

# ASTR 220: Collisions in Space

## Spring 2016 Syllabus

January 26, 2016

### 1 Course Overview

The course "ASTR 220 - Collisions in Space: The Threat of Asteroid Impacts" will attempt to answer the questions: What threat is there from space? What can we do to protect ourselves? Is it worth the cost? These questions have been prominent in the media, as the threat of asteroid impacts is hyped, and much fact and fiction is spread.

We will learn first about the origins of the solar system and asteroids, then we will focus specifically on near-Earth asteroids (NEAs), which are the ones that threaten the Earth. We will learn how astronomers observe asteroids in order to determine their key properties, such as size, mass, density, binarity, porosity, and rotation rate.

The next portion of the course will focus on the effects of impacts and the chances that an impact will occur. The effects of impacts of various sizes will be discussed, using historical impacts on the Earth, such as the Tunguska event and Meteor Crater, as evidence. The methods astronomers use to search for and discover NEAs will be demonstrated, as well as the uncertainties that remain in the characterization of any NEA's orbit. The orbit, as well as its uncertainties, is utilized by astronomers to determine the probability of an impact. Finally, the methods of communication astronomers use to convey these risks to the public will be discussed.

We will then focus on how an impact by an NEA could be prevented. The effects of the amount of warning time and the size of the impactor on a defense strategy will be taken into account. On-going missions to test defense strategies will be discussed.

In the final portion of the course, we will focus on the policy issues related to NEA searches and impact defense. The current budget for searches and defense will be presented. The risks of impacts and the effects of impacts, including costs, will be compared to the risks and effects of other disasters in order to provide context. We will discuss whether any search and defense effort should be funded and mounted entirely by the US, or whether the efforts should be international in scope.

#### 1.1 I-Series Course

As described in the University's GenEd program, "The I-Series is the signature program of General Education at the University of Maryland. I-Series courses are lively and contemporary. They speak to important issues that spark the imagination, demand intellect, and inspire innovation. They challenge students to wrestle with big questions, and examine the ways that different disciplines address them.

"I-Series courses are not surveys of particular fields of knowledge. Instead, I-Series courses provide students with the basic concepts, approaches, and vocabulary of particular disciplines and fields of study as well as an understanding of how experts in those disciplines and fields employ terms, concepts, and approaches."

## 1.2 Learning Outcomes

Why are you taking ASTR 220? Most likely you want to fulfill your GenEd I-series and/or science requirement. However, if you take full advantage of this class, you can learn not only a lot about the universe around you, but also other skills that will help you in any future career you choose.

To this end, I hope you will realize a number of learning outcomes, which you might think of as “goals”, by the time you finish ASTR 220 this semester. These goals include, but are not limited to, astronomical knowledge.

The main I-series learning outcome is “At the completion of the course, the students will be able to identify the major questions and issues in their I-series course topic.” Within the context of ASTR 220, these questions and issues are:

- Explain why we as a society should be concerned about asteroid impacts.
- Explain what asteroids are and why they may impact the Earth.
- Explain why astronomers cannot predict if and when an impact will occur.
- Explain what possible steps might be taken to defend the Earth against an impact.

The following goals are abilities that you have now that your enthusiastic participation in ASTR 220 will strengthen. These abilities will be useful to you in any career you choose. In particular, since many people now change careers several times, the ability to learn new skills is crucial - ASTR 220 can help you learn how to do this.

- The ability to think critically and logically about information you encounter.
- How to learn about unfamiliar concepts and ways of thinking.
- How to communicate your knowledge to others.
- How to work effectively with others.

## 1.3 Active Learning

*“Tell me and I forget. Teach me and I remember. Involve me and I learn.” – Benjamin Franklin, 1706-1790.*

Astronomy is a growing science where new discoveries are being made daily. In order to understand how astronomy works, it’s crucial for you to actively engage in the scientific process: examining evidence to explain how things work and why things happen. When you figure out scientific concepts through your own effort and the application of what you learn in class, you will remember and understand them *much* better. This will improve your grades.

The following are key results from cognitive science and education research:

1. Learning is productive/constructive - learning requires mental effort.
2. Knowledge is associative, which means it is linked to prior mental models and formal structures.
3. Cognitive response is context dependent: what and how you learn depends on the educational setting.
4. Most people require some social interactions in order to learn effectively.

These results are captured in this quotation from How People Learn (National Research Council, National Academy Press, 1999): “Students enter your lecture hall with preconceptions about how the world works. If their initial understanding is not engaged, they may fail to grasp the new

concepts and information that are taught, or they may learn them for the purposes of a test but revert to their preconceptions outside the classroom.”

The traditional course model has students listening to a long lecture where facts and concepts are ostensibly learned. Many students try to understand the material by simply memorizing facts from lecture and the textbook without understanding the underlying concepts and principles. **THIS IS NOT LEARNING.** In a traditional course, students have little opportunity to actively engage in learning the material in order to truly understand the concepts and their ramifications.

This course will be employing learning techniques that have been shown through research to be most effective.

- **Active learning:** You will engage in the course material by answering questions and doing activities in class.
- **Social learning:** You will discuss topics and concepts with classmates, which will solidify your understanding of the material and clear up questions.
- **Metacognitive learning:** You will analyze how you think and learn so you can improve your learning and study habits.

### 1.3.1 Distractions Detract from Learning

In order to learn most effectively, you need to focus on the course material while in class. Education research has found that students who try to do other tasks while in class (text on their phones, surf the web, read the newspaper, etc.) do not learn the material as well and earn lower course grades.

In class, you and your peers will determine the class policy regarding the use of cell phones, texting, laptops, etc. The policy you determine will be written up and placed on the class website on ELMS under “Syllabus”.

