Astronomy 1001: Exploring the Universe  
Spring 2016  

Syllabus and Course Information

Instructor: Michael Rutkowski  
Office: PAN 355, Office Hours: By Request, email me in advance  
Email: rutkowsk@astro.umn.edu  
NOTE: Please make sure all emails subject headings begins “AST1001-”

Lecture: Monday/Wednesday/Friday, 10:10 – 11:00 AM, Willey 20

Please read this entire syllabus carefully. You are responsible for understanding the requirements and procedures described here. You are also responsible for all announcements, assignments, changes, etc. whether or not you attend the course lectures on any given day.

Text:

Textbook: The Essential Cosmic Perspective, Bennett, Donahue, Schneider & Voit

There is a custom UMN version of the 7th edition at the UMN bookstore that includes online access to Mastering Astronomy (“MA”). The 6th edition is also acceptable, although you will need to obtain access to MA separately from the Pearson website. Note: There are differences in the chapter numbers between the 6th and 7th editions and it is your responsibility to ensure that you are completing the correct chapter.

Online: Mastering Astronomy (for homework; see below)  
Presentations will be uploaded in advance of course examinations for reference, but these materials will not be equivalent substitutes for attendance


Course Description:

This course explores the universe and our place within it. It is designed to provide a primarily qualitative survey of the history and science of astronomy, but instruction, homework and course exercises will require the use of algebra and general trigonometry throughout in order to provide greater context to lecture topics. Students should be comfortable with, or willing to further develop, the following mathematical skills:

1. Perform simple algebraic manipulation and simplification of math expressions.
2. Be able to substitute numbers in formulae and calculate the result
3. Read, understand, and draw conclusions from graphically represented data (i.e., graphs, plots)

It is highly recommended that you attend all lectures. Almost all you need to know to succeed in the course will be covered in lectures, and the lectures may assist in understanding the associated lab material when the calendars align. The online presentations alone will not cover all of the lecture material.

AST 1001 satisfies the Liberal Education Physical Science w/ Lab and the Environmental Theme requirements. A key component of the course is to develop an understanding of how science allows us to explore the physical world around us. Environmental theme topics will be addressed in both lectures and labs.

Student Learning Outcomes

Students will:

1. Develop a sense of the scale of the solar system, Milky Way, and the universe;
2. Explore the underlying reasons for Moon’s changing phases and position in the sky;
3. Take a tour of the solar system;
4. Learn about the physics behind the structure of the sun and planets;
5. Be introduced to the properties of light and explore them in a variety of astrophysical contexts;
6. Encounter fundamental laws of nature that describe the motion of objects and light through space;
7. Explore the life cycle of stars from birth to death;
8. Understand how planets beyond our solar system are discovered and characterized;
9. Learn about exotic astronomical objects like white dwarfs, neutron stars, and black holes;
10. Learn the basic characteristics of galaxy morphologies, and be able to connect this to their stellar content;
11. Encounter Hubble’s Law, its implications for galaxy motions, and the observational basis for the expansion of the universe;
12. Explore the history of the universe from the moment of the big bang to its eventual fate according to the present scientific knowledge.

Beyond the specific astronomy content, students will also develop the following general skills:
1. Using equations and arithmetic to solve simply physical problems;
2. Interpreting information presented in graph or chart form;
3. Using dimensional analysis and “back of the envelope” calculations to understand to produce informed estimates;
4. Working effectively in small groups;
5. Recording experimental results and presenting the graphically and in a report;
6. Being able to participate in, and contribute to a discussion related to astronomy.

Online Reference Materials:

We will be using the online software Mastering Astronomy (MA) for hosting reference tutorials and materials. This site can be accessed online at www.masteringastronomy.com. The goal of homework is to give you a chance to develop your understanding of the course material, and an opportunity to practice the types of questions that will appear on your exams. The MA access code is included with the textbook bundle available at the bookstore. If you have obtained your textbook elsewhere, you need to purchase access to MA directly from Pearson. The course ID associated with this section is AST1001SPRING2016MR. Be sure to select “The Essential Cosmic Perspective, 7th Edition” as your text.

Labs

Labs start on the 2nd week of class. Students must achieve 50% of possible lab credits to pass the course. For details, see your TA’s syllabus for specific information about each labs.

Observational Project

A key component of this course is to undertake an observational project – in this case observing the phases of the moon over the course of the semester. You are required to complete a series of observations, with specific times and deadlines throughout the semester, and to submit your results in both an online and paper format. You must receive at least 50% of the total available moon project points to pass the course.

The website for submitting your observations of the moon is: http://www.physics.umn.edu/resources/moonproject/

Background information and instructions on how to complete this project can be found at the start of the lab manual. If you do not understand, after your first lab section and first week of lectures how to complete this project, please visit my office hours to ensure you do not fall behind.

You must submit your observations in three parts to your Lab Instructors lockbox. Due to the recent move from Tate Hall for reconstruction, please ask your Lab Instructor about the specific location of this lockbox. Part I: At least 3 observations entered online and paper photocopies of the “Observing Form” must be handed by Friday, February 19 by 3PM.
Part II: At least 9 total observations entered online and paper photocopies of the Observing Form due Friday, March 25 by 3PM.

Final Report: Final observations (a total of 15) entered online and paper photocopies, and the final report due by Friday, April 22 by 3PM.

START MAKING OBSERVATIONS RIGHT AWAY! Don’t miss a clear day or night to make an observation, especially during the winter months. As you will come to understand, the moon does not appear at the same time and place every night. Every semester, some students will put off observations until the end of the semester – don’t. Check often on submitted observations to ensure that you are making your observations correctly. When submitting Observing Forms, do not submit your original forms, submit a photocopy. The closest photocopier to the classroom is likely in Andersen Library.

