Miami Dade College

**Course Description**

**AST1002 | Descriptive Astronomy | 3.00 credits**

This course provides a comprehensive look at modern astronomy, emphasizing the use of the scientific method and the application of physical laws to understand the universe including Earth and its environment. Throughout this course, students will develop the ability to discern scientific knowledge from non-scientific information by using critical thinking. Student learning outcomes: students will define terms used to measure and describe the universe; students will explain the processes involved in the formation and evolution of celestial bodies over astronomical time according to different models and theories; students will describe how scientific theories evolve in response to new observations and critically evaluate their impact on society; students will formulate empirically testable hypotheses derived from the study of physical processes and phenomena; students will apply logical reasoning skills through scientific criticism and argument to separate science from non-science; and students will gather and analyze astronomical data and communicate results in graphic and written forms. Special Fee.

**Course Competencies**

**Competency 1:** The student will demonstrate knowledge and comprehension of the history of astronomy by:

1. identifying ancient observations and notions about the Earth and the sky and how they contributed and developed into our current knowledge of Astronomy and cosmology.
2. describing historical and scientific developments (along with scientists involved) with emphasis on the transition from a geometric to a heliocentric model of the Universe and on the relevance of classical and modern physical concepts to Astronomy.

**Competency 2:** The student will demonstrate knowledge and comprehension of the basics of astronomical observation by:

1. defining celestial sphere, horizon, zenith, poles, equator, celestial poles, celestial equator, ecliptic, zodiac, equinoxes, and solstices and their relation to the motion of the Earth.
2. defining latitude, longitude, declination, and right ascension and their use in locating objects.
3. recognizing prominent constellations
4. interpreting constellation charts.
5. relating the position of Polaris and the Southern Cross to an observer's latitude on Earth.
6. estimating angular distances between celestial objects.
7. relating the parallax of an object to its distance.

**Competency 3:** The student will be able to demonstrate knowledge and comprehension of celestial motions by:

1. defining an astronomical unit, light- year and parsec.
2. labeling and describing different parts of an object's orbit around a central mass, such as ellipse, focus, semi-major axis, eccentricity, apogee, perigee, aphelion, and perihelion.
3. defining and relating velocity, acceleration, and force.
4. defining linear and angular momentum and describing how the conservation of these parameters affects the motion of celestial objects.
5. summarizing Kepler's laws of planetary motion.
6. summarizing Newton's laws of motion and gravitation.
7. describing the relation of calendars and time-keeping methods to the motion of the Earth.

**Competency 4:** The student will be able to demonstrate knowledge and comprehension of electromagnetic radiation by:

1. describing what light is and identifying its fundamental physical properties.
2. differentiating various types of electromagnetic radiation such as visible, ultraviolet, infrared, x-rays, gamma rays, microwave, and radio.
3. describing radiation laws (Wien, Stefan- Boltzmann) and their usefulness in determining the temperature of celestial objects.
4. describing what is a spectrum and its relation to the atomic structure.

5. identifying the uses of spectra in Astronomy (identifying chemical composition measuring temperature, magnetic field and radial velocity).

**Competency 5:** The student will be able to demonstrate knowledge and comprehension of telescopes by:
1. describing refractors and reflectors.
2. defining light gathering power, magnification, and resolution.
3. explaining the advantages of space telescopes.
4. describing advances in astronomical observations such as adaptive optics and interferometry.
5. recognizing the importance of viewing astronomical objects in different electromagnetic wavelengths.

**Competency 6:** The student will be able to demonstrate knowledge and comprehension of the Earth-Sun configuration by:
1. describing how the tilt of the rotational axis is the primary cause for the seasons.
2. identifying the tropics of Cancer and Capricorn, the Arctic and Antarctic Circles and the regions they define.
3. relating the seasons to the solstices and equinoxes.
4. explaining the phases of the Moon.
5. explaining how the interaction of the Sun, Earth, and Moon produces the tides.
6. describing what is meant when a moon is tidally locked to its parent body.
7. explaining the solar and lunar eclipses.

**Competency 7:** The student will be able to explain the solar and lunar eclipses by:
1. labeling Earth's interior layers and explaining their most relevant properties.
2. describing density and differentiation and applying these terms to Earth's layered structure.
3. describing plate tectonics and its relevance to geological features (continents, mountain ranges, volcanoes, rifts, faults, craters).
4. distinguishing four separate types of rocks and describing how each is formed.
5. explaining the process of radioactive dating of rocks.
6. describing the general properties of oceans and other bodies of water on Earth and how they interact with continents and the atmosphere.
7. labeling Earth's atmospheric layers and explaining their most relevant properties.
8. describing atmospheric processes such as weather and hurricanes.
9. describing the magnetosphere and the origin of Earth's magnetic field.
10. arranging important times in Earth's history including when it formed and when the ocean, life and oxygen first appeared and discussing why these components were vital to the evolution of life on Earth.

