Physics 3371.010
Astrophysics

Spring 2018

Course Information

Meeting Place & Time
VIN 147
MWF 09:00-09:50 AM

Instructor
Dr. Kenneth Carrell
Office: VIN 119
Phone: (325) 942-2136
Email: kenneth.carrell@angelo.edu
Office Hours: MTR 1:30-3:00 PM, M-F 11am-12pm (if no groups)

Course Description

Physics 3371, Astrophysics, is a three credit hour course on the fundamental physical concepts applied to observational and theoretical astronomy. Covered material will include the physical processes occurring in and around stars, details of the stellar life cycle, structure of the universe as a whole, and the latest discoveries and research.
Required Materials

**Foundations of Astrophysics** by Ryden & Peterson  

The ASU Bookstore has this for sale, or you can find it at any of the various online stores. Supplemental material will be brought in from a variety of sources other than this text, but this book will provide the rough framework and a good study guide for the course.
Goals, Objectives, and Outcomes

General Course Goals
There are three general goals for Physics 3371.

1. After completing the Astrophysics course, you should be able to comprehend, apply, and analyze the most important scientific models governing modern astrophysics and be familiar with the astronomical objects studied by astronomers.
2. After completing the Astrophysics course, you should be able to comprehend, apply, and analyze the practices and methodologies used by modern astronomers in constructing astrophysical models.
3. After completing the Astrophysics course, you should have a broader understanding and appreciation of the intellectual and cultural benefits gained through astronomy as a science.

Course Objectives
Upon completion of the Astrophysics course, you should be able to:

1. Recognize scientific and quantitative methods and the differences between these approaches and other methods of inquiry used in modern astrophysics and to communicate the findings, analyses, and interpretations in writing.
2. Identify and recognize the differences among competing modern astrophysical scientific theories.
3. Demonstrate the ability to translate, interpret, and extrapolate the most important scientific models governing modern astrophysics, the practices and methodologies used by both modern and historic astronomers in constructing astrophysical models, and to be familiar with the astronomical objects studied by astronomers.
4. Further develop critical/logical thinking, scientific reasoning, and problem solving skills in the area of astrophysics.
Learning Outcomes
When you complete this course, you should be able to apply the following intellectual skills to astrophysical concepts:

- **Knowledge**: define, recite, describe, label, list
- **Comprehension**: explain, predict, summarize, translate
- **Application**: change, compute, construct, predict
- **Analysis**: compare, contrast, diagram, infer
- **Synthesis**: combine, compose, create, revise, summarize
- **Evaluation**: appraise, compare, critique, contrast

Course Administration

Class Attendance

- Class attendance is both an ASU and course requirement.
- You are expected to attend all scheduled class meetings.
- You are responsible for all course material and information that is presented in class.
- If you miss class, get the class notes and information from a fellow student.
- Attendance (or lack thereof) often makes a difference in your success in this class.

Late Work

- **Unexcused late work or missed tests will not be accepted.**
- If your assignments are not submitted by the posted deadline or if you miss an in-class test, you will receive a zero for that assignment.
- You must contact your professor **before** the assignment is due if you believe it will be late or as soon as possible after the due date in the case of an unexpected emergency.
Academic Integrity

Angelo State University expects its students to maintain complete honesty and integrity in their academic pursuits. Students are responsible for understanding and complying with the university Academic Honor Code and the ASU Student Handbook.

Accommodations for Disabilities

The Student Life Office is the designated campus department charged with the responsibility of reviewing and authorizing requests for reasonable accommodations based on a disability, and it is the student’s responsibility to initiate such a request by contacting the Student Life Office. The Student Life Office will establish the particular documentation requirements necessary for the various types of disabilities.

Religious Holidays

A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. A student who fails to do class work for the observance of a religious holy day shall be allowed to take an examination or complete an assignment scheduled for that day within a reasonable time after the absence.

Assessing Outcomes & Grade Determination

Method of Assessing Outcomes
Student learning outcomes will be assessed with:

- Daily/weekly work – various homework and in-class assignments will be given throughout the semester.
- Several tests (likely ~3) will be given throughout the semester, either as take-home and/or in-class exams.
- A final exam at the end of the semester.
Grade Determination
Your final grade will be determined by your scores on all homework, projects, tests and exams plus any extra credit points earned throughout the semester.

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>Homework / Daily Work</td>
<td>40%</td>
</tr>
<tr>
<td>Midterm Exams</td>
<td>40%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>20%</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100%</strong></td>
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Angelo State University employs a letter grade system. Grades in this course are determined on a percentage scale:

- A = 90-100%
- B = 80-89%
- C = 70-79%
- D = 60-69%
- F = 59% and below

Final course grades will also be determined in part based on attendance as follows:

<table>
<thead>
<tr>
<th>Number of Absences</th>
<th>Highest Grade Possible</th>
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</thead>
<tbody>
<tr>
<td>0-4 (&lt;85% attendance)</td>
<td>A</td>
</tr>
<tr>
<td>5-7 (75-85% attendance)</td>
<td>B</td>
</tr>
<tr>
<td>8-10 (65-75% attendance)</td>
<td>C</td>
</tr>
<tr>
<td>11-13 (55-65% attendance)</td>
<td>D</td>
</tr>
<tr>
<td>14+ (&lt;55% attendance)</td>
<td>F</td>
</tr>
</tbody>
</table>
List of Topics and Approximate Scheduling

NOTES:
1) this is subject to change both in topics covered and length of time spent to accommodate class and professor preferences
2) Chapter & section numbers below correspond to required textbook

• Mathematics of Astronomy (~1 week)
  o Distances, flux & brightness, magnitudes (Ch 13, Sec 1-2)

• Interaction of Radiation and Matter (2 weeks)
  o Atomic structure & processes (Ch 5, Sec 1-2)
  o Emission & absorption spectra (Ch 5, Sec 3)
  o Equation of Radiative Transfer (Ch 5, Sec 4)
  o Local thermodynamic equilibrium (Ch 5, Sec 6)
  o Blackbody radiation (Ch 5, Sec 7)

• Physical Properties of Stars (1 weeks)
  o Stellar temperature, radius, and mass (Ch 13, Sec 3-6)

• Orbital Mechanics (1 week)
  o Kepler, Newton, and orbits due to gravity (Ch 3)

• Stellar Atmospheres (1 week)
  o Hydrostatic equilibrium and classifying stars (Ch 14)

• Stellar Interiors (2 weeks)
  o Equations of stellar structure (Ch 15, Sec 1)
  o Energy generation in stars (Ch 15, Sec 2-3)

• Star Formation (1 week)
  o Star formation and evolution of Sun-like stars (Ch 17, Sec 1-2)
- **Variable Stars** *(1 week)*
  - Cepheid & RR Lyrae type stars (Ch 17, Sec 3)

- **Stellar Remnants** *(2 weeks)*
  - White dwarfs, neutron stars, & black holes (Ch 18)

- **Everything Else** *(whatever is left)*
  - Galaxies
    - Classification
    - Spectra
    - Distances
    - Active Galaxies
    - Clusters & Superclusters
  - Cosmology & History of the Universe