Astronomy 101 Syllabus Checksheet

Your assignment for this evening is to read the attached syllabus and to complete this page. This sheet is due at the beginning of the next lecture.

Print your name_____

Student number_____

Local phone number_____

Home phone number_____

E-mail address:_____

My section number is _____. (MEMORIZE THIS NUMBER!)

When and where does your discussion section meet? _____

When and where does your laboratory meet? _____

I have read the attached syllabus, have a clear understanding of the class policies (including attendance, academic integrity and the honor pledge) pertaining to this course, and understand how my grade for Astronomy 101 will be determined.

_____ Date_____

Please answer the following questions:

Why are you taking Astronomy 101?

Before this class when did you last have some astronomy presented to you in school?

List 3 things that you would like to learn in this astronomy class.

1.

2.

3.

ASTRONOMY 101

GENERAL ASTRONOMY 4 credits Spring 2015

Instructor: Grace L. Deming
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Office: Physical Sciences Complex 1208C
Office Hrs. Mon. 9:30 - 11:30, Thurs. 12:30 - 2:30
or by appointment

ALL E-mails MUST use "ASTR101" as the "Subject" or they may be missed.
ELMS will be used to post materials and update grades. QUESTIONS about posted grades MUST be discussed with your TA within 1 week after posting. CHECK grades often.

Course Description:

Astronomy 101 is an introductory course in astronomy for non-science majors. This course satisfies the CORE distributive studies requirement for a laboratory physical science and the GENED requirement for a laboratory natural science. As specified by the CORE & GENED guidelines, this course will use active learning techniques, emphasize critical thinking and concentrate on written expression. **Credit will not be given for both ASTR 100 & 101.** (ASTR 100 is a CORE non-lab physical science course and GENED non-lab natural science course.)

In this class you will examine how modern astronomers collect and analyze electromagnetic radiation (the astronomer's fancy expression for light) to reveal the nature of this immense universe surrounding us. But astronomy is an old science. The course begins with our familiar surroundings here on Earth and early observations made by many cultures of the motions of the heavens. As more precise observations were made with new instruments, astronomers began to understand the motions seen in the heavens in terms of the gravitational force—a theme still important today (dark matter). As we move away from Earth out into the Solar System, comparisons will be drawn between the planets most similar to Earth (Venus and Mars) and the outer planets (like Jupiter). Examination of the very distant stars and their life cycles will begin with our own star, the Sun. For only the last 75 years, astronomers have realized that the Sun and planets are a tiny part of the vast collection of stars (some with their own planets) that make up our Milky Way Galaxy and that our galaxy is only one of billions in an expanding universe.

Learning Goals: After completing this course, students should be able to:

1. Demonstrate understanding of how knowledge is acquired using the scientific method, giving examples from the science of astronomy.
2. Develop a broad understanding of objects, distances, and timescales in the universe; and how humans, our Earth, and Solar System fit in.
3. Achieve a level of understanding of astronomical concepts so that they may appreciate and share in the excitement of future astronomical discoveries.
4. Explain scientific ideas and reasoning to others through written and oral communications.
5. Appreciate the roles of observation, experimentation, quantitative data analysis, abstract reasoning, and hypothesis testing in advancing scientific knowledge.
6. Understand motions and celestial events that are observable to the naked eye from Earth.

Course Philosophy:

Yes, I know that you are probably taking this class to fulfill your science requirement. I hope that you chose astronomy because it sounded more interesting to you than your other options. Maybe it was all that you could fit into your schedule! An educated individual should at least appreciate science and what scientists do, please make the most of this learning experience.

We can understand the universe that surrounds us! What a shame it would be for you to go through life without taking advantage of the vast body of scientific knowledge our ancestors

have accumulated. Modern astronomers have an obligation to share our discoveries with everyone. You'll want to be informed in order to make responsible decisions regarding our planet's future. Forming opinions supported by the interpretation of scientific data is crucial in dealing with environmental problems (such as ozone depletion and global warming) and answering basic questions about humanity (Are we alone in the universe? Is space exploration worth the cost?).

