American Public University System
American Military University | American Public University

SPST440

Course Summary

Course : SPST440 **Title :** Stars and Galaxies **Length of Course :** 8 **Faculty :**
Prerequisites : N/A **Credit Hours :** 3

Description

Course Description:

This course is designed to familiarize students with celestial objects found beyond the Solar System. Students learn about the origin and evolution of stars and galaxies. Topics covered in the course include main sequence stars, red giants, white dwarfs, neutron stars, and black holes. Galaxy classification is also considered. Students have the opportunity to use the new APUS remote observatory for celestial observations.

Course Scope:

This course focuses on the study and characterization of stars and galaxies, as well as the evolution and structure of the universe. The student will not only study these objects and topics but will research and discuss the history, methods and challenges of determining the structures and characteristics.

The student will participate in discussions, complete homework assignments, and take quizzes and exams to demonstrate knowledge gained in the subject areas.

Objectives

After successful completion of SPST440, students will be able to:

CO1: Describe luminosity, apparent brightness, and the methods used to determine the distances to stars and galaxies.

CO2: Describe how astronomers use the Hertzsprung-Russell (H-R) diagram to classify stars and summarize their evolution.

CO3: Apply the information available about material in the universe to describe the interstellar medium and describe the process of star and solar system formation.

CO4: Describe the evolution of stars from birth through old age and death.

CO5: Apply the principles of General Relativity to observations of the universe.
CO6: Analyze the structure of the Milky Way galaxy as well as other galaxies in the universe.
CO7: Describe the evolution and distribution of galaxies and the structure of active galaxies, quasars and supermassive black holes.
CO8: Analyze the theory and consequences of The Big Bang.

Outline

Week 1: introduction

Learning Outcomes

LO-1: Explain the difference between luminosity and apparent brightness
LO-2 Understand how astronomers use color indexes and spectral classes to characterize stars
LO-3: Understand how astronomers can learn about a star's radius and composition by studying its spectrum

Required Readings

Astronomy eBook Chapter 17

Assignments

Personal Introduction Discussion Post
Discussion Post #1
Homework #1
Week 1 Quiz

Week 2:

Learning Outcomes
LO1: Understand how we can apply Newton's version of Kepler's third law to derive the sum of star masses in a binary star system
LO2: Apply the relationship between stellar mass and stellar luminosity to determine the physical characteristics of a star
LO3: Describe how astronomers use the H-R diagram to classify stars and summarize their evolution

Required Readings
Astronomy eBook Chapters 18 and 19

Assignments

Discussion Post #2
Homework #2
Week 2 Quiz

Week 3:

Learning Outcomes
LO1: Describe the major types of interstellar material and discuss how we can observe each type
LO2: Define cosmic rays and describe their composition
LO3: Identify the processes by which parts of a molecular cloud collapse to produce stars

Required Readings
Astronomy eBook Chapters 20 and 21

Assignments
Discussion Post #3
Homework #3
Week 3 Quiz

Week 4:

Learning Outcomes
LO1: Describe what happens to main-sequence stars of various masses as they exhaust their hydrogen supply
LO2: List the different types of star clusters and describe how they differ in number of stars, structure, and age
LO3: Explain what happens in a star's core when all the hydrogen has been used up
LO4: Discuss the creation of new chemical elements during the late stages of stellar evolution
LO5: Explain the steps of a core collapse and explosion

Required Readings
Astronomy eBook Chapters 22 and 23

Assignments
Discussion Post #4
Homework #4
Week 4 Quiz

Week 5:

Learning Outcomes

LO1: Discuss some of the key ideas of the theory of general relativity
LO2: Distinguish between Newtonian ideas of gravity and Einsteinian ideas of gravity
LO3: Describe unusual motion of Mercury around the Sun and explain how general relativity explains the observed behavior
LO4: Provide examples of evidence for light rays being bent by massive objects, as predicted by general relativity's theory about the warping of spacetime
LO5: Explain the event horizon surrounding a black hole
LO6: Use the concept of warped spacetime near a black hole to track what happens to any object that might fall into a black hole
LO7: Describe what a gravitational wave is, what can produce it, and how fast it propagates
LO8: Understand the basic mechanisms used to detect gravitational waves

Required Readings
Astronomy eBook Chapter 24

Assignments
Discussion Post #5
Homework #5
Midterm Exam

Week 6:

