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American Public University System

The Ultimate Advantage is an Educated Mind

School of Science, Technology, Engineering & Math

Course Number: SPST 652

Course Name: Geology of the Moon and Mars

Credit Hours: 3 Length of Course: 8 weeks

Prerequisite: SPST650 and SPST651

Course Description

This course examines the processes which have shaped, and continue to shape, both the surfaces and interiors of the Moon and Mars, such as impact cratering, volcanism, and tectonics. A detailed review of past and current manned/unmanned geological exploration of each body will also be addressed. Critical aspects of the Lunar and Martian geology and environments relevant to human exploration and possible future settlements will be emphasized.

As NASA and its commercial partners, as well as space agencies in other countries, prepare to return to the Moon and then push forward to Mars, a solid understanding of the environments of each of these worlds is critical. This course aims to give you an in depth look at the geology of each object.

Course Scope

This course is intended for students in the Astronomy and Earth Studies concentration of the Space Studies Master's program. The course will begin by considering the formation and development of the Moon. It will analyze both the surface and interior processes that have shaped the lunar surface, including cratering, volcanism, and tectonic activity. The lunar modules of the course will rely heavily on the knowledge gained through the Apollo missions and the lunar orbiters of the varied lunar terrains.

The second half of the course will study the Martian surface. It will explore the water features on Mars, including outflow channels, gullies, and canyons. It will also describe the role of volcanism on Mars. The course will compare Mars' past conditions and how they have shaped the features we see on Mars today. It will analyze the Martian atmosphere, including wind features as well as the polar ice caps. The course will present data from both the Martian rovers and surveyors.

In this course, students will have the opportunity to analyze data from both the lunar and Martian surfaces, as well as Martian weather data. Students will also learn to compose detailed laboratory reports based on data and observations.

Course Objectives

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

- 1: Describe current theories of the origin of the Moon and the past history of Mars. (CO-1)
- 2: Analyze the key findings from robotic exploration of the surface of the Moon and Mars. (CO2)
- 3: Explain the effects of impact cratering, volcanism, and tectonic activity on the surface of the Moon and Mars. (CO-3)
- 4: Describe the geology of the interior structure of both the Moon and Mars. (CO-4)
- 5: Explore the process of cratering counts to determine surface ages and properties. (CO-5) 6: Discuss the details and geologic contributions of the Apollo missions as well as the goals of the Artemis mission. (CO-6)
- 7: Examine the evolution and characteristics of the Martian atmosphere. (CO-7) 8: Develop an understanding of why the exploration of the Moon and Mars is important to humanity as a space-faring civilization. (CO-8)

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

Geologic History of the Moon

Don. E. Wilhelms

The Surface of Mars

Michael H. Carr

<https://ebookcentral.proquest.com/lib/apus/detail.action?docID=288500>

Evaluation Procedures and Grading

Reading Assignments: Weekly reading assignments are notes in the lessons. Make sure you complete the readings before accomplishing any other assignment.

Introduction Forum Assignment: In week 1, you are required to post in the introductions forum, and the post must be at least 250 words to meet the APUS-wide requirement. Details about this posting are in the description at the top of that forum.

Forum Assignments: You have seven forum assignments in the course (other than the Introduction Forum). You are required to post your own response to the prompt and to respond to at least two of your classmates. Your main post should represent thorough research on, and understanding of, the topics, and your responses must be substantive (not merely saying “Good post”). The forum assignments combined are worth 10% of your course grade. Main posts are due on Wednesday at midnight Eastern time. Responses are due by Sunday at midnight Eastern time.

Laboratory assignment: There are two laboratory projects in the class, which combined account for 30% of your grade. These are designed to help you deepen your understanding of the concepts in the class, and also give you experience working with real astronomical data. Each laboratory submission should include a formal writeup that presents your data in a professional, scientific manner. The website below provides an excellent overview of what a complete laboratory report should contain:

<https://libguides.lmu.edu/c.php?g=324079&p=2174135>

1. Lab 1: Use the GEAS lab software to practice the technique of crater counts in characterizing different lunar terrain. Present your results in a scientific laboratory report.
2. Lab 2: Use the GEAS lab software to apply the crater counting technique to images of the Martian terrain. Present your results in a scientific laboratory report.

You have multiple weeks to work on each lab because they require quite a bit of time to complete. **Budget your time wisely and do not wait until the week they are due to begin.** Your lab work and lab report should reflect multiple weeks of effort.

Research Papers: There will be two short research papers in the class, which combined account for 20% of your grade. These papers provide an opportunity for you to develop a deeper understanding of the topics covered in the class as well as the chance to develop writing and research skills. The papers should be written in APA format and should reflect a formal, scientific report style. The use of first/second person in the papers is inappropriate, as is “flowery” writing. The papers should be well researched, but should reflect your own understanding of the material; the overuse of quotes will be penalized. Sources from the paper should be reliable; the use of Wikipedia or similar sites is not allowed. Some science news sites may be used, but the bulk of the references should come from scientific (peer reviewed) research papers. The APUS library is a great resource for finding appropriate works as well as receiving help with punctuation/grammar/etc (see [Writing@APUS](#)).

1. **Paper 1:** Write a 5-page paper comparing the Apollo and Artemis missions.
2. **Paper 2:** Write a 5-page paper describing in depth a specific Martian Surface Feature.