### 1.3.2 A Safe Learning Environment

The campus is meant to be a safe place to learn, free from harassment and intimidation of any kind. If you have experienced any form of harassment as a member of the university community, you should contact the Office of Civil Rights & Sexual Misconduct ([www.umd.edu/Sexual\\_Misconduct](http://www.umd.edu/Sexual_Misconduct)) on campus. Please be aware that faculty (and Teaching Assistants) are required by law to report any instance of misconduct brought to their attention. For confidential assistance, contact CARE ([www.health.umd.edu/care](http://www.health.umd.edu/care)).

## 1.4 Course Structure

**This is not a traditional lecture course.**

The learning procedure for this course will be as follows:

1. **BEFORE LECTURE**, you will watch a pre-lecture video I have created using slides, images, and animations. This is where you will learn the basic facts, vocabulary, equations, and other information you need to begin understanding a particular topic.
2. **BEFORE LECTURE**, you will take a pre-lecture quiz to test your comprehension of the pre-lecture material.
3. During lecture, you will participate in various active, social, and metacognitive learning activities to deepen your understanding of the material, strengthen your grasp of the underlying concepts, and clear up any problems, misunderstandings, and confusion.
4. **DURING LECTURE**, you will write a topic brief to help yourself process and understand the material you just learned.

You will be split into teams of about 4 students - you will work with your team in lecture and discussion section in order to help yourself and your team members learn the material more effectively. In lecture, the active learning will also include concept tests, which are not graded. *You are expected to participate with your team in discussion and lecture, or you may lose class participation credit (see the section on grading later in the syllabus).*

You will also be required to complete several projects with your team. Each team member must contribute meaningfully to the project. Each team will develop guidelines to guide their teams behavior, work process, and to outline procedures for “firing” a team member. *A team member who is fired from a team for a team project will receive a zero for that project.* In addition, I will repeatedly ask each team member to evaluate how well the team is working together and in what way each team member is contributing. **For each of the team projects, I may adjust an individual student’s score if I feel these evaluations justify the adjustment.**

## 1.5 Mutual Expectations

I believe that it is essential that we, as members of a learning community, agree upon what is expected of each other. As a course instructor, my role is to design and manage a learning environment that is rigorous, engaging, and employs evidence-based teaching practices. As a student, your role is to take *personal responsibility* for your learning and actively engage in all aspects of the course. This leads to the mutual expectations that we have of each other in our respective roles.

**You, as a student, have the right to expect that:**

- All work is evaluated by reasonable, objective, and transparent criteria intended to assess learning.
- All students are treated with equality, professionalism, and respect.
- I will be prepared and on-time for every class meeting and scheduled appointment.
- I will maintain a classroom conducive to active learning, discussion, and critical thinking.
- I will be available to assist with coursework and offer referrals to other resources upon request.
- I will read and respond to your emails within 24 hours on weekdays.
- I will do my best to answer any questions that you have, and if I don’t know the answer, I’ll do my best to work with you so that we can find it (in other words, I won’t just make stuff up.)

**I, as an instructor, have the right to expect you will:**

- Devote the necessary time and energy to master the course material. Note: according to University of Maryland guidelines, you should budget an average of 3 out-of-class hours per week for each hour in-class. If your schedule does not currently permit you to satisfy these requirements, I advise you to take the course at another time.
- Be *prepared* and *on-time* for every class meeting, having completed the assigned work before class.
- Save newspapers, puzzles, texting, IM, email, Facebook, etc., for outside of class.
- Sleep in your bed, in someone else’s bed, in the hall, on a park bench...but not in class.
- Take responsibility for getting anything you might have missed from a fellow classmate.
- Monitor your email and ELMS messages at least once every 24 hours.

- Adhere to all course and university policies, deadlines, requirements, and grading criteria.
- Conduct yourself in a professional manner, including in your written communication. Here's a guide for writing emails to instructors or TAs: <http://ter.ps/email>
- Seek assistance when you need it and see that your questions are answered to your satisfaction.

## 1.6 Math in This Course

ASTR 220 is a GenEd physical science course, which requires it to have “quantitative reasoning”: math. The math used in the class is at the level you were capable of when you entered the university; however, I realize that your last math class may have been some time ago.

The math we will be using is as follows:

- Scientific notation. You can brush up on this on the website Scientific Notation at <http://janus.astro.umd.edu/cgi-bin/astro/scinote.pl> .
- Units. You can review SI units at <http://physics.nist.gov/cuu/Units/index.html> .
- We will be using mathematical equations to calculate physical quantities. Occasionally, we will be re-arranging these equations using algebra. For a review of this idea, visit <http://www.purplemath.com/modules/solvelit.htm> .
- We will be interpreting graphs.

On the class website on ELMS, under “Pages” is a document with examples of the different kinds of math problems you will be doing in ASTR 220. If you have any math difficulties, please visit your TA or me for help!

## 2 Practical Information

ASTR 220 Introduction to Astronomy is a 3-credit Physical Science course within the Distributive Studies - Natural Sciences part of GenEd; it is also an I-Series course. It does not have a laboratory section, but it does have a discussion section. There are no pre-requisites for this class; this class is aimed at non-science majors. ASTR 220 meets Tuesdays and Thursdays from 9:30 - 11:45am in CSS 2400.

### 2.1 Contact Information and Office Hours

| Person                   | Email  | Office    | Phone   | Office Hours                  |
|--------------------------|--|-----------|---------|-------------------------------|
| Dr. Melissa Hayes-Gehrke | <a href="mailto:mhayesge@umd.edu">mhayesge@umd.edu</a>                   | PSC 1208B | x5-1562 | Wed 3 - 4pm, Fri 10 - 11am    |
| Mr. Kenneth Koster       | <a href="mailto:kkoester@terpmail.umd.edu">kkoester@terpmail.umd.edu</a> | CSS 0255  | -       | Tue 1-1:45pm, Wed 2:15-3:45pm |
| Ms. Alyssa Pagan         | <a href="mailto:apagan1@terpmail.umd.edu">apagan1@terpmail.umd.edu</a>   | CSS 0255  | -       | Tue 11am - 12pm, Wed 1 - 2pm  |

**Note: All email addresses are @umd.edu.** Please feel free to email your TA or me to arrange appointments at other times to discuss the class.

