Astronomy 101B - Fall 2015

Professor:  Dr. Ryan E. Johnson, Masters Hall 205, x6021, rjohnson@gettysburg.edu

Office Hours:  MWF 3:00-4:00 pm

Course Description
In this course, I will present you with an introduction to astrophysics and the current best view of our solar system. Throughout the semester, my focus will be on explaining how we know what we know. Our understanding of objects in the solar system pulls from many different scientific disciplines: astronomy, physics, geology, chemistry, biology, and meteorology. We will begin with the same tools the earliest astronomers possessed: our eyes and our imagination. From observations, we will follow the method of scientific inquiry to illuminate all that we know about the solar system.

I want to emphasize that science is not the answer; it is a method for exploring possible answers. Combining so many disciplines into one course may seem daunting, but we will forge ahead bravely armed with a single overriding tenet in our explorations, which is: “That which we observe beyond the Earth, must be similar to that which we observe on the Earth.” What this means is that the most fundamental forces in nature, those forces that are responsible for the movement or transport of everything we see on the Earth (the weak and strong nuclear forces, the electromagnetic forces and the gravitational force), are truly fundamental forces in the universe. As these forces are, to varying degrees, responsible for everything we see on Earth, we assume that these same forces govern that which we see in the universe.

Save the tenet mentioned above, there are no leaps of faith in astronomy. Everything you will learn about the universe in this course is based on evidentiary proof. As we proceed through the course, you would do well to keep in mind the question “how do we know,” since the “how” is much more important than the “what.”

Course Outcomes
Upon the completion of this course, you will be able to:
1. Use evidence and observation, rather than conjecture, to better understand the natural world around you.
2. Understand how mathematical models help make testable predictions.
3. Understand some of plethora of information contained in recorded light images

The Multiple Inquiries Curricular Goal at Gettysburg
This course satisfies the Multiple Inquiries (MI) curricular goal at Gettysburg. The purpose of the MI curricular requirement at Gettysburg is to foster “the development of an understanding of multiple frameworks of analysis and of proficiency in reading texts that span the breadth of human expression.” Natural philosophy, or study of the natural world, is the oldest science in which humans have engaged. As such, the methods that we use provide a framework through which we interact and engage with our environment. Through this course, I want to help you to better acquire and process information and ideas through the lens of physics. I also want you to be able to integrate the knowledge of the scientific process (the scientific method) that comes from studying astronomy and use that to inform your life.

Meeting Times
A101-B: MWF 2:10-3:00 pm
L1: M 7-10pm, Masters Hall Rm. 212, Mr. Ian Clarke (iclark@gettysburg.edu)
L2: T 7-10pm, Masters Hall Rm. 212, Mr. Craig Foltz (cfoltz@gettysburg.edu)
L3: W 7-10pm, Masters Hall Rm. 212, Mr. Craig Foltz (cfoltz@gettysburg.edu)
L4: R 7-10pm, Masters Hall Rm. 212, Mr. Ian Clarke (iclark@gettysburg.edu)
Please Note: You must attend the lecture and lab section in which you are enrolled. Space and our use of student response devices (clickers) means you cannot hop between lecture sections. We also have limited space and equipment in labs and so cannot accommodate more than the course cap in the lecture or lab space. Class and lab start times are firm, and being tardy to either will mean that you may miss valuable information that is communicated in the first 5-10 minutes of each class and lab.

**Textbook and Required Materials**
- Astronomy 101 Lab Manual
- A “clicker” – small response keypad available in the bookstore
- A scientific calculator – you will need this for the entire course: labs, HW, exams and in-class questions. A smartphone calculator is not acceptable for this purpose (not to mention that phones should be OFF during class). You should be comfortable enough using your calculator, along with all of its trigonometric and arithmetic functions, so that you are not slowed down in an exam situation.

**Office Hours**
My office hours are MWR, from 3-4 pm in Masters 205. These are the times when my door is open and I am available for drop-in questions. To ensure that I am not distracted or otherwise occupied, any meetings outside of my office hours are by appointment only. Since problem solving is an interactive process that requires discussion, any questions regarding homework problems should be asked in person, rather than by email. If you are absent for a legitimate reason or are requesting any special accommodation on an assignment, you should discuss this with me in private rather than just before or after class, as those times are too distracting for me to give a thoughtful response.

**Peer Science Mentors (PSMs)**
A PSM is another student, typically one who is a major in the department, who is available for review sessions and help with homework assignments. Their charge will not be to give you answers, but to help you figure out the answers for yourselves. The PSMs assigned to this class are Madison Hill (hillma03@gettysburg.edu) and Paul Lessard (lesspa01@gettysburg.edu). Both will have regular drop-in hours each week and are available for one-on-one or small group appointments. When studying or working through your assignments, I encourage you to avail yourselves of their assistance.

**Grading**
Your course grade will be computed from a combination of your homework assignments, in-class participation/quizzes, exams and laboratory work. Homework and in-class work will give you the best opportunity to practice your problem solving, so take full advantage of them. Quizzes will be given approximately each week and will cover reading and homework material since the previous quiz or exam.

