CENTRAL TEXAS COLLEGE  
PHYS 1404  
SOLAR SYSTEM  

Semester Hours Credit: 4

INSTRUCTOR: ____________________

OFFICE HOURS: ________________

I. INTRODUCTION

A. Study of the sun and its solar system, including its origin.

B. This course may be used as an elective in many programs, and may also fulfill the science requirement for a degree plan in many programs. It is the duty of the student to ascertain whether this course will properly transfer to that student’s targeted university or college.

C. This course is occupationally related and serves as preparation for careers in the field of education for teachers and business majors.

D. Prerequisites: None

II. LEARNING OUTCOMES

Upon successful completion of this course, The Solar System, the student will be able to:

A. Trace the development of astronomy as a science from its earliest beginnings to the present day.

B. Describe the electromagnetic spectrum and explain the purposes of the different types of observing techniques and instruments used in astronomy.

C. Explain the significance of the appearance of astronomical objects seen in the sky, describe celestial positions, and explain the working of time zones and calendars.

D. Recognize major constellations, stars, star groups, and features on the moon and planets when seen in the sky.

E. Describe the arrangement, structure, and compositions of the solar system, including the sun, planets, and non-planetary bodies.

F. Discuss the possibility of life existing elsewhere in the solar system.
III. INSTRUCTIONAL MATERIALS

The instructional materials identified for this course are viewable through www.ctcd.edu/books.

IV. COURSE REQUIREMENTS

A. Reading Assignment:
Specific topics from the textbook will be included in the course outline (Section VIII). Students should read the assigned material for each assigned topic, take notes during the lecture, read the chapter a second time and rewrite notes during this second reading in a way that makes the greatest amount of sense to the student as well as make drawings, if necessary, and critically examine the course material repetitiously multiple days in advance of the exam.

B. Requirements:
Students may want to record the lectures to help master the material. Students will need to provide written answers to end of chapter questions. Students will answer multiple choice questions that are derived from the end of chapter questions. A quiz will be taken at the beginning of class time that will be derived from the aforementioned multiple choice questions. A rule of thumb is to spend 3 hours of study time for every 1 hour of class time.

C. Class Performance:
Students are expected to attend lecture and lab during their scheduled time.
If for any reason a student cannot or decides not to complete the course, then it is the responsibility of the student to withdraw from the course prior to the withdrawal date. The Instructor will not withdraw/drop a student from the course at any time. If a student ceases to attend class and does not withdraw from the course, then an appropriate course grade will be submitted at the end of the semester.

If you must be absent from any class meeting, it is your responsibility to find out what happened in class while you were gone. Make friends with one or more other students in class so that you can ask them what happened and secure any assignments which were given during your absence. Absenteeism is no excuse for not being ready for the current class.

This course, like most science courses, builds on itself. Concepts presented at the beginning of the course will be expanded on and provide the foundation for later material. If you do poorly on any exam, it is important that you go back over the material to be sure that you understand it.
V. EXAMINATIONS

There will be four unit exams given at the times announced. Lowest unit exam score will be dropped. Missed unit exams will not be made up under any circumstances. There will also be a mandatory comprehensive final exam. The final exam cannot be missed – doing so will earn an “F” in the course.

VI. SEMESTER GRADE COMPUTATION

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
<th>Grade Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit exams</td>
<td>40%</td>
<td>90% - 100% = A</td>
</tr>
<tr>
<td>Final exam</td>
<td>10%</td>
<td>80% - 89% = B</td>
</tr>
<tr>
<td>Quizzes</td>
<td>10%</td>
<td>70% - 79% = C</td>
</tr>
<tr>
<td>Home work</td>
<td>10%</td>
<td>60% - 69% = D</td>
</tr>
<tr>
<td>Planetarium &amp; Observations</td>
<td>10%</td>
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<td>Laboratory</td>
<td>20%</td>
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<tr>
<td>Total</td>
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<td></td>
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VII. NOTES AND ADDITIONAL INSTRUCTIONS FROM COURSE INSTRUCTOR

A. Withdrawal from the course: It is the student’s responsibility to officially drop/withdraw from a class if circumstances prevent attendance or if the student decides not to continue with the course and this must be done before the withdrawal date. An instructor cannot initiate a withdrawal based on the student’s request. All students who desire to or must officially withdraw from a course on or after the first scheduled class meeting must file an Application for Withdrawal with the local CTC representative by the last date to withdraw. Students enrolled in distance learning courses and who do not have access to a local CTC representative should submit a withdrawal form to EaglesOnCall@ctcd.edu or the CTC Records Office in Killeen, Texas.

*Applications for Withdrawal will be accepted at any time before the completion of the 12th week of classes for 16-week courses, the sixth week of classes for eight-week courses, or the fourth week of classes for six-week courses.
*For non-GoArmyEd active military students, the effective date of withdrawal is the filing date with the Education Center. For all other students, the effective date of withdrawal is the date that the withdrawal application is received by the Central Texas College representative.

