Term Information

Effective Term	Spring 2021
Previous Value	*Summer 2012*

Course Change Information

What change is being proposed? (If more than one, what changes are being proposed?)

To offer the course as DL

What is the rationale for the proposed change(s)?

To expand learning opportunities for GE students.

What are the programmatic implications of the proposed change(s)?

(e.g. program requirements to be added or removed, changes to be made in available resources, effect on other programs that use the course)?

None.

Is approval of the requrest contingent upon the approval of other course or curricular program request? No

Is this a request to withdraw the course? No

General Information

Course Bulletin Listing/Subject Area	Earth Sciences
Fiscal Unit/Academic Org	School of Earth Sciences - D0656
College/Academic Group	Arts and Sciences
Level/Career	Undergraduate
Course Number/Catalog	2205
Course Title	The Planets
Transcript Abbreviation	Planets
Course Description	Survey of the solar system's planets and moons with focus on surface environments, dynamics, and the ability to host life.
Semester Credit Hours/Units	Fixed: 3

Offering Information

Length Of Course	14 Week, 12 Week, 8 Week, 7 Week, 6 Week
Flexibly Scheduled Course	Sometimes
Does any section of this course have a distance education component?	Yes
Is any section of the course offered	100% at a distance
Previous Value	*No*
Grading Basis	Letter Grade
Repeatable	No
Course Components	Lecture
Grade Roster Component	Lecture
Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Never
Campus of Offering	Columbus, Lima, Mansfield, Marion, Newark

Prerequisites and Exclusions

Prerequisites/Corequisites	
Exclusions	
Previous Value	Not open to students with credit for EarthSci 205 or GeolSci 205.
Electronically Enforced	No

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code	40.0699
Subsidy Level	Baccalaureate Course
Intended Rank	Freshman, Sophomore, Junior, Senior

Requirement/Elective Designation

General Education course:

Physical Science

The course is an elective (for this or other units) or is a service course for other units

Course Details

Course goals or learning objectives/outcomes

- students will

  • develop an intuition for the vast spatial and temporal scales in our Universe and how to make order-of-magnitude-estimates (or educated guesses) of quantities that are hard to know or remember precisely,

- • revisit basic physics concepts related to motion, energy, and gravity; and how light and matter interact, which allows us to learn a tremendous amount of information from light,
- • use those concepts to understand planetary geology and atmospheres,
- visit each planet in the solar system, as well as many moons, asteroids, and comets, and learn how they are similar or different in terms of their interiors, surfaces, and atmospheres, including some that may well harbor conditions for life
- • be provided with an up-to-date overview of the evermore daring exploration of our solar system by space crafts.

Previous Value

Content Topic List

- Solar system formation
- Age of the Earth and solar system
- Light and matter
- Heat and energy
- Gravity
- Plate tectonics
- Conditions for life in the solar system
- Solar system exploration
- Meteorite impacts
- Volcanoes and earthquakes on Earth and beyond
- Water on Earth and beyond

Sought Concurrence

No

Attachments

- Planets Assessment Plan.docx: GE Assessment plan

  (GEC Course Assessment Plan. Owner: Panero,Wendy R)
- EarthSC 2205 Moortgat.pdf: ASCTech approval

  (Other Supporting Documentation. Owner: Panero,Wendy R)
- syllabus_2205_2018.pdf: P Syllabus

  (Syllabus. Owner: Panero,Wendy R)
- ES2205_online_syllabus-1.pdf: DL Syllabus

  (Syllabus. Owner: Panero,Wendy R)

Comments

- Revised online syllabus to include requested details. *(by Panero,Wendy R on 04/28/2020 01:40 PM)*
- Sent back to address feedback of NMS Panel. *(by Vankeerbergen,Bernadette Chantal on 04/28/2020 01:34 PM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Panero,Wendy R	04/13/2020 01:54 PM	Submitted for Approval
Approved	Panero,Wendy R	04/13/2020 01:55 PM	Unit Approval
Approved	Haddad,Deborah Moore	04/13/2020 04:13 PM	College Approval
Revision Requested	Vankeerbergen,Bernadette Chantal	04/28/2020 01:34 PM	ASCCAO Approval
Submitted	Panero,Wendy R	04/28/2020 01:40 PM	Submitted for Approval
Approved	Panero,Wendy R	04/28/2020 01:41 PM	Unit Approval
Approved	Haddad,Deborah Moore	04/28/2020 01:53 PM	College Approval
Pending Approval	Jenkins,Mary Ellen Bigler Hanlin,Deborah Kay Oldroyd,Shelby Quinn Vankeerbergen,Bernadette Chantal	04/28/2020 01:53 PM	ASCCAO Approval

SYLLABUS
EARTHSC/2205

Planets
Spring 2021 – Online

COURSE OVERVIEW

Instructor

Instructor: Joachim Moortgat

Email address: Moortgat.1@osu.edu

Phone number: 614-688-2410

Office hours: http://carmenzoom.osu.edu/moortgat-office-hour

Course description

In this course we will explore our Solar System, study the origin and evolution of materials within it so that we may better understand our place in the Universe, the prospect of life elsewhere, and the destiny of humanity on Earth and in space. The goal of this course is for students to understand the principles, theories, and methods of modern science, the relationship between science and technology, the implications of scientific discoveries and the potential of science and technology to address problems of the contemporary world.

Course learning outcomes

By the end of this course, students should successfully be able to:

- to understand the basic facts, principles, theories, and methods of modern science.
- to understand key events in the development of science and recognize that science is an evolving body of knowledge.
- to describe the inter-dependence of scientific and technological developments.