Your course grade will be determined from the following percentages:

- 10% Class participation/Quizzes
- 10% Homework
- 20% Laboratory
- 36% 3 In-class Exams (12% each)
- 24% Comprehensive Final Exam

This course is not graded on a curve. At a minimum, letter grades are assigned by your percentile score (i.e. the range 60-70 is some kind of D, 70-80 is come kind of C, 80-90 is some kind of B and 90-100 is some kind of A). So if you score 81 percent, you are guaranteed at least a B-. Late work will not be accepted. At the end of the term, your 2 lowest homework grades will be dropped. While your homework grades may not have a large bearing on your final grade, some of the material which you are expected to know for the exams is covered in the homework, and so may have a significant effect on your exam success.

**Lab**
Labs will begin the first week of classes, so the first lab will be the same as the first day of class. Lab manuals will be handed out in class and you MUST have one for your first, and every, lab meeting. You should read the lab prior to attending so that you are prepared for the night’s experiment. The default lab location is Masters Hall, room 212, but we also have observing labs at the Gettysburg College Observatory, weather permitting. Your lab instructors are: Mr. Ian
In-Class Work, Participation and Clickers

Often we will stop in class to ponder questions and do exercises. Whether you are working alone, or along with nearby classmates, each person is responsible for participating in these activities. In-class work will include conceptual questions, quantitative problems, and anything else that helps us process and think through new material. When you come to class you should be prepared, engaged and ready to think on your feet.

For quick response questions, you will not be graded on whether your answers are correct, but rather that you earnestly participate in the exercise. To measure your participation, we use “clickers.” A clicker is a small, hand-held device that allows you to interact with PowerPoint slides that have questions displayed on them. A question will be posed during class and will then be open for you to answer from a multiple-choice list. Your responses are recorded throughout the session and saved so that I can evaluate them outside of class. Some important thing to remember regarding the clickers are:

- Each clicker is assigned to you individually and every response is saved. The clickers will be my primary means of determining your presence/participation in class.
- Since your in-class participation is part of your course grade, as per the Gettysburg College honor code, YOU must be there to participate and interact with your own clicker. If you are not in class you cannot receive credit for in-class work and it cannot be made up. If someone is not present in class but his/her clicker is recorded as being present, that is a clear violation of the honor code. All involved parties will be sent directly to the Dean’s office for a preliminary conference, no questions asked. **Do not loan your clicker out to anyone, since doing so will be viewed no differently than having someone else complete and hand-in an assignment with your name on it.**
- Although you will not be penalized for answering a question incorrectly with your clicker, individual accountability is important. This is time for you to practice problems and concepts and it is your responsibility to take full advantage that time. These questions and exercises will help better prepare you for in-class exams.
- Take care of your clicker and be sure that its batteries are not dead. There will be a period at the beginning of each class where you may chime in to make sure your clicker is working that day. If you have a problem with your clicker, let me know. If we can’t figure out the issue, take it back to the bookstore for a new one. **To accommodate the occasional illness or technological difficulty, you are allowed three free drops with the in-class work. These free drops encompass ALL missed days, including both legitimate and unexcused absences/dead batteries/broken/forgotten clickers so use them wisely!**

Homework

The homework (HW) is a combination of conceptual questions and quantitative problems from your text. HW will be posted on Moodle weekly. Each HW is graded primarily on your problem solving (quantitative) ability but HW problems will also have a qualitative context that you should bear in mind. Although they will not all be graded, review questions, discussion questions and “learning to look “ questions will synthesize material from each chapter and help your overall understanding. You will also be responsible for these questions at exam time, so you would do well not to ignore them.

Solutions will be posted to Moodle after the assignment is due, and so no late HW will be accepted. You are expected to work through these solutions, be critical of your own work, and consult with me if you have any questions. Think of the HW as practice for the exams. Since all exams will be closed book and closed notes, you should use the HW as an opportunity to test how well you know the material in a non-exam setting. Revisiting your HW assignments is one of the most effective ways to prepare for the exams.

Exams

Written exams will be given in class, closed book and closed notes. You are permitted only a writing implement, paper and your calculator for exams. Please ensure that all other items, especially cell phones, are put away during exams. Failure to do so may result in your failing the exam. **Absolutely no make-up exams will be given and missed exams will be given a zero!** The tentative (except for final) exam dates are: Exam 1 – Fri, 9/25; Exam 2 – Fri, 10/23; Exam 3 – Fri, 11/20; Final Exam – Mon, 12/14 (6:30-9:30 pm). Students who have a known institutional conflict (such as athletes...
who must travel to a sporting event), and thus cannot be available for an exam, should contact me at least three weeks in advance of that exam date. I understand that on very rare occasions students will have a true medical or family emergency that will cause them to miss an exam. To accommodate these situations and also be fair to students who may have other reasons for performing poorly on an exam, I have the following exam grading policy: If your score on the final exam is higher than at least one of your exam grades, your final exam grade will replace your lowest exam score. Naturally, if you must miss an exam due to an emergency, the missed exam (graded as a zero) will be your lowest exam score and is eligible to be replaced by your grade on the final. For example, a student scores a 70, 80, and 90 on their three exams, and then scores an 80 on the final. The student’s lowest exam score (a 70) will then be replaced with their final exam score (an 80). If a student were instead to have an unexcused absence during the second exam, they would be given a zero and their three exam scores would be 70, 0, and 90. In this case, their final exam score would still replace the lowest exam score (a zero in this case). This policy is meant to offset a poor performance on one exam and should not be used as an excuse to miss an exam entirely. Remember that the final exam is cumulative, and the three midterm exams are the best source of studying for material that may be on the final.