*Students who used financial aid, military tuition assistance, VA benefits, or other non-personal funds may be required to repay tuition and fees to the funding agency. For specific repayment requirements, contact the Office of Student Financial Aid or Veterans Services Office before withdrawing. Military tuition assistance students should visit their military Education Center or Navy College Office.
*Students may not withdraw from a class for which the instructor has previously issued a grade of “F.”
B. **An Administrative Withdrawal:** Administrative Withdrawal: A student may be administratively withdrawn by a designated member of the administrative staff of the College under the following conditions:

- The student has been placed on Academic Suspension or Disciplinary Suspension;
- The student has an outstanding financial obligation owed to the college; or
- The student registered for a course without the required prerequisite or departmental permission.

The college is under no obligation to refund tuition and fees, or other costs associated with a student who is administratively withdrawn.

C. **An Incomplete Grade:** Incomplete, Course in Progress (for non-developmental courses): An “IP” grade may be assigned by an instructor if a student has made satisfactory progress in a course with the exception of a major quiz, final exam, or other project. The “IP” grade may also be assigned for extenuating circumstances beyond a student’s control such as personal illness, death in the immediate family, military orders, or in the case of distance learning courses, institutional technology failures and mail delays. Notice of absences with supporting documentation may be required by the instructor. The instructor makes the final decision concerning the granting of the incomplete grade. The instructor may set a deadline for completing the remaining course requirements. In no case will the deadline exceed 110 days after the scheduled end of the course. An “IP” grade cannot be replaced by the grade of “W.” If a student elects to repeat the course, the student must register, pay full tuition and fees and repeat the entire course. At the end of the 110 calendar days if the student has not completed the remaining coursework as required by the instructor, the “IP” will be converted to an “FI” and appear as an “F” on the student’s official transcript. A student who merely fails to show for the final examination will receive a zero for the final and a “F” for the course.

D. **Cellular Phones:** Cell phones will be turned off while the student is in the classroom or laboratory. Use of a cell phone during an exam or quiz will result in a zero for that work. If a student, in any way, makes a copy of exam questions, homework or quiz questions – then that student will be dropped from the course with an “F”. The number for your family members to call in an emergency is 254-526-1200.

E. **Americans with Disabilities:** Disability Support Services (DSS) provides support services for students who have appropriate documentation of a disability. Students requiring classroom, academic or other accommodations are responsible for contacting DSS located on the central campus, Building 111, Room 207, (254) 526-1291. This service is available to all students, regardless of location. Reasonable accommodations will be given through DSS in accordance with American with Disabilities Act (ADA) and Section 504 Rehabilitation Act. Additional information from DSS is available at [http://www.ctcd.edu/disability-support](http://www.ctcd.edu/disability-support).
F. **Instructor Discretion:** The instructor reserves the right of final decision in course requirements.

G. **Civility:** Individuals are expected to be cognizant of what a constructive educational experience is and respectful of those participating in a learning environment. Failure to do so can result in disciplinary action up to and including expulsion.

H. For complete information consult the College Catalog!

VIII. **COURSE OUTLINE**

A. **Charting the Heavens**

1. **Unit Objectives:** Upon successful completion of this unit, the student will be able to:
   a. Describe how scientists combine observation, theory, and testing in their study of the universe.
   b. Describe the size of the universe.
   c. Explain the concept of the celestial sphere and how we use angular measurement to locate objects in the sky.
   d. Describe how and why the sun and the stars appear to change their positions from night to night and from month to month.
   e. Explain why Earth’s rotation axis shifts slowly with time, and say how this affects Earth’s seasons.
   f. Describe how our clocks and calendars are linked to earth’s rotation and orbit around the Sun.
   g. Describe how the relative motions of Earth, the Sun, and the Moon lead to eclipses.
   h. Explain the simple geometric reasoning that allows astronomers to measure the distances and sizes of otherwise inaccessible objects.

B. **Copernican Revolution**

1. **Unit Objectives:** Upon completion of this unit, the student will be able to:
   a. Describe how some ancient civilizations attempted to explain the heavens in terms of Earth-Centered models of the universe.
   b. Explain how the observed motions of the planets led to our modern view of a Sun-Centered solar system.
   c. Describe the major contributions of Galileo and Kepler to our understanding of the solar system.
   d. State Kepler’s laws of planetary motion.
   e. Explain how astronomers have measured the true size of the solar system.
   f. State Newton’s laws of motion and universal gravitation and
explain how they account for Kepler’s laws.

g. Describe the connection between physics and astronomy; specifically, the Newton’s laws of gravity & motion, Kepler’s laws of orbital motion and Einstein’s laws of relativity.

h. Explain how the law of gravitation enables us to measure the masses of astronomical bodies.