### 2.2 Class Website

The course website will be on ELMS with the Canvas system; students can login to their course(s) by going to <https://myelms.umd.edu/> . A University ID and password are required to access ELMS courses. Information on changing or resetting your password is available from <https://ldap.umd.edu/cgi-bin/chpwd> .

When you login to ELMS, under the “Courses” menu you will see a link for the ASTR 220 website. This website has all course handouts and information, including the syllabus and exam solutions. All course announcements will be posted here. You will also be able to view your grades (and no one else’s).

### 2.2.1 What If I Need to Contact You?

If I have to contact you, I will do so by messaging you through the class website on ELMS or by emailing your UMD email account. **MAKE SURE TO CHECK YOUR ELMS MESSAGES and UMD EMAIL FREQUENTLY.** You can set up ELMS to email your messages. You can also set up your UMD email account to forward to another account by visiting: <http://www.testudo.umd.edu/apps/saddr/> . **I am not responsible if you miss crucial information that was emailed or messaged to you concerning this course.**

## 2.3 Discussion Sections

If you are taking ASTR 220, you **MUST** attend a discussion section. Make sure that you are registered for one of the following sections. **Discussion sections begin on Wednesday, Jan. 27, 2016.**

| Section | Day       | Time       | Room     | TA           |
|---------|-----------|------------|----------|--------------|
| 0101    | Wednesday | 1 - 1:50pm | CSS 2428 | Ken Koester  |
| 0102    | Wednesday | 2 - 2:50pm | CSS 2428 | Alyssa Pagan |

The discussion sections are intended to help you learn the material needed for the pre-lecture quizzes, team projects, and exams. You will be actively learning the material through discussion with your team and the other students in the class. One of the primary activities in discussion section will be to work on exam problems from previous semesters.

Your grade for each discussion section will be based on both attendance and participation. In each discussion section, you will sign in on an attendance sheet. You must attend **AND** participate for the majority of the time. If you are late, the TA may deduct some points from your discussion score for that day. The TA will evaluate the level of your participation by doing a rough grading of your activity on an “excellent”, “satisfactory”, and “unsatisfactory” scale. The TA will use his/her discretion for judging attendance and participation, and *his/her decision is final and will be supported by me.*

There are 14 discussion sections. Your two lowest discussion section scores will be dropped. The remaining scores make up 10% of your course grade. If you add the class after the first or second discussion section, then that/those score(s) is/are the one(s) that will be dropped from your grade.

**It is your responsibility to remember to sign in at each discussion section. If you forget, you MAY NOT sign in retroactively or make it up.**

## 2.4 Textbook

There is no required textbook.

## 3 Grading

On all material in the course, credit will only be given for those answers that answer the question asked; partial credit may be given. Credit will not be given simply for effort. The table below shows the breakdown of the course grade.

| Work                              | Percentage of Course Grade |
|-----------------------------------|----------------------------|
| pre-lecture quizzes (16 of 21)    | 10%                        |
| topic briefs                      | 10%                        |
| discussions (12 of 14)            | 10%                        |
| research poster                   | 13%                        |
| spacecraft proposal               | 10%                        |
| student decisions                 | 7%                         |
| class participation (26 of 29)    | 5%                         |
| participation in team evaluations | 5%                         |
| midterm exams (2)                 | 15%                        |
| final exam                        | 15%                        |

**Note:** once your grade is calculated following the table above, any Contract Deduction you received will be subtracted from your grade. (See subsection “ASTR 220 Contract” below.)

| Letter Grade | Minimum Course Grade Percentage |
|--------------|---------------------------------|
| A+           | 97.5%                           |
| A            | 92.5%                           |
| A-           | 90%                             |
| B+           | 87.5%                           |
| B            | 82.5%                           |
| B-           | 80%                             |
| C+           | 77.5%                           |
| C            | 72.5%                           |
| C-           | 70%                             |
| D+           | 67.5%                           |
| D            | 60%                             |
| D-           | 52.5%                           |

I expect that an average student in this class will earn a B-. If the exams or assignments prove more difficult than expected, the minimum grade percentages for each letter grade may be lowered; they will never be raised.

**No extra credit** will be given in this class. If you do not feel you are doing as well as you could be on the assignments, arrange to meet with your TA or me to discuss them before they are due. Don't wait until the end of the semester!

### 3.1 ASTR 220 Contract

The ASTR 220 syllabus is a contract between student and instructor which lists the guidelines, rules, and conditions for the class. The Contract requires you to answer some simple questions about the administration and grading of the class, which you can answer by reading the syllabus.

**You must complete the ASTR 220 Contract Questions correctly by the beginning of lecture (9:30 am) on Thursday, Feb. 11, 2016, in order to NOT receive a deduction in your course grade. After a one-day grace period, you will receive a deduction of 2.5% to your course grade per calendar day that you do not complete the contract questions correctly.**

Here is an example tabulation of the amount that will be **DEDUCTED** from your course grade if you do not correctly answer the ASTR 220 Contract Questions **BEFORE** the following dates and times:

| Before Date and Time       | Days After Due Date | Deduction | Result to Your Grade      |
|----------------------------|---------------------|-----------|---------------------------|
| Thursday, Feb. 11, 9:30am  | 0                   | 0%        | No effect                 |
| Friday, Feb. 12, 9:30am    | 1                   | 0%        | No effect                 |
| Thursday, Feb. 18, 9:30am  | 7                   | 15%       | Better than B impossible  |
| Wednesday, Feb. 24, 9:30am | 13                  | 30%       | Better than C- impossible |
| Tuesday, Mar. 1, 9:30am    | 19                  | 45%       | Better than D- impossible |
| Wednesday, Mar. 2, 9:30am  | 20                  | 47.5%     | IMPOSSIBLE TO PASS COURSE |

The ASTR 220 Contract questions are administered as a quiz on the class's website on ELMS: <https://myelms.umd.edu/>. Go to this website and log in. Under "Courses", click on the ASTR 220 link. Then, on the menu on the left side, choose "Assignments". You will see an item called "ASTR 220 Contract Questions". Click on that to begin the quiz.