- recognize social and philosophical implications of scientific discoveries and understand the potential of science and technology to address problems of the contemporary world.

Specific to the topic of Planets, students will

- develop an intuition for the vast spatial and temporal scales in our Universe and how to make order-of-magnitude-estimates (or educated guesses) of quantities that are hard to know or remember precisely,
- revisit basic physics concepts related to motion, energy, and gravity; and how light and matter interact, which allows us to learn a tremendous amount of information from light,
- use those concepts to understand planetary geology and atmospheres,
- (virtually) visit each planet in the solar system, as well as many moons, asteroids, and comets, and learn how they are similar or different in terms of their interiors, surfaces, and atmospheres, including some that may well harbor conditions for extraterrestrial life,
- be provided with an up-to-date overview of the evermore daring exploration of our solar system by space crafts.

HOW THIS COURSE WORKS

Mode of delivery: This course is 100% online. There are no required sessions when you must be logged in to Carmen at a scheduled time. The online materials consist of reading, videos, practice quizzes, short assignments, and discussions boards.

Pace of online activities: This course is divided into **weekly modules** that are released one week ahead of time. Students are expected to keep pace with weekly deadlines but may schedule their efforts freely within that time frame.

Credit hours and work expectations: This is a **3-credit-hour course**. According to Ohio State policy, students should expect around 3 hours per week of time spent on direct instruction (instructor content and Carmen activities, for example) in addition to 6 hours of homework (reading and assignment preparation, for example) to receive a grade of (C) average.

Attendance and participation requirements: Because this is an online course, your attendance is based on your online activity and participation. The following is a summary of everyone's expected participation:

- **Participating in online activities for attendance**: **AT LEAST ONCE PER WEEK**
  You are expected to log in to the course in Carmen every week. (During most weeks

you will probably log in many times.) If you have a situation that might cause you to miss an entire week of class, discuss it with me *as soon as possible.*

- **Office hours and live sessions**: **OPTIONAL**
  All live, scheduled events for the course, including my office hours, are optional.
- **Participating in discussion forums**: **2+ TIMES PER WEEK**
  As part of your participation, each week you can expect to post at least twice as part of our substantive class discussion on the week's topics.
- **Group project**: you will be assigned to a group of 5 to 6 students for the duration of the semester. Together with your group, you will work on a proposal to establish the first human colony on one of the planets, moons, asteroids, or comets in our Solar System; a plan that you will present as a group at the end of the semester on CarmenZoom. Your presentation will be graded on a rubric (on Carmen) that includes both the presentation materials (slides) and oral delivery, and how well you covered topics such as how to travel there, what resources are/aren't available, how you might resolve the lack of certain resources, what life on your object would be like (e.g., in terms of temperatures, gravity, seasons, sunlight, etc.). You will have a group section on Carmen where you should have a weekly discussion (at a time fitting your own schedules) about progress on this project, as well as help each other out with the other online materials for each week's Unit. In other words, this is a more intimate setting for discussions than the class-wide discussion forum.

COURSE MATERIALS AND TECHNOLOGIES

Textbooks

RECOMMENDED

- *The Cosmic Perspective: The Solar System*

  Bennett, Danahue, Schneider, and Voit,

  Pearson Education Inc. (any edition)

Course technology

For help with your password, university email, Carmen, or any other technology issues, questions, or requests, contact the OSU IT Service Desk. Standard support hours are available at https://ocio.osu.edu/help/hours, and support for urgent issues is available 24/7.

- **Self-Service and Chat support:** http://ocio.osu.edu/selfservice
- **Phone:** 614-688-HELP (4357)
- **Email:** 8help@osu.edu

- **TDD:** 614-688-8743

BASELINE TECHNICAL SKILLS FOR ONLINE COURSES

- Basic computer and web-browsing skills
- Navigating Carmen: for questions about specific functionality, see the Canvas Student Guide.

REQUIRED TECHNOLOGY SKILLS SPECIFIC TO THIS COURSE

- CarmenConnect text, audio, and video chat
- Recording a slide presentation with audio narration
- Recording, editing, and uploading video

REQUIRED EQUIPMENT

- Computer: current Mac (OS X) or PC (Windows 7+) with high-speed internet connection
- Webcam: built-in or external webcam, fully installed and tested
- Microphone: built-in laptop or tablet mic or external microphone
- Other: a mobile device (smartphone or tablet) or landline to use for BuckeyePass authentication

REQUIRED SOFTWARE

- None

CARMEN ACCESS

You will need to use BuckeyePass multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you take the following steps:

- Register multiple devices in case something happens to your primary device. Visit the BuckeyePass - Adding a Device help article for step-by-step instructions.
- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click “Enter a Passcode” and then click the “Text me new codes” button that appears. This will text you ten passcodes good for 365 days that can each be used once.
- Download the Duo Mobile application to all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service.

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357 (HELP) and the IT support staff will work out a solution with you.

GRADING AND FACULTY RESPONSE

How your grade is calculated

ASSIGNMENT CATEGORY	POINTS
Midterm 1	25
Midterm 2	25
Midterm 3	25
Group presentation	10
Weekly assignments (10) and quizzes (5)	15
Engagement: up to 10 bonus points. **Best group presentations (5), top 10% constructive activity on discussion boards (5), valuable suggestions to improve on-line materials (2.5).**	10
Total	**100 + 10 bonus**

See course schedule below for due dates.

Late assignments

Late submissions will not be accepted. Please refer to Carmen for due dates.

