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Astronomy 201

Sections & Times: L (Fri 9:30 am - 12:30 pm), TUY (Mon 5:45 - 8:35 pm) per online schedule

Instructor: Dr. George R. Bart Email: gbart@ccc.edu,
Office: Rm. 3850, tel. (773) 907-4096 or 4093 to secretary only for emergency
 Do not call just to report an expected absence. For messages only use
 Web: <http://ccc.blackboard.com> message system or email: gbart@ccc.edu.
Hours: Best: after class meets for 1 hr; others are available; see TR Profile page;.

Rooms: Days and times may vary each semester. Usual Rooms: 3833 or 3974.
Text: *Astronomy, A Beginner's Guide to the Universe* by **Chaisson & McMillan 5th or 6th**
 Ed., Pearson/Prentice Hall, 2006-2010. See below for more details about course
 materials. Current ISBN13: 978-0-321-59876-9 includes Mastering Astronomy.

Catalog Description: **ASTRONOMY 071 0201 - Descriptive Astronomy I** **IAI# P1906**
 Descriptive survey of major astronomical facts, concepts, and relationships, starting
 with the solar system and extending to stars, galaxies, and cosmogonies. Writing
 assignments, as appropriate to the discipline, are part of the course. Pre-requisite -
 eligibility for English 101; 3 Lecture Hrs. per week based on 16 weeks. Cr. Hrs. 3

Course Content: The course presents a sophomore college level general education overview of scientific
 knowledge about astronomy via lecture, lab, and multimedia in an Internet hybrid
 format such that they meet on campus only about ½ of the scheduled time. More info is
 at <http://tinyurl.com/nh68u9>

Quizzes and Field Trip: Online quizzes are required frequently to prepare for scheduled major exams. Quizzes
 should be taken after a review of the text readings, video, Internet and PowerPoint slide
 content. No make-up quizzes will be offered; instead, the lowest one quiz grade will be
 dropped. In the event that you miss any quiz, a grade of zero will be entered for it. **This
 also applies to the independent field trip report that is required of hybrid students
 and represents 20% of the final grade.**

Homework: Doing homework is essential for success in this class. A standing assignment is to do
 assigned reading, monitor the course Blackboard site for announcements and view the
 assigned videos. Homework is assigned weekly and will be due by the scheduled dates
 and times (unless otherwise stated). If you miss a class, you will need to request any
 handouts or homework assignments you missed. ***NB: This is your responsibility.***

Midterm Grades: At midterm, overall assessment letter grades A, B, ..., F will be recorded for each
 student based upon their scores on required assessment assignments such as major
 tests, homework, and quizzes. Any missing tests, assignments, or class participation
 activities are scored as zero. However, if one major test or any two or more other
 assignments of one type are scored below 30%, the midterm evaluation will be that the
 student is not actively pursuing the course and the midterm grade will be recorded as
 ADW (administrative withdrawal). **You must complete assignments, labs and tests
 with no excuses to avoid an ADW.**

A longer more detailed syllabus is provided on the first day of class.

ASTRONOMY 201

OBJECTIVES - The main objective is for students to learn about the solar system, stars, other celestial objects and the universe at large from a scientific perspective, to learn to value quantitative observations, and to have knowledge of the sky. The student will learn to use common sense to interrelate the elementary astronomical facts with ordinary simple experiences. Particularly stressed will be how our understanding of the universe has changed, from the days of ancient Greece to the present, because of the development of a scientific attitude, methodology, and technology. Student learning will arise from various activities. Specifically, this involves:

- Applying critical thinking techniques to answer: How do we know what we know? How do we convince others of the new knowledge? Can we apply scientific methodology to repudiating or substantiating claims to the paranormal?
- Identifying, and locating celestial objects and places.
- Explaining the geometry and physics of celestial objects (Moon, Solar System, stars, and beyond).
- Classifying celestial objects by using the physical properties of light and geometry (brightness, color, location).
- Appreciating the nature of astronomy with respect to the scale of distances and quantities involved with satisfying curiosity about celestial phenomena.
- Performing simple mathematical calculations using computational aids when appropriate.
- Doing Internet activities related to the preceding.