**Late work/absences**

Work that is not completed and handed in by the date/time it is due will not be accepted except under the most extreme circumstances. Given that you have ample time to complete your work, I expect you to be able to allocate your time appropriately so that, if anything, you turn your work in early rather than late. I respect that each student is an adult here by choice, and so whatever reason you have for missing class will be assumed valid. By that same token, you should not expect any special accommodations to makeup work that you missed during your absence.

**Academic Integrity and the Gettysburg Honor Code**

Any instance of academic dishonesty in any aspect of this course will result in severe consequences, including possible failure of the course. While you may work together on homework assignments, please do not be tempted to copy answers, as some problems have random values inserted which, while requiring the same knowledge, will result in different answers for each student. While you are encouraged to work together to complete labs and homework assignments, the work that you hand in must be born of your own efforts and knowledge. Submitting work that is not born of your own efforts, and in your own words, not only robs you of the opportunity to learn but also lessens the academic integrity of the entire institution. Neither ignorance nor carelessness is an acceptable defense in cases of plagiarism. A guideline for whether a collaborative effort could be considered plagiarism is to ask yourself the question: Could I reproduce all of the work I am handing in without the aid of any person and using only those sources I have specifically cited in the assignment? If you are at all in doubt about whether your planned course of action would violate the Gettysburg Honor Code, ask me before continuing. Your academic integrity is extremely important at Gettysburg and, as such, the lack thereof will be met with swift and serious consequences.
**Tentative Schedule**

The following schedule is to be used as a guide to the topics that we will be discussing and the relevant chapters in the text that you will be responsible for reading. This schedule is tentative in that the topics we discuss each day may change depending on how much time is required for each. Each topic is listed with the appropriate chapter in the text in parentheses (example: (2.1) means chapter 2, section 1). You are expected to have read the appropriate sections on each topic before the week they are listed on the syllabus. For each exam, I have listed the chapters I expect to contain testable material at that point. Although these may be adjusted as we proceed throughout the semester, you will be notified before each exam which chapters and sections you will be responsible for.

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<tr>
<th>Week Beginning</th>
<th>Topic (Text Chapters)</th>
<th>Important Dates</th>
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| 8/31           | Syllabus and Introduction  
Our Place in the Universe (1)  
Observing the Night Sky (2.1-2.2)                                                                                                                      | First Lab starts Monday                |
| 9/7            | Measuring the Sky and Celestial Motions (2.3)  
Seasons (2.4)                                                                                                                                                    |                                        |
| 9/14           | Our Moon and Eclipses (3.1-3.3)  
The Birth of Astrophysics (4.1-4.3)                                                                                                                                  |                                        |
| 9/21           | Galileo (4.4)  
Gravity and Newton’s Laws (5.1)                                                                                                                                  | Fri, 9/25 - Exam 1 (Ch 1-4)            |
| 9/28           | Gravity and Newton’s Laws cont’d (5.2)  
Light and other forms of Electromagnetic Radiation (6.1)                                                                                                         |                                        |
| 10/5           | Telescopes at different wavelengths (6.2-6.6)  
Atoms and Spectra (7)                                                                                                                                               |                                        |
| 10/12          | Our Local Star (8)                                                                                                                                                    | Fall Reading days (no class on Monday, 10/12, no labs)                                      |
| 10/19          | Other Stars: How we measure them (9.1-9.2)  
Our Solar System (19.1-19.2)                                                                                                                                      | Fri, 10/23 – Exam 2 (Ch 5-8)            |
| 10/26          | Formation of Solar System cont’d (19.3)  
Extra-solar Planets and Kepler (19.4)                                                                                                                               |                                        |
| 11/2           | The Earth (20)  
The Moon and Mercury (21)                                                                                                                                 |                                        |
| 11/9           | Venus and Mars (22)                                                                                                                                                  |                                        |
| 11/16          | Outer Planets-Jupiter and Saturn (23)  
Outer Planets-Uranus and Neptune (24.1-24.2)                                                                                                                             | Fri, 11/20 - Exam 3 (Ch 9,19-22)        |
| 11/23          | Pluto, Kuiper Belt, Meteorites, Asteroids and Comets (24.3-25)                                                                                                      | Thanksgiving-No class on W or F this week                                                  |
| 11/30          | Planetary Satellites and the Search for Water (misc+lectures)                                                                                                         |                                        |
| 12/7           | Life Elsewhere in the Cosmos (26)  
Final Exam Review                                                                                                                                                  | Last day of classes – Fri, 12/11  
Final Exam – Mon, Dec 14 (6:30-9:30 PM)                                                    |