Nourish your curiosity by thinking for this class and challenging yourself for the rest of your life. Curiosity has brought our species to this level—pondering our place in the universe. I hope your interest in astronomy will continue well beyond this course. Many times an astronomical discovery leads to asking more new questions than providing answers to old ones. Long after this semester, I hope you will continue to think critically and share in the excitement of new astronomical discoveries.

Course Expectations:

***Attendance*:** To be successful in this course, you need to attend class. We meet 4 times a week.

Lecture: Tues. and Thurs. from 11:00 - 12:15 in Physics 1412

The universe is difficult to cover in one semester. I will select topics that I consider basic, important, or for which I have a personal fondness. Images, demonstrations, movies and notes will enhance lectures. There will also be daily skywatches and activities that are crucial to your success in this course. In lecture there will be times when I ask you to discuss a question individually or in a small group and turn in a written response (lecture activities). Unexcused absences result in a grade of zero on lecture activities and could impact your grade. If you miss a lecture, please look at another student's notes and make sure you understand what was covered. Weekly lecture summaries, terms and study questions will be posted on ELMS. These summaries are not a substitute for lecture. See your teaching assistant or me if you have questions.

Discussion: See the schedule of classes for the time of your discussion section 0101 to 0108. 50 mins. Discussion section is conducted by your teaching assistant (TA). We have a specific schedule (see p. 6) of activities that will prepare you for lab or expand a topic from lecture.

Laboratory: See the schedule of classes for the time of your lab section 0101 to 0108. 2 hrs. Understanding laboratory techniques, procedures, and reaching conclusions based on observations are crucial in understanding all sciences. Since most of astronomy deals with far removed objects, astronomers must utilize the information relayed to us in the form of electromagnetic radiation (light). Two labs use computers to simulate data collection and reduction. Additional important information will be provided in the "Lab and Discussion Syllabus" given during the first week of lab and discussion. The Discussion/Lab Schedule can be found on page 6 of this syllabus.

Preparation: You need to be prepared to think and work in lecture, discussion, and lab.

Reading the textbook: The reading assignments are given on pages 4 & 5 of this syllabus. You may want to preview material before class, followed by a more careful reading after lecture. You should study your class notes in the evening to make sure everything is clear and that you can answer any questions posed during the lecture.

Math/science anxiety: If you have always disliked math and/or science in the past, I hope this is the course that changes your opinion. You completed high school math/science requirements for graduation. That's all the background needed for Astronomy 101. We even review algebra in the first week of lab. You can do it! We will help you.

Study Habits: Study wisely and ask for help if you need it. Studying the night before an exam may not be sufficient. Because each class covers a lot of material, it will be much easier for you to keep up on a daily basis—schedule a daily astronomy study time. Review the material one

lecture at a time and keep up. If you have questions, please see one of the TAs or me. We are here to teach; please ask for help when you need it.

Grading

Two 100 pt. exams (Mar. 5; Apr. 23)	200
Labs (11 x 15 pts.) (page 3 & 7)	165
3 homeworks (3 x 20 pts.) (pages 8&9)	60
Discussion activities (pages 3 & 7)	76
Lecture activities (page 3)	49
Final exam 150 pts. (May 14)	150
Total points	700

University regulations will apply regarding academic integrity, the Honor Pledge, and excused absences. These policies can be found in the Undergraduate Catalog. A single lecture, discussion, or laboratory "sick day" or excused absence will be granted **only** if the student emails **Prof. Deming (lecture)** or **your TA (discussion/lab)** within 24 hrs. Students using their "sick day" must sign a form during the next class attended stating the date of illness and acknowledge that the information is true and correct. Prolonged & additional absences require a doctor's note.

You will be asked to sign the Honor Pledge on exams: *"I pledge on my honor that I have not given or received any unauthorized assistance on this examination."* Midterm exams will consist of multiple choice questions and questions that require a written response (short answer). **A full credit makeup exam will be given only to those students who have a VALID EXCUSE and WHO CALL OR EMAIL Prof. Deming BEFORE THE EXAM IS GIVEN to the class.** (The "sick day" may not be used for exams.) Excused students missing exams need to make arrangements with **Prof. Deming** for a makeup exam **(which may be entirely composed of essay questions)** to be taken no more than one week after the scheduled exam time or a grade of zero will result. If the university closes on a date for an exam or homework collection, the exam or homework collection will occur in the next scheduled class.