C. Electromagnetic Radiation

1. Unit Objectives: Upon completion of this unit, the student will be able to:
   a. Describe the basic properties of wave motion.
   b. Describe how electromagnetic radiation transfers energy and information through interstellar space.
   c. Describe the major regions of the electromagnetic spectrum and explain how earth’s atmosphere affects our ability to make astronomical observations at different wavelengths.
   d. Explain what is meant by the term “blackbody radiation” and describe the basic properties of such radiation.
   e. Describe how we can determine the temperature of an object by observing the radiation it emits.
   f. Show how the relative motion between a source of radiation and its observer can change the perceived wavelength of the radiation, and explain the importance of this phenomenon to astronomy.

D. Spectroscopy

1. Unit Objectives: Upon completion of this unit, the student will be able to:
   a. Describe the characteristics of continuous, emission, and absorption spectra and the conditions under which each is produced.
   b. Explain the relation between emission and absorption lines and what we can learn from those lines.
   c. Specify the basic components of the atom and describe our modern conception of its structure.
   d. Discuss the observations that led scientists to conclude that light has particle as well as wave properties.
   e. Explain how electron transitions within atoms produce unique emission and absorption features in the spectra of those atoms.
   f. Describe the general features of spectra produced by molecules.
   g. List and explain the kinds of information that can be obtained by analyzing the spectra of astronomical objects.
   h. Explain the significance of the various forms of light and how they are used in astronomy.
E. **Tools of Astronomy**

1. **Unit Objectives**: Upon completion of this unit, the student will be able to:
   a. Sketch and describe the kinds of telescopes, explain their use, and learn how to use them.
   b. Explain the particular advantages of reflecting telescopes for astronomical use, and specify why very large telescopes are needed for most astronomical studies.
   c. Explain the purposes of some of the detectors used in astronomical telescopes.
   d. Describe how Earth’s atmosphere affects astronomical observations, and discuss some of the current efforts to improve ground-based astronomy.
   e. Discuss the advantages and disadvantages of radio astronomy compared with optical observations.
   f. Explain how interferometry can enhance the usefulness of astronomical observations.
   g. Explain why some astronomical observations are best done from space, and discuss the advantages and limitations of space-based astronomy.
   h. Describe why it is important to make astronomical observations in different regions of the electromagnetic spectrum.

F. **Solar System**

1. **Unit Objectives**: Upon completion of this unit, the student will be able to:
   a. Describe the overall scale and structure of the solar system.
   b. Summarize the basic differences between the terrestrial and the Jovian planets.
   c. Identify and describe the major non-planetary components of the solar system.
   d. Describe some of the spacecraft missions that have contributed significantly to our knowledge of the solar system.
   e. Outline the theory of solar system formation that accounts for the overall properties of our planetary system.

G. **Earth**

1. **Unit Objectives**: Upon completion of this unit, the student will be able to:
   a. Summarize the physical properties of planet Earth.
   b. Explain how Earth’s atmosphere helps to heat us, as well as protect us.
   c. Outline our current model of Earth’s interior and describe some of the experimental techniques to establish the model.
   d. Summarize the evidence for the phenomenon of “continental drift”
and discuss the physical processes that drive it.
e. Discuss the nature and origin of Earth’s magnetosphere.
f. Describe how both the Moon and the Sun influence Earth’s surface and affect our planet’s spin.

H. Moon and Mercury

1. Unit Objectives: Upon completion of this unit, the student will be able to:
a. Specify the general characteristics of the Moon and Mercury, and compare them with those of Earth.
b. Describe the surface features of the Moon and Mercury, and recount how those two bodies were formed by events early in their history.
c. Explain how the Moon’s rotation is influenced by its orbit around Earth and Mercury’s by its orbit around the Sun.
d. Explain how observations of cratering can be used to estimate the age of a body’s surface.
e. Describe the evidence for ancient volcanism on the Moon and Mercury.
f. Compare the Moon’s interior structure with that of Mercury.
g. Summarize the leading theory of the formation of the Moon.
h. Discuss how astronomers have pieced together the story of the Moon’s evolution, and compare its evolutionary history with that of Mercury.

I. Venus

1. Unit Objectives: Upon successful completion of this unit, the student will be able to:
a. Summarize Venus’s general orbital and physical properties.
b. Describe the characteristics of Venus’s atmosphere and contrast it with that of Earth.
c. Compare the large-scale surface features and geology of Venus with those of Earth and the Moon.
d. Discuss the evidence for ongoing volcanic activity on Venus.
e. Explain why the greenhouse effect has produced conditions on Venus very different from those on Earth.
f. Describe Venus’s magnetic field and internal surfaces.