If you answer some questions incorrectly, you may re-do the quiz as many times as necessary in order to get them all right. At a later time, the deduction you will receive to your course grade (as described above) will be computed based on when you correctly completed the questions. This deduction will be entered in a column in the gradebook called "Contract Deduction".

### 3.2 Pre-lecture Quizzes

There will be 21 pre-lecture quizzes for the course. (The following lectures will **NOT** have pre-lecture videos nor pre-lecture quizzes: 1, 12, 21, 22, 24, 26, 27, 28.) Pre-lecture quizzes will be based on the pre-lecture video material. Your 16 highest pre-lecture quiz scores will count toward your course grade.

The Pre-lecture Quizzes will be done on the class's website on ELMS: <https://myelms.umd.edu/>. Go to this website and log in. Under "Courses", click on the ASTR 220 link. Then, on the menu on the left side, choose "Modules". You will see modules for each of the course lectures; within each lecture's module is the pre-lecture video and Pre-lecture Quiz.

The Pre-lecture Quizzes are not timed, but the quiz must be submitted prior to the due date: 9:30am on the day of the lecture. **You can only submit the quiz once.** You can start a quiz and save your answers for later without submitting it, but if you forget to submit your saved answers, they will not count.

What if you miss a quiz? Your 5 lowest or missing ones will be dropped, so you if you miss a quiz, it will count as one of those.

- If you save your answers and forget to submit them, you may not submit them later after the due date.
- *You are responsible for planning ahead to insure that you have a reliable internet connection to submit the quiz.* The failure of an internet connection at the last moment is **NOT** an excuse and you will receive a zero for that quiz.
- If you are too sick to use the computer and complete the quiz, then you will receive a zero, and it will count as one of your dropped quizzes. (If you have an illness that causes you to miss more than one consecutive quiz, please see the "Absences" section for what to do.)

### 3.3 Topic Briefs

There will be 22 topic briefs for the course; all lectures that have pre-lecture quizzes also have topic briefs. In addition, a special topic brief will be required for the combination of Lectures 27 and 28 and will be due in class on Thursday, May 5, 2016.



The topic briefs will require you to utilize exploratory writing to answer a rather open-ended question about the material presented that day. The topic briefs will be written in class and handed in at the end of the class.

The purpose of the topic briefs is to improve your writing skills and to stimulate thinking about issues, questions, and problems raised by the class material. You will achieve the best score on the topic briefs by showing that you are thinking carefully about the relevant concepts and expressing your thinking clearly in writing.

To put your topic briefs into a meaningful context, you will imagine that you are a staff member working for a US senator. Your area of expertise is astronomy and asteroids. Through the topic briefs, you will be explaining and clarifying astronomical concepts to the senator.

The topic briefs will be graded on a scale of 1 - 5, with the guidelines below on how the topic briefs will be graded. With these guidelines, **I expect the average student to receive a 4** with a score of 5 indicating an above-average topic brief.

- **5:** The writer understands the concept well. The writer discusses course material relevant to the question in easily-understood prose. There are no major errors in the use of astronomical terms. The response is easily readable with no major grammatical or other errors, although there may be a few small errors. The response is long enough to completely answer the question in a satisfactory way (usually a paragraph).
- **4:** The writer understands the concept reasonably well, but compared to a 5 response, there are some inaccuracies or vagueness in the discussion. Or the material in the response may be quite good, but be far too short to answer the question satisfactorily. Or, there may be a few major grammatical/writing errors or many smaller errors (such as punctuation and misspelling)..
- **3:** The writer has some misunderstandings about the concepts discussed in the response; however, the writer has demonstrated considerable thought and effort in trying to understand the material. Or the response could have been a 4, except for a large number of typos, many social messaging abbreviations, or sections of the response that were incomprehensible.
- **2:** The writer has not addressed the question directly, but has written a “data dump” of material from the class. The response consists of true but unconnected facts, definitions, and statements from the lecture.
- **1:** A 2, but where the facts presented have numerous inaccuracies. Or a response that is completely incomprehensible.

The scores of your topic briefs will be summed to determine your grade for this portion of the course grade. The total scores required to achieve each letter grade are listed below.

| Sum of Topic Brief Scores | Letter Grade | Score Used in Calculation of Course Grade |
|---------------------------|--------------|---|
| 96 pts                    | A+           | 100%                                      |
| 93 pts                    | A+           | 97.5%                                     |
| 87 pts                    | A            | 92.5%                                     |
| 82 pts                    | A-           | 90%                                       |
| 79 pts                    | B+           | 87.5%                                     |
| 74 pts                    | B            | 82.5%                                     |
| 71 pts                    | B-           | 80%                                       |
| 68 pts                    | C+           | 77.5%                                     |
| 63 pts                    | C            | 72.5%                                     |
| 60 pts                    | C-           | 70%                                       |
| 57 pts                    | D+           | 67.5%                                     |
| 52 pts                    | D            | 60%                                       |
| 43 pts                    | D-           | 52.5%                                     |
| 32 pts                    | F            | 40%                                       |
| 23 pts                    | F            | 27%                                       |
| 13 pts                    | F            | 15%                                       |

Note that you do not have to complete all of the topic briefs to receive a high grade, nor do you have to complete all of them with a score of 5. For example, you may receive an A- by receiving a score of 5 on 17 topic briefs, or by receiving a score of 4 on 21 topic briefs.

