THE UNIVERSITY OF ARIZONA

Spring 2019 PTYS/ASTR 170B2 (001)

The Universe and Humanity: Origin and Destiny
Tuesday/Thursday 9:30-10:45 am
Kuiper Space Sciences Building, room 308

Description of Course
This is an introductory course on the origin and evolution of the Universe and our Solar System with a focus on how humanity has arrived at our current perspective of our place in the Universe. We will cover basic scientific concepts and discoveries that have shaped our understanding of the cosmos. The topics include the contents of the Universe, the nature of light and matter, Newton's laws of motion and the laws of thermodynamics and their application to studying planets and other astronomical objects.

The course webpage is available at www.D2L.arizona.edu.

Instructor: Professor Renu Malhotra
Kuiper Space Sciences 515, 520-626-5899, renu@lpl.arizona.edu
Office hours: Tuesday & Thursday noon-1:30 pm
I am also happy to schedule appointments outside of office hours. The best way to reach me is by e-mail. I will do my best to answer emails within 24 hours, although this might not always be possible.

Graduate Teaching Assistant: Ms. Lindsay Slick
phone: 520-621-7274, email: lrslick@lpl.arizona.edu
Office hours (in KSS room 330): Monday 1:00-2:00 pm, Wednesday 10:00-11:00

Required materials

Lecture Tutorials for Introductory Astronomy, 3rd Ed by Prather et al.
We will use this book during almost every class session.

The Cosmic Perspective Fundamentals, by Bennett et al.
We will assign a list of readings from this textbook prior to almost every class .

TurningPoint® ResponseCard NXT or QT (a.k.a. "clicker")

Additional Resources
Academic support, including tutoring in Math, Science and Writing, available at THE THINK TANK (https://thinktank.arizona.edu/).

Course Objectives and Expected Learning Outcomes
A student who completes this course successfully will have developed and demonstrated a broad knowledge of Earth and our Solar system in the wider cosmic context, and an

understanding of how humanity has arrived at our current perspective of our place in the Universe by the practice of scientific principles. This is a course for non-science majors; it partially fulfills the University's general education Tier One science requirement. This course is not mathematics intensive, but will make use of high-school algebra, geometry and trigonometry. The course has a writing component, which, together with the quantitative component, will emphasize logical and quantitative reasoning, using information effectively, and demonstrating one's understanding by communicating effectively.

Grades
A — 90-100% B — 80-90% C — 70-80% D — 60-70% E — 0-60%

This represents the minimum letter grade a student will be assigned for the listed scores (i.e. a course grade of 80% guarantees *at least* a B). The instructor reserves the right to adjust the grade boundaries based on her expectations of student performance.

Grading Scheme

Homework — 20%	E-quizzes — 5%
Mid-term Exams — 20%	Participation — 10%
Writing assignments — 25%	Final Exam — 20%

Homework: Problem-solving assignments will be assigned in nearly every class session, but will only be collected randomly throughout the semester. In most cases, the assigned homework is to complete the lecture-tutorial we assign during class, with any additional questions or assignments posted on D2L; the due date will be the next class meeting. We expect to collect and fully grade up to six of these assignments through the semester. The lowest graded assignment will be dropped (so, for example, if we grade these assignments 4 times, only your best 3 scores will contribute to your course grade). We will also randomly collect these assignments and check for completion; these completion scores will contribute 25% of the homework grade. **Late homework will not be accepted.** Homework solutions will be posted on D2L.

Mid-term Exams: There will be 2 mid-term exams. The dates of these are listed in the Course Schedule at the end of this syllabus. In the unlikely event that the dates must be changed, students will be given notice in advance. The lowest score of the mid-term exams will be dropped, so a student's best mid-term exam score will contribute towards 20% of the course grade. Many of the exam questions will be based on homework and in-class think-pair-share questions. **There will be no make-up exams** unless absence on an exam day is approved by the UA Dean of Students (or Dean's designee) or absence is the result of a religious holiday; it is the student's responsibility to provide documentation at least one week in advance. Make-up exams may be in a different format (e.g. they may be oral rather than written).

Writing Assignments: As this is a Tier-One General Education course, the required work is moderately writing-intensive (see http://gened.arizona.edu/content/writing-component). Over the course of the semester a minimum of 2500 words of written work is required, distributed among homework assignments, in-class work, and other assignments. Therefore, in addition to

the problem-solving homework assignments, there will be three essay assignments. Guidelines for the structure of these essay assignments will be provided. Students will receive feedback on one or more of these essays, and an opportunity to rewrite and resubmit it for an improved grade. The Approximate Course Schedule lists the due dates for the writing assignments. **Late assignments will not be accepted.** If you are absent on any of the due dates, it is your responsibility to turn in the assignment. The writing assignments will contribute 25% towards the course grade.