J. Mars

1. Unit Objectives: Upon successful completion of this unit, the student will be able to:
a. Summarize the general orbital and physical properties of Mars.
b. Describe the observational evidence for seasonal changes on Mars.
c. Compare the surface features and geology of Mars with those of the Moon and Earth, and account for these characteristics in terms of Martian history.
d. Discuss the evidence that Mars once had a much denser atmosphere and running water on its surface.
e. Explain where that ancient water on Mars may be found today.
f. Compare the atmosphere of Mars with those of Earth and Venus, and explain why the evolutionary histories of these three worlds diverged so sharply.
g. Discuss what is known of the internal structure of Mars.
h. Describe the characteristics of the Martian moons, and explain their probable origin.

K. Jupiter

1. Unit Objectives: Upon successful completion of this unit, the student will be able to:
   a. Specify the ways in which Jupiter differs from the terrestrial planets in its physical and orbital properties.
   b. Discuss the processes responsible for the appearance of Jupiter’s atmosphere.
   c. Describe Jupiter’s internal structure and composition, and explain how their properties are inferred from external measurements.
   d. Summarize the characteristics of Jupiter’s magnetosphere.
   e. Discuss the orbital properties of the Galilean moons of Jupiter, and describe the appearance and physical properties of each moon.
   f. Explain how tidal forces can produce enormous internal stresses in a Jovian moon, and discuss some effects of those stresses.

L. Saturn

1. Unit Objectives: Upon successful completion of this unit, the student will be able to:
   a. Summarize the orbital and physical properties of Saturn, and compare them with those of Jupiter.
   b. Describe the composition and structure of Saturn’s atmosphere and interior.
   c. Explain why Saturn’s internal heat source and magnetosphere differ from those of Jupiter.
   d. Describe the structure and composition of Saturn’s rings.
   e. Define the Roche limit, and explain its relevance to the origin of Saturn’s rings.
   f. Summarize the general characteristics of Titan, and discuss the chemical processes in its atmosphere.
g. Discuss some of the orbital and geological properties of Saturn’s smaller moons.

M. **Uranus and Neptune**

1. **Unit Objectives:** Upon successful completion of this unit, the student will be able to:
   a. Describe how both chance and calculation played major roles in the discoveries of the outer planets.
   b. Summarize the similarities and differences between Uranus and Neptune, and compare these planets with the other two Jovian worlds.
   c. Describe what is known about the interiors of Uranus and Neptune.
   d. Explain what the moons of the outer planets tell us about their past.
   e. Contrast the rings of Uranus and Neptune with those of Jupiter and Saturn.

N. **Solar System Debris**

1. **Unit Objectives:** Upon successful completion of this unit, the student will be able to:
   a. Describe the orbital properties of the major group of asteroids.
   b. Summarize the composition and physical properties of a typical asteroid.
   c. Detail the composition and structure of a typical comet, and explain the formation and appearance of its tail.
   d. Discuss the characteristics of cometary orbits and what they tell us about the probable origin of comets.
   e. Describe the composition of the solar system beyond Neptune, and explain why astronomers no longer regard Pluto as a planet.
   f. Distinguish among the terms *meteor*, *meteoroid*, and *meteorite*.
   g. Summarize the orbital and physical properties of meteoroids, and explain what these properties suggest about the probable origin of meteoroids.

O. **The Formation of Planetary System**

1. **Unit Objectives:** Upon successful completion of this unit, the student will be able to:
   a. List the major facts that any theory of solar system formation must explain and indicate how the leading theory accounts for them.
   b. Explain how the terrestrial planets formed.
   c. Describe why planetary densities depend on distance from the Sun.
   d. Discuss the leading theories for the formation of the Jovian worlds.
   e. Describe how comets and asteroids formed, and explain their role
in determining planetary properties.

f. Outline the properties of known extrasolar planets.

g. Discuss how extrasolar planets fit in with current theories of solar system formation.

P. The Sun

1. Unit Objectives: Upon successful completion of this unit, the student will be able to:

a. Summarize the overall properties and internal structure of the Sun.

b. Describe the concept of luminosity, and explain how it is measured.

c. Explain how studies of the solar surface tell us about the Sun’s interior.

d. List and describe the outer layers of the Sun.

e. Discuss the nature and variability of the Sun’s magnetic field.

f. Describe the various types of solar activity and their relation to solar magnetism.

g. Outline the process by which energy is produced in the Sun’s interior.

h. Explain how observations of the Sun’s core changed our understanding of fundamental physics.

Q. Life in the Universe

1. Unit Objectives: Upon successful completion of this unit, the student will be able to:

a. Summarize the process of cosmic evolution as it is currently understood.

b. Evaluate the chances of finding life elsewhere in the solar system.

c. Summarize the various probabilities used to estimate the number of advanced civilizations that might exist in the Galaxy.

d. Discuss some of the techniques we might use to search for extraterrestrials and to communicate with them.