Learning Outcomes
LO1: Explain why William and Caroline Herschel concluded that the Milky Way has a flattened structure centered on the Sun and solar system
LO2: Describe the challenges of determining the Galaxy's structure from our vantage point within it
LO3: Describe the structure of the Milky Way Galaxy and how astronomers discovered it
LO4: Explain what has been revealed by high-resolution near-infrared imaging of the galactic center and discuss how these near-infrared images, when combined with Kepler's third law of motion, can be used to derive the mass of the central gravitating object
LO5: Distinguish between population I and population II stars according to their locations, motions, heavy element abundances, and ages
LO6: Describe the discoveries that confirmed the existence of galaxies that lie far beyond the Milky Way Galaxy
LO7: Describe the properties and features of elliptical, spiral, and irregular galaxies
LO8: Describe the use of variable stars to estimate distances to galaxies
LO9: Describe models for the nature of an expanding universe

Required Readings
Astronomy eBook Chapters 25 and 26

Assignments
Discussion Post #6
Homework #6

Week 6 Quiz

Week 7:

Learning Outcomes
LO1: Describe how quasars were discovered
LO2: Describe the characteristics of quasars
LO3: Describe how astronomers study distant galaxies
LO4: Explain the cosmological principle and summarize the evidence that it applies on the largest scales of the known universe
LO5: Describe the largest structures seen in the universe, including voids, groups, clusters, and superclusters of galaxies
LO6: Explain how astronomers know that the solar system contains very little dark matter
LO7: Summarize the evidence for dark matter in most galaxies
LO8: Explain how we know that galaxy clusters are dominated by dark matter

Required Readings
Astronomy eBook Chapters 27 and 28

Assignments
Discussion Post #7
Homework #7
Week 7 Quiz

Week 8:

Learning Outcomes
LO1: Describe how we estimate the age of the universe
LO2: Explain why astronomers think dark energy exists
LO3: Describe what the universe was like during the first few minutes after it began to expand
LO4: Explain how the first new elements were formed during the first few minutes after the Big Bang
LO5: Explain why we can observe the afterglow of the hot, early universe

Required Readings
Astronomy eBook Chapter 29

Assignments
Discussion Post #8
Homework #8
Final Exam

Evaluation

Grading:

Name	Grade %
Discussions	39.6 %
Week 1: Stellar Brightness & Magnitude	4.95%
Week 2: Choose a topic	4.95%
Week 3: Choose a topic	4.95%
Week 4: Choose a topic	4.95%
Week 5: Choose a topic	4.95%
Week 6: Choose a topic	4.95%
Week 7: Choose a topic	4.95%
Week 8: Course Wrap Up & Choose a Topic	4.95%
Homework	39.6 %
Homework #1	4.95%
Homework #2	4.95%
Homework #3	4.95%
Homework #4	4.95%
Homework #5	4.95%
Homework #6	4.95%
Homework #7	4.95%
Homework #8	4.95%
Quizzes	12.3 %
Exams	8.5 %

Midterm	5%
Final Exam	3.5%

Materials

Book Title: Astronomy - e-book available online, links provided in the classroom Content section **Author:** OpenStax

Publication Info: OpenStax

ISBN: 9781938168284

Book Title: Stars and Stellar Evolution - e-book available in the APUS Online Library **Author:** DeBoer, Klaas

Publication Info: EDP Sciences

ISBN: 9782759803569

Course Guidelines

Writing Expectations

All written submissions should be submitted in a font and page set-up that is readable and neat. It is recommend students try to adhere to a consistent format consistent with the APA Style Guide.

- Typewritten in double-spaced format submitted inside the electronic classroom (unless classroom access is not possible and other arrangements have been approved by the professor).
- 12-point font.
- Page margins Top, Bottom, Left Side and Right Side = 1 inch, with reasonable accommodation being made for special situations and online submission variances.

Citation and Reference Style

Attention Please: Assignments completed in a narrative essay or composition format must follow APA Style Guide.

Late Assignments

The University encourages all work to be completed according to the course schedule. The University Late Work Policy can be found in the Student Handbook here.

Netiquette

Online universities promote the advancement of knowledge through positive and constructive debate – both inside and outside the classroom. Discussions on the Internet, however, can occasionally degenerate into needless insults and "flaming." Such activity and the loss of good manners are not acceptable in a university setting – basic academic rules of good behavior and proper "Netiquette" must persist. Remember that you are in a place for the rewards and excitement of learning which does not include descent to personal attacks or student attempts to stifle the Discussion of others.

- **Humor Note:** Despite the best of intentions, jokes and especially satire can easily get lost or taken seriously. If you feel the need for humor, you may wish to add "emoticons" to help alert your readers: ;-), :), J

Disclaimer Statement

Course content may vary from the outline to meet the needs of this particular group.

University Policies

Student Handbook

- Drop/Withdrawal policy
- Extension Requests
- Academic Probation
- Appeals
- Disability Accommodations

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