What if you miss a topic brief? As noted above, you do not have to complete every topic brief in order to receive a good grade. If you miss one, you receive a zero on it. (If you have an illness that causes you to miss more than one consecutive lecture and topic brief, please see the “Absences” section for what to do.)

### 3.4 Research Poster

You will be conducting a research project with your team that results in one research poster being submitted by your team. Each team will be researching a different topic, chosen from a list of topics provided by me. The assignment of topics will be discussed in class. Your team will have to determine how to split up the workload and how to ensure the research poster is submitted on time.

#### Details of the research poster:

- The overall size should be 36” × 48”. (This can be done in Powerpoint - details provided later.)
- Include a heading section at the top which states the title of your research poster, the names of all team members, and your team number.
- Write your paper at a level so that another student in the course would be able to understand the topic.
- The poster must have a bibliography section. Your in-text citations and bibliography should follow the MLA format. You can read about the MLA format at: <http://owl.english.purdue.edu/owl/resource/747/01/> .
- Your bibliography should list at least 3 sources that you have used. **You may not use Wikipedia or a similar website as a source** - find the original, authoritative sources. If you’re not sure if a source is legitimate, please ask me!

A detailed hand-out will include complete instructions for the formatting, intermediate steps that are due, and a grading rubric.

Your team must submit a poster prospectus on your topic prior to the Research Poster due date, as well as a rough draft. The teams will critique each other's rough drafts and give suggestions for improvement. All teams will be presenting their Research Posters to me and the class during lecture, which is described in the section below.

The overall grade of the Research Poster will have the following components:

- Research Poster: 60%
- Poster prospectus: 5%
- Completion of Rough Draft: 5%
- Presentation of the Research Poster: 20%
- Questioning of Other Presenters: 10%

After this grade is determined, I may adjust it for each student according to my interpretation of the team evaluations (see above in "Active Learning").

- Poster prospectus: due in lecture on Thursday, Feb. 25, 2016.
- Research Poster rough draft: due in lecture on Thursday, Mar. 10, 2016.
- Research Poster: submitted by computer file by 9:30am on Thursday, Mar. 31, 2016.
- Poster Questions: due in lecture on Tuesday, Apr. 5, 2016.
- Presentation of Research Posters in class: Tuesday, Apr. 12, and Thursday, Apr. 14, 2016.
- Answers to Poster Questions: due in lecture on Tuesday, Apr. 19, 2016.

### **3.4.1 Presentation of the Research Poster**

The class will have two poster sessions, which will take place during two lectures. Half of the teams will present their posters on one day, and half on the other day.

Your team will display your Research Poster and should be ready to give a "spiel" summarizing your Research Poster that takes 5 minutes or less. The teams who are not presenting posters on that day will be viewing the posters and asking questions. I will visit each Research Poster to hear each presentation and ask questions. During your oral presentation, each team member should contribute.

The teams that are not presenting Research Posters on that day will be required to ask questions (submitted to me earlier) on some of the posters. After the poster session, these teams will write up their questions and answers for submission to me.

## **3.5 Spacecraft Proposal**

You will be "proposing" a spacecraft mission with your team: the mission's goal is either to study a near-Earth asteroid or to deflect a near-Earth asteroid on an impact course. I will assign each team a mission goal. Your team will have a budget and will have to design your spacecraft using components from a list I will provide. Your team will have to decide which components are best suited to achieve the goal of your mission. Your team will submit a spacecraft mission proposal describing your goal, the design of your spacecraft, and how your design will meet the mission goal - the hopes that your spacecraft will receive government funding!

To make sure that you are thinking about this project with sufficient time to write an adequate proposal, a rough draft of the Spacecraft Proposal is due in lecture on Tuesday, Apr. 12, 2016. I will read it promptly and return the rough draft with feedback that you can use for your full proposal.

The Spacecraft Proposal itself is due in lecture on Tuesday, Apr. 26, 2016. The proposal does not have a required minimum length: it may be as short as is sufficient to fully describe your proposed spacecraft and your design choices. The details of the proposal will be discussed in class.

Your Spacecraft Proposal will be evaluated by me. It will also be evaluated (anonymously) by other teams in the class in a peer-review session in lecture on Thursday, Apr. 28, 2016. Each proposal will be evaluated by at least two other teams to ensure that no one team grades too harshly or easily.

The grade you receive on your Spacecraft Proposal will be based on the following components:

- 70% will be based on my evaluation of the proposal.
- 20% will be based on the evaluation of the proposal by your peers.
- 5% will be based on your participation in the peer review of your classmates' proposals.
- 5% will be based on your rough draft.

After this score is determined, I may adjust it for each student according to my interpretation of the team evaluations (see above in “Active Learning”).

### 3.6 Student Decisions

As we learn in the course about the possibilities of impacts by near-Earth asteroids and how we could defend the Earth, we will also learn that many situations could arise where tough decisions will have to be made and there is no “correct” decision.

A number of situations will be posed where a decision about how to defend the Earth must be made. Two teams will be assigned to each situation as “representatives”, with one team representing each side of the decision. Additional teams will act as “judges” to make the decision. The representative teams will each decide how to make the best argument for the decision they represent, including what evidence best supports their position. Each representative team will write an argument (less than 500 words), which they will submit ahead of time so I can distribute them to the judging teams.

In lecture, the representative teams will present their arguments orally in front of the class; each representative team will have 4 minutes to make their argument. Then, each representative team will have 2 minutes to ask the other representative team questions to try to point out flaws in the other team’s argument. After that, the judging teams exit the room and deliberate on the arguments in order to decide which argument was most convincing while the next topic is presented. After the presentation of the next topic, the judges will announce their decision and turn in a brief written decision that includes their reasoning.

Each team will have one situation in which they are a “representative” and one in which they are a “judge”. Each team’s grade for the Student Decisions will be based on:

- The team written argument when they are a “representative” for a situation: 60%.
- The team presentation of their argument when they are a “representative” for a situation: 30%.
- The team written decision when they are a “judge” for a situation: 10%.

