Week & Date **Syllabus for ASTR 1200 Doug Duncan, Fall 2018**

***** be sure to read "About this Course" on the class Desire 2 Learn website*****

The **Mastering Astronomy Course Code** is there, under "Mastering Astronomy"

Do assigned readings BEFORE TUESDAYS - there will be clicker questions on the reading.

Reading assignments are pink on this syllabus.

Homework will usually be assigned on Tuesday, due the following Tuesday

Read the textbook ***Strategically!*** **Focus on answering the "Learning Goals."**

Week 1 **Introductions. The amazing age of discovery in which we live.**

Aug. 28 **The sky and its motions.**

My goals for the course. What would *you* like to learn about?

What do I expect from you? Good news/bad news. Science vs. stories about science.

This is a "student centered" class. I'm used to talking (Public Radio career). Here *you* talk too.

Whitewater river analogy: If you don't want to paddle, don't get in the boat.

Grading. Cheating. Clickers and why we use them. Homework out/in Fridays. Tutorials. Challenges.

How to do well in the class. [reading clicker quiz] Why employers love to hire graduates of this class!

Read bottom syllabus; "Statement of Expectations" for Arts & Sciences Classes"

Policy on laptops and cell phones.

Registrations: Clickers, Mastering Astronomy.

Highlights of what the term will cover -- a bargain tour of the universe

Bloom's Taxonomy of Learning

What can we observe about the stars? Magnitude and color.

Visualizing the Celestial Sphere - extend Earth's poles and equator to infinity!

Visualizing the local sky: atltitude and azimuth

Homeworks #1, How to Use Mastering Astronomy, due Sept. 4 at 2pm, and Homework 1b, "Science and Pseudoscience," either email to me or turn in at class Sept. 6

-Register Mastering Astronomy, AND your clicker. MA class code: MADUNCAN1200F2018

-Register according to instructions on CULearn: "Course Information…Stuff You Must Do"

Reading: Chapter 1, *The Cosmic Perspective.* Scale of earth in space, civilization in time.

Chapter 2 **:** Sky motions**.**

Week 2 **Sky motions continued. Note - Thursday we may be outside part of class! (last 15 min)**

Sept. 4 **Tue. class is in Fiske Planetarium!**

Constellations

Measuring sky angles with your hand

Daily and Yearly sky motions

The sky in different places on the earth

Phases of the Moon. Rainbows and Double Rainbows. Blue Sky and Orange Eclipses

Preparing for the "Survivor Planetarium Challenge" and "Height of Gamow Tower"

Homeworks #2: On Mastering Astronomy. Due Sept. 11.

Reading: Chapter S1.2 and S1.3 (S1.1 is optional), Celestial Timekeeping and Navigation

Week 3 **What is Science? How do you decide what to believe? How science can be benefit you.**

Sept. 11 **Numbers, proportions, estimation. Telescopes. Survivor Challenge in the Planetarium**

The nature of science and astronomical discovery.

What science *isn't*. Cargo Cult Science and pseudoscience.

Identification of class psychics.

Science as a way of not fooling yourself (paper cup with hole question)

First in-class "Challenge:" How many Jupiters make one Sun?

Numbers and estimation in astronomy. Proportions. Units.

How telescopes work.

Visible and Invisible light telescopes. Tour famous ones

Homeworks #3: Mastering Astronomy, AND #3b. Numbers, Estimation, Ratios (Due in class Sept. 18)

Do readings BEFORE MONDAYS!

Chapter 3, The Science of Astronomy. Chapter 6, Telescopes.

Week 4 **Motions, Energy, and Gravity in the Universe**

Sept. 18

Tue. class is in Fiske Planetarium. The "Survivor Challenge"

Different forms of energy. What it temperature? Four phases of matter.

PheT Gas pressure applet

Kepler's laws. *Why do things move that way?*

Scalars and Vectors. Position, velocity, acceleration. Newton's laws. *Derive Keper's 3rd law* .

Homework #4 Mastering Astronomy AND Preparing for Night Observing - called "Night Observing at Sommers Bausch" - on the class website on D2L. Do Part A only. Part B you use when your night observing is scheduled.

Reading: Chapter 4 *Motion, Energy, Gravity*

Week 5 **Light, Color, Spectra**

Sept. 25

The wonderful nature of light!

Properties of light. White light. Kirchoff-Bunsen laws.

Black body spectra. R**2 T**4. B-V colors.

Wave-like and particle-like experiments.