You also have more than one week to work on each paper. **Use this time to ensure that your paper is carefully proofread and well researched.** The research, writing, and analysis in the papers should reflect multiple weeks of work.

Exam: There will be a midterm and a final exam in this class; each is worth 20% of your course grade. You may use the textbooks on the exams, but you may not receive help from another person during the exam or any other resources except your own notes. This is on the honor system, and you are expected to act accordingly. The midterm exam will focus on lunar surface features; the final will focus on Martian surface features. There is no time limit, and the exams do not have to be completed in one sitting.

Late Work: Late work will not be accepted without prior approval by the professor. Late work, if approved, must be submitted no more than one week beyond the original due date. The table below shows the points for each assignment.

| Assignments | % of Course Grade |
|----------------------------|-------------------|
| Forum Assignments (8) | 10% |
| Labs (2) | 30% |
| Research Papers (2) | 20% |
| Midterm Exam | 20% |
| Final Exam | 20% |
| Total Course Points | 100% |

Please see the [Student Handbook](#) to reference the University's [grading scale](#).

8 – Week Course Outline

Please see the table below for the weekly readings and assignments.

| <u>Week</u> | <u>Topic</u> | <u>Readings</u> | <u>Assignment</u> |
|-------------|--------------|-----------------|-------------------|
|-------------|--------------|-----------------|-------------------|

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|----------|--------------------------------------|--|---|
| 1 | Lunar Surface & Regolith | Text Reading: <i>Once and Future Moon, Chapter 2 & 3</i> <i>Geologic History of the Moon, Chapter 1 & 2</i> | Introductions Forum Post |
| 2 | Lunar Volcanism and Tectonics | Text Reading: <i>Once and Future Moon, Chapter 5</i> <i>Geologic History of the Moon, Chapter 5 & 6</i> | Week 2 Forum Paper 1: Comparison of Apollo & Artemis |
| 3 | Lunar Highlands | Text Reading: | Week 3 Forum |
| | | <i>Once and Future Moon, Chapter 6</i> <i>Geologic History of the Moon, Chapter 3, 4, & 7</i> | Lab 1: Cratering and the Lunar Surface |
| 4 | Volcanism on Mars | Text Reading: <i>The Surface of Mars, Chapter 3 & 4</i> | Week 4 Forum Midterm Exam |
| 5 | Canyons, Valleys, and Gullies | Text Reading: <i>The Surface of Mars, Chapter 5 & 6</i> | Week 5 forum |

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|----------|--|--|--|
| 6 | Oceans & Ice | Text Reading: <i>The Surface of Mars,</i> <i>Chapter 7 & 8</i> | Week 6 forum Paper 2: Martian Surface |
| 7 | Winds and the Polar Environment | Text Reading: <i>The Surface of Mars,</i> <i>Chapter 9 & 10</i> | Week 7 Forum Lab 2: The Martian Surface |
| 8 | Mars: A Global View | Text Reading: <i>The Surface of Mars,</i> <i>Chapter 11, 12, & 13</i> | Week 8 Forum Final Exam |

Course Guidelines

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 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: ;-), :), ☐

Disclaimer Statement

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.

Communications

Student Communication

To reach the instructor, please communicate through the MyClassroom email function accessible from the Classlist of the Course Tools menu, where the instructor and students email addresses are listed, or via the Office 365 tool on the Course homepage.

- In emails to instructors, it's important to note the specific course in which you are enrolled. The name of the course is at the top center of all pages.
- Students and instructors communicate in Discussion posts and other learning activities.
- All interactions should follow APUS guidelines, as noted in the [Student Handbook](#), and maintain a professional, courteous tone.
- Students should review writing for spelling and grammar.
- [Tips on Using the Office 365 Email Tool](#)

Instructor Communication

The instructor will post announcements on communications preferences involving email and Instant Messaging and any changes in the class schedule or activities.

- Instructors will periodically post information on the expectations of students and will provide feedback on assignments, Discussion posts, quizzes, and exams.
- Instructors will generally acknowledge student communications within 24 hours and respond within 48 hours, except in unusual circumstances (e.g., illness).
- The APUS standard for grading of all assessments (assignments, Discussions, quizzes, exams) is five days or fewer from the due date.
- Final course grades are submitted by faculty no later than seven days after the end date of the course or the end of the extension period.

University Policies

Consult the [Student Handbook](#) for processes and policies at APUS. Notable policies:

- [Drop/Withdrawal Policy](#)
- [Extension Requests](#)
- [Academic Probation](#)
- [Appeals](#)
- [Academic Dishonesty / Plagiarism](#)
- [Disability Accommodations](#)
- [Student Deadlines](#)
- [Video Conference Policy](#)

Mission

The [mission of American Public University System](#) is to provide high quality higher education with emphasis on educating the nation's military and public service communities by offering

respected, relevant, accessible, affordable, and student-focused online programs that prepare students for service and leadership in a diverse, global society.

Minimum Technology Requirements

- Please consult the catalog for the minimum hardware and software required for [undergraduate](#) and [graduate](#) courses.
- Although students are encouraged to use the [Pulse mobile app](#) with any course, please note that not all course work can be completed via a mobile device.