

ASTR - 20 - The Solar System

1 - Spring 2021 Course Review Form

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Proposer: Shimonee Kadakia

DCC approval date May 19, 2021

Select all that apply*

- No Changes
- Reactivation
- Course Name
- Course Number
- Descriptive Title
- Discipline
- Catalog Description
- Conditions of Enrollment (Prerequisites, Corequisites, and Recommended Preparation)
- Lecture/Lab Hours
- Outside Study Hours
- Units
- Grading Method
- Credit Status
- A.A./A.S. General Education Requirement
- Transfer Status (CSUGE, IGETC)
- Student Learning Outcomes (SLOs)
- Course Objectives
- Major Topics
- Primary Methods of Evaluation
- Instructional Methods
- Work Outside of Class
- Texts and Materials
- Distance Education Delivery: Add Online Version (Complete the addendum)
- Distance Education Delivery: Add Hybrid Version (Complete the addendum)

Justification for Course Modifications:

This course was already approved for online delivery but not for hybrid. We have added the hybrid DE option to make this consistent with Astro 25, which is authorized for both online and hybrid (not in an emergency).

Corrected primary method of evaluation from "skills demonstration" to "Problem solving demonstrations (computational or non-computational)"

Updated textbooks.

Corrected recommended prep to current English course number.

Subject:*

ASTR

Course Number:* 20

Descriptive Title:* The Solar System

Division: Natural Sciences

Course Disciplines: Astronomy, Physics

Catalog Description:*

This course is an introduction to the major planets and the smaller members of the solar system such as moons, asteroids, Kuiper Belt Objects, and comets. Theories of the origin and histories of the planets are presented. The early history of astronomy and the Copernican Revolution are discussed. Sky phenomena such as constellations, the seasons, eclipses, and planetary motions are demonstrated in the planetarium. The possibility of life elsewhere in the solar system is examined.

Prerequisite:

Co-requisite:

Recommended Preparation: English 1A or qualification by appropriate assessment

Enrollment Limitation:

Hours Lecture (per week): 3

Hours Laboratory (per week): 0

Outside Study 6

Hours:*

Total Hours:* 54

Course Units:* 3

Grading Method: Letter Grade only

Credit Status: Credit, degree applicable

Transfer CSU: Yes

Effective Date: Prior to July 1992

Transfer UC: Yes

Effective Date: Prior to July 1992

General Education:
ECC Area 1 - Natural Sciences

Term:

Other:

CSU GE: Area B1 - Physical Universe and its Life Forms: Physical Science

Term:

Other:

IGETC: Area 5A - Physical Science

Term:

Other:

Student Learning Outcomes:

SLO #1 Scientific Method

Students will be able to recognize the elements of the Scientific Method in the discussion of a scientific problem.

SLO #2 Seasons

Students will be able to explain the causes of seasonal variations in the length of the day, direction of sunrise and sunset, and the amount of solar heating on the Earth.

SLO #3 Planet Origins

Students will be able to describe the modern theory of the origin of the planets and discuss the evidence that supports the theory.

Course Objectives:

1. Judge whether a particular study is science or a "pseudo-science" using the scientific method.
2. Predict the phase of the Moon and/or type of eclipse that would be seen in the sky, given the positions of the Earth, the Sun, the Moon, and the observer.
3. Explain the causes of seasonal variations in the length of the day, the direction of sunrise and sunset, and the amount of solar heating.
4. Discuss the Copernican Revolution and the contributions of Galileo, Kepler, and Newton, including the Law of Gravity.
5. Compare the characteristics of the major planets and major moons of the Solar System.
6. Estimate the age of the solar system, given data on the isotopic composition of meteorites.
7. Construct a history of a planet in terms of the processes of impact, volcanism, tectonics, and erosion.
8. Describe the composition and properties of planetary atmospheres. Contrast the conditions on planets with atmospheres with the conditions on airless worlds. Compare the climatic conditions on the inner planets.
9. Compare and contrast the terrestrial, gas giant, and ice giant planets.
10. Evaluate the possibilities for life on a given planet.
11. Diagram how the planets were formed.
12. Describe how the greenhouse effect warms the surface of a planet.

Major Topics

I. Overview of the Universe and the Scientific Method (6 hours, lecture)

- A. The Solar System
- B. The Universe
- C. The Scientific Method

II. Sky Phenomena (7.5 hours, lecture)

- A. The Celestial Sphere and Constellations
- B. The Seasons
- C. Eclipses and Phases of the Moon
- D. Planetary Motions

III. Ancient Astronomy (3 hours, lecture)

- A. The Origins of Western Astronomy
- B. The Geocentric and Heliocentric Models of the Solar System

IV. The Copernican Revolution (6 hours, lecture)

- A. Copernicus
- B. Galileo
- C. Tycho Brahe
- D. Kepler
- E. Newton

V. Gravity (7.5 hours, lecture)

- A. The Law of Inertia
- B. Acceleration Due to Gravity
- C. Orbital Motion
- D. The Law of Grav/G. The Tidal Force

