ASTR 110 WI  INTRODUCTION TO ASTRONOMY
CRN 63009, Credits: 3
MW 8:30-9:45 AM, Imiloa 133

INSTRUCTOR: Marvin Kessler
OFFICE: Hale Imiloa 136
OFFICE HOURS: MW, 11:15 AM-12:30 PM
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 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. Writing
In a writing intensive course the student is expected to use writing as a way to stimulate critical thinking. This process is well explained by John Bean in his book, Engaging Ideas, where he focuses on writing as critical thinking. There he explains that writing can actually contribute to critical thinking, not just report it after the fact. In academic writing, students often come away with the mistaken notion that there is a divorce between thinking and writing. First you think, and then you write down what you think. Bean’s article explains that in real life most writers come to their insights while writing. In WI-Introduction to Astronomy students are encouraged to gain insight by writing, but, if they are not able to achieve that lofty goal, they at least are expected to learn from writing. The hallmarks of a writing intensive course are listed as follows on the WCC website:

- Writing promotes learning of course content.
- Writing is considered to be a process in which multiple drafts are encouraged.
- Writing contributes significantly to each student’s course grade.
- Students do a substantial amount of writing, a minimum of 4,000 words. Depending on the types of writing appropriate to the discipline, students may write critical essays or reviews, journal entries, lab reports, research reports or reaction papers.
- To allow for meaningful teacher-student interaction on each student’s writing, the class is restricted to 20 students.
- Individual conferences on writing assignments are required in WI courses at Windward CC.

3. Conferences
At least one formal conference will be held during the semester. Frequent brief conferences before and after class and via email are also encouraged. This is in addition to the exchange of written comments and suggestions by teacher and student.

4. 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.
5. **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.

6. **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. **Four written 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. There will be five questions on a test. Each answer should comprise about 100 words, with a total of 500 words for the entire test. The 500 words count toward the four thousand word goal of a writing intensive course. The five questions will be based on the questions that were given for homework. “Blue Books” should be used for the tests. Study guides will be provided for each of the tests.

2. **Reaction Papers**: During the semester three videos will be shown. These have been chosen based on their astronomical content and excellence of presentation. The student will be expected to write a reaction paper on each of these videos. The paper will be worth 25 points toward the final grade. The paper should be a minimum of 500 words in length. A rubric giving instructions on how to write the paper will be provided.

3. **Research Paper**: The student will compose a 1500 word research paper on a topic of his/her choice. A rubric will be provided. This must be completed at least a month before the end of the semester so as not to interfere with preparation for the final exam.

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, the student should 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. **Homework**: Homework will be assigned on Monday and handed in at the beginning of class on Wednesday. Homework is not graded. The purpose of homework is to point out the most important topics for the student to study. **Late homework will not be accepted.** Students who do not hand in homework on time are still expected to complete the homework in preparation for tests. In general, mathematical problems will not be assigned.

6. **The Final Exam** will be worth 100 points. It will be a multiple-choice test, and it will cover all the major topics of the course. It will not specifically count toward the WI portion of the course. A study guide will be provided.

This adds up to a total of 310 possible points, as follows:

<table>
<thead>
<tr>
<th>Task</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Four Tests (25 points each)</td>
<td>100</td>
</tr>
<tr>
<td>Three Reaction Papers (25 points each)</td>
<td>75</td>
</tr>
<tr>
<td>Research Paper (50 points)</td>
<td>50</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>335</strong></td>
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</tbody>
</table>
All papers must be handed in at the scheduled times. 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). All scores will be recorded on Laulima. 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. Course grades will be reported 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.

**WORKBOOK:** *Lecture-Tutorials for Introductory Astronomy, Third Edition*, by Adams, Prather, and Slater

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 show time; 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.
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: turn in 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 One
      Choose topic for Research Paper.

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)
   Wednesday: Chapter 7, The Terrestrial Planets
      Why are Earth, Venus, and Mars different from one another?
      Go over homework (This is done each Wednesday)
Week 6    Feb. 16 and 18
Monday: no class; Presidents’ Day
Wednesday: Video: “Wonders of the Solar System: Dead or Alive?”
          Reaction Paper on this video is due on Monday.

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: Research Paper is due today.
        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
      Reaction Paper is due on Monday.

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

   UNIT V   The Galaxies

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”
      Reaction Paper is due on Monday.

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_____________________________