Grading scale used for final grades:

A+ 100 - 97%	A < 97 - 92%	A- < 92 – 90%	excellent mastery of subject
B+ < 90 - 87%	B < 87 – 82%	B- < 82 – 80%	good mastery of subject
C+ < 80 - 77%	C < 77 – 70%	C- < 70 – 68%	acceptable mastery of subject
D+ < 68 – 65%	D < 65 – 60%	D- < 60 – 57%	borderline understanding of subject

F < 57% failure

There may need to be some adjustment to the exam scores depending on the class average; however, any adjustment will be to lower the percentages given above, never to raise them. For example, if everyone scores 82% or above on Exam I, you would all receive a B or better for Exam I. Extra credit questions appear on each exam and there will be one extra credit problem on each of the homework assignments. **There will be no extra credit term papers.** Students with a documented disability who wish to discuss academic accommodations should contact me as soon as possible. Students who have a religious observance conflicting with class times during the semester should contact me or your TA as soon as possible.

Textbooks Required

The Cosmic Perspective: Fundamentals (2010), Bennett, Donahue, Schneider, Voit. ISBN 978-0-3-2156695-9 (either paper or e-book is fine; CD not necessary) and Experiments in Astronomy, Blitz and A'Hearn, 1991. ISBN 9781256935704 **(this must be new, no rentals or used copies).** You must buy the Lab book; after Lab #2, or you will receive a 2-pt. deduction per lab.

Lecture Schedule

Jan. 27 Introducing Your Universe
Read: Syllabus & textbook p. xi-xii and pp.1-9
Homework: read syllabus, complete and turn in blue coversheet next lecture

Jan. 29 Scientific Method, Sky Appearances, Celestial Spheres
Read: C. 3 section 3.2 pp. 44, 45, 48,49; C.2 pp. 24-26 up to Understanding the Moon.

Feb. 3 Seasons and Lunar Phases
Read: C. 2 pp. 18-23 and section 2.2 pp.26-29 (to What Causes Eclipses)

Feb. 5 Eclipses, Pre-telescopic Discoveries on Six Continents
Read: C. 2 pp.29-31. Review lunar phases lecture handout before Lab meets

Feb. 10 Geocentric Model (Aristotle, Ptolemy, Hipparchus)
Read: C. 2 section 2.3; C. 3 pp.36-38

Feb. 12 Heliocentric Model (Copernicus, Tycho, Kepler, Galileo, Newton)
Read: C. 3 pp. 39-44; 46, 47

Feb. 17 Understanding Gravity, Characteristics and Formation of the Solar System
Read:C. 3 section 3.3; C.1 section 1.3 (up to Pluto); C. 4 p. 54, sections 4.1 & 4.2

Feb. 19 Age of Earth, Planet Earth
Read: C. 4 section 4.3; C. 5 pp. 75-77
Homework # 1 due at beginning of class—see page 8

Feb. 24 Geological Processes: Earth, Moon & Mercury
Read: C. 5 pp. 78-79 and 82-83 (to Mars); Fig. 5.23

Feb. 26 Comparing Terrestrial Surfaces: Earth, Mars and Venus
Read: C. 5 pp. 83-85; Fig. 5.23

Mar. 3 Comparing Terrestrial Atmospheres: Earth and Venus
Read: C. 5 pp. 80-82, 85-89, section 5.3 ; Fig. 5.23

Mar. 5 EXAM I (100 PTS.)

Mar. 10 Asteroids; Jovian Planets and their Moons
Read: C. 6 pp. 94, 105-106 (to Kuiper Belt), and section 6.1

Mar. 12 Comets and Pluto
Read: C. 6 pp.106-107, C. 1 section 1.3

Mar. 16-20 Spring Break

Mar. 24 Impacts and Exoplanets
Read: C. 6 (pp. 107-110), C. 7 p. 112, sections 7.1, 7.2, 7.3

Mar. 26 Electromagnetic Radiation and Spectra
Read: Review p. 80; pp. 130, 148, 115; review lecture handout before Lab

Mar. 31 Our Star: the Sun and solar energy
Read: C. 8 pp. 127-129, 131-132; review p. 77(last paragraph) and Fig. 5.3

Apr. 2 Stellar Properties and the HR Diagram
Read: C. 8 sections 8.2 and 8.3 and p. 195; review lecture handouts before Lab

Apr. 7 Evolution of the Sun (Birth)
Read: C. 9 p. 143, section 9.1.

Apr. 9 Life of the Sun (Middle age and Death)
Read: C. 9 section 9.2 pp. 149-152 top; C. 10 section 10.1 pp.163-164 up to white dwarfs & accretion
Homework #2 due at beginning of class - see pages 9

Apr. 14 Evolution of Massive Stars, Supernovae
Read: C.9 section 9.2 pp. 152-155, section 9.3.
Apr. 16 Neutron Stars and Black Holes
Read: C. 10 p. 162, sections 10.1 neutron stars pp. 165-168, 10.2 and 10.3 (not supermassive black holes)
Apr. 21 Extraterrestrial Life
Read: C. 15 p. 246, sections 15.1, 15.2 to p. 253 and 15.3

***Apr. 23 EXAM II* (100 pts.)**

Apr. 28 Galaxies in the Universe
Read: C. 11 section 11.2
Apr. 30 Our Milky Way Galaxy
Read: C. 11 p. 178, section 11.1
Homework # 3 due at beginning of class - see page 9
May 5 The Expanding Universe
Read: C.12 p. 194, sections 12.1, 12.2, and C. 13 section 13.2, 13.1
May 7 Galactic Evolution
Read: C. 12 section 12.3 and C. 11, section 11.3 and C. 10 p. 173 (supermassive black holes)
May 12 Dark Matter and Dark Energy
Read: C. 14 p. 226, sections 14.1, 14.2 and 14.3; C. 1 sections 1.2 and review 1.1

Thursday May 14 FINAL EXAM 8:00 AM – 10:00 AM Physics Lecture Hall Room 1412

Exam 1 (multiple choice and short answer) covers lectures from Jan. 27 through Mar. 3 along with all reading indicated for these dates. Prof. Deming will tell you in class on Mar. 3 where the material on the exam ends.

Exam II (multiple choice and short answer) covers lectures from Mar. 10 through Apr. 21 with all reading indicated for these dates. Prof. Deming will tell you in class on Apr. 21 where the material on the exam begins and ends.

Final Exam (multiple choice and short answer) is cumulative but there will be a greater emphasis on lectures from Apr. 28 through May 12 with all reading indicated for these dates. At least 70% of the short answer section on the final exam will come from this last portion of the course. Multiple choice questions will be split more evenly between the three segments of this course.

DISCUSSION AND LABORATORY SCHEDULE

(All Labs are 15 points except Lab 2 is 30 pts.)

Jan. 27-30 ***No Discussion or Laboratory sections meet***

Feb. 3 – 6 *Disc:* Introductions, Discussion & Lab procedures (5 pts.)
Lab: #1 Math Tools and Lab Introduction

Feb. 10 – 13 *Disc:* Review of motions in the sky (5 pts.)
Lab: Lunar Phases Lab

Feb. 17 – 20 *Disc:* Group Discussion (6 pts.) on Astrology
COMPLETE AND BRING TO DISCUSSION: Astrology Experiment
See pages 10 & 11 of this syllabus. This assignment is worth 10 pts.
Lab: #2 Celestial Spheres—Part 1

Feb. 24 – 27 *Disc:* What would you weigh on another planet? (5 pts.)
Lab: #2 Celestial Spheres—Part 2

Mar. 3—6 *Disc:* Review for Exam (5 pts.)
Lab: **No scheduled new lab**
Makeup labs will be done this week. Requires permission from your TA

Mar. 10 – 13 *Disc:* Exam return; Planetary surfaces (5 pts.)
Lab: # 3 Lunar and Martian Features

Mar. 16-20 ***Spring Break***

Mar. 24 - 27 *Disc:* Orbits (5 pts.)
Lab: #4 Moons of Jupiter

Mar. 31–Apr.3 *Disc:* Light and Spectra (5 pts.)
Lab: #7 Spectroscopy

Apr. 7 –10 *Disc:* Stellar Properties (5 pts.)
Lab: #8 Stellar Spectra

Apr. 14 – 17 *Disc:* Nebulae (5 pts)
Lab: #11 Interstellar Medium

Apr. 21 - 24 *Disc:* Review for Exam II (5 pts.)
Lab: **No scheduled new lab**
Makeup labs will be done this week. Requires permission from your TA

Apr. 28–May 1 *Disc:* Exam return; Galaxies (5 pts.)
Lab: #13 Galaxies

May. 5 – 8 *Disc:* Cosmology (5 pts.)
Lab: #14 Expansion of the Universe (Last lab)

May 12 ***No discussion sections or new labs***

May 12 **Makeup lab 5:30-7:30 pm Requires permission from your TA.**
May 13 **Makeup lab 10 am – noon Requires permission from your TA.**

Homework Assignments (20 pts. each)

Homework is due at 11 AM on the lecture date indicated. Electronic submissions will not be accepted. Homework handed in after 11 AM on the due date will be considered late (2 pts. deducted). (If you are slightly late (less than 20 min.) and lecture has begun, please look for a TA near the MAIN door and give your homework to him/her.) The next lecture is designated as the "late" date for homework. You may turn it in before the "late" date. Homework won't be accepted after the late dates/times indicated. **Write your section number (0101 – 0108) in the upper right corner on all papers submitted**. Any sources other than your textbook must be referenced. Unless indicated, each question is worth 4 pts. Homework may be typed or neatly handwritten. We must be able to read and understand your homework for you to receive full credit. **Please show your calculations on any numerical problems and justify all written answers**—yes or no is not enough. **Do not copy from the book, this is plagiarism and is a case of academic dishonesty.** Read the book **then CLOSE THE BOOK,** and phrase all answers using **YOUR OWN WORDS.** **Do not copy from your friend—this is also considered a violation.** You may discuss homework with a friend, but each person turns in their own work. **Even is you work together, no two papers can be identical—your work should reflect your unique thoughts.** The university's honor code will be enforced. Make sure that you read (and understand) these policies in the UG Catalog or the Lab & Discussion syllabus.

Homework # 1: Due Feb. 19 at 11 AM (unacceptable after 11 AM Feb. 24)

1. For each of the following, make a sketch showing positions of the Sun, Earth & Moon. For each, name the lunar phase seen in College Park & give the approx. time the Moon rose. [9 pts.]

a) The Moon sets at midnight.

b) On this day a lunar eclipse occurs for people living in Perth, Australia.

c) You see the Moon setting in the western sky. It is 10 AM.

d) You see the Moon with bright earthshine in the western sky.

e) You see the Moon with bright earthshine in the eastern sky.

f) It is two days after a last quarter moon.

2. How would our seasons be affected in College Park if the Earth's axis were tilted at 0^{o}? How about if it were tilted at 45^{o}? **3.** Which one of Galileo's telescopic observations falsified the geocentric model? Explain.

4. Problem: A comet has perihelion distance of 0.6 AU and aphelion distance of 39.4 AU. Find the semimajor axis of the orbit. Calculate the orbital period. **Show your work**. (3 pts.)

Extra Credit (5 pts. max): In what region (country or continent) of the world did your ancestors live? Go far enough back so that you are outside the USA and/or to a civilization that existed before the use of the telescope. Write a 1-page paper (double spaced with reasonable fonts and margins; or single spaced, neatly handwritten) describing what your ancestors in this region knew about astronomy (without telescopes). For example, my ancestors came from Europe, so I could choose and discuss one of the ancient cultures that erected stone monuments that demonstrated knowledge of the Sun's seasonal motion. Length=1 p. **Reference all URLs used.** *To receive any extra credit points you need to probe further and include new information not presented in class. Include at least one reference other than Prof. Deming or your textbook.*

Homework # 2: Due Apr. 9 at 11 AM (unacceptable after 11 AM Apr. 14)
1. What energy source powers Io's volcanoes? Explain. **2.** In which ways is a dwarf planet similar to a planet? In which ways is it different? **3.** Why are auroras more common at lower latitudes during solar maximum rather than solar minimum? Explain. **4.** What information about stars can astronomers learn by studying spectra? Give 3 stellar properties and briefly describe how spectral analysis is involved. **5.** Problems: a) Compare the intensity of sunlight at Earth's distance from the Sun to that at Neptune. SEE page 58. b) -- to that of asteroid 32569 Deming when it is at aphelion distance of 3.25 AU. Show your work.