Demo the Doppler Effect; invisible wavelengths of light, greenhouse effect

Homework #5a. MA: Light and Spectra , and #5b Fiske Lobby "Seeing the Invisible" - due in class Sept. 27

Reading: Chapter 5, *Light and Matter*

Week 6 **The Sun and Midterm 1**

Oct. 2

Midterm 1 is Tue. Oct. 2

Structure of the sun: photosphere, chromosphere, corona, core

Fission and Fusion - enery sources

Hydrostatic equilibrium ; Solar Seismology; Solar neutrinos

Solar "Weather" and "Solar Storms" -- sun - earth interactions

Reading: Chapter 14, Our *Star*

Homework #6. The Sun

Week 7 **Surveying the Stars**

Oct. 9

Oct. 9 Fiske Planetarium "Solar Superstorms"

Luminosities, Temperatures, Masses of Stars

The HR Diagram

Reading: Chapter 15, *Surveying the Stars*

Homework #7. MA Tutorial: The HR Diagram and 7b What do we know about Aliens? Due in class Oct. 16

Week 8 **Stars and their evolution I: Starbirth**

Oct. 16

Star clusters and the Hertzsprung-Russel (HR) diagram

Nebulae; star formation

Energy sources, Gravity, Fission and fusion.

Lives of Low Mass Stars

Lives of High Mass Stars

Binary Stars

Reading: Chapter 16, *Star Birth* and start *Chapter 17, Star Stuff*

Homework #8: Mastering Astronomy Stellar Evolution

Week 9 **Stars and stellar evolution II: Star Lives, Star Deaths!**

Oct. 23

red giants and synthesis of the elements

white dwarfs and planetary nebulae

supernovae

neutron stars, pulsars, black holes

gamma ray bursts and gravity waves

Oct. 23 Fiske Planetarium "Black Holes the Other Side of Infinity"

Homework #9: Mastering Astronomy: multiple choice about stellar evolution

Reading: Chapter 17 and 18, *Star Stuff, The Bizarre Stellar Graveyard*

Week 10 **Discovery of our own Milky Way Galaxy and Its Structure.**

Oct. 30 The Shapley-Curtis debate
Radio and infrared observations
A modern picture of the Milky Way
Reading: Chapter 19, *Our Galaxy*
Oct. 30 Fiske Planetarium - Explore the Milky Way
Homework #10: Mastering Astronomy, "About our Galaxy"

Week 11 **Galaxies and the Foundation of Cosmology and Midterm 2**
Nov. 6 **Midterm 2 is Tue. Nov. 6**
Types of galaxies
Measuring cosmic distances
Hubble's law - the universe is expanding!
Homework #11: 2 Mastering Astronomy tutorials: "Cosmic Distances" and "Hubble's Law"
Reading: Chapter 20, *Galaxies and the Foundation of Modern Cosmology*

Week 12 **Galaxy Evolution**
Nov. 13 Roles of density and angular momentum
Role of environment
Starbursts and Quasars
Homework #12: Mastering Astronomy, including "Black Hole" tutorial
Reading: Chapter *21. Galaxy Evolution*

Week 13 **Thanksgiving. No classes.**
Nov. 20

Week 14 **The Big Bang and the Beginning of Time and Space**
Nov. 27 The accidental discovery of primordial radiation (seeing the beginning of the universe with a TV!)
The Big Bang Theory; testing models of the early universe
Adding "Inflation" to the original Big Bang Theory
The latest observations and What We Still Don't Know
Homework #14: Mastering Astronomy
Reading: Chapter 22: *Dark Matter, Dark Energy, and the Fate of the Universe*

Week 15 **Dark Matter, Dark Energy, and the Fate of the Universe**
Dec. 4 Dark matter is found in other galaxies just like in the Milky Way (review rotation curves)
Dark matter between galaxies: X-rays and graviational lenses
Overall structure and fate of the universe
Tue. Dec. 4, Fiske Planetarium "Cosmic Origins"
Reading: Chapter 23: *The Beginning of Time*
Homework #15: Mastering Astronomy

Week 16 **Extra-solar planets and Life in the Universe**
Dec. 8 **Science and Pseudoscience. Science as a way of trying not to fool yourself.**
Astrology

Final Exam **Mon. Dec. 17 4:30 p.m.– 7:00 p.m.**

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the Disability Services website. Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition or injury, see Temporary Medical Conditions under the Students tab on the Disability Services website.

If you have a conflict with any class activities due to religious or other reasons, please tell us well in advance. Last minute requests cannot be accommodated. Plan ahead! See full details about religious holidays at http://www.colorado.edu/policies/fac_relig.html

I expect you to follow the University's Honor Code. Because this class is so participatory, and not so "exam-based", a reasonable effort on your part throughout the term will lead to a passing grade, whether or not you think you are "good" at science, and you will know well before the final how you are doing. You should not be nervous at finals time in this class! However, cheating is the one sure way to fail. All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the policy may include: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code (honor@colorado.edu); 303-492-5550). Students who are found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code as well as academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found at the Honor Code Office website.

Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. For more information, see the policies on classroom behavior and the Student Code of Conduct.

The University of Colorado Boulder (CU Boulder) is committed to fostering a positive and welcoming learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct (including sexual assault, exploitation, harassment, dating or domestic violence, and stalking), discrimination, and harassment by members of our community. Individuals who believe they have been subject to misconduct or retaliatory actions for reporting a concern should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127 or cureport@colorado.edu. Information about the OIEC, university policies, anonymous reporting, and the campus resources can be found on the OIEC website.

Please know that faculty and instructors have a responsibility to inform OIEC when made aware of incidents of sexual misconduct, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about options for reporting and support resources.