Exams

There are three exams in this course – two midterms and the final. Some fraction of the exam questions will be taken directly from the lecture notes and homework. You are allowed one side of 8.5” by 11” paper of notes for each midterm, and two sides for the final. You must take all three exams to pass the course.

Exam Dates

Mid-term 1: Date: 29 February 2016 – Willey Hall 175
Mid-term 2: 11 April 2016 – Willey Hall 175
Final exam: 14 May 2016, 8:00 – 10:00am (location TBD).

Grading

<table>
<thead>
<tr>
<th>Component</th>
<th>Total Points</th>
<th>% of grade</th>
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<tbody>
<tr>
<td>12 labs</td>
<td>240 (20 points per lab)</td>
<td>24</td>
</tr>
<tr>
<td>Observational Project</td>
<td>140</td>
<td>14</td>
</tr>
<tr>
<td>Mid-term 1</td>
<td>160</td>
<td>16</td>
</tr>
<tr>
<td>Mid-term 2</td>
<td>160</td>
<td>16</td>
</tr>
<tr>
<td>Final Exam</td>
<td>300</td>
<td>30</td>
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<tr>
<td><strong>Total for the course</strong></td>
<td><strong>1000</strong></td>
<td><strong>100</strong></td>
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Grades will be assigned approximately as follows (this may change):

A: 940-1000    A-: 890-939     B+:860-889    B:820-859    B-:780-819
C+:750-779     C: 670-709      C-: 600-669    D+:550-599    D:500-549

Note! To receive a passing grade in the class you must:

• Earn at least 50% of the total available lab points (120/240)
• Earn at least 50% of the total available moon project points (70/140)
• Take all three exams

Maintain all materials for which you have received a grade (laboratory reports, observational projects assignments, and examinations) until the end of the semester. When the instructor’s score and you self-calculated score differ, these grades will be critical to resolving any conflicts. Following the first lab, grade summaries will be posted weekly under the scores lines at http://www.astro.umn.edu/courses/1001/

Students should review their grade summaries for accuracy periodically during the semester and after the final examination.

Course Policies & Procedures

Special Accommodations: Any students with special learning accommodations must contact the instructor during the first two weeks of class (before the second lab)
**Student Mental Health Services:** As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce your ability to participate in daily activities. University of Minnesota services are available to assist you with addressing these and other concerns you may be experiencing. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website at [http://www.mentalhealth.umn.edu](http://www.mentalhealth.umn.edu)

**Examinations:** Room assignments for the exams will be announced in class. Bring two pencils and a photo-ID to all exams. Exams will consist of multiple-choice questions. *If you cannot make it to an exam, see the instructor well in advance (a week or more). If you miss an exam, see the instructor immediately.*
<table>
<thead>
<tr>
<th>Dates</th>
<th>Topic</th>
<th>Chapter Reading (7th edition)</th>
<th>Lab Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1: Jan 20</td>
<td>Phases of the Moon, Introduction to the sky on a sphere</td>
<td>2</td>
<td>No Lab</td>
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<tr>
<td>W2: Jan 25</td>
<td>Astronomical Distances, Historical and Cultural Astronomy</td>
<td>1, 3</td>
<td></td>
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<tr>
<td>W3: Feb 1</td>
<td>Motion, Energy and Gravity</td>
<td>4</td>
<td></td>
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<tr>
<td>W4: Feb 8</td>
<td>Light and Telescopes</td>
<td>5</td>
<td></td>
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<tr>
<td>W5: Feb 15</td>
<td>The Solar System: Terrestrial Planets</td>
<td>6, 7 (not 7.5)</td>
<td>Feb 19, 3 PM--3 lunar observations due</td>
</tr>
<tr>
<td>W6: Feb 22</td>
<td>The Solar System: Jovian Planets</td>
<td>8</td>
<td></td>
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<tr>
<td>W7: Feb 29</td>
<td><strong>Mid-term Exam 1</strong>, Asteroids, Comets, Earth’s Environment</td>
<td>9</td>
<td>Exam in Willey 125</td>
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<tr>
<td>W8: Mar 7</td>
<td>The Sun: Our Nearest Star</td>
<td>11</td>
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<td>W9: Mar 14</td>
<td><strong>SPRING BREAK</strong></td>
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<td>W10: Mar 21</td>
<td>The characteristics of stars</td>
<td>12</td>
<td>No Lab; March 25, 3PM— 9 observations due</td>
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<tr>
<td>W11: Mar 28</td>
<td>Star Formation, Stellar Evolution</td>
<td>13</td>
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<td>W12: Apr 4</td>
<td>The Milky Way</td>
<td>15</td>
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<tr>
<td>W13: Apr 11</td>
<td><strong>Mid-term Exam 2</strong>, Stellar Death and Life after the “Main Sequence”</td>
<td>14</td>
<td>Exam in Willey 125</td>
</tr>
<tr>
<td>W14: Apr 18</td>
<td>Galaxies, Galaxy Evolution and The Hubble Law</td>
<td>16</td>
<td>April 22, 3PM—15 observations due</td>
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<tr>
<td>W15: Apr 25</td>
<td>Cosmology and the Big Bang</td>
<td>17, 18</td>
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<tr>
<td>W16: May 1</td>
<td>Exoplanets and life in the universe</td>
<td>10, 7</td>
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<tr>
<td>5/14</td>
<td><strong>Final Exam</strong></td>
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<td>Room TBD</td>
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