VI. Electromagnetic Radiation (3 hours, lecture)

- A. The Electromagnetic Spectrum
- B. Creating Light
- C. Detecting Light

VII. The Solar System (3 hours, lecture)

- A. Layout of the Solar System
 - 1. Orbits
 - 2. Rotation
- B. Properties of Planets
 - 1. Size
 - 2. Mass and Density
 - 3. Magnetic Fields
 - 4. Rotation
- C. Classification of the Planets
- D. Age of the Solar System
 - 1. Relative Age Dating using Surface Features
 - 2. Dating of Igneous Rocks and Meteorites using Radio-active Isotopes
- E. Origin of the Solar System
- F. The Possibility of Life in the Solar System

VIII. The Terrestrial Planets and the Moon (9 hours, lecture)

A. Structure

1. 4-Layer Structure
2. Density

B. Surface Processes

1. Impact Cratering: Crater Morphology
2. Volcanism: Types of Volcanos
3. Erosion: Landslides, Wind, Water, Ice
4. Tectonics: Plate Tectonics on Earth

C. Atmospheres

1. Composition
2. Properties
3. Greenhouse Effect
4. Carbon Dioxide Cycle-Stabilizing Effect on Climate

D. The Moon

E. Mercury

F. Venus

G. Mars: Past and Present

H. The Earth

IX. The Outer Planets and their Moons (6 hours, lecture)

A. Jupiter and Saturn

B. Ring Systems and the Roche Limit

C. Uranus and Neptune

D. Galilean Satellite System: Role of Tides in their Evolution

E. Titan: Primordial Atmosphere

F. Triton: Capture and Eventual Tidal Destruction

X. Smaller Solar System members (3 hours, lecture)

A. Meteors, Meteoroids, and Meteorites

B. Asteroids or Minor Planets

C. Kuiper Belt Objects

1. Pluto and Charon

D. Oort Cloud Comets

E. Impacts and Their Role in the History of the Earth

Total Lecture Hours: 54

Total Laboratory Hours: 0

Total Hours: 54

Primary Method of Evaluation Problem solving demonstrations (computational or non-computational).

**Typical Assignment
Using Primary
Method of
Evaluation:**

Figure 1 shows a comet traveling in an elliptical orbit around the Sun. The comet is shown as it moves through four different segments of its orbit (labeled A, B, C, and D). During each segment of the orbit the comet sweeps out the triangular shaped area shaded in gray. Assume each of the shaded triangular shaped areas has the same size (area). Rank the time it took (from greatest to least) for the comet to move along each of the segments (A-D) of the orbit.

Ranking order: Greatest 1_____ 2_____ 3_____ 4_____ Least

Or, the time to travel each segment would be the same. _____ (indicate with a check mark).

In a short paragraph, carefully explain your reasoning for ranking this way.

**Critical Thinking
Assignment 1:**

Make a table showing which of the 4 planetary surface-shaping processes has occurred in each of the planets (Mercury to Neptune). With the use of photos, show examples of one process on each planet. For each planet, tell why the "missing" processes did not occur there, or have not been found there.

**Critical Thinking
Assignment 2:**

1. In a paragraph, explain why the seasons are opposite in the southern hemisphere.

**Other Evaluation
Methods:**

Completion, Essay Exams, Homework Problems, Matching Items, Multiple Choice, Other Exams, Quizzes, Term or Other Papers

**Instructional
Methods:**

Demonstration, Discussion, Group Activities, Lecture, Multimedia presentations, Other (specify)

If other:

**Work Outside of
Class:***

Other (specify), Problem solving activity, Required reading, Study, Written work (such as essay/composition/report/analysis/research)

If Other:

**Up-To-Date
Representative
Textbooks:**

Kay, Palen, Blumenthal, 21st Century Astronomy, 6th ed. W.W. Norton & CO. 2019.

Comins, Discovering the Universe, 11th edition, W.H. Freeman, 2019.

**Alternative
Textbooks:**

Bennett et al. The Cosmic Perspective, 9th edition, Pearson, 2020.

**Required
Supplementary
Readings:**

**Other Required
Materials:**

Requisite:

Category:

**Requisite and
Matching
skill(s):** **Bold the
requisite skill. List
the corresponding
course objective
under each skill(s).**

Requisite:

**Requisite and
Matching Skill(s):**
**Bold the requisite
skill(s). If applicable**

Requisite course: English 1A

**Requisite and
Matching
skill(s):** **Bold the
requisite skill. List
the corresponding
course objective
under each skill(s).**

Students have a higher chance of success if they possess college-level reading and writing skills.

ENGL 1A - Read and apply critical-thinking skills to numerous published articles and to college-level, book-length works for the purpose of writing and discussion.

ENGL 1A - Compose multi-paragraph, thesis-driven essays with logical and appropriate supporting ideas, and with unity and coherence.

Requisite: or qualification by appropriate assessment

**Requisite and
Matching skill(s):**
**Bold the requisite
skill. List the
corresponding
course objective
under each skill(s).**
If applicable

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Compose multi-paragraph, thesis-driven essays with logical and appropriate supporting ideas, and with unity and coherence.

**Enrollment
Limitations and
Category:**

**Enrollment
Limitations Impact:**

Course Created by: Course created by Bruce
Fitizpatrick on

Date: 11/01/1985

**Original Board
Approval Date:**

**Last Reviewed
and/or Revised by:** Shimonee Kadakia

Date: 05/19/2021

**Last Board Approval
Date:** 07/19/2021

Acalog Course OID:

Effective Date: