American Public University System

The Ultimate Advantage is an Educated Mind

School of Science, Technology, Engineering & Math
Course Number: SPST427
Course Name: Space Resources
Credit Hours: 3
Length of Course: 8 weeks
Prerequisite: None

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Instructor & Office Hours: See link in classroom too!

Course Description

This class introduces students to the fundamentals of space and planetary resources, including lunar and asteroid mining, solar power in space, and Martian resources. It will provide an understanding of the cost / value of such resources and how they can be gathered. It will also explore policy and laws relating to resources in space and how these apply to mining and ownership. Students will explore the current technologies that may be used for mining space resources, their limitations, and what innovations are needed to improve the process. The class will also examine the viability of mining and transporting space resources and how such a venture can be economically feasible.

Course Scope

This course is intended for students in space studies who are enrolled within the Space Entrepreneurship concentration. The course will begin by defining what we mean by "space resources" and exploring why they are of interest. It will focus on the different resources that are known to be present on objects such as the Moon, asteroids, and Mars. The course will examine the types and estimated quantities of resources in each of these objects and consider the unique challenges resource extraction poses in each environment. The course will describe the current technologies that may be used for mining space resources and analyze the adjustments needed to effectively use each in space. It will discuss space policies and laws that are applicable to the extraction and use of space resources. It will also examine the environmental challenges of mining in the harshness of space. Finally, the class will consider the viability of space mining prospects from an economic standpoint and describe how transport can be effectively achieved.

Course Objectives

Upon successful completion of this course students will be able to:

CO1. Explain why space resources are vital to human occupation of space.

CO2. Describe the off-world mining.

CO3. Summarize various ways of processing space resources.

CO4. Understand the basic distribution of resources on the Moon, Mars, and asteroids.

CO5. Use the components of space entrepreneurship to design and finance a space mining project.

CO6. Apply mining techniques to harvest resources to build a lunar or Martian city.

CO7. Analyze policies and legislation relating to the mining and use of space resources.

CO8. Describe the economics of space mining and the logistics relating to transport of space resources.

CO9: Understand the components of a project plan and how a project plan supports successful space endeavors.

CO10: Create a viable project plan for mining space resources.

Course Delivery Method

This course delivered via distance learning will enable students to complete academic work in a flexible manner, completely online. Course materials and access to an online learning management system will be made available to each student. Online assignments are due by Sunday evening of the week as noted and include Forum questions (accomplished in groups through a threaded forum), examination, and individual assignments submitted for review by the Faculty Member). Assigned faculty will support the students throughout this eight-week course.

Course Resources

Space Mining and Manufacturing: Off-World Resources and Revolutionary Engineering Techniques (Springer Praxis Books) 1st ed. 2019 Edition

Evaluation Procedures

Assignments:
There are 2 assignments in this class; combined they equal 4% of your final grade. In the first assignment, you will describe the components of a project plan in preparation for beginning your own project plan. In the second assignment, you will submit a topic sentence, outline, and preliminary reference list for your research paper. The topic sentence should be specific and should direct the organization of the paper. The outline should be detailed, with at least 3 levels of organization (I. A. 1.). Each point should be a complete sentence or phrase (not a single word). The references should be in APA format.

Team Project:
The signature assignment for this class is a group project in which you will complete a formal project plan and a powerpoint presentation highlighting the important components of the plan. The project plan and presentation are worth 45% of your grade.

Forum Assignments:
There will be 13 total forums in this class. There will be an introductory forum, plus 7 weekly forums (one per week after the first week of class). There will also be 5 group forums in which you will collaborate with your group members as you work to create your project and presentation. Participation in the group forums is mandatory and graded. Lack of timely and substantial participation in the group forums will result in a penalty on your team project submission. Combined the forums count for 16% of your grade.

Exams:
There will be two exams in the class: a midterm exam and a final exam. Both will be based on the information in the text and readings. These will be open book, short answer exams. The final exam will be cumulative. Combined the exams count for 25% of your grade.

Research Paper:
There will be one research paper in this class. It will be on a topic of your choosing relating to Space Resources. The paper should be roughly 8 pages of text (not including title page, abstract, references, etc… The paper should include references from peer-reviewed journals

(not just news sources); all references should be cited in APA format. This assignment counts as 10% of your grade.

Late Work:
In general, late work is not accepted. Please work hard to ensure that you are present and stay up to date with the class assignments, especially the group project.

Assignments	% of Course Grade
Introduction Forum	1%
Forum Assignments (12)	15%
Project Plan	30%
Project Presentation	15%
Assignments	4%
Research Paper	10%
Midterm Exam	10%
Final Exam	15%
Total Course Points	100%

Please see the Student Handbook to reference the University's grading scale.

8 – Week Course Outline and Grading

The table below shows the points for each assignment.

Week	Topic	Readings	Assignment
1	**What are Space Resources**	**Text Reading:** *Chapter 1: Space Exploration: What for?*	Introductions Forum Post Assignment 1: What is a project plan?
2	**Space Resources on the**	**Text Reading:** *Chapter 2: Extraterrestrial Resources and Where to Find Them*	Week 2 Forum Group Forum: Location, Resource, Role

	Moon/Small Bodies		Assignment 2: Research paper topic sentence and outline
3	**Space Resources on Mars**	**Text Reading:** *Readings listed in lesson*	Week 3 Forum Research Paper due
4	**Off-World Mining**	**Text Reading:** *Chapter 3: Off-World Mining*	Week 4 Forum Group Forum: project plan Midterm Exam
5	**Resource Processing and Environmental Challenges**	**Text Reading:** *Chapter 4: Processing of Space Resources Chapter 5: The Art of Manufacturing in Space*	Week 5 forum Group Forum: presentation slides
6	**Transport/Factories in Space**	**Text Reading:** *Chapter 6: Building Factories in Space Chapter 7: sections 1-5: Making it Happen*	Week 6 forum Group forum: Finishing Touches
7	**Space Laws to Consider**	**Text Reading:** *Chapter 7: sections 6-8: Making it Happen*	Week 7 Forum Project Plan due Project presentation due Group evaluations due
8	**Economic Viability**	**Text Reading:** *Chapter 8: For the Benefit of Humankind*	Week 8 Forum Final Exam

Please see the Student Handbook to reference the University's grading scale.

Policies

Please see the Student Handbook to reference all University policies. Quick links to frequently asked question about policies are listed below.

> Drop/Withdrawal Policy
> Plagiarism Policy
> Extension Process and Policy
> Disability Accommodations

Writing Expectations
All written submissions should be submitted in a font and page set-up that is readable and neat. It is recommended that students try to adhere to a consistent format, such as that described below.
- Typewritten in double-spaced format with a readable style and font and submitted inside the electronic classroom (unless classroom access is not possible and other arrangements have been approved by the professor).
- 11 or 12-point font in a style such as Arial, Helvetica or Times New Roman.

Citation and Reference Style
Assignments completed in a narrative essay or composition format must follow a widely accepted citation style, such as APA, Turabian or MLA. Please refer to the APUS Online Library for further examples, or contact the instructor with questions.

Late Assignments
Students are expected to submit classroom assignments by the posted due date and to complete the course according to the published class schedule. As adults, students, and working professionals, I understand you must manage competing demands on your time. Should you need additional time to complete an assignment, please contact me **before the due date** so we can discuss the situation and determine an acceptable resolution. Routine submission of late assignments is unacceptable and may result in points deducted from your final course grade.

Netiquette
Online universities promote the advancement of knowledge through positive and constructive debate – both inside and outside the classroom. Forums 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 Forum of others.

- **Technology Limitations:** While you should feel free to explore the full-range of creative composition in your formal papers, keep e-mail layouts simple. The Sakai classroom may not fully support MIME or HTML encoded messages, which means that bold face,

italics, underlining, and a variety of color-coding or other visual effects will not translate in your e-mail messages.

- **Humor Note:** Despite the best of intentions, jokes and <u>especially</u> 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: ;-), :), ☐

<u>Disclaimer Statement</u>
Course content may vary from the outline to meet the needs of this particular group.

Online Library

The Online Library is available to enrolled students and faculty from inside the electronic campus. This is your starting point for access to online books, subscription periodicals, and Web resources that are designed to support your classes and generally not available through search engines on the open Web. In addition, the Online Library provides access to special learning resources, which the University has contracted to assist with your studies. Questions can be directed to **librarian@apus.edu**.

- **Charles Town Library and Inter Library Loan:** The University maintains a special library with a limited number of supporting volumes, collection of our professors' publication, and services to search and borrow research books and articles from other libraries.
- **Electronic Books:** You can use the online library to uncover and download over 50,000 titles, which have been scanned and made available in electronic format.
- **Electronic Journals:** The University provides access to over 12,000 journals, which are available in electronic form and only through limited subscription services.
- **Tutor.com**: AMU and APU Civilian & Coast Guard students are eligible for 10 free hours of tutoring provided by APUS. Tutor.com connects you with a professional tutor online 24/7 to provide help with assignments, studying, test prep, resume writing, and more. Tutor.com is tutoring the way it was meant to be. You get expert tutoring whenever you need help, and you work one-to-one with your tutor in your online classroom on your specific problem until it is done.

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