After this score is determined, I may adjust it for each student according to my interpretation of the team evaluations (see above in “Active Learning”).

Important dates for the Student Decisions:

- “Representative” arguments are due in lecture on Thursday, Apr. 28, 2016. (Bring a rough draft to discussion on Wednesday, Apr. 27, 2016.)
- Student Decision days are in lecture:
  - Tuesday, May 3, 2016
  - Thursday, May 5, 2016

More details on this project will be discussed in class.

### 3.7 Participation in Team Evaluations

One of the teamwork skills you will be developing in this class is the ability to give constructive feedback about how your teammates are working with your team and to receive constructive feedback about your own performance with your team. You will be required to provide feedback about yourself and your team members at several points throughout the semester. Your *sincere* participation in these team evaluations will receive full credit; the content of your evaluation and feedback will NOT be graded for “correctness”.

Seven team evaluations are planned. Your sincere participation them will receive 100% for this component of the course grade; your lowest or missing team evaluation score will be dropped.

See the Absences section below if you miss a team evaluation opportunity.

| Team Evaluation Event   | Evaluation Occurs Between Dates |
|---|---------------------------------|
| Email Check   | Feb. 12 - 15                    |
| Poster Prospectus due   | Feb. 26 - 29                    |
| Poster rough draft due  | Mar. 10 - 21                    |
| Poster due  | Apr. 1 - 4                      |
| Poster oral presentation<br>Spacecraft Proposal rough draft due | Apr. 15 - 18                    |
| Spacecraft Proposal due<br>Student Decisions argument due       | Apr. 27 - May 2                 |
| Student Decisions oral argument                                 | May 6 - 9                       |

You will receive instructions in class for how to complete the team evaluations.

### 3.8 Class Participation

Class participation is crucial for your understanding of the material in the classes and for your success in the course. I will assume that if you are attending class that you are participating in class; consequently I will be recording your attendance at each lecture. When you come to lecture, you should pick up a small attendance form that has “ASTR 220” and that day’s date on it. Write your name and discussion section on the form **LEGIBLY** and then turn it into one of the boxes by the door when you leave.

Your grade for this part of the course will be calculated as follows: there are 29 lectures in the course. You may miss 3 or fewer lectures with no penalty. (These apply to **unexcused absences**; if you have an excused absence there are alternatives. See the “Absences” section below.) The fraction of times you attended lecture (with a maximum of 26) out of 26 will be multiplied by the 5% portion of the course grade allocated for class participation. For example, if you attend 23 lectures, your class participation grade will be:  $(23/26) \times 5\% = 0.89 \times 5\% = 4.5\%$

There will be no strict time deadline for when you need to arrive and pick up the daily class participation form as long as you are present for the majority of the lecture. However, if I or the TA feel that you are abusing this, I reserve the right not to credit your class participation in that

lecture. On the days of midterm examinations, your midterm exam will count as your proof of class participation.

The concept tests in lecture will **not** be graded; however, I expect you to participate in them, and I may call on specific people or teams to answer questions in lecture. Your work on these items is a resource for you and for studying, as you find that a number of exam questions will follow from understanding the concepts presented in them. If I observe that you are not participating, I will ask you to leave and revoke your class participation credit for that lecture.

It is **UNACCEPTABLE** for you to fill out an class participation form for a friend and to do so is an act of academic dishonesty. **Even if your friend is in lecture**, he/she must fill out the class participation form for him/herself and **must turn it in for him/herself**.

If you have joined the class after the first day of class, make sure to notify me and pick up a “late add” sheet that will fill you in on what you missed and what you need to make up.

### 3.9 Exams

| Test       | Date                    | Time     |
|------------|-------------------------|----------|
| Midterm 1  | Thursday, Mar. 3, 2016  | in class |
| Midterm 2  | Thursday, Apr. 21, 2016 | in class |
| Final Exam | Friday, May 13, 2016    | 8 - 10am |

You may use a scientific calculator on the exams. You **may not** use any other type of device, such as a cell phone, computer, or tablet. A list of equations used in the class, as well as astronomical unit conversions, will be provided on the exam.

**Do not be late for the exams – you will not receive extra time.** Traffic problems are not an excuse. Bring your student ID with you to the exams.

All examinations will be held in CSS 2400. The final examination will be cumulative. The midterm exams, midterm re-test due dates, final exam, and in-class presentations of the Research Posters and Student Decisions are Major Scheduled Grading Events.

**If you are ill on the day of an exam and cannot attend the exam, you or someone else must contact me BEFORE THE EXAM IS FINISHED.** If you are entitled to a makeup exam, it may be in another format of my choice. See the “Absences” section of the syllabus for more.

If the University is officially closed on the day of a midterm exam, the exam will be held in the next regularly scheduled lecture.

If you find a mistake in the grading of the exam or wish to have the grading of a problem re-checked, you must do so prior to the next exam. After that time, no further changes will be made to the prior exam’s grade. I will retain the final examination for each student for one year after the final examination has been given.

#### 3.9.1 Team Exams

All of the midterm exams and the final exam will have both an individual and group component. Approximately 2/3 of the exam time will be allotted for each student to complete the exam individually, and approximately 1/3 of the exam time will be allotted for student teams to complete the same exam. Exact details will be announced in class prior to the exams.

Each student’s “box score” for an exam, which is the score that counts toward his/her course grade, will be a combination of his/her score on the individual exam as well as the team exam. The box score will be weighted so that 75% is based on the individual exam and 25% is based on the team exam. However, if the score on the team exam is lower than that student’s score on the individual exam, then the group exam will not be included, and the box score for that student will be 100% of the score on the individual exam.