EXPECTED MEASURABLE STUDENT LEARNING OUTCOMES

In general, the successful student, upon completion of this course, should meet the learning goals listed at the beginning of each textbook chapter. Extremely concisely they are that the student will be able to:

- Discuss the place of the Earth in the Solar System, Milky Way Galaxy, and Universe giving evidence of the spherical shape, rotation and revolution of the Earth.
- Use latitude and longitude to identify geographical locations and time zones on Earth.
- Recognize, explain and reason about day and night sky events.
- Describe the orbital motions of the Earth and the Moon in relation to lunar phases, lunar and solar eclipses, origin of the seasons, etc.
- Describe the composition, structure, likely origin of the solar system and the significance of Kepler's Laws.
- Critically reason with the concepts presented in the textbook.
- Recognize, classify and accurately use the vocabulary and images of astronomy.
- Identify the basic physics influencing astronomy such as the properties of gravity, motion, light, and electromagnetic waves.
- Perform simple calculations related to the concepts presented.
- Describe the main characteristics of the heavenly bodies studied.
- Compare the Sun relative to other stars in terms of its magnitude, luminosity, color and type. Describe its position in the Milky Way Galaxy and compare the Milky Way galaxy to other galaxies.
- Accurately describe the life cycle of stars by using the names of the major star types, by using the H-R diagram and by explaining the variety of stellar properties.
- Classify galaxies as elliptical, spiral, or irregular when shown photographs of them.
- Identify the major large scale universe structural features and properties including the Local Group, Hubble's Law and its significance.
- Use technology for Internet activities related to the preceding.

TRUMAN GEN ED GOALS

This course addresses the Truman College General Education Goals:

- The student exhibits social and ethical responsibility and is aware of her or his place in the global community.
- The student performs effectively in the workplace and has the ability to work and make effective use of a wide variety of current technologies.
- The student communicates effectively in both written and oral formats.
- The student demonstrates the ability to think critically, abstractly, and logically.
- The student gathers interprets and analyzes data.

ACADEMIC INTEGRITY & CCC POLICIES

This course implements the CCC Academic Integrity policy. The CCC has no tolerance for violations of academic integrity. The student policy manual states, “Plagiarism and cheating of any kind are serious violations of these standards and will result, minimally, in the grade of ‘F’ by the instructor” (39). All course work will be checked for Academic Integrity. In this course, the first violation will result in an “F” for the assignment; the second violation will result in course failure. Make-ups and revisions are not available after an infraction of academic integrity. CCC policies relating to student, academic, and organizational procedures are online at <http://www.ccc.edu/menu/Pages/Policies.aspx> and the Student Policy Manual PDF may be downloaded at <http://www.ccc.edu/departments/Documents/studentpolicymanual.pdf>

ACADEMIC SUPPORT SERVICES

Numerous academic support services are available to students of Truman College. Some are:

Tutoring Center. For students who need help with their assignments: Room L129, 773-907-4785, www.trumancollege.edu/student-services/tutoring.

Student Success and Leadership Institute (SSLI). For students who need various other support services to achieve their educational goals: Room 1435, 773-907-4714, www.trumancollege.edu/student-services/ssli.

TRIO Student Support Services. For low-income students, first generation college students, or students with disabilities who need academic support: Room 1435, 773-907-4797, www.trumancollege.edu/trio. Registration is required at the start of each semester.

Disability Access Center. The Center verifies needs pursuant to the American Disabilities Act (ADA), determines student academic accommodations, and issues accommodation letters. Registration is required at the start of each semester: Room 1428, 773-907-4725, www.trumancollege.edu/student-services/dac.

FERPA

FERPA (Family Educational Rights and Privacy Act) is a federal law that protects the privacy of student educational records. Faculty cannot reveal information about students, or discuss student records over the phone or unsecure e-mail. CCC student e-mail meets FERPA requirements. See: www.ed.gov/policy/gen/guid/fpco/ferpa/index.html.

Course Materials List – Astronomy 201

Text books

- *Astronomy: A Beginner's Guide to the Universe*, 5th or 6th ed., by Eric Chaisson and Steve McMillan, Addison-Wesley, 2006/2008. The book includes a companion website free with a new book purchase or for \$30 to \$73 extra with a used text. The site includes features such as an eBook and other study aides. There still is an old free 3rd ed, site without and eBook at <http://cwx.prenhall.com/bookbind/pubbooks/chaisson4/>
For the 5th ed., the ISBN is 013187165X and for the 6th ed. it is 0321590678.
- Students planning to use Mastering Astronomy resources should seek help from the teacher to gain extra credit.

