

## Astronomy Part 2 Course Syllabus

### Course Description:

In Astronomy Part 2, students will build off the basic knowledge they gained in Part 1 of the course as well as explore additional, specialized topics. Additional foundational topics include Stars and Spectroscopy and Galaxies, where students will delve deep into the life cycles and classification of stars and galaxies. The specialized topic of astrobiology will be taught, as well as an introduction into the idea of the search for life in our solar system and the search for exoplanets in others. Students will learn about space, the interstellar medium, and its properties as well as the unsolved mysteries of dark energy and dark matter. Another unit examines exciting exotic objects and phenomena, like supernovae and black holes. Finally, students will get an introduction to cosmology and will learn the characteristics and current theories about our universe.

Part 1: 5 credit hours

Part 2: 5 credit hours

### Course Outline

#### Unit 1 - Stars and Spectroscopy

- 1.1 What are Stars?
- 1.2 Stellar Evolution and Classification
- 1.3 The Hertzsprung-Russell (H-R) Diagram
- 1.4 Binary Star Systems
- 1.5 Variable Stars
- 1.6 Layers of the Sun

#### Unit 2 – Galaxies

- 2.1 Galaxy Types and Classification
- 2.2 The Milky Way Galaxy
- 2.3 The Local Group and Laniakea Supercluster
- 2.4 Hubble Deep Field and Ultra Deep Field
- 2.5 Galactic Evolution

### California Standards

#### In this Unit students will learn:

The basics of stars and spectroscopy, including what stars are and stellar evolution. To classify stars, and the Hertzsprung-Russell Diagram.

About binary star systems and star clusters, as well as variable stars.

About the how stars work and their layers, using the sun as a case study.

[Earth Sciences: 1e, 1g, 2b, 2d, 2e, 2f ]

#### In this Unit students will learn:

The basics of galaxies, including their types and classifications. The Milky Way galaxy and the Laniakea Supercluster.

About the Hubble deep field and ultra deep field, and about galactic evolution and collisions.

[Earth Sciences: 1g, 2a, 2b ]

## Unit 3 - Astrobiology and the Search for Life in the Solar System

- 3.1 What is Astrobiology?
- 3.2 The Search for Life in the Solar System: Europa
- 3.2 The Search for Life in the Solar System: Europa
- 3.3 The Search for Life in the Solar System: Enceladus
- 3.4 The Drake Equation
- 3.5 Exoplanets
- 3.6 Methods of Detecting Exoplanets

## Unit 4 - Space and its Properties

- 4.1 The Interstellar Medium
- 4.2 Principles of Spacetime
- 4.3 Dark Matter
- 4.4 Elementary Particles and the Higgs Field
- 4.5 Dark Energy

## Unit 5 - Exotic Objects and Phenomena

- 5.1 Supernovae
- 5.2 White Dwarfs and Planetary Nebulae
- 5.3 Brown Dwarfs
- 5.4 Neutron Stars
- 5.5 Black Holes, Pulsars and Quasars

## Unit 6 - The Universe

- 6.1 The Beginning of the Universe
- 6.2 The Expanding Universe
- 6.3 Misconceptions About the Universe
- 6.4 The Accelerating Universe
- 6.5 The Three Fates of the Universe
- 6.6 A Multiverse

### In this Unit students will learn:

About astrobiology and the status of the search for life in the solar system.

About Europa and Enceladus, and their potential for harboring the existence of

life. More about the search for life elsewhere in the galaxy, and the Drake equation. More about the search for life elsewhere in the galaxy, and the Drake equation.

About exoplanets, and methods for detecting them.

[Earth Sciences: 1g, 2b]

### In this Unit students will learn:

The properties of space and interstellar medium.

About the principles of Einstein's theory of relativity.

About dark matter and dark energy.

The Higgs Field about elementary particles.

[Earth Sciences: 2c, 2d, 2e, 2f, 2g]

### In this Unit students will learn:

About exotic objects and phenomena, including supernovae, white dwarfs and brown dwarfs, neutron stars, black holes, pulsars and quasars.

[Earth Sciences: 2b, 2c, 2d, 2e, 2f, 2g]

### In this Unit students will learn:

Key characteristics of the universe, including how it began and how it continues to expand.

Common misconceptions about the universe. That the universe is accelerating, the three potential fates of the universe, and the idea of a multiverse.

[Earth Sciences: 2c, 2d, 2e, 2g]