Grading scale

93–100: A
90–92.9: A-
87–89.9: B+

83–86.9: B
80–82.9: B-
77–79.9: C+
73–76.9: C
70 –72.9: C-
67 –69.9: D+
60 –66.9: D
Below 60: E

Faculty feedback and response time

I am providing the following list to give you an idea of my intended availability throughout the course. (Remember that you can call **614-688-HELP** at any time if you have a technical problem.)

- **Grading and feedback:** For large weekly assignments, you can generally expect feedback within **7 days**.
- **Email:** I will reply to emails within **24 hours on days when class is in session at the university**.
- **Discussion board:** I will check and reply to messages in the discussion boards every **24 hours on school days**.

OTHER COURSE POLICIES

Discussion and communication guidelines

The following are my expectations for how we should communicate as a class. Above all, please remember to be respectful and thoughtful.

- **Writing style**: While there is no need to participate in class discussions as if you were writing a research paper, you should remember to write using good grammar, spelling, and punctuation. A more conversational tone is fine for non-academic topics.
- **Tone and civility**: Let's maintain a supportive learning community where everyone feels safe and where people can disagree amicably. Remember that sarcasm doesn't always come across online.

- **Citing your sources**: When we have academic discussions, please cite your sources to back up what you say. (For the textbook or other course materials, list at least the title and page numbers. For online sources, include a link.)
- **Backing up your work**: Consider composing your academic posts in a word processor, where you can save your work, and then copying into the Carmen discussion.

Throughout this semester, you will work in the same small group. Collaborating as a group does not come natural to everyone, in general, and working with a group of people with all different backgrounds can take even more practice. But an abundance of recent research has demonstrated that diverse teams are most effective. Many successful companies now try to capitalize on the full breath of their 'human capital'.

Diverse teams make strong teams. Assuming of course that

- all team members are respectful towards each other,
- one or more team members do not dominate discussions at the expense of others, and
- all team members carry their weight and contribute equally.

Diversity statement

As your instructor in this course, I strongly support OSU's general commitment to diversity:

“The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.”

If you experience any lack of respect in this context either by myself or any of your fellow students, please do not hesitate to reach out to me, my TA, or a neutral party (e.g. the Office of Diversity and Inclusion: odi@osu.edu). Also, if you have a name and/or set of pronouns that differ from those apparent on Carmen, please let me know!

Academic integrity policy

POLICIES FOR THIS ONLINE COURSE

- **Quizzes and exams**: You must complete the midterms yourself, without any external help or communication. Weekly quizzes are intended as self-checks and can be repeated as many times as you like.

- **Reusing past work**: In general, you are prohibited in university courses from turning in work from a past class to your current class, even if you modify it. If you want to build on past research or revisit a topic you've explored in previous courses, please discuss the situation with me.
- **Falsifying research or results**: All research you will conduct in this course is intended to be a learning experience; you should never feel tempted to make your results or your library research look more successful than it was.
- **Collaboration and informal peer-review**: The course includes many opportunities for formal collaboration with your classmates. While study groups and peer-review of major written projects is encouraged, remember that comparing answers on a quiz or assignment is not permitted. If you're unsure about a particular situation, please feel free just to ask ahead of time.
- **Group projects**: This course includes a group project, which can be stressful for students when it comes to dividing work, taking credit, and receiving grades and feedback. I have attempted to make the guidelines for group work as clear as possible for each activity and assignment, but please let me know if you have any questions.

OHIO STATE'S ACADEMIC INTEGRITY POLICY

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the University's *Code of Student Conduct*, and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the University's *Code of Student Conduct* and this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the University, or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the University's *Code of Student Conduct* is never considered an excuse for academic misconduct, so I recommend that you review the *Code of Student Conduct* and, specifically, the sections dealing with academic misconduct.

If I suspect that a student has committed academic misconduct in this course, I am obligated by University Rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the University's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the University.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Other sources of information on academic misconduct (integrity) to which you can refer include:

- The Committee on Academic Misconduct web pages (COAM Home)
- *Ten Suggestions for Preserving Academic Integrity (Ten Suggestions)*
- *Eight Cardinal Rules of Academic Integrity* (www.northwestern.edu/uacc/8cards.htm)

Copyright disclaimer

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Statement on Title IX

Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at http://titleix.osu.edu or by contacting the Ohio State Title IX Coordinator, Kellie Brennan, at titleix@osu.edu

Your mental health

A recent American College Health Survey found stress, sleep problems, anxiety, depression, interpersonal concerns, death of a significant other, and alcohol use among the top ten health impediments to academic performance. Students experiencing personal problems or situational crises during the quarter are encouraged to contact Ohio State University Counseling and Consultation Service (614-292-5766; www.ccs.osu.edu) for assistance, support and advocacy. This service is free and confidential.

Other resources

For an overview and contact information regarding student academic services offered on the OSU main campus, please visit: http://advising.osu.edu/welcome.shtml

For an overview and contact information for student services offered on the OSU main campus, please visit: http://ssc.osu.edu.

ACCESSIBILITY ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

Requesting accommodations

Students with disabilities (including mental health, chronic or temporary medical conditions) that have been certified by the Office of Student Life Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office of Student Life Disability Services is located in 098 Baker Hall, 113 W. 12th Avenue; telephone 614- 292-3307, slds@osu.edu; slds.osu.edu.

If you would like to request academic accommodations based on the impact of a disability qualified under the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973, contact your instructor privately as soon as possible to discuss your specific needs. Discussions are confidential.

In addition to contacting the instructor, please contact the Student Life Disability Services at 614-292-3307 or ods@osu.edu to register for services and/or to coordinate any accommodations you might need in your courses at The Ohio State University.

Go to http://ods.osu.edu for more information.

Accessibility of course technology

This online course requires use of Carmen (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations with your instructor.