**Competency 8:** The student will be able to demonstrate knowledge and comprehension of the Earth-Moon system by:
1. describing the Moon's surface, interior, and history of formation.
2. recalling important events in the exploration of the Moon.

**Competency 9:** The student will be able to demonstrate knowledge and comprehension of the planets in our Solar System by:
1. summarizing the evolution of our Solar System from a nebula to a protostar with planetesimals, and eventually the sun and the planets.
2. demonstrating how the radial temperature profile of our early solar system determined planetary characteristics and recognizing important sources of heat internal to planets today.
3. identifying the main categories of planets (i.e., Terrestrial, Jovian, and Dwarf).
4. describing the planets in our system, including their orbits, spins, sizes, relative densities, structure, composition, temperature, and mass.

**Competency 10:** The student will be able to demonstrate knowledge and comprehension of the minor bodies in our Solar System by:

1. identifying and describing prominent satellites in our Solar System and discussing current theories about their origin.
2. locating satellites likely to currently have liquid water and proposing ideas on the origin of the heat used to keep the water from freezing.
3. classifying asteroids and describing their composition and location.
4. describing comets and providing their composition and location.
5. describing meteors and meteorites.
6. describing the Kuiper belt and the Oort cloud and their connection to the origin of comets.

**Competency 11:** The student will be able to demonstrate knowledge and comprehension of stellar characteristics by:

1. labeling the Sun's interior layers and explaining their most relevant properties.
2. describing the composition of the Sun.
3. labeling the Sun's atmospheric layers and explaining their most relevant features and properties.
4. describing nuclear fusion and the proton- proton cycle and relating this process to the generation of energy.
5. describing the solar cycle and its relevance to space weather.

**Competency 12:** The student will be able to demonstrate knowledge and comprehension of the Milky Way galaxy by:

1. describing star brightness, the scales of apparent and absolute magnitude, and the relation between luminosity, apparent magnitude, and distance.
2. describing color index and the relation between star color and temperature.
3. defining the major spectral classes of stars, including the classification of the Sun.
4. describing the H-R diagram and defining the stellar parameters used in the plot.
5. categorizing stars on the main sequence and examining the differences of stars not on the main sequence to include white dwarfs, giants, and supergiants.
6. describing methods used to determine stellar radial and proper motion, and rotation.
7. describing methods used to determine stellar distances, including parallax, Cepheid, and RR-Lyrae variable stars.
8. describing methods to determine a star's mass, include the observation of multiple star systems such as binaries.
9. describing the roles of interstellar nebulae and nuclear fusion in the process of star formation and its subsequent evolution.
10. discussing the formation of elements found on the periodic table and the relation to a star's evolution.
11. describing the evolution of stars with low, mid, and high initial masses, including white dwarfs, pulsars, neutron stars, supernovae, and black holes.
12. describing how open and globular clusters can describe a star's age.

**Competency 13:** The student will be able to demonstrate knowledge and comprehension of galaxies by:

1. describing the interstellar medium, the spiral structure of the disk, and the galactic halo.
2. describing the shape, size, mass, and spiral structure of our own galaxy.
3. discussing the rotation of the Milky Way and the orbit of our Sun.

**Competency 14:** The student will be able to demonstrate knowledge and comprehension of the basic concepts of modern cosmology by:

1. identifying the types of galaxies, including spiral, elliptical, and irregular.
2. using Hubble's Law to describe the expansion of the universe and discussing how this law can estimate distances to galaxies.
3. describing quasars and other active galaxies and explaining the meaning of spectral redshifts.
4. describing the clustering and evolution of galaxies.

**Competency 15:** The student will be able to demonstrate knowledge, comprehension, application, and synthesis of

the main concepts in astronomy by:

1. discussing the theory of the Big Bang and the observations that support it.
2. discussing recent improvements Hubble's law and its meaning.
3. discussing current theories on the future of the Universe.

**Learning Outcomes:**

- Communicate effectively using listening, speaking, reading, and writing skills
- Use quantitative analytical skills to evaluate and process numerical data
- Formulate strategies to locate, evaluate, and apply information