## 4 Absences and Accommodations

The University Attendance and Assessment Policy will be strictly followed in this class. This policy can be found online at <http://www.testudo.umd.edu/soc/atedasse.html>. According to this policy, the instructor is obligated to allow makeup work or provide alternate arrangements **only** for **excused** absences.

An excused absence is an absence that results from “illness of the student, or illness of a dependent as defined by Board of Regents policy on family and medical leave; religious observance (where the nature of the observance prevents the student from being present during the class period); participation in University activities at the request of University authorities; and compelling circumstance beyond the student’s control.” [Taken from the UM Attendance and Assessment Policy.] Note that a “compelling circumstance” is essentially an emergency.

- Examples of a “compelling circumstance”: a death in the immediate family, a serious car accident involving yourself or a family member, your house burning down. (I hope you don’t have any of these!)
- Some examples of incidents that are **NOT** emergencies: running out of gas for your car, your bike tire being flat, the bus being late, bad traffic on the highway, your printer breaking. These are circumstances for which you need to plan ahead and allow yourself extra time daily to arrive on campus, just in case. If you experience one of these delays and it causes you to miss a lecture, remember that you may miss up to 3 classes with no penalty to your grade.

### 4.1 What to Do If You Have an Excused Absence

- **Planned Excused Absences.**
  - **If you must be absent FROM LECTURE for a university-approved athletic event (or other university activity) or religious observance...** you must contact me *at least 1 week in advance* to make appropriate arrangements to complete the topic brief within one week of your absence. You must be prepared to hand in projects **before** your absence. You are still responsible for completing any online work on time or prior to when you leave.
  - **If you must be absent FROM DISCUSSION SECTION for a university-approved athletic event (or other university activity) or religious observance...** you must contact the TA for your discussion section *at least 1 week in advance*. Your TA will make arrangements will you to complete work to makeup your absence. *You must make up missed discussion section work within one week of your return unless your TA makes extended arrangements!* If you register for the class after the first discussion section is held, the missed discussion section counts as your dropped score.
- **Unplanned Excused Absences.**
  - **If you miss an EXAMINATION because of illness or a compelling circumstance...** you or another person must contact me by phone (x5-1562) or email (mhayesge@umd.edu) **BEFORE THE LECTURE PERIOD IS FINISHED** - if you are too ill to get out of bed, get a friend or relative to contact me. These are Major Scheduled Grading Events as described by University policy, so you are required to have a University Health Center excuse or another official medical excuse to present to me upon your return to class. If you have a “compelling circumstance”, you must be prepared to document it. Once you have contacted me, you must take a makeup examination as soon as possible, but no later than one week after you return to your normal class schedule. The makeup examination may be in an alternate format of my choice.

- **If you miss a LECTURE (no exam) because of illness or a compelling circumstance...** you must contact me by phone (x5-1562) or email (mhayesge@umd.edu) **within 48 hours** - if you are too ill to get out of bed, get a friend or relative to contact me. You must be prepared to document how your absence fell under the University’s excused absence policy, or see me and fill out an excused absence form. Since it is not required to do all topic briefs, there will be no makeup for the one you miss.
- **If you miss a DISCUSSION SECTION because of illness or a compelling circumstance...** you must contact your TA **within 48 hours**. Your TA will make arrangements for you to complete makeup work. *You must make up missed discussion section work within one week of your return to classes unless your TA makes extended arrangements!*
- **If you are unable to be online to complete a PRE-LECTURE QUIZ...** the quiz you miss will count as one of your dropped scores. Your internet connection being “down” is not an emergency!
- **If you are unable to be online to complete a TEAM EVALUATION...** you or another person must contact me by phone (x5-1562) or email (mhayesge@umd.edu) **BEFORE THE TEAM EVALUATION PERIOD IS FINISHED** - if you are too ill to get out of bed, get a friend or relative to contact me. These are Major Scheduled Grading Events as described by University policy, so you are required to have a University Health Center excuse or another official medical excuse to present to me upon your return to class. If you have a “compelling circumstance”, you must be prepared to document it.
- **If you have an extended illness causing you to miss more than one lecture and/or discussion in a row,** you must notify me as soon as you are able. For such an extended illness, University policy states that you must provide an excuse from the University Health Center or other medical provider. You must present this excuse to me in person within one week of returning to your normal class schedule so that we can make special arrangements for making up the work missed.

## 4.2 What to Do If You Have an Unexcused Absence

- **Unplanned Unexcused Absences.** Examples of reasons for unexcused absences: traffic problems, oversleeping, forgetting the assignment was due, missing the bus.
  - **If you miss a regular LECTURE (no exam)** for an “unexcused” reason, you may not be counted as present, nor may you makeup the topic brief.
  - **If you miss a DISCUSSION SECTION** for an “unexcused” reason, you may not make it up. You may miss one discussion section with no penalty.
  - **If you miss a PRE-LECTURE QUIZ or TEAM EVALUATION online** for an “unexcused” reason, you may not make it up.
  - **If you miss a MIDTERM EXAM** for an “unexcused” reason, you may not make it up.
- **Planned Unexcused Absences.** I realize that important events may occur at inconvenient times. Examples of important events that are not “compelling circumstances”: participating in a wedding, attending a major political event, attending a job interview.
  - If you have an important event that will occur during **discussion section**, contact your TA at least **one week** ahead to time. At your TA’s discretion, you may make arrangements following the “planned excused absence” policy described above to make up the work you will miss. **No student may do this more than once.**



- If you have an important event that will occur during a **PRE-LECTURE QUIZ or TEAM EVALUATION** due date, then you must submit it early.
- If you have an important event that will occur **on the date of a midterm exam**, contact me **at least 2 weeks in advance** and explain to me the nature of the event. **At my discretion**, I may allow you to take an examination **EARLY**. I may require documentation of your participation in the event (for example, a program with you listed as a participant). **No student may take an exam early more than once, and I am under no obligation to allow ANY student to take an exam early.**
- You may not be counted as present for the lecture(s) you will miss. You may not make up the topic brief.