- Carmen (Canvas) accessibility
- Streaming audio and video with transcripts and/or closed captioning.
- Synchronous course tools

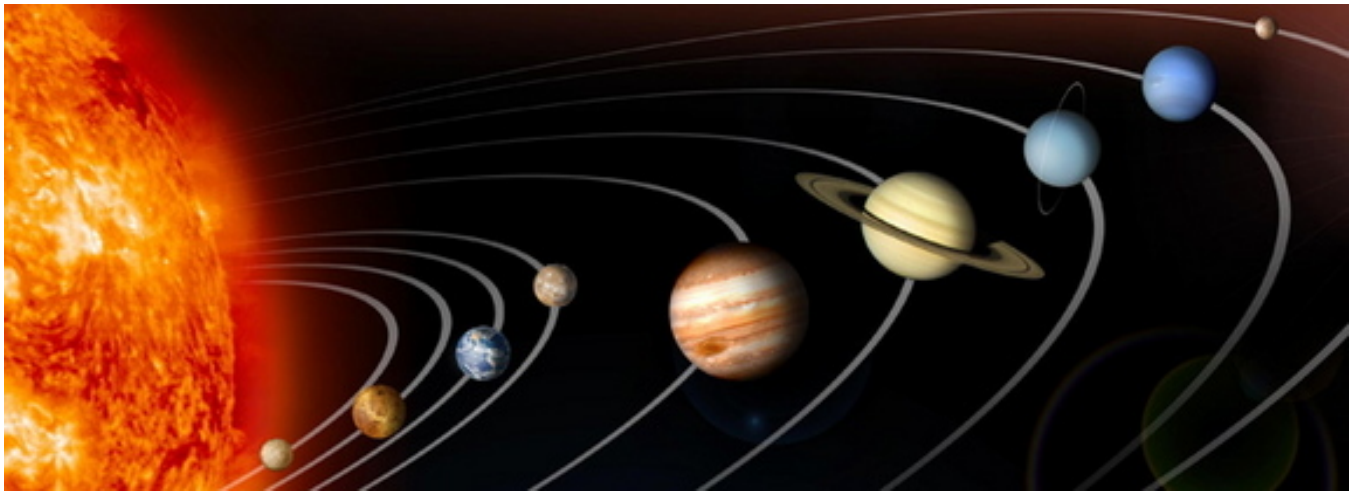
COURSE SCHEDULE

Note: All reading is optional extra background from the recommended book. The same topics are covered in detail in the online materials. All Assignments are due at the end of the week in which they are listed.

Week	Dates	Topics, Readings, Assignments, Deadlines
1	**1/11 – 1/15**	Reading: §1.1 – §1.3 (18pg) Introductions The Scale and Age of the Universe Assignment 1 Quiz
2	**1/18 – 1/22**	Reading: §2.1 (7pg) Patterns in the Night Sky Assignment 2 Quiz
3	**1/25 – 1/29**	Reading: §2.2 – §2.4 (14pg) Seasons, Moon Phases, Eclipses, and Retrograde Planetary Motions Assignment 3 Quiz
4	**2/1 – 2/5**	Reading: §3.2 – §3.5 (18pg) & Video The Copernican Revolution, Kepler, Brahe, and Galileo. The Scientific Method & Astrology Assignment 4 Quiz
5	**2/8 – 2/12**	Midterm 1 (and practice session) ***Optional*** visit to OSU Department of Astronomy Planetarium for on-campus students.
6	**2/15 – 2/19**	Reading: §4.1 – §4.5 (20pg) Concepts from Physics Required to Understand Planets

Week	Dates	Topics, Readings, Assignments, Deadlines
		Assignment 5 Quiz
7	**2/22 – 2/26**	Reading: §5.1 – §5.4 (20pg) Properties of Light & Matter Assignment 6 Quiz
8	**3/1 – 3/5**	Reading: Ch. 7 & Ch. 8 (13pg) The Formation of our Solar System Assignment 7 Quiz
9	**3/8 – 3/12**	Midterm 2 (and practice session)
10	**3/15 – 3/19**	Spring Break
11	**3/22 – 3/26**	Reading: §9.1 – §9.2 (13pg), §9.3 – §9.6 (16pg; cursory) Planetary Geology Group work on presentations Quiz
12	**3/29 – 4/2**	Reading: Ch. 10 (30pg) Atmospheric Basics, Weather & Climate, and Earth's Atmosphere. Group work on presentations Quiz
13	**4/5 – 4/9**	Reading: Ch. 11 (25pg) Jovian Planets and their Moons

Week	Dates	Topics, Readings, Assignments, Deadlines
		Group work on presentations Quiz
14	**4/12 – 4/16**	Reading: Ch. 12 (21pg) Asteroids, Comets, and Dwarf Planet Group work on presentations Quiz
15	**4/19 – 4/23**	Midterm 3 (and practice session)



The Planets

EARTHSC 2205, Spring 2018
Tuesdays & Thursdays
12:45 pm – 2:05 pm
Scott Lab E125
https://osu.instructure.com/courses/35757

Professor: Joachim Moortgat
Office: Mendenhall Lab 303
Email: moortgat.1@osu.edu
Office hours: by appointment

TA: Ken Peterman
peterman.50@buckeyemail.osu.edu

Course Goals

In ES2205, we will explore our Solar System, study the origin and evolution of materials within it so that we may better understand our place in the Universe, the prospect of life elsewhere, and the destiny of humanity on Earth and in space. The goal of this course is for students to understand the principles, theories, and methods of modern science, the relationship between science and technology, the implications of scientific discoveries and the potential of science and technology to address problems of the contemporary world. Therefore, this course fulfills the requirements for the GEC, Category 2. Breadth; A. Natural Sciences: Physical Sciences. The associated expected learning outcomes are

1. to understand the basic facts, principles, theories and methods of modern science.
2. to understand key events in the development of science and recognize that science is an evolving body of knowledge.
3. to describe the inter-dependence of scientific and technological developments.
4. recognize social and philosophical implications of scientific discoveries and understand the potential of science and technology to address problems of the contemporary world.