Other materials

- A personal computer with Internet access is needed to conveniently conduct aspects of the assignments. Students without home Internet access may use free WiFi and computers with Internet access at Truman, other CCC campuses and all Chicago Public Libraries.
- Pocket scientific calculator may be useful and is allowed on tests.
- Some T120 \$1 VHS tapes may be useful. If possible, program a DVR/VCR to record automatically the TV video showings listed elsewhere for convenient time-shifted viewing. If an episode is missed, a set of the key episodes can be viewed in Truman's LRC and online.

Required Videos & Internet Readings/Handouts (Content is on course Blackboard site.)

- "Characteristics of the Scientific Method", Bertrand Russell
- "Theory of Knowledge" for *The Encyclopaedia Britannica*, Bertrand Russell
- "The Scientific Method", a FAQ web site by Paul Johnson
- "Scientific Method 2", a self test activity created by Tami Maloney
- Video content - see video list
- PowerPoint Lecture Slides
- Course Online Documents, Assignments, and featured websit

COURSE READING & VIEWING OUTLINE FOR ASTRONOMY 201

TEXT: *Astronomy A Beginner's Guide*, 5th/6th Ed., by Chaisson & McMillan in print or eBook.
 Pearson/Prentice Hall, 2006/2008. (A 5th Ed. version of this page is available on Blackboard.)

VIDEO SERIES: A = *Astronomy: Observations & Theories* = New TV series
 U = *Universe: The Infinite Frontier* = Old TV series

SPECIAL TOPIC VIDEOS ARE FOUND ON BLACKBOARD SITE.

<u>Unit</u>	<u>Topic</u>	<u>6th Ed. Pages</u>	<u>Video Lessons</u>
1	Scientific Method Articles Charting the Heavens (Chs. 0.1-2, 0.5), Earth & Its Moon (Ch. 5), Time Zones Article	Online Sources 1-11, 18-23 131-161 Online Sources	A & U-1, 2, 3
2	Copernican Revolution (Chs. 0.3-5, 1.1-3),	12-18, 24-34,	A-4, U-4, 5
3	The Solar System (Ch.4), Terrestrial Planets (Ch. 6)	98-133, 162-191	A-16, 17 U-19 to 22
4	Jovian Planets (Ch. 7), Moons, Rings, & Plutoids (Ch. 8)	192-239	A-18, 19 U-23 to 25

TEST 1

5	Math Review (Chs. A.1-3), Motion, Force, Energy (Chs. 1.4)	A1-A3, 35-41	A-5, U-6
6	Light and Matter (Ch. 2)	42-67	A-5, 6, U-6, 7
7	Measuring the Stars Parallax and Luminosity (Ch. 10.1-2), Optional -Telescopes (Ch. 3)	266-273 68-97	A-5, 8, U-6, 9

TEST 2 = MIDTERM

8	The Sun (Ch. 9), Stellar Properties (Ch. 10.3-7)	240-265, 274-289	A-6, 7, 8 U-7, 8, 9
9	Interstellar Medium (Ch. 11), Stellar Evolution (Ch. 12)	290-345	A-9, U-10, 11

TEST 3

10	Neutron Stars and Black Holes (Ch. 13)	346-373	A-10, 11, U-12, 13
11	Milky Way, Normal and Active Galaxies (Chs. 14-15)	374-429	A-12, 14 U-14, 16
12	Galaxies and Dark Matter (Ch. 16)	430-455	A-13, U-15
13	Cosmology (Ch. 17), Optional - Life in the Universe (Ch. 18)	456-483, 484-503	A-15, U-17, 18 A-20, U-26

FINAL EXAM

ASTRONOMY 201

Brief Topical Outline - City Colleges of Chicago

Topic	Key items to be covered for examinations (See Vocabulary List for complete listing.)
SCIENTIFIC METHOD	
General Principles	Facts, hypotheses, theories, laws, models Induction and deduction, experimental verification of predictions
HISTORICAL VISUAL ASTRONOMY	
Earth as a solar body	Radius, diameter, circumference and other general physical properties, Equatorial bulge
Evidence for shape of the Earth	Earth's shadow on the Moon Changing position of stars as one travels north or south Disappearance of ships moving away from shore Magellan's voyage High altitude photographs Artificial satellites
Motions of Earth	What's seen: rise/set, star trails, Moon/planet motions; rotation, revolution, pole, axis, equator, zenith, star trails, Foucault pendulum, ellipse, focus, parallax, perihelion, aphelion, precession, nutation
Measurement of time and distance	Solar day—variation and mean solar day, sidereal day, Greenwich meridian, standard time meridian, time zones, international date line, arctic circles, tropics, celestial sphere, poles, equator, longitude, latitude, season, equinoxes, solstices, plane of the ecliptic, celestial equator, year, Julian calendar (characteristics), Gregorian calendar and revised leap year rule.
THE SOLAR SYSTEM	
Theories of Solar System Geocentric theory Heliocentric theory Laws of Planetary Motion	Retrograde motion Ptolemy's explanation/model Copernicus' explanation/model Tycho Brahe's observations Kepler's three laws of planetary motion (by name not just by number) Invention of telescope and Galileo's observations General description of Newton's explanation
Other members of the Solar system	
Moon	Rotation and revolution. Phases, tides, eclipses (lunar and solar), surface features and characteristics
Planets	Name and position of each, dwarf planets, Inferior and superior, outer versus inner type characteristics
Comets	Orbits and nature. Halley's Comet
Asteroids	Brief description
Meteors and meteorites	Nature and composition
The Sun	Age, size, mass, rotation, atmospheric regions, source of energy, sun spots, utilization of sun's energy
Other stars	Brief general description, Galaxy, Milky Way, Big Bang
Origin of the Solar System	Other planetary systems

Topic	Key items to be covered for examinations (See Vocabulary List for complete listing.)
MATH AND PHYSICS TOOLS	
Scientific Notation	Powers of ten, metric prefixes, Astronomical Units (AU), Light Years (LY), decimal shifting rules, exponent rules, calculator notation
Simple graphs and proportions	Variations: Direct - linear, quadratic (square); Inverse -reciprocal (1st power), square (2nd power) slope, intercept, initial values
Motion	Newton's Laws, inertia, weight, mass. force, energy
Gravity	Newton's General Law and approximation to near planetary surfaces, weightlessness
Light	Wave/photon duality, wavelength, frequency, Electromagnetic Spectrum, color, energy(frequency), intensity(inverse square law behavior)
STARS	
Distance Brightness Groupings By location By geometric size By spectral color By mass By activity/detection Life cycle	Stellar parallax, parsec (pc), distance determination problem - Cepheid's period luminosity relation, closest star Visual (apparent), absolute, magnitudes = m versus M; distance determination - brightness, Cepheid's period luminosity relation, examples Constellations, binary, trinary, etc., globular clusters, galaxies, examples Dwarf, typical solar (Sun, $1 R_{\odot}$ = Sun's radius), giant, super giant, largest O, B, A, F, G, K, M (O be a fine girl/guy kiss me!) (blue to red) and subdivisions, Sun's type $1 M_{\odot}$ = Sun's mass, neutron stars, black holes, examples Variable, nova, supernova, radio, X-ray. pulsar → neutron star, examples Hertzsprung-Russell (H-R) diagram, spectral class & size → M → distance, expected progression of Sun's life
GALAXIES AND THE UNIVERSE	
Discovery of galaxies	Milky Way, Andromeda, What do they look like? How many stars? Structure: Disk, bulge, arms, globular cluster halo, size, distance
Types	
Spiral/Barred Spiral (S/BS)	Flattened, rotation, arms, bulge, halo only old stars in random motion, disk has star formation, arms and bar have ongoing star formation
Elliptical (E)	No disk/structure, only old stars, hot X-ray emitting gas, no star formation
Irregular (Irr)	No structure, explosive appearance, young & old stars, abundant gas, dust, star formation, irregular internal motions.
Active	Quasars, Radio, X-ray, Seyfert
Clusters & Clusters of Clusters	Exceptionally many galaxies in one region of space, Local Group
Discovery of galaxies	Milky Way, Andromeda, What do they look like? How many stars? Structure: Disk, bulge, arms, globular cluster halo, size, distance
Special Galaxy Properties	
Red Shift	Hubble's Law, Expansion of Universe, Age of Universe, Cosmology
Dark Matter	Irregular Universe density, Dark energy
Relativity	Gravitational Lensing, Black Holes everywhere, accretion disk, event horizon, high energy particle lobes/jets
Evolution	Big Bang, black body cosmic radiation, inflation, nuclear synthesis