If you have a number of such important events during the semester and will consequently miss a lot of class time, you will not do well in this class, and you should reconsider taking it.

### 4.3 Student Accommodations

If you have a documented disability, you must provide me with a copy of the University documentation by Friday, Feb. 5, 2016. When you bring me the documentation, we can discuss the accommodation you are permitted.

## 5 Academic Integrity

The process of scientific inquiry and education depends on the integrity of all participants. The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student, you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit <http://www.studenthonorcouncil.umd.edu/whatis.html>.

### 5.1 Copyright

My lectures and course materials, including powerpoint presentations, tests, outlines, and similar materials, are protected by copyright. I am the exclusive owner of copyright in those materials I create. You may take notes and make copies of course materials for your own use. You may not and may not allow others to reproduce or distribute course materials publicly, whether or not a fee is charged, without my express written consent.

### 5.2 Working Together

I encourage students in the class to discuss the material, including the pre-lecture quizzes and topic briefs. This means you **should**:

- Talk about the question and where you might find the answer.
- Talk about the concepts and details in the question.
- Work on example math problems on scratch paper or chalkboard.

These things are encouraged. However, be very careful that when you answer the pre-lecture quizzes, you do so **independently**. That means that there are things you **should not do**:

- Give another student an answer to a pre-lecture quiz question or topic brief.
- Develop exact sentences and paragraphs for your topic briefs with another student.
- Work out complete math problems for another student.
- Cut-and-paste or hand-copy work from one student to another, **even if you worked out the answer together**.
- Copy text or wording directly from the pre-lecture videos without quoting it and providing the source.

You must write your work up independently so that I and the TA know that you understand the problem. If you have identical work to that of another classmate, even if you worked on it jointly, you will be responsible for an act of **academic dishonesty** and the work of all students involved will be referred to the Student Honor Council. I have referred past incidents to the Honor Council and **all** of the students involved have been found responsible and been given XFs for the course.

### 5.3 Plagiarism

The Student Honor Council defines plagiarism as “intentionally or knowingly representing the words or areas of another as one’s own in academic exercise.” This means that if you copy material from another source, such as a textbook, a website, or another student, without giving credit to your source, you have plagiarized and are guilty of academic dishonesty.

When you are writing up your projects, be careful to avoid plagiarizing a textbook or a website. When you quote a phrase from a textbook or another source, make sure to indicate it is a quote and give your source.

**Plagiarism is not tolerated in this class!** If you plagiarize a significant amount of a project, your work will be sent to the Student Honor Council for evaluation and possible penalty – the typical penalty for such an offense is an XF for the class.

## 6 Schedule and Due Dates

The schedule of topics and due dates is on the next page. “AST 1” is the Asteroid History Paper rough draft, and “AST 2” is the final version. “RP 1” is the Research Poster prospectus. “RP 2” is the Research Poster rough draft. “RP 3” is the Research Poster final draft. “RP 4” is the Research Poster questions, and “RP 5” are the answers to those questions. “SP 1” is the rough draft for the Spacecraft Proposal. “SP 2” is the Spacecraft Proposal. “Decisions” are the “representative” papers presenting an argument on an issue for the Student Decisions.

| Lecture             | Date | Topic  | Due       |
|---------------------|------|--|-----------|
| 1                   | 1/26 | T Introduction to the asteroid impact threat                   |           |
| 2                   | 1/28 | Th Where is the Earth in the universe?                         |           |
| 3                   | 2/2  | T Gravity  |           |
| 4                   | 2/4  | Th How Orbits Work   |           |
| 5                   | 2/9  | T Changing Orbits  |           |
| 6                   | 2/11 | Th Spacecraft  |           |
| 7                   | 2/16 | T Solar System Formation                                       |           |
| 8                   | 2/18 | Th Properties of Light   |           |
| 9                   | 2/23 | T Asteroid Size & Shape, part 1                                |           |
| 10                  | 2/25 | Th Asteroid Size & Shape, part 2; Asteroid Surface Composition | RP 1      |
| 11                  | 3/1  | T Asteroid Interior Structure & Composition; Comets            |           |
| 12                  | 3/3  | Th <b>MIDTERM 1</b>  |           |
| 13                  | 3/8  | T Effects of Impacts, part 1                                   |           |
| 14                  | 3/10 | Th Effects of Impacts, part 2                                  | RP 2      |
| <b>SPRING BREAK</b> |      |  |           |
| 15                  | 3/22 | T Identifying and Studying Impact Craters on the Earth         |           |
| 16                  | 3/24 | Th Finding New Asteroids and Determining Their Orbits          |           |
| 17                  | 3/29 | T Predicting if an Asteroid Will Impact the Earth              |           |
| 18                  | 3/31 | Th Defense Strategies, part 1                                  | RP 3      |
| 19                  | 4/5  | T Defense Strategies, part 2                                   | RP 4      |
| 20                  | 4/7  | Th Defense Strategies, part 3                                  |           |
| 21                  | 4/12 | T <b>POSTER DAY</b>  | SP 1      |
| 22                  | 4/14 | Th <b>POSTER DAY</b>   |           |
| 23                  | 4/19 | T International and US Space Policy                            | RP 5      |
| 24                  | 4/21 | Th <b>MIDTERM 2</b>  |           |
| 25                  | 4/26 | T Cost-Benefit of Asteroid Defense                             | SP 2      |
| 26                  | 4/28 | Th <b>SPACECRAFT PROPOSAL PEER REVIEW</b>                      | Decisions |
| 27                  | 5/3  | T <b>STUDENT DECISIONS</b>                                     |           |
| 28                  | 5/5  | Th <b>STUDENT DECISIONS</b>                                    |           |
| 29                  | 5/10 | T What Is Being Done Now                                       |           |
|                     | 5/13 | F <b>FINAL EXAM, 8 - 10am</b>                                  |           |