Throughout the semester, we will come across many interesting facts about the planets, the Universe at large, and the history and methods of scientific discovery. The objective of the course, however, is not to memorize, for example, the sizes, weights and distances of all the planets, but rather to 1) develop an intuition for *comparative* scales in both space and time, 2) get comfortable with working in different/appropriate units of length and time, 3) understand the basic concepts of orbital/rotational motions of objects in our solar system (and beyond), 4) develop an appreciation for the fundamental laws of physics that govern motion, energy, and light in order to 5) be able to interpret our observations of planetary geology, atmospheres, and other properties, made by past, current, and future spacecraft explorations and telescopes.

Course Requirements

This class meets twice per week, on Tuesdays and Thursdays, from 12:45 pm to 2:05 pm in Scott Lab E125. In order to succeed in the course, you should be prepared to meet the following requirements:

Attend class & Read the assigned materials.
The lectures will follow the book 'Cosmic Perspective, The Solar System' (details below), which is well written and contains a wealth of illustrations and supplemental exercises (and answers). It can be considered as both the 'lecture notes' and study guide for the course. Unless specified otherwise in the lectures, a thorough understanding of the material in the book is (necessary and) sufficient to pass the three midterm exams. Classroom meetings/lectures will elaborate on the key concepts, with the goal of illuminating these concepts through discussion, demonstrations, exercises, and quizzes. Students are expected to read the material before class (roughly 20 pages per week), and the exams may include questions that are covered in the text and not explicitly in the lectures.

Take scheduled exams on time.
Exams must be taken when scheduled, with exceptions made only for the following excused absences:

- Documented University sanctioned event
- Documented death in the family
- Observation of a religious holiday
- Illness or injury that prevent attendance

If an exam is missed due to an *excused* absence, a make-up exam will be scheduled through the OSU Testing Center's Make-Up Examination Program. Exams missed due to an *unexcused* absence will receive a grade of 0 and cannot be made up.

Important Dates

Midterm 1 Exam: Tuesday, February 6
Midterm 2 Exam: Tuesday, March 8
Midterm 3 Exam: Thursday, April 19

Course Grading

1. **Hands-on Sessions – 22%**
   Most Thursdays, you will work on a hand-on experience in a small group setting (same group throughout the semester) to digest some of the material discussed in Tuesday lectures.

2. **Midterm 1 – 22%**

3. **Midterm 2 – 22%**

4. **Midterm 3 – 22%**

5. **Group Presentations – 12%**
   Each group will be assigned a Planet or other celestial object (moon, asteroid, comet) and use concepts discussed in the lectures (properties of these objects, and space travel) to devise a plan to establish a first human colony on this new frontier. A few classes (see schedule below) will be devoted to short ($\sim$ 15 mins) presentations of your final mission plans.

6. **Quizzes – 10% BONUS**
   At the end of most (not necessarily all) classes there will be a short exit-quiz, which you can complete on any web-enabled device. This will inform both the instructor and yourself on whether the presentation and understanding of lecture materials was clear.

Letter grades correspond to the following percentages (and *final* grades will be curved if the course median score drops below 80%):

A: 93-100	B: 83-86	C: 73-76	D: 60-66
A-: 90-92	B-: 80-82	C-: 70-72	E: < 60
B+: 87-89	C+: 77-79	D+: 67-69	

Important Note: If you do the math, you will see that the midterms, labs, presentation, and quizzes sum to 110%. That means that you can theoretically skip all lectures, or miss a few labs (not encouraged!), or the group presentation and still get a $\sim$ 100%, A, grade. For the same reason, you do *not* have to inform the instructor of absences for any reason and such emails may not receive a response. You *should* however inform your group-mates out of curtesy if you miss a lab or meetings regarding the final presentations.

Course Materials

The following book is available for purchase at the OSU book store and on reserve in Thompson Library:

The Cosmic Perspective: The Solar System 5th or later edition,
Bennett, Danahue, Schneider, and Voit,
Pearson Education Inc.

The course will follow this book, and it can be used as the main lecture notes and study guide. Ample exercises are provided to prepare for the exams, including answers in the back of the book.

Additional material presented in class will be made available through the Canvas course site: `https://osu.instructure.com/courses/35757`.

Course Policies

Academic and Personal Integrity:

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct: `http://studentaffairs.osu.edu/csc`.

Distractions:

Please arrive on time and do not leave before the end of class. Laptops, tablets and cell phones may be used as aids in classroom participation, but please be considerate/respectful and refrain from using this time to catch up on social media etc.

Students with Disabilities:

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you have a disability requiring accommodation, please contact me privately to discuss your specific needs. For additional information, visit `http://ods.osu.edu`.

Course Schedule

Week 1 — Reading: §1.1 – §1.3 (18pg)

Tuesday, January 9
Lecture: Introduction & §1.1 – §1.3: Scale and Age of the Universe

Thursday, January 11
Lab

Week 2 — Reading: §2.1 (7pg)

Tuesday, January 16
Lecture: §2.1: Patterns in the Night Sky

Thursday, January 18
Lab

Week 3 — Reading: §2.2 – §2.4 (14pg)

Tuesday, January 23
Lecture: Seasons, Moon Phases, Eclipses, and Retrograde Planetary Motions

Thursday, January 25
Lab

Week 4 — Reading: §3.2 – §3.5 (18pg) & Video

Tuesday, January 30
Lecture: Mostly §3.3, Copernican Revolution, Kepler, Brahe, Galileo.