E-quizzes: Prior to most class sessions, there will be assigned readings and a short true/false and/or multiple choice quiz. The quiz will be posted on D2L immediately after the preceding class session, and it will be due before the start of class (it will close at 9:29 AM on the day of class). These quizzes are designed to familiarize students with the concepts we will be covering in class. These quizzes are not difficult, and they are open book/open note/open internet, and you will be given two attempts at each quiz question. Completing these quizzes contributes 5% towards the course grade.

Participation: There will be in-class activities (lecture-tutorials) and/or think-pair-share questions that require working in pairs or small groups. Participation in these activities will contribute 10% towards the course grade. Your participation grade will be based on answering critical thinking-type questions in class and/or short, unannounced questionnaires that will be conducted with clickers. If you have a pre-approved absence (see **Attendance** section above), your participation grade will not be negatively affected. It is in your best interest to attend class and participate. Exam questions will be heavily based on lecture tutorials and in-class questions. If we observe on multiple occasions that you are not participating during lecture tutorials or think-pair-share questions, we will give you a warning. If you continue to not participate after the warning you will receive a zero for your overall participation grade.

The final exam will take place 8:00-10:00 AM on Tuesday May 7th.
This exam will be cumulative and will feature many questions based on homework, in-class think-pair-share questions, and previous exams. The final exam contributes 20% towards the course grade.

The UA's policies on final exams are at http://www.registrar.arizona.edu/courses/final-examination-regulations-and-information and the final exam schedule for Spring 2019 is at https://www.registrar.arizona.edu/courses/final-examination-schedule-spring-2019

Other grading notes: If you wish to dispute a grade, you must bring it to our attention within 72 hours after an assignment/exam is returned. You should first take any disputes to the Graduate Teaching Assistant. If you are not satisfied with that resolution, you may then bring it to the course instructor who has final say on all grades. Exam score disputes should be taken directly to the instructor.

Late work will not be accepted for credit. If you have to miss class, any due work should be turned in early, either during posted office hours or by other arrangement. The only exception to the no late work rule will be during the first two weeks of class for students who enroll in the

course after the first class meeting. Modified due dates for assignments missed by these students because of late enrollment will be decided on a case-by-case basis.

There are no planned extra credit opportunities, but the instructor reserves the right to add them throughout the term. Any such opportunities will not amount to more than 5% of the overall course grade.

Honors Credit
This course is available for Honors credit under an Honors Contract. Students interested in taking this class to receive Honors credits should contact Prof. Malhotra at the beginning of the semester, and complete this form:
https://www.honors.arizona.edu/documents/students/ContractRequestFrom.pdf

Absence and Class Participation Policy
The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at: http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, http://policy.arizona.edu/human-resources/religious-accommodation-policy. It is the student's responsibility to seek such accommodations by communicating with the instructor in a timely manner.

Absences pre-approved by the UA Dean of Students (or Dean's designee) will be honored in accordance with the UA's policy; see https://deanofstudents.arizona.edu/absences.

Class attendance is vital to success in this course. Attendance will be recorded for most class sessions with student responses to in-class activities/questionnaires with clickers. These responses will contribute to your class participation grade. Many class sessions will involve some time spent working in small groups on problem-solving activities. There will also be think-pair-share questions discussed during class that are likely to appear later on exams but will not always be posted in the lecture notes on the course website at D2L.

Academic Integrity
Read and abide by the UA's code of academic integrity:
http://deanofstudents.arizona.edu/policies-and-codes/code-academic-integrity. Violations of the code of academic integrity lead to a written record of the incident sent to the Dean of Students who maintains records for all students with violations.

Collaboration on homework is expected and encouraged; however, any work that you submit for grading should be in your own words. If you directly copy your homework answers from someone else (or from the web, a textbook, etc), you will receive a zero on that assignment and an official written warning. A second violation could result in failing the entire course. If we assess that your homework is not sufficiently independent, you will be required to meet with

the instructor or a TA to discuss how to collaborate on homework while still providing independent answers. Any subsequent violations will be treated as cheating.

If you plagiarize any portion of your writing assignments, the minimum penalty is a zero grade on that assignment; higher penalties may be imposed depending on the degree of violation. Be sure to understand what plagiarism is and how to avoid it. The Library provides resources that you should utilize: http://www.library.arizona.edu/help/tutorials/plagiarism/. The University also provides plagiarism workshops: http://deanofstudents.arizona.edu/workshops. The University's writing center can also help you with specific writing assignments: http://thinktank.arizona.edu/tutoring/writing. You can also come to office hours and have us look at your project and identify any problems before it is due. Ignorance of what constitutes plagiarism will not mitigate the consequences of plagiarism.

If you are caught cheating on an exam, you will fail the entire course. Cheating on an exam does not happen accidentally, and there is no excuse for it. Don't do it.

Accessibility and Accommodations
At the University of Arizona we strive to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, you are welcome to let us know so that we can discuss options. You are also encouraged to contact Disability Resources (520-621-3268) to explore reasonable accommodation.

Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.

Classroom Behavior Policy
Please turn off all cellphones for the duration of class (setting them to silent is not enough, vibrate settings can be just as disruptive as ringtones). Appropriate use of laptops and tablets, such as taking notes, viewing lecture slides, viewing supplementary material is acceptable (you should always make sure the speakers are muted). If your laptop/tablet use is inappropriate and distracts other students, continued use will not be allowed.

Students are expected to refrain from disruptive behavior. Students observed engaging in disruptive activity or activity irrelevant to the class will be asked to cease this behavior. Those who do not cease will be asked to leave and may be reported to the Dean of Students.

Threatening Behavior Policy
The UA's Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students.

Nondiscrimination and Anti-harassment Policy The University is committed to creating and maintaining an environment free of discrimination. Students are expected to be familiar with the UA's Nondiscrimination and Anti-harassment policy: http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy.

Subject to Change Statement
The information contained in this course syllabus, other than the grade and absence policies, may be subject to change with advance notice, as deemed appropriate by the instructor.

Approximate Course Schedule

The schedule below is provisional, except for the final exam. The writing assignment due dates and mid-term exam dates are unlikely to change, but assignments and topics might shift. Reading assignments for each class will be posted on D2L in advance. Almost every class session will be associated with a D2L quiz (not listed below) based on the assigned readings. Always check D2L for schedule updates.

	Date	**Topic**	**Reading [pages refer to the textbook, The Cosmic Perspective Fundamentals]**	Assignments
1	Th Jan 10	Course Overview, length scales in the Universe	p. 2-9	
2	T Jan 15	Time scales in the Universe	p. 10-13	
3	Th Jan 17	Our Place in the Solar System: Position and motion in the sky, day/night		Lecture-Tutorial Page 1-4 (up to Q6)
4	T Jan 22	Our Place in the Solar System: Seasons	p. 19-23	Lecture-Tutorial Page 93, 94, 98
5	Th Jan 24	Moon/Venus phases, eclipses, planetary transits over the Sun	p. 26-31	Lecture-Tutorial Page 81-83
6	T Jan 29	Copernican revolution and Kepler First and Second Laws	p. 36-53	Lecture-Tutorial Page 21-24
7	Th Jan 31	Kepler's Third Law	p. 36-53	Lecture-Tutorial Page 25-28
8	T Feb 05	Newton’s Laws and gravity	p. 42, 50	Writing assignment #1 due + peer evaluation; Lecture-Tutorial Page 29-32
9	Th Feb 07	Light: EM spectrum, inverse square law, luminosity	p. 80, 134-135	Lecture-Tutorial Page 47-48 (up to Q6)
10	T Feb 12	**Exam #1 (until Newton’s Laws)**		
11	Th Feb 14	Light: Blackbody radiation	p. 80	Lecture-Tutorial Page 59-61 (up to Q10)
12	T Feb 19	Light: Atoms and spectra	p. 132	Lecture-Tutorial Page 63, 64, 69

13	Th Feb 21	Light: Doppler shift	p. 116	Lecture-Tutorial Page 75-78 (up to Q9)
14	T Feb 26	Earth: Atmosphere, greenhouse effect	p. 79-81,90-93	Lecture-Tutorial Page 105, 107 (Q10-11), 108, 109
15	Th Feb 28	Earth: Radiometric dating		
16	T Mar 12	Earth: Internal structure, surface activity	p. 76-79	
17	Th Mar 14	**Exam #2 (until Radiometric dating)**		
18	T Mar 19	Plate tectonics	p. 79,89 + other (see class notes)	
19	Th Mar 21	Moon and impact cratering	p. 82 + other (see class notes)	Writing assignment #2 due
20	T Mar 26	Mercury, Venus	p. 86-87	
21	Th Mar 28	Mars	p. 83-86	
22	T Apr 02	Jupiter, Saturn, Uranus, Neptune	p. 96-106	
23	Th Apr 04	Planetary Rings and Moons	p. 107-111	Writing assignment #3 – part 1 due
24	T Apr 09	Asteroids, comets, the Kuiper belt	p. 106	
25	Th Apr 11	Solar system formation and evolution	p. 54-61,63-73	Writing assignment #3 – first draft due
26	T Apr 16	Stars: our Sun, parsec, magnitudes, parallax	p. 129-136,199-200	Page 34-34 (Q6), Page 37-39
27	Th Apr 18	Stars: Stellar types, H-R diagram	p. 137-145	
28	T Apr 23	Stars: Evolution, formation, lifetimes	p. 146-164	Writing assignment #3 – final draft due
29	Th Apr 25	Exoplanets: detection methods, Current census	p. 114-120	
30	T Apr 30	Exoplanets: comparison to our Solar System, potential for Life	p. 121-125, 250-267	
	T May 07	**8:00-10:00 AM Final Exam (all topics)**		