Extra Credit (5 pts. max):
Go to the James Webb Space Telescope page: http://www.jwst.nasa.gov/birth.html Read the information about stellar birth & view the video. Describe how the James Webb Space Telescope will help astronomers understand star birth and planet formation. More information about the telescope can be found at : http://www.jwst.nasa.gov/about.html Click under the orange box to the left for more information links. Who was James Webb? When is the planned launch date? How will the Webb telescope compare to the Hubble space telescope? (Length=1 page)

Homework # 3: Due Apr. 30 at 11 AM (unacceptable after 11 AM May 5)
1. Why is it highly likely that if life exists elsewhere in the galaxy that it will be based on carbon chemistry? Explain. **2.** Choose one planet or moon in our Solar System that has the best chance of having some type of life. Support your choice in a paragraph. **3.** Describe Hubble's classification scheme for galaxies. Make a sketch of each main galaxy type. **4.** Explain how a black holes like that in the Cygnus X-1 system produces X-rays. Include a labeled sketch **5.** If the fastest airplane travels at 1600 km/h, how many years would it take to travel on this plane to reach our Sun? How many years would it take to reach the nearest star (Proxima Centauri)? **(Show your work.)**

Extra Credit (5 pts. max): **When is your birthday?** Visit the Astronomy Picture of the Day web site http://antwrp.gsfc.nasa.gov/apod/calendar/allyears.html Choose an interesting image that appeared on any of the years you celebrated your birthday & report on your findings. Reference all URLs used. (1 page)

Please complete the following experiment and bring it to your discussion section on Feb.17 or 18. This exercise is due at the beginning of your discussion section.

Name_____ **Section**_____

Astrology Experiment (10 pts.)

The purpose of this exercise is for students to experimentally test the legitimacy of horoscopes and astrology. After the group discussion that will take place in discussion section, students should be able to distinguish between astronomy and astrology.

I. Individual Assignment
For two days, collect a horoscope from the newspaper or web. Read the horoscope early in the morning. At the end of the day write a short paragraph describing any significant events from that day. Do this for both days (be sure to include the horoscopes with the paragraphs).

How accurate were your horoscopes in predicting the day's events?

*Continue to collect horoscopes for two more days. This time do **NOT** look at them until the end of the day **AFTER** you have written down in a paragraph the details that happened to you during the day. Compare the horoscopes to your written paragraphs (again, include the horoscopes with the paragraphs.)*

How accurate were your horoscopes for these two days?

Are they more accurate, less accurate, or about the same as those on the first two days?

What conclusions would you draw regarding the predictive powers of astrology, based on the results for your experiment?

Staple your horoscopes and paragraphs to this sheet and bring to discussion section for the group discussion on astrology (Feb. 17 or 18).

AFTER you have completed your experiment, answer the 5 questions on the back!

1. There are 12 astrological signs. Assuming an equal number of people in each sign and thinking critically about typical astrological predictions, what is the likelihood that 1/12 of the world's population is having identical experiences? Explain.

2. Horoscopes for the same day from three different sources can be found below. Compare the predictions. What would you conclude from this example?

These horoscopes were written for September 13, 2011 for Cancer:

The Washington Post: When you look around your home, you see a lot of things you really need, and a lot of things you don't. Instead of increasing the number of things you own, scale down the number of things you want.

The Diamondback: Someone who claims to be doing something in your best interest is only taking unfair advantage of his or her association with you.

Centredaily.com: Performance, not appearance, is what really counts. If you know in your heart that you are extending your best effort today, don't be fretful over what associates may or may not think. Use the days ahead to increase your inventory of knowledge by studying enjoyable subjects that could improve your marketability. These interests have a profitable destiny.

3. Review the "Scientific Method". What steps must be completed to support a scientific hypothesis?

4. People who believe in astrology often cite their personal experiences with valid (in their opinion) predictions. They have "faith" in the astrologer's ability to predict events based on the positions of celestial objects. What is your reaction to this "faith/it works for me" argument? Is this a suitable argument when evaluating scientific knowledge? Discuss.

5. Keeping in mind your answers to the above questions, would you classify astrology as a science? Support your answer.