Surveying the Stars
Magnitude and Spectral Classes of stars
LT, p. 109: “H-R Diagram”

Week 12 April 6 and 8
Monday: Continue chapter 11
The Hertzsprung-Russell Diagram
Write short essay on the video.

UNIT V The Galaxies

Week 13 April 13 and 15
Monday: Lecture on Chapter 12, Star Stuff,
Go over handout on the Lifeline of stars.
Black Holes.
LT, p. 121, “Stellar Evolution”
Wednesday: Test 4

Week 14 April 20 and 22
Monday: Chapter 14, Our Galaxy.
Dark Matter
LT, p. 123: “Milky Way Scales”
Wednesday: Chapter 15, A Universe of Galaxies.
The Distance Chain: measuring distances in the universe

Week 15 April 27 and 29
Monday: Continue chapter 15 on galaxies.
LT, p. 131: “Looking at Distant Objects”
LT, p. 133, “Expansion of the Universe”
Wednesday: Video, “Known Universe: Biggest and Smallest”
Write short essay on the video.

Week 16 May 4 and 6
Monday: Review
Wednesday: Review

Week 17 May 11 to 15, FINAL EXAM WEEK
The above schedule has been carefully thought out and will be followed as much as possible, but there may have to be adjustments as the semester progresses. 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 one 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 interesting (at least 100 words; may use reverse side of page):

Student Signature_______________________________