Thursday, February 1
Lab: Scientific Method & Astrology

Week 5 — Midterm 1

Tuesday, February 6
! Midterm 1 !

Thursday, February 8
Visit to OSU Department of Astronomy Planetarium
Location: 100 W 18th Ave, Columbus, OH 43210

Week 6: §4.1 – §4.5 (20pg)

Tuesday, February 13
Lecture: §4.1 – 4.5: Concepts from Physics Required to Understand Planets

Thursday, February 15
Lab

Week 7: §5.1 – §5.4 (20pg)

Tuesday, February 20
Lecture: §5.1 – §5.4: Properties of Light & Matter

Thursday, February 22
Lab

Week 8: Ch. 7 (optional) & Ch. 8 (13pg)

Tuesday, February 27
Lecture: Ch. 7 & Ch. 8: Formation of our Solar System

Thursday, March 1
Lab: 5 student group presentations.

Week 9: Midterm 2

Tuesday, March 6
Review & Practice Session

Thursday, March 8
! Midterm 2 !

Week 10

Spring Break

Week 11 — Reading: §9.1 – §9.2 (13pg), §9.3 – §9.6 (16pg; cursory)

Tuesday, March 20
Lecture: Ch. 9: Planetary Geology

Thursday, March 22
Lecture/Lab: Ch. 9: Planetary Geology

Week 12 — Reading: Ch. 10 (30pg)

Tuesday, March 27
Lecture: §10.1, §10.2, and §10.6 Atmospheric Basics, Weather & Climate, and Earth's Atmosphere.

Thursday, March 29
Lecture/Lab: Planetary Atmospheres

Week 13 — Reading: Ch. 11 (25pg)

Tuesday, April 3
Lecture: Ch. 11: Jovian Planets

Thursday, April 5
Lecture/Lab: Jovian Moons

Week 14 — Reading: Ch. 12 (21pg)

Tuesday, April 10
Lecture: Ch. 12: Asteroids, Comets, and Dwarf Planets

Thursday, April 12
Lab: 5 student group presentations

Week 15 — Midterm 3

Tuesday, April 17
Midterm 3 Review & Practice Session

Thursday, April 19
! Midterm 3 !

GEC COURSE ASSESSMENT PLAN FOR EARTHSCI 2205: The Planets

INTRODUCTION

Here we present the assessment plan for a 3-credit hour, 100% distance learning general education (GE) course on the physical geology of The Planets. The Planets (EarthSci 2205) meets the University Bachelor of Arts GE requirement as a 'stand-alone' course. We would like to initiate this course in the Arts and Sciences College, School of Earth Sciences, in the autumn semester of 2020. This course is designed to align with the GE category of Natural Science (Physical Science) goals and learning outcomes.

COURSE DESCRIPTION

This course provides a basic introduction to our Solar System, study the origin and evolution of materials within it so that we may better understand our place in the Universe, the prospect of life elsewhere, and the destiny of humanity on Earth and in space. The goal of this course is for students to understand the principles, theories, and methods of modern science, the relationship between science and technology, the implications of scientific discoveries and the potential of science and technology to address problems of the contemporary world.

The course will be 3-credit hours and delivered 100% as an online class. The online course content was developed in parallel with the in-person delivery in Spring 2020, which then led to the nearly seamless transition to distance learning after spring break. The first surveys of student success in comparison to in-person learning will therefore be available at the end of the Spring 2020 semester.

The foundation of Natural Science is fully met in the course as students will (1) develop an intuition for the vast spatial and temporal scales in our Universe and how to make order-of-magnitude-estimates (or educated guesses) of quantities that are hard to know or remember precisely, (2) revisit basic physics concepts related to motion, energy, and gravity; and how light and matter interact, which allows us to learn a tremendous amount of information from light, (3) use those concepts to understand planetary geology and atmospheres, (4)(virtually) visit each planet in the solar system, as well as many moons, asteroids, and comets, and learn how they are similar or different in terms of their interiors, surfaces, and atmospheres, including some that may well harbor conditions for extraterrestrial life, (5) be provided with an up-to-date overview of the evermore daring exploration of our solar system by space crafts.

GE RATIONALE

The following section discusses how each individual GE expected learning outcome will be met in most or all of the following: (a) the course objectives, (b) the readings, (c) the topics, (d) the weekly assignments, and a (e) group project.

GE Physical Sciences ELO1: Students understand the basic facts, principles, theories and methods of modern science.

- Class modules focus on the fundamental principles of the scale of the universe, the origins of the phases of the moon, eclipses, and planetary motion, taught in the context of the scientific method, drawing upon the underlying physics of kinematics and the interaction of light with matter.

- The above topics are addressed through reading of online modules, weekly assignments, and are assessed through quizzes, midterms, and a summative group project.

GE Physical Sciences ELO2: Students understand key events in the development of science and recognize that science is an evolving body of knowledge.

- Class modules address the humanity's changing understanding of the Earth's place in the cosmos and the development of the theory of plate tectonics as platforms on which to demonstrate the role of the scientific method in changing scientific understanding.
- The above topics are addressed through reading of online modules, weekly assignments, and are assessed through quizzes, midterms, and a summative group project.

GE Physical Sciences ELO3: Students describe the inter-dependence of scientific and technological developments.

