

COURSE OUTLINE

Course Number PHY 121	Course Title The Universe	Credits 3
Hours: Lecture/Lab/Other 2/2/0	Pre-requisite MAT037 or MAT042 with grade C or better	Implementation Spring 2023

Catalog description:

Introduces students to the world beyond Earth with a survey of modern astrophysics. Study encompasses three dominant sections: stellar astronomy, planets and life, galaxies and cosmology. Laboratory data analysis requires algebra. Offered at off-site locations only. *Lec/lab/rec* 2/2/0

<u>General Education Category:</u> <u>Not GenEd</u>	<u>Course coordinator:</u> Jing Huang (609) 570-3429 huangj@mccc.edu
----------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------

Required texts & Other materials:

The Cosmic Perspective: Fundamentals

Authors: Bennett, Donohue, Schneider, & Voit (ISBN 0-321-56704-8)
Pearson Addison Wesley

Sizing up the Universe (optional)

Authors: Gott & Vanderbei (ISBN 978-1426206511)
National Geographic

Course Student Learning Outcomes (SLO):

Upon successful completion of this course the student will be able to:

1. demonstrate understanding of the astronomy concepts, laws, and principles [Supports ILG #3; PLO #1]
2. Solve theoretical problems by applying physics concepts, laws, and principles. [Supports ILG #2, #3, #10, and #11; PLO #2]
3. Solve laboratory problems by applying their knowledge and experience with lab equipment. [Supports ILG #3, #4, and #11; PLO #3]
4. Demonstrate their knowledge and experience with lab equipment. [Supports ILG #3, #4; PLO #4]
5. Demonstrate ability to communicate effectively [Supports ILG#1, #3, and #4; PLO #5]

Course-specific Institutional Learning Goals (ILG):

Institutional Learning Goal 1. Written and Oral Communication in English. Students will communicate effectively in both speech and writing.

Institutional Learning Goal 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.

Institutional Learning Goal 3. Science. Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.

Institutional Learning Goal 4. Technology. Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.

Institutional Learning Goal 10. Information Literacy: Students will recognize when information is needed and have the knowledge and skills to locate, evaluate, and effectively use information for college level work.

Institutional Learning Goal 11. Critical Thinking: Students will use critical thinking skills to understand, analyze, or apply information or solve problems.

Program Learning Outcomes for Physics (PLO)

1. Students are expected to develop a framework of knowledge, including concepts, laws, and principles
2. Students are expected to develop problem-solving skills for theoretical problems
3. Students are expected to develop hands-on problem-solving skills
4. Students are expected to develop hands-on experience with modern laboratory equipment
5. Students are expected to develop communication skills

Units of study in detail – Unit Student Learning Outcomes:

Unit I [Stars] [Supports Course SLOs #1, #2, #3, #4, #5]

Learning Objectives

The student will be able to...

- The properties of stars: Spherical potentials and black body radiation
- The fundamental forces of physics
- Stellar structure 1: Gravity and energy production
- Stellar structure 2: The source of stellar energy, and stellar evolution
- The death of stars: red giants, white dwarfs, neutron stars and black holes
- The interstellar medium and chemical enrichment

Unit II [Planets] [Supports Course SLOs #1, #2, #3, #4, #5]

Learning Objectives

The student will be able to...

- The formation of stars and planets
- The solar system: the Sun and planets
- The motions of the planets, initial conditions and Kepler's laws
- The asteroid belt, the Kuiper belt, Plutinus, comets and meteors
- The history of the Earth and life
- Discovery of planets around other stars

Unit III [The Galaxy and the Universe] [Supports Course SLOs #1, #2, #3, #4, #5]

Learning Objectives

The student will be able to...

- The Milky Way galaxy
- Galaxies and clusters
- The distance scale and the expanding Universe
- The cosmic microwave background
- The origin of the Universe
- The future fate of the Universe

Laboratory experiments [Supports Course SLOs #3, #4, #5]

- The seasons
- Parallax
- Measuring the Local Gravitational Acceleration
- The Speed of Light
- The Age of the Universe
- The Phases of the Moon
- The Age of the Earth
- Measuring Planets Around Nearby Stars
- Stellar Spectroscopy I
- Stellar Spectroscopy II
- Stellar Spectroscopy III
- Sun Spots
- White Dwarf Masses
- Planetary Masses II
- Ages of Star Clusters
- Transits of Venus
- Centers of Gravity

Evaluation of student learning:

Students are expected to attend all lectures and laboratory sessions. The evaluation will be based on performance and participation. Tests and quizzes cover both lecture and laboratory materials.

Course Component	Weight	Notes
Tests	20 %	There is no makeup test. Drop one lowest score.
Final, cumulative	30 %	
Laboratory	20 %	There is no makeup lab. Drop one lowest score.
Quizzes	30 %	