## COURSE OUTLINE

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>PHY 121</td>
<td>The Universe</td>
<td>3</td>
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<table>
<thead>
<tr>
<th>Hours:</th>
<th>Pre-requisite</th>
<th>Implementation</th>
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<tbody>
<tr>
<td>lecture/Lab/Other</td>
<td>MAT 135</td>
<td>Spring 2019</td>
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<tr>
<td>2/2/0</td>
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Introduces students to the world beyond Earth with a survey of modern astrophysics. Study encompasses three dominant sections: stellar astronomy, planets and life, and galaxies and cosmology. Laboratory data analysis requires algebra. Offered at off-site locations only. *Lec/lab/rec 2/2/0*

### Is course New, Revised, or Modified?
New

### Required texts/other materials:

**Text:**  
*The Cosmic Perspective: Fundamentals*  
Authors: Bennett, Donohue, Schneider, & Voit (ISBN 0-321-56704-8)  
Pearson Addison Wesley

*Sizing up the Universe (optional)*  
Author: Gott & Vanderbei  
National Geographic

### Revision date:
02/14/2019

### Course coordinator:
Jing Huang, 609-570-3429 email huangj@mccc.edu

### Information resources:
None

### Other learning resources:
None

### Course Competencies/Goals:
The student will be able to:

I. Understand the history of astronomy.
II. Learn about the development of modern cosmology.
III. Observe the night sky and learn about the planets.
IV. Understand stellar evolution, star formation, and the origin of chemical elements.
V. Learn about the discovery galaxies, galaxy formation, cosmology, and the origin of the Universe.

Course-specific General Education Knowledge Goals and Core Skills.

General Education Knowledge Goals
Goal 2. Mathematics. Students will use appropriate algebra concepts and operations to interpret data and to solve problems.

MCCC Core Skills
Goal B. Critical Thinking and Problem-solving. Students will use critical thinking and problem solving skills in analyzing information.
Goal F. Collaboration and Cooperation. Students will develop the interpersonal skills required for effective performance in group situations.

Units of study in detail.

Astrophysics is one of the most important branches of modern physics. The course will include some material about the history of astronomy and the development of modern cosmology but will concentrate on three areas of current major interest: stellar evolution, star formation, and the origin of the chemical elements; the discovery of new planetary system; and galaxies, galaxy formation, cosmology, and the origin of the Universe. The lecture topics are listed below and the laboratories are associated with the lectures.

Section 1: Stars
1. The properties of stars: Spherical potentials and black body radiation (CG IV, GE 2, B)
2. The fundamental forces of physics (GE 2)
3. Stellar structure 1: Gravity and energy production (CG IV, GE 2)
4. Stellar structure 2: The source of stellar energy, and stellar evolution (CG IV, GE 2)
5. The death of stars: red giants, white dwarfs, neutron stars and black holes (CG IV, GE 2, B)
6. The interstellar medium and chemical enrichment (CG IV)
Review
Unit Exam

Section 2: Planets
7. The formation of stars and planets (CG IV, GE 2, B, F)
8. The solar system: the Sun and planets (CG III, GE 2, B, F)
9. The motions of the planets, initial conditions and Kepler’s laws (CG III, GE 2, B)
10. The asteroid belt, the Kuiper belt, Plutinos, comets and meteors (CG III, GE 2, B)
11. The history of the Earth and life (CG III, GE 2, B, F)
12. Discovery of planets around other stars (CG III, GE 2, B)
Review
Unit Exam

Section 3: The Galaxy and the Universe
13. The Milky Way galaxy (CG V, GE 2, B)
14. Galaxies and clusters (CG V, GE 2, B)
15. The distance scale and the expanding Universe (CG V, GE 2, B)
16. The cosmic microwave background (CG V, GE 2, B)
17. The origin of the Universe (CG V, GE 2, B, F)
18. The future fate of the Universe (CG V, GE 2, B, F)

Review

Unit Exam

Laboratory Experiments:
  1. The seasons
  2. Parallax
  3. Measuring the Local Gravitational Acceleration
  4. The Speed of Light
  5. The Age of the Universe
  6. The Phases of the Moon
  7. The Age of the Earth
  8. Measuring Planets Around Nearby Stars
  9. Stellar Spectroscopy I
  10. Stellar Spectroscopy II
  11. Stellar Spectroscopy III
  12. Sun Spots
  13. White Dwarf Masses
  14. Planetary Masses II
  15. Ages of Star Clusters
  16. Transits of Venus
  17. Centers of Gravity

**Evaluation of student learning**

The course grade will be based on three unit exams, eighteen homework assignments, and six laboratories. The grade will be based on the following percentages:

- Unit exams 40%
- Homework 20%
- Labs 40%

A student who has special needs because of a documented disability is entitled to receive accommodations (Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973). Students are to submit the accommodation form to the instructor at the start of the semester. For more information, contact Arlene Stinson, Director of the Center for Inclusion, Transition and Accessibility, LB 217, 570-3525, stinsona@mccc.edu

**Academic Integrity Statement:**

Mercer County Community College is committed to academic integrity – the honest, fair and continuing pursuit of knowledge, free from fraud or deception.

- Students should never:
  - Knowingly represent the work of others as their own
  - Knowingly represent previously completed academic work as current
  - Fabricate data to support academic work
  - Use or obtain unauthorized assistance in the execution of any academic work
  - Give fraudulent assistance to other students
  - Unethically use technological means to gain academic advantages
Violators of the above actions will be penalized. For a single violation the faculty member will determine the course of action. This may include, assigning a lower grade on the assignment, lowering the course grade, failing the student, or another penalty that is appropriate to the violation. The student will be reported to the Academic Integrity Committee, who may impose other penalties for a second (or later) violation. The student has right to a hearing and also to appeal any decisions. These rights are outlined in the student handbook.