- Class modules address the key to technology developments of telescopes and space missions necessary for the exploration of the solar system and the Galaxy.
- The above topics are addressed through reading of online modules, weekly assignments, and are assessed through quizzes, midterms, and a summative group project.

GE Physical Sciences ELO4: Students recognize social and philosophical implications of scientific discoveries and understand the potential of science and technology to address problems of the contemporary world.

- Class modules explore the pros and cons of the historical, environmental, socio-economic, ethical and moral impacts of the human exploration of space.
- The above topics are addressed through reading of online modules, weekly assignments, and are assessed through quizzes, midterms, and a summative group project.

EXPECTED LEARNING OUTCOMES (ELOS)

The following table presents the general topics addressed throughout the course and how each topic aligns with the GE Natural Science (Physical Science) category expected learning outcomes in general terms.

Topic #	Topic List	# Weeks	PS ELO 1	PS ELO 2	PS ELO 3	PS ELO 4	Course ELO 1	Course ELO 2	Course ELO 3	Course ELO 4	Course ELO 5
1	The Scale and Age of the Universe	1	x			x	x	x			
2	Patterns in the Night Sky	1		x							
3	Seasons, Moon Phases, Eclipses, and Retrograde Planetary Motions	1	x					x			
4	The Copernican Revolution, Kepler, Brahe, and Galileo.	1		x		x		x			
5	The Scientific Method & Astrology	1	x			x	x				
6	Concepts from Physics Required to Understand Planets	1	x				x	x			
7	Properties of Light & Matter	1	x				x	x			
8	The Formation of our Solar System	1		x			x		x		x
9	Planetary Geology	1			x				x		x
10	Atmospheric Basics, Weather & Climate, and Earth's Atmosphere.	1			x				x		x
11	Jovian Planets and their Moons	1			x	x				x	x
12	Asteroids, Comets, and Dwarf Planet	1			x	x				x	x

	PS ELO 1: Students understand the basic facts, principles, theories an methods of modern science
	PS ELO 2: to understand key events in the development of science and recognize that science is an evolving body of knowledge.
	PS ELO3: to describe the inter-dependence of scientific and technological developments
	PS ELO 4: recognize social and philosophical implications of scientific discoveries and understand the potential of science and technology to address problems of the contemporary world
	Course ELO 1: develop an intuition for the vast spatial and temporal scales in our Universe and how to make order-of-magnitude-estimates (or educated guesses) of quantities that are hard to know or
	Course ELO 2: revisit basic physics concepts related to motion, energy, and gravity; and how light and matter interact, which allows us to learn a tremendous amount of information from light
	Course ELO 3: use those concepts to understand planetary geology and atmospheres
	Course ELO 4: (virtually) visit each planet in the solar system, as well as many moons, asteroids, and comets, and learn how they are similar or different in terms of their interiors, surfaces, and atmospheres, including some that may well harbor conditions for extraterrestrial life
	Course ELO 5: be provided with an up-to-date overview of the evermore daring exploration of our solar system by space crafts.

COURSE ASSESMENT STRATEGY

Two techniques will be used to assess the extent to which the course satisfies expected learning outcomes (ELOs) associated with the Natural Science (Physical Science) category. These will include:

(1) A direct method to asses student performance with respect to the ELOs. To specifically test if the course is achieving its goals and ELOs this direct measure includes embedded testing into assignments, quizzes, midterms and final exams. Results will be analyzed each semester to evaluate whether this course is meeting its objectives. The goal for the embedded question assessment is that 80% of students give the correct answer for the embedded multiple-choice questions. Questions for which fewer than 80% of students give a correct answer or disagree with meeting the objectives will be pinpointed as areas of weakness.

For the DL course, the accuracy rate for embedded questions will also be compared to the accuracy rate in the in-person course of prior years to assess the quality of the course compared to the in-person delivery. After this period, the procedure will be repeated annually to ensure the course continues to meet GE goals and ELOs.

(2) An indirect method to track student knowledge, learning experience and perceptions in the form of a student survey (pre and post-tests) given at the beginning of course and at the end of course. Survey questions would be the same both times. Changes in the answers from beginning to end of semester would characterize the impact of the course on its students and serve as a guide for adjustments to the course contents, organization, etc. The survey questions will be repeated each semester

GE Expected Learning Outcomes	**Methods of Assessment** **Direct methods are required. Additional indirect methods are encouraged.*	**Level of student achievement expected for the GE ELO.** *(for example, define percentage of students achieving a specified level on a scoring rubric)*	**What is the process that will be used to review the data and potentially change the course to improve student learning of GE ELOs?**
<u>ELO 1</u> Students understand the basic facts, principles, theories and methods of modern science.	**1.** Embedded questions into quizzes, midterm and final exam **2.** Group project Students work together to propose a unique space mission, integrating much of the skills and content of the semester. Grading Criteria: ***Excellent*** *(demonstrates superior creativity, originality, or understanding in approach, content, or presentation)* ***Above average*** *(demonstrates creativity, originality, or understanding beyond basic expectations)* ***Acceptable*** *(meets basic expectations for presentation, approach and content)* ***Marginal*** *(below average in presentation, approach, understanding or content)* **3.** Student Survey (pre and post-tests) Pre and Post tests are identical to check gains in understanding of material. The test consists of 15-20 questions relevant	**1.** The expectation is that 80% of students give the correct answer for the embedded multiple-choice test questions, averaged across all sections **2.** The expectation is that 90% of students achieve the level of "acceptable" or better	Standardized questions for which fewer than 80% of students give a correct answer will be pinpointed as areas of weakness. To address weaknesses instructor will analyze the instructional materials and craft changes. Embedded questions will be collected by the instructor and incorporated into the end of semester assessment report The student surveys (pre and post- tests) are distributed by the instructor. Students are encouraged to take survey by way of small extra credit earning. The results are shared with evaluation team throughout the end of semester assessment report Review SEIs with special emphasis on any negative comments on activities.

	to the course ELOs. Pre-tests are administered in the first week of classes. Post-tests are administered during the last week of classes or incorporated into the final exam. **4.** End of Semester Self-Assessment Questionnaire (10 questions) were students indicate which of the following responses they feel better represents their knowledge on end of course goals (see syllabus): *Extremely well/very well/adequately well/not very well/not at all*	**3.** The expectations is that students would increase their knowledge per goal by at least 25%. **4.** The expectation is that 100% of students will feel they have achieved the goal at the level of "adequately well" or better	In-class discussion and real time feedback from students
<u>ELO 2</u> Students learn key events in the development of science and recognizes that science is an evolving body of knowledge.	**1.** Embedded questions into weekly assignments, midterm and final exam **2.** Student Survey (pre and post- tests): see above **3.** End of Semester Self-Assessment: see above	**1.** The expectation is that 80% of students give the correct answer for the embedded multiple-choice test questions, averaged across all sections **2.** The expectations is that students would increase their knowledge per goal by at least 25%. **3.** The expectation is that 100% of students will feel they have achieved the goal at the level of "adequately well" or better	

ELO 3 Students describe the inter-dependence of scientific and technological developments.	**1.** Embedded questions into weekly assignments, midterm and final exam **2.** Questionnaire/ Discussion Forum Approximately 15-20 questions relevant to an assigned topic followed by online forum where students discuss and summarize questionnaire. Grading criteria for forum based on: Contribution frequency, depth of presentation (critical thinking), relevant content and supporting evidence, netiquette **3.** Student Survey (pre and post- tests): see above **4.** End of Semester Self-Assessment: see above	**1.** The expectation is that 80% of students give the correct answer for the embedded multiple-choice test questions, averaged across all sections **2.** The expectation is that 85% of students achieve 80% or higher based on grading rubric. **3.** The expectations is that students would increase their knowledge per goal by at least 25%. **4.** The expectation is that 100% of students will feel they have achieved the goal at the level of “adequately well” or better	

ELO 4 Students recognize social and philosophical implications of scientific discoveries and understand the potential of science and technology to address problems of the contemporary world.	**1.** Embedded questions into weekly assignments, midterm and final exam **2.** Digital Poster/Discussion Forum: see above **3.** Student Survey (pre and post- tests): see above **4.** End of Semester Self-Assessment: see above	**1.** The expectation is that 80% of students give the correct answer for the embedded multiple-choice test questions, averaged across all sections **2.** The expectation is that 85% of students achieve the level of "acceptable" or better **3.** The expectations is that students would increase their knowledge per goal by at least 25%. **4.** The expectation is that 100% of students will feel they have achieved the goal at the level of "adequately well" or better.	

Arts and Sciences Distance Learning Course Component Technical Review Checklist

Course: EARTHSC 2205
Instructor: Joachim Moortgat
Summary: Planets

Standard - Course Technology	Yes	Yes with Revisions	No	Feedback/ Recomm.
6.1 The tools used in the course support the learning objectives and competencies.	X			• Carmen • CarmenZoom for meetings • Office 365 for recording slide presentations
6.2 Course tools promote learner engagement and active learning.	X			• Discussion boards on Carmen • Presentations involve group work
6.3 Technologies required in the course are readily obtainable.	X			All are available for free via OSU site license
6.4 The course technologies are current.	X			All tech is updated regularly
6.5 Links are provided to privacy policies for all external tools required in the course.	X			No external tools are used
Standard - Learner Support				
7.1 The course instructions articulate or link to a clear description of the technical support offered and how to access it.	X			Links to 8HELP are provided
7.2 Course instructions articulate or link to the institution's accessibility policies and services.	X			a
7.3 Course instructions articulate or link to an explanation of how the institution's academic support services and resources can help learners succeed in the course and how learners can obtain them.	X			b
7.4 Course instructions articulate or link to an explanation of how the institution's student services and resources can help learners succeed and how learners can obtain them.	X			c
Standard – Accessibility and Usability				
8.1 Course navigation facilitates ease of use.	X			Recommend using the Carmen Distance Learning "Master Course" template developed by ODEE and available in the Canvas Commons to provide student-users with a consistent user experience in terms of navigation and access to course content.
8.2 Information is provided about the accessibility of all technologies required in the course.	X			Accessibility links are provided for all tools.
8.3 The course provides alternative means of access to course materials in formats that meet the needs of diverse learners.	X			
8.4 The course design facilitates readability	X			
8.5 Course multimedia facilitate ease of use.	X			All assignments and activities that use the Carmen LMS with embedded multimedia facilitates ease of use. All other multimedia resources facilitate ease of use by being available through a standard web browser

Reviewer Information

- Date reviewed: 4/7/20
- Reviewed by: Ian Anderson

Notes: None

[a]The following statement about disability services (recommended 16 point font):
Students with disabilities (including mental health, chronic or temporary medical conditions) that have been certified by the Office of Student Life Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office of Student Life Disability Services is located in 098 Baker Hall, 113 W. 12th Avenue; telephone 614- 292-3307, slds@osu.edu; slds.osu.edu.

[b]Add to the syllabus this link with an overview and contact information for the student academic services offered on the OSU main campus.
http://advising.osu.edu/welcome.shtml

[c]Add to the syllabus this link with an overview and contact information for student services offered on the OSU main campus. http://ssc.osu.edu. Also, consider including this link in the “Other